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EVALUATING THE IMPACT OF HEAL PREGNANCY INTERVENTION ON BREASTFEEDING INITIATION AND DURATION

by

DOLLY NOEL RINEHART, BS

APPROVED:

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DEDICATION

To my parents, Michael and Elizabeth Rinehart

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# EVALUATING THE IMPACT OF HEAL PREGNANCY INTERVENTION ON BREASTFEEDING INITIATION AND DURATION

by

DOLLY NOEL RINEHART
BS, Miami University, 2013

Presented to the Faculty of The University of Texas

School of Public Health

in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF PUBLIC HEALTH

THE UNIVERSITY OF TEXAS
SCHOOL OF PUBLIC HEALTH
Houston, Texas

May, 2019

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# PREFACE

From past experiences, I have seen how difficult it is for pregnant women with limited resources to receive quality breastfeeding education. HEAL is a wonderful program providing important resources to an underserved population in Houston, TX. I am very grateful for the opportunity to have been a part of this project.

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ACKNOWLEDGEMENTS

I would like to thank Dr. Shreela Sharma for her continued support and encouragement while completing this thesis. Also, I would like to thank Dr. Ru-Jye (Lindi) Chuang and Ms. Melissa Danho for their help conducting post-delivery surveys and understanding the HEAL program. I would like to thank dietetic internship directors Ms. Laura Moore and Ms. Jeanne PigaPlunkett for believing in me and helping me along the way. Finally, I would like to thank my parents, Mike and Beth Rinehart for encouraging me to follow my dreams and teaching me the importance of helping those in need.

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# EVALUATING THE IMPACT OF HEAL PREGNANCY INTERVENTION ON BREASTFEEDING INITIATION AND DURATION

Dolly Noel Rinehart, BS, MPH
The University of Texas
School of Public Health, 2018

Thesis Chair: Shreela V. Sharma, PhD, RD, LD

ABSTRACT: Despite nationwide improvements in breastfeeding behaviors, many minority, low-socioeconomic status women in the United States fail to follow breastfeeding recommendations. Healthy Eating Active Living (HEAL), a free antenatal program in Houston, Texas, teaches pregnant women healthy lifestyle behaviors and promotes breastfeeding. The objective of this paper was to determine the impact of HEAL on breastfeeding initiation and length of breastfeeding duration among predominantly low-income, minority, underserved women in Houston, TX. Methods: HEAL is a natural experiment rooted in Social Cognitive Theory and Theory of Planned Behavior. Data was collected from two sources, the HEAL pregnancy post-delivery survey and the HEAL infancy baseline survey. Data used was collected from March 2015 through October 2018. Women in the intervention group were recruited through University of Texas (UT) Physicians clinics to participate in HEAL pregnancy. Women in the control group did not attend HEAL pregnancy but did attend HEAL infancy and were also recruited through UT Physicians. Logistic regression analysis was conducted to evaluate the impact of HEAL on both breastfeeding initiation and duration. Further analysis was conducted adjusting for

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covariates of interest. Results: Of the 328 women analyzed in this study, 164 were in the intervention group and 164 in the control group. Those in the intervention group receiving HEAL pregnancy program had 1.57 times the odds of initiating breastfeeding compared to those who did not receive HEAL pregnancy program in the control group, but differences in rates of initiation between intervention and control groups were not significant. When analyzed by category, intervention group participants with an annual income of $25,000 or greater had 4.59 times greater odds of initiate breastfeeding compared to those with an income less than $10,000. Those in the intervention group receiving HEAL pregnancy program had two times greater odds of breastfeeding for 12 weeks or longer as compared to those in the control group, but differences in length of duration between the intervention and control groups were not significant. Further analysis revealed those in the intervention group who had an income greater than $25,001 had 5.5 times greater odds of breastfeeding 12 weeks or longer as compare to those with an annual income less than $10,000 (Adj. OR= 5.47, 95% OR=1.588-18.852, p=0.007). Conclusion: This study revealed both breastfeeding initiation and length of breastfeeding duration improved among women who participated in the HEAL pregnancy program as compared to women who did not participate in the intervention. Although results were not significant, relatively small sample size and ceiling effect may have attributed to the results. Further research is needed to understand how antenatal breastfeeding education affects breastfeeding behaviors after delivery.

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# BACKGROUND

## Literature Review

### *Breastfeeding and Chronic Disease*

Human breast milk is the ideal, natural source of nutrition for most infants. Proven time and again to benefit both mother and infant's overall health, breastfeeding reduces the risk for acute and chronic illness (Center for Disease Control and Prevention [CDC]: About Breastfeeding, 2018). Infants who are breastfed have a reduced risk of developing or experiencing obesity, asthma, Type 2 Diabetes Mellitus (T2DM), ear and respiratory infections, Sudden Infant Death Syndrome (SIDS), gastrointestinal infections, and necrotizing enterocolitis (CDC: About Breastfeeding, 2018). Mothers who breastfeed reduce their risk of high blood pressure, T2DM, ovarian cancer, and breast cancer (CDC: About Breastfeeding, 2018). Yet despite the well-known benefits for both mother and infant, many women do not breastfeed.

The World Health Organization (WHO) recommends infants be exclusively breastfed for 6 months, and breastfed through 2 years of age with the addition of complementary foods (WHO: Breastfeeding, 2018). An infant who is exclusively breastfed only consumes breastmilk and no other supplemental food or drink (including water) (WHO: Breastfeeding, 2018). The length of time an infant is breastfed, or duration of breastfeeding, has a protective effect against childhood obesity. A meta-analysis by Yan and associates found a dose-response effect related to duration of breastfeeding and reduced childhood obesity (Yan, Liu, Zhu, Huang, & Wang, 2014). Childhood obesity affects nearly 1 in 5 school age children in the United States and can lead to many health problems later in life such as T2DM and



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heart disease (CDC: Childhood obesity facts, 2018). In the United States, a nation majorly impacted by chronic diseases, improving breastfeeding behaviors is another step to prevent short- and long-term health problems.

***Epidemiology of Breastfeeding***

Globally, the United Nations Children's Fund (UNICEF) estimates about 40% of infants age 0 to 5 months are exclusively breastfed (UNICEF: Infant and young child feeding, n.d.). The region of Eastern and Southern Africa has the highest rate of exclusive breastfeeding worldwide at 56%, the East Asian and Pacific region has the lowest rate at 22%, and North America has the second lowest breastfeeding rate at 26% (UNICEF: Infant and young child feeding, n.d.). Exclusive breastfeeding, once a standard behavior, has become an uncommon practice in many parts of the world.

In 2015, a reported 83.2% of infants born in the United States (US) were ever breastfed (i.e. breastfeeding initiation), 24.9% of infants were exclusively breastfed at 6 months, and 35.9% were breastfed at 12 months (CDC: Breastfeeding report card, 2018). Thus, while breastfeeding initiation rates are high, continuation of breastfeeding appears to be low. Racial gaps exist as only 17.2% of Non-Hispanic African American infants in the US were exclusively breastfed through 6 months, compared to 20.9% Hispanic infants, and 29.5% Non-Hispanic White infants (CDC: Rates of any and exclusive breastfeeding, n.d.). Socioeconomic gaps are also critical to note as only 16.4% of infants born into a family with a poverty income ratio less than 100 are exclusively breastfed through 6 months, compared to 32.1% of infants born into a family with a poverty income ratio of 600 or greater (CDC: Rates of any and exclusive breastfeeding, n.d.).



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Breastfeeding rates in Texas are similar to national rates with 85% of infants ever breastfed, 56.6% breastfed at 6 months, 24.1% exclusively breastfed through 6 months, and 35.2% breastfed at 12 months (CDC: Breastfeeding report card, 2018). Once again, racial gaps are present with 16.3% of Non-Hispanic African American infants in Texas being exclusively breastfed through 6 months compared to 23.6% of white infants (Anstey, Chen, Elam-Evans, & Perrine, 2017). Data reported in the Texas Women Infants and Children (WIC) Infant Feeding Practices Survey (IFPS) from 2016 does not accurately describe the entire state of Texas, nor that of Harris County, as it is only administered to women who participate in WIC. However, it can be used to describe the breastfeeding behaviors of the population who participates in WIC. Most women who completed the survey were Hispanic or Latina (64.7%) (2016 IPFS Report, n.d.). According to the survey, 86.0% of infant were ever breastfed, of women who had infants older than 6 months 22.9% reported they breastfed for 6 or more months, but only 6.0% of infants were breastfed exclusively for 6 months (2016 IPFS Report, n.d.). Within Harris County specifically, 84.8% of infants were ever breastfed, of women who had infants older than 6 months 22% reported they breastfed for 6 or more months, but only 4.1% were exclusively breastfed for 6 months (2016 IPFS Report, n.d.).

This data demonstrates how women who receive WIC resources are even less likely to exclusively breastfeed for 6 months compared to the general population. Although many mothers initiate breastfeeding, length of exclusive breastfeeding is limited. Often, mothers who participate in WIC are of a minority race/ethnicity and have a limited income. Although WIC encourages breastfeeding as the optimal infant feeding practice, it is clear mothers are



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not receiving the education, resources, and support they need to exclusively breastfeed for 6 months. In a state and nation majorly affected by obesity and chronic disease, programs targeting pregnant women with limited resources are important in impacting the health of future generations.

***Modifiable Factors Related to Breastfeeding Initiation and Duration***

Research has found there are many different factors which can affect both a mother's choice to breastfeed and the length of time she will breastfeed. Maternal obesity is one factor which has been shown to negatively affect breastfeeding outcomes (Turcksin, Bel, Galjaard, & Devlieger, 2014). Mothers who are obese will often intend to breastfeed for a significantly shorter length of time compared to normal weight mothers (Turcksin et al., 2014). Multiple studies have shown mothers who are obese have decreased rates of breastfeeding initiation compared to normal weight mothers (Turcksin et al., 2014). Obese mothers also breastfeed for a shorter amount of time compared to normal weight mothers (Turcksin et al., 2014). Breastfeeding interventions which target mothers who are obese are necessary and important for improving breastfeeding initiation rates and increasing the length of breastfeeding.

Whether or not a mother smokes may also affect breastfeeding duration as mothers who smoke stop breastfeeding earlier than non-smoking mothers (Cohen, Alexander, Krebs, Young, Cabana, Erdmann, . . . Saavedra, 2018). Early skin-to-skin contact and practicing "rooming in" are both positively associated with increased breastfeeding initiation and continuation (Cohen et al., 2018). These practices are common at Baby Friendly hospitals but are not encouraged everywhere. Finally, mothers who receive breastfeeding education and attend breastfeeding classes are 41% more likely to initiate breastfeeding and breastfeed



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longer than mothers who did not receive education or attend classes (Cohen et al., 2018). Factors such as maternal obesity, maternal smoking habits, hospital practices, and the receipt of breastfeeding education can all impact breastfeeding initiation and duration. It is important to recognize these factors when designing and implementing programs aimed at impacting both breastfeeding initiation and duration.

***Antenatal Breastfeeding Programs***

A recent Cochrane Review found there was no conclusive evidence to suggest antenatal breastfeeding education had any impact on improving breastfeeding initiation or duration (Lumbiganon, Martis, Laopaiboon, Festin, Ho, & Hakimi, 2016). However, researchers did find multi-component programs improved the proportion of women exclusively breastfeeding at three and six months (Lumbiganon, et al., 2016). While one educational component may not be enough to impact breastfeeding rates, programs with multiple components impacting psychosocial factors such as self-efficacy, motivation, and confidence may influence breastfeeding duration (de Jager, Broadbent, Fuller-Tyszkiewicz, Nagle, McPhie, & Skouteris, 2015). This Cochrane review demonstrated the need for well designed, accurately delivered, antenatal breastfeeding education programs to demonstrate their impact on breastfeeding behaviors.

Many organizations provide antenatal breastfeeding education, including hospitals, WIC, and Le Leche League. In Houston, TX, breastfeeding classes are offered at the Women's Hospital of Texas (free online classes or $50 in person classes) (The Woman's Hospital of Texas, n.d.), at the Motherhood Center ($120 per group class, $350 per private class) (Motherhood Center, n.d.), at the Lactation Specialist of Houston ($40 per group class,



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$80 per private class) (Lactation Specialist of Houston, n.d.), at the Texas Children's Pavilion for Women (free 45 minute class after taking a tour, $55 per 30 minute private consultation, or $50 per group class) (Texas Children's Hospital - Pavilion for Women, n.d.), and the list continues. It is clear there isn't a shortage of breastfeeding classes and education programs, however these programs are not feasible for many women with limited resources in the Houston area. For women of low-socioeconomic status (SES), prenatal breastfeeding classes seem to be a luxury they cannot afford. Although WIC and organizations such as the Lactation Foundation offer services to women of low-SES, there is only so much they can offer to the many women who need their services (The Lactation Foundation, n.d.). There is a critical need for programs targeting women of low-SES that provide breastfeeding education and resources during pregnancy.

Healthy Eating Active Living, or HEAL, fills the gap by providing women of low-SES with quality, evidenced based, multicomponent antenatal breastfeeding education. HEAL is funded through the 1115 Medicaid Transformation Waiver program called the Delivery System Reform Incentive Payment Program (DSRIP) which helps to address local gaps in service. HEAL was designed to reach both minority and low socioeconomic populations, providing participants with a resource to help them during and after their pregnancy. The six-week program teaches women cooking skills, low impact physical activity, healthy dietary habits, and promotes breastfeeding (Sharma, Chuang, Byrd-Williams, Danho, Upadhyaya, Berens, Hoelscher, 2018). HEAL is grounded in the Theory of Planned Behavior and Social Cognitive Theory and is aimed at impacting the constructs of knowledge, self-efficacy, attitude, behavioral capabilities, intentions, social support through



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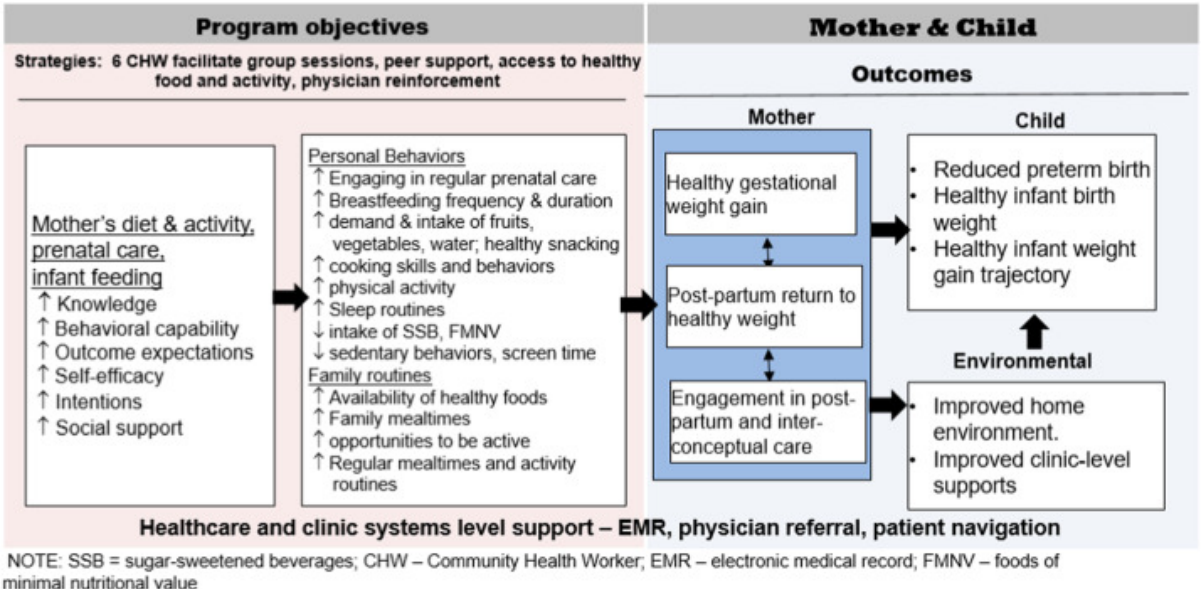
activities and observational learning (Sharma et al., 2018). The logic model for the HEAL program is shown in Figure 1.0.

Figure 1.0 - HEAL Pregnancy Program Logic Model



(Sharma et al., 2018)

The majority of HEAL pilot program participants were African American (53.1%) or Hispanic (32.4%), and had an income <$10,000 (39.0%) (Sharma et al., 2018). Original analysis of the pilot study data showed women who attended HEAL reported a significant increase pre-to-post intervention in the length of intended breastfeeding duration (10.3 months v, 11.2 months; $p = 0.009$) (Sharma et al., 2018). There was a 7% increase pre-to-post intervention in the number of women who intended to exclusively breastfeed ($p = 0.012$) (Sharma et al., 2018). HEAL also impacted women's perceived benefits of breastfeeding. There was a 13.4% increase in the number of women who strongly agreed that breastfeeding makes for a healthier baby ($p = 0.029$ for time x dosage interaction) (Sharma et al., 2018) and



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a 21% increase in the number of women who strongly agreed babies should be exclusively breastfed for the first 6 months of life ($p < 0.001$ for time x dosage interaction) (Sharma et al., 2018).

African American women who participated in HEAL were more likely to express the intention to breastfeed pre- to post-intervention compared to baseline ($p<0.001$) and there was a significant increase in participants overall intended duration of breastfeeding ($p<0.001$) (Durrani, 2017, unpublished data). Among Hispanic participants there was a significant change pre- to post-intervention in intention to breastfeed ($p=0.003$), intended duration of exclusive breastfeeding ($p=0.003$), and intended overall duration of breastfeeding ($p<0.001$) (Durrani, 2017, unpublished data). HEAL has demonstrated significant impact on intention to breastfeed among predominantly low-income, pregnant, minority women, and fulfills a need within the Houston, TX community. However, what remains to be seen is whether this improved intention among HEAL participants translates to breastfeeding practices post-delivery.

**Public Health Significance**

An objective of *Healthy People 2020* is to "Increase the proportion of infants who are breastfed" (Healthy People 2020, n.d.). Sub-objectives include increasing the proportion of infants who are - ever breastfed, breastfed at 6 months, breastfed at 1 year, breastfed exclusively through 3 months, and breastfed exclusively through 6 months (Healthy People 2020, n.d.). Several of the objectives have been met, including increase the proportion of infants who are ever breastfed, breastfed at 1 year, and breastfed exclusively through 3



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months (CDC: Breastfeeding report card, 2018). This leaves two sub-objectives, increasing the proportion of infants who are breastfed at 6 months and exclusively breastfed through 6 months, still to be met.

The lack of optimal breastfeeding behaviors in the US attributes to excess cost, disease, and death (Bartick, Schwarz, Green, Jegier, Reinhold, Colaizy, . . . Stuebe, 2016). Suboptimal breastfeeding practices attribute to 3,340 annual excess deaths in the US (721 child deaths and 2,619 maternal deaths) (Bartick et al., 2016). The cost of suboptimal breastfeeding is immense and amounts to "$3.0 billion for total medical costs, $1.3 billion for non-medical costs, and $14.2 billion for premature death costs" (measured in 2014 US dollars) (Bartick et al., 2016). The numbers speak for themselves, increasing the rate of optimal breastfeeding in the US may influence both health and cost savings (Bartick et al., 2016).

As previously stated, in the US, the lowest breastfeeding rates are seen in both minority and low-socioeconomic populations. HEAL provides breastfeeding education to these populations, positively impacting their intention to breastfeed and their perceived benefits of breastfeeding (Sharma et al., 2018). Delivering HEAL as part of the standard of care ensures women who previously received no formal breastfeeding education while pregnant, have the knowledge and resources they need to successfully breastfeed their infant. Results of this study will indicate how effective HEAL has been on impacting the rate of breastfeeding initiation and length of breastfeeding duration among low-income, minority populations. This information will allow program developers, directors, and staff to



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understand how the program can be changed or improved to further impact breastfeed behaviors among HEAL participants.

**Aims and Hypotheses**

This is a secondary data analysis of data collected from HEAL Pregnancy program post-delivery surveys and data from HEAL Infancy program baseline surveys completed by women who attended the HEAL Pregnancy program and then attended the HEAL Infancy program. The two aims of this paper, the hypotheses related to the aims, and the methods of measurement are listed below.

**Aim 1:** To determine the impact of the HEAL Pregnancy program on breastfeeding initiation among predominantly low-income, minority, underserved women in Houston, TX.

**Hypothesis for Aim 1:** Women who attended the HEAL Pregnancy program, initiated breastfeeding at a higher rate compared to women who did not attend the HEAL Pregnancy program.

**Method of Measurement:** HEAL Pregnancy program post-delivery survey question 14, and HEAL Infancy program baseline survey question 13.

Table 1.0 - Aim 1 and Description of Variable

| **Aim** | **Main Variable** | **Type of Variable** | **Measurement Used** | **Answer Choices** |
|---|---|---|---|---|
| Aim 1: To determine the impact of the HEAL Pregnancy program on breastfeeding initiation among predominantly | Breastfeeding Initiation | Categorical | HEAL Post-Delivery Survey: Q14 "When you left the hospital or birthing center, how were you feeding your infant?" | 1 = Breastfeeding only<br>2 = Formula feed only<br>3 = Breastfeed and formula |



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| | | | | |
|---|---|---|---|---|
| low-income, minority, underserved women in Houston, TX. | | | HEAL Infancy Baseline Survey: Q13 "Did you ever breastfeed this baby?" | 1 = Yes<br>0 = No |

**Aim 2:** To determine the impact of the HEAL Pregnancy program on length of breastfeeding duration (in weeks) among predominantly low-income, minority, underserved women in Houston, TX.

**Hypothesis for Aim 2:** Women who attended the HEAL Pregnancy program breastfed longer compared to women who did not attend the HEAL Pregnancy program.

**Method of Measurement:** HEAL Pregnancy program post-delivery survey question 18a, and HEAL Infancy program baseline survey question 13a.

Table 2.0 - Aim 2 and Description of Variable

| **Aim** | **Main Variable** | **Type of Variable** | **Measurement Used** | **Answer Choices** |
|---|---|---|---|---|
| Aim 2: To determine the impact of the HEAL Pregnancy program on length of breastfeeding duration (in weeks) among predominantly low-income, minority, underserved women in Houston, TX. | Breastfeeding duration | Continuous and Categorical | HEAL post-delivery survey: Q18a "How long did you breastfeed your infant? | 1 = Duration in weeks<br>2 = Currently Exclusively breastfeeding<br>3 Never exclusively breastfed<br>4 = Other |
| | | | HEAL Infancy Baseline Survey: Q13a "How old was your baby when you completely stopped | 0 = Never breastfed<br>1= less than 12 weeks<br>2 = 12 weeks to 6 months<br>3 = 7 months or more |



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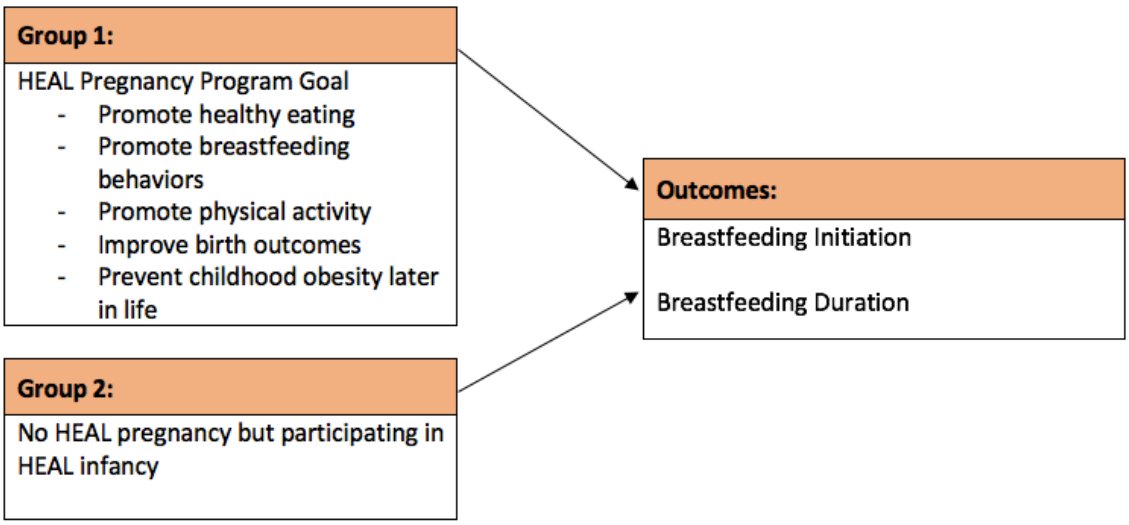
| | | | | |
|---|---|---|---|---|
| | | | feeding your baby breastmilk?" | 4 = I am currently breastfeeding |

Figure 2.0 - Logic Model for the proposed study




## METHODS

### Study Design

HEAL is delivered by University of Texas Physicians (UTP), the University of Texas School of Public Health (UTSPH), and other community organizations. HEAL is an ongoing natural experiment rooted in Social Cognitive Theory and the Theory of Planned Behavior (Sharma et al., 2018). The six-week program consists of a one-on-one session with a dietitian, and five group sessions led by a Community Health Worker (CHW). Topics covered in pregnancy group sessions include: 1) how to make the most of prenatal



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appointments, 2) preparing for breastfeeding, 3) physical activity while pregnant, and 4) understanding one's food environment and making healthy choices (Sharma et al., 2018).

A typical session lasts about 90 minutes and includes a CHW facilitated discussion on the weekly topic, cooking demonstrations, recipe tasting, and physical activity. At the completion of each session women are able to take home about 20-25 pounds of fresh produce for their families. Goal setting activities are performed each week and focus on the health behaviors the group discussed (Sharma et al., 2018). Breastfeeding education is delivered during the third group session by a lactation consultant and includes a demonstration of the correct way to breastfeed, a discussion of cultural expectations, identifying common breastfeeding problems, and finding sources of social support (Sharma et al., 2018). Participants also receive written materials with breastfeeding information to assist them after the HEAL program is complete. Breastfeeding may also be discussed at many different times during the program (Sharma et al., 2018).

**Study Sample**

Eligible HEAL Pregnancy program participants were recruited from UTP, the clinical services branch of the UT McGovern Medical School. Women who were recruited were generally <28 weeks pregnant, on Medicaid or were Medicaid eligible, had a BMI ≥ 25 $kg/m^2$, and understood English. Women were recruited to participate in the HEAL Infancy program several different ways, but have generally been patients at the UTP clinic within the past two years. Women who attended the HEAL Pregnancy program were recruited to participate in the HEAL Infancy program at the end of the post-delivery survey or through other contacts with program staff. Community Health Workers at the UTP TMC pediatrics



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clinic tell mothers of infants about the program and if they are interested, their information is passed on to a HEAL team member who contacts them. HEAL team members "scrub" (review) UTP charts for mothers with infants in the qualifying age range (<13 months old) and then contact them to offer the program. Social workers can refer UTP patients to the HEAL Infancy program and often past HEAL participants give HEAL contact information to an eligible friend or family member. For this proposal, we will consider the intervention group as those women who completed the HEAL pregnancy program (and may have subsequently enrolled in the HEAL infancy program and/or completed the HEAL post-delivery survey).

There were 404 women who completed the HEAL Pregnancy program between March 2015 and October 2018. Among which, 164 women completed the HEAL pregnancy program and post-delivery survey, or completed the pregnancy program and then completed the infancy baseline survey, and women who completed both pregnancy post-delivery survey and infancy baseline survey. For the women who completed both surveys, the information collected from the infancy baseline survey will be used in the proposed study. Therefore, the sample size of this proposed study is 164. Data used for the study sample was collected from March 2015 through October 2018.

The control group used for data analysis was women who only attended the HEAL Infancy program. Control group included 164 women who completed the infancy baseline survey. These women were not exposed to the HEAL Pregnancy program and did not receive any of the breastfeeding education from HEAL. The recruitment strategies were the same as



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previously stated. Data used from the infancy baseline survey data was collected from January 2016 through October 2018.

**Data Collection**

Women who attended the HEAL Pregnancy program were administered a post-delivery survey after giving birth. Post-delivery surveys were administered over the phone by trained program staff and took about 5 to 10 minutes to complete. The survey collected information on the delivery, the infant's health, infant feeding practices, and maternal health. If a participant did not know the answer to a question they were asked to give an estimate. Participants were called at the primary phone number they listed while participating in the HEAL Pregnancy program. Participants were contacted up to three times to complete the survey, and if there was no response after the third contact, the case was closed. Items of the survey measuring breastfeeding initiation and length of breastfeeding duration are shown in Table 3.

Women who attended both the HEAL Pregnancy program as well as the HEAL Infancy program completed a baseline survey during the first HEAL Infancy session. This self-complete survey was delivered on paper and took about 20 minutes to complete. The baseline survey collected information on the mother, the delivery, the infant, infant feeding practices, mother's level of physical activity, and mother's eating habits. Surveys were checked for completion by trained program staff. Items of the survey measuring breastfeeding initiation and length of breastfeeding duration are shown in Table 4.



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**Measures**

Table 3.0 - Items Regarding Breastfeeding on the HEAL Pregnancy Post-Delivery Survey and HEAL Infancy Baseline Survey

| **HEAL Post Delivery Survey Questions:** | **Response Options:** | **Construct Measured:** |
|---|---|---|
| Q14: When you left the hospital or birthing center, how were you feeding your infant? | ○ Breastfeeding only<br>○ Formula feed only<br>○ Breastfeed and formula | Breastfeeding initiation |
| **HEAL Infancy Baseline Survey Questions:** | **Response Options:** | **Construct Measured:** |
| Q13: Did you ever breastfeed this baby? | ○ Yes<br>○ No | Breastfeeding initiation |
| Q13a: How old was your baby when you completely stopped feeding your baby breastmilk? | ○ I am currently breastfeeding (not used in analysis)<br>○ Less than 12 weeks<br>○ 12 weeks - 6 months<br>○ 7 months or more<br>○ never breastfed | Breastfeeding duration |

**Human Subjects Considerations**

The HEAL program is offered as part of the standard of care and is IRB exempt. Approval from University of Texas Committee for the Protection of Human Subjects is attached.



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**Data Analysis**

Data analysis was conducted using STATA 15 (STATA Inc. College Station, TX, USA). Socio-demographic information overall and stratified by intervention and control group, was illustrated using descriptive statistics (frequencies, percent, means and SD). Differences in socio-demographic qualities and self-report pre-pregnancy BMI between the intervention and control groups were assessed using a paired t-test for continuous variables and chi-square test for categorical variables. Prevalence of breastfeeding initiation and breastfeeding duration were computed using descriptive statistics (frequency). Logistic regression analysis (for dichotomous outcome of breastfeeding initiation and categorical variable of breastfeeding duration) was used to assess the impact of the HEAL pregnancy program on breastfeeding initiation and duration as compared to not participating in the HEAL pregnancy program. Reported breastfeeding initiation and reported breastfeeding duration of both groups were then analyzed adjusting for socio-demographic variables of significant interest (age, race, and income). Significance level was set at $p < 0.05$ with a confidence interval of 95%.

We were unable to analyze breastfeeding duration as originally planned, but analysis of partial data was able to be conducted. Based on 95 participants completion of the infancy baseline survey who reported they were not currently breastfeeding their infant, it was possible to analyze breastfeeding duration of 40 intervention group participants and 55 control group participants.



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## RESULTS

### *Sociodemographic Variables*

A total of 328 participants were analyzed in this study, 164 were in the intervention group and 164 in the control group. In the intervention group, a majority of participants were between the ages of 26-30 years (32.7%) and 31-35 years (27.8%). In the control group a majority of participants were between the ages of 21-25 years (27.44%) and 31-35 years (26.22%). Overall the majority of participants were between the ages of 26-30 (26.38%), and 31-35 (26.99%). There were significant differences in age between the two groups (p=0.041). The intervention group was older than the control group.

Overall, most participants were African American (43.73%) and Hispanic (36.39%). A majority of the intervention group participants were African American (43.6%), as were most of the control group participants (43.9%). There were no significant differences in race between the intervention and control groups. A majority of intervention group members were not married (56.10%) and most control group members were not married (55.28%). There were no significant differences in marital status between the two groups.

Level of education was similar between the two groups with 43.83% of intervention group and 38.27% of control group having completed 1 to 3 years of college. There were no significant differences in education levels between the two groups. However, there were significant differences in the employment status of the intervention and control groups (p=0.019). Most of the intervention group participants were working for pay (37.2%), while most of the control group were not working (41.61%), but looking for a job. Overall, the majority of participants were not working, but looking for a job.



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There were significant differences in annual income of the intervention and control groups (p=0.013). A majority of the intervention group (33.33%) had an annual income of $10,001 to $25,000, while a majority of the control group (44.44%) reported an annual income less than $10,000. Overall, most participants reported an annual income less than $10,000 (34.42%). There were no significant differences in self-report pre-pregnancy body mass index (BMI) between intervention and control groups. Most participants in the intervention group were obese with a BMI greater than 30 $kg/m^2$ (51.92%), as were most of the participants in the control group (43.84%).

Women in both groups reported assistance programs they participated in and there were no significant differences between the groups in regards to any assistance program participation. Women, Infants & Children (WIC) participation was 70% in the intervention group and 78% in the control group. Supplemental Nutrition Assistance Program (SNAP) participation was 54% in the intervention group and 53% in the control group. Medicaid/Texas Health Steps participation was 73% in the intervention group and 68% in the control group. Medicare participation was 13% in the intervention group and 9% in the control group. Free/reduced meals at school participation was 21% in the intervention group and 16% in the control group. Children's Health Insurance Program (CHIP) participation was 11% in the intervention group and 9% in the control group.

The mean age of the intervention group was 28.4 (Standard Deviation [SD] ± 5.33) years and the mean age of the control group was 28.65 (SD ± 6.69) years. There were no significant differences in mean age between the two groups. The mean self-report pre-



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pregnancy BMI of the intervention group was 32.98 (SD ± 10.27) and the mean self-report pre-pregnancy BMI of the control group was 31.04 (SD ± 10.3). There were no significant differences between the mean self-reported pre-pregnancy BMI of the intervention and control groups. Data regarding social demographic variables can be found in Table 4.0.

***Breastfeeding Initiation***

Of the intervention group receiving the HEAL pregnancy program, 89.63% of participants reported initiating breastfeeding post-delivery. Of the control group, 84.66% of participants reportedly initiated breastfeeding. Those in the intervention group receiving HEAL pregnancy program had 1.57 times the odds of initiating breastfeeding compared to those who did not receive HEAL pregnancy program in the control group (Unadjusted Odds Ratio [OR]: 1.57, 95% Confidence Interval [CI]: 0.811-3.026, p-value=0.182). Data regarding breastfeeding initiation can be found in Table 5.0.

The results of the adjusted logistic regression analysis of breastfeeding initiation adjusting for covariates are presented in Table 6.0. Assessing the socio-demographic characteristics as covariates in the primary logistic regression analysis to assess the impact of HEAL pregnancy intervention on breastfeeding initiation, showed there was a significant variation in annual income by intervention and control group (Adjusted OR: 2.098, 95% CI: 1.292-3.406, p-value=0.003). A majority of intervention group participants who initiated breastfeeding had an annual income greater than $25,001 (43.7%). A majority of control group participants who initiated breastfeeding had an income less than $10,000 (40.95%). When analyzed by category, intervention group participants with an annual income of



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$25,000 or greater had 4.59 times greater odds of initiate breastfeeding compared to those with an income less than $10,000 (Adj, OR: 4.59, 95% CI: 1.62-12.96, p-value=0.004). Overall, there were significant differences in frequency of breastfeeding initiation between intervention and control groups when adjusting for income (p=0.002). There were no significant differences in breastfeeding initiation when adjusting for age (Adj, OR: 0.966, 95% CI: 0.731-1.276, p-value=0.807) or race (Adj. OR: 1.11, 95% CI: 0.764-1.59, p-value=0.595).

***Breastfeeding Duration***

Of the partial data analyzed, half of the intervention group participants reported breastfeeding for less than 12 weeks (50%) and half reported breastfeeding for more than 12 weeks (50%). A majority of control group participants reported breastfeeding for less than 12 weeks (67.72%). Those in the intervention group receiving HEAL pregnancy program had two times greater odds of breastfeeding for 12 weeks or longer as compared to those in the control group (Unadjusted OR: 2.056, 95% CI: 0.890-4.75, p-value=0.092). Data regarding breastfeeding duration can be found in Table 7.0.

The results of the adjusted logistic regression analysis of breastfeeding duration adjusting for covariates are presented in Table 8.0. Assessing age, race, and annual income as covariates in the primary logistic regression analysis to assess the impact of HEAL pregnancy program on breastfeeding duration, showed there was a significant variation in annual income by intervention and control group (Adj. OR: 2.377, 95% CI: 1.287-4.292, p-value=0.006). A majority of intervention group participants who reported breastfeeding longer than 12 weeks had an annual income greater than $25,001 (65%). A majority of



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control group participants who reported breastfeeding longer than 12 weeks also had an income greater than $25,001 (46.15%). Further analysis revealed those in the intervention group who had an income greater than $25,001 had 5.47 times greater odds of breastfeeding 12 weeks or longer as compare to those with an annual income less than $10,000 (Adjusted OR= 5.47, 95% OR=1.588-18.852, p=0.007). There were no significant differences in breastfeeding duration when adjusting for age (Adj, OR: 1.336, 95% CI: 0.912-1.957, p-value=0.136) or race (Adj. OR: 0.963, 95% CI: 0.624-1.486, p-value=0.865). Data results of adjusted logistic regression analysis of breastfeeding duration adjusting for covariates can be found in Table 8.0.

Table 4.0: Demographics of Intervention and Control Groups

| **Demographic Characteristics** | **Overall: n[A] (%)** | **Intervention: n (%)** | **Control: n (%)** | **p-value** |
|---|---|---|---|---|
| **Age** | | | | |
| 16-20 | 25 (7.67) | 8 (4.94) | 17 (10.37) | 0.041* |
| 21-25 | 83 (25.46) | 38 (23.46) | 45 (27.44) | |
| 26-30 | 86 (26.38) | 53 (32.72) | 33 (20.12) | |
| 31-35 | 88 (26.99) | 45 (27.78) | 43 (26.22) | |
| 36-47 | 44 (13.50) | 18 (11.11) | 26 (15.85) | |
| **Race/Ethnicity** | | | | |
| Hispanic | 119 (36.39) | 59 (36.20) | 60 (36.59) | 0.849 |
| African American | 143 (43.73) | 71 (43.56) | 72 (43.90) | |
| White | 35 (10.70) | 16 (9.82) | 19 (11.59) | |
| Other | 30 (9.17) | 17 (10.43) | 13 (7.93) | |



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|---|---|---|---|---|
| **Marital Status** | | | | |
| Married | 144 (44.31) | 72 (43.9) | 72 (44.72) | 0.882 |
| Not Married | 181 (55.69) | 92 (56.10) | 89 (55.28) | |
| **Education** | | | | |
| Never attended or attended Grades 1 to 11 | 29 (8.95) | 10 (6.17) | 19 (11.73) | 0.069 |
| Grade 12 or GED[B] | 96 (29.63) | 42 (25.93) | 54 (33.33) | |
| College 1 to 3 years | 133 (41.05) | 71 (43.83) | 62 (38.27) | |
| College 4 or more years | 66 (20.37) | 39 (24.07) | 27 (16.67) | |
| **Employment Status** | | | | |
| Working for pay | 102 (31.38) | 61 (37.20) | 41(25.47) | 0.019* |
| Not working, looking for a job | 113 (34.77) | 46 (28.05) | 67 (41.61) | |
| Not working, not looking for a job | 110 (33.85) | 57 (34.76) | 52 (32.92) | |
| **Annual Income** | | | | |
| <10,000 | 95 (34.42) | 39 (26) | 56 (44.44) | 0.013* |
| 10,001 to 25,000 | 85 (30.80) | 50 (33.33) | 35 (27.78) | |
| 25,001 to 50,000 | 74 (26.81) | 47 (31.33) | 27 (21.43) | |
| 50,001 or greater | 22 (7.97) | 14 (9.33) | 8 (6.35) | |
| **Pre-Pregnancy BMI[C] (self-report)** | | | | |
| Normal (BMI < 24.9) | 73 (24.17) | 31 (19.87) | 42 (28.77) | 0.173 |
| Overweight (BMI 25-29.9) | 84 (27.81) | 44 (28.21) | 40 (27.40) | |
| Obese (BMI >30) | 145 (48.01) | 81 (51.92) | 64 (43.84) | |



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| **Assistance Program Participation** | | | | |
| WIC (Women, Infants & Children) | 243 (74.09) | 115 (70.12) | 128 (78.05) | 0.101 |
| SNAP (Supplemental Nutrition Assistance Program) | 175(53.35) | 88 (53.66) | 87(53.05) | 0.912 |
| Medicaid/Texas Health Steps | 231 (70.34) | 120 (73.17) | 111 (67.68) | 0.276 |
| Medicare | 37 (11.28) | 22 (13.41) | 15 (9.15) | 0.222 |
| Free/reduced meals at school | 61 (18.60) | 34 (20.73) | 27 (16.46) | 0.321 |
| CHIP (Children's Health Insurance Program) | 32 (9.76) | 18 (10.98) | 14(8.54) | 0.457 |
| | | | | |
| | **Overall: n** | **Intervention: Mean ± SD[D]** | **Control: Mean ± SD** | **p-value** |
| Age in Years | 323 | 28.36 ± 5.33 | 28.65 ± 6.69 | 0.663 |
| BMI pre-pregnancy (self-report) | 305 | 32.98 ± 10.27 | 31.04 ± 10.30 | 0.099 |

A: N = Sample Size
B: GED = General Education Development
C: BMI = Body Mass Index
D: Standard Deviation
* Indicates the value is significant or $p < 0.05$. Analysis of categorical demographic variables conducted using frequency and chi-squared tests. Analysis of continuous demographic variables conducted using t-test.



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Table 5.0 - Changes in Breastfeeding Initiation due to Exposure to HEAL Pregnancy Intervention

| Breastfeeding Initiation | Intervention: n[A] (%) | Control: n (%) | Unadjusted OR[B] | 95% Confidence Interval | p-value |
|---|---|---|---|---|---|
| Yes | 147 (89.63) | 138 (84.66) | 1.57 | [0.811, 3.026] | 0.182 |
| No | 17 (10.37) | 25 (15.34) | | | |

A: N = Sample Size
B: OR = Odds Ration
* Indicates the value is significant or $p < 0.05$. Analysis conducted using logistic regression analysis

Table 6.0 - Analysis of Breastfeeding Initiation by Intervention Status when Adjusting for Age, Race, and Income

| Covariate | Breastfeeding Initiation (Intervention) n[A] (%) | Breastfeeding Initiation (Control) n (%) | Adjusted OR[B] | 95% Confidence Interval | p-value |
|---|---|---|---|---|---|
| **Age** | | | 0.966 | 0.731-1.276 | 0.807 |
| 16-20 | 7 (4.79) | 14 (10.14) | | | |
| 21-25 | 34 (23.29) | 39 (28.26) | | | |
| 26-30 | 47 (32.19) | 28 (20.29) | | | |
| 31-35 | 42 (28.77) | 36 (26.09) | | | |
| 35-47 | 16 (10.96) | 21 (15.22) | | | |
| **Race/Ethnicity** | | | 1.105 | 0.764-1.598 | 0.595 |
| Hispanic | 55 (37.67) | 49 (35.51) | | | |
| African American | 61 (41.78) | 59 (42.75) | | | |
| White | 16 (10.96) | 17 (12.32) | | | |



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|---|---|---|---|---|---|
| Other | 14 (9.59) | 13 (9.42) | | | |
| **Annual Income** | | | 2.098 | 1.292-3.406 | 0.003* |
| <10,000 | 31 (22.96) | 43 (40.95) | | | |
| 10,001 to 25,000 | 45 (33.33) | 30 (28.57) | | | |
| 25,001 or greater | 59 (43.70) | 32 (30.48) | | | |

A: N = Sample Size
B: OR = Odds Ratio
* Indicates the value is significant or $p < 0.05$. Analysis conducted using logistic regression analysis

Table 7.0: Breastfeeding Duration by Intervention Status (Partial Data from Infancy Baseline Survey)

| **Length of Breastfeeding Duration** | **Overall: n[A] (%)** | **Intervention: n (%)** | **Control: n (%)** | **Unadjusted OR[B]** | **95% Confidence Interval** | **p-value** |
|---|---|---|---|---|---|---|
| Less than 12 weeks | 57 (60.0) | 20 (50.0) | 37 (67.27) | 2.056 | 0.890-4.75 | 0.092 |
| 12 weeks or more | 38 (40.0) | 20 (50.0) | 18 (32.73) | | | |

A: N = Sample Size
B: OR = Odds Ratio
Analysis of categorical variables conducted using frequency and logistic regression analysis

Table 8.0 - Analysis of Breastfeeding Duration by Intervention Status when Adjusting for Age, Race, and Income

| **Covariate** | **Breastfed 12 weeks or more (Intervention) n[A] (%)** | **Breastfed 12 weeks or more (Control) n (%)** | **Adjusted OR[B]** | **95% Confidence Interval** | **p-value** |
|---|---|---|---|---|---|
| **Age** | | | 1.336 | 0.912-1.957 | 0.136 |
| 16-20 | 0 (0.0) | 0 (0.0) | | | |



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| | | | | | |
|---|---|---|---|---|---|
| 21-25 | 2 (10.0) | 5 (27.78) | | | |
| 26-30 | 7 (35.0) | 6 (33.33) | | | |
| 31-35 | 8 (40.0) | 5 (27.78) | | | |
| 35-47 | 3 (15.0) | 2 (11.11) | | | |
| **Race/Ethnicity** | | | 0.963 | 0.624-1.486 | 0.865 |
| Hispanic | 7 (35.0) | 5 (27.78) | | | |
| African American | 11 (55.0) | 7 (38.89) | | | |
| White | 1 (5.0) | 3 (16.67) | | | |
| Other | 1 (5.0) | 3 (16.67) | | | |
| **Annual Income** | | | | | |
| <10,000 | 2 (10.0) | 3 (23.08) | 2.377 | 1.287-4.292 | 0.006* |
| 10,001 to 25,000 | 5 (25.0) | 4 (30.77) | | | |
| 25,001 or greater | 13 (65.0) | 6 (46.15) | | | |

A: N = Sample Size
B: OR = Odds Ratio
* Indicates the value is significant or $p < 0.05$. Analysis conducted using logistic regression analysis

## DISCUSSION

This study revealed both breastfeeding initiation and length of breastfeeding duration improved among women who participated in the HEAL Pregnancy program as compared to women who did not participate in the intervention. Differences in breastfeeding initiation rates between the intervention and control groups were not significant, however we can attribute this lack of significance to ceiling effect and small sample size. The ceiling effect is important to note as overall, the majority of women in both groups initiated breastfeeding. Although difference in length of breastfeeding initiation between the intervention and control



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groups was not significant, they did approach significance. Overall, this analysis showed the HEAL pregnancy program was making an impact and reaching its target audience.

Our study saw similar results when compared to other studies measuring the impact of antenatal breastfeeding education on breastfeeding behaviors. A study conducted in the UK measured the impact of peer support worker intervention on breastfeeding initiation rates of multiethnic women attending an antenatal clinic (Macarthur, Jolly, Ingram, Freemantle, Dennis, Hanburger, … Khan, 2009). This study found the intervention had no significant impact on rates of breastfeeding initiation when comparing intervention and control groups (Macarthur et al., 2009). Researchers commented that the service may have needed to be more "intense' in order for an effect to be seen (Macarthurr et al., 2009).

Our study also did not see significant results when analyzing the intervention's impact on breastfeeding initiation, but breastfeeding initiation was positively associated with participation in the HEAL pregnancy program. Participants who initiated breastfeeding were 1.57 times as likely to have participated in the HEAL pregnancy program. When women attend HEAL sessions while pregnant, they have the opportunity to explore and learn about breastfeeding before giving birth. This free program provides women of low-SES and minority groups with education and tools to at least try breastfeeding their infant. For many women, HEAL is the only formal or informal breastfeeding education they receive. Lack of significance between the intervention and control group regarding breastfeeding initiation may be attributed to small sample size, ceiling effect, and possibly because many of the participants gave birth in the Texas Medical Center (TMC). Hospitals in the TMC practice cutting edge medicine and strongly encourage initiation of breastfeeding after birth whenever



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possible. This may have attributed to the high rate of breastfeeding initiation among both groups.

Although sociodemographic variables age, employment status, and annual income were significantly different between intervention and control groups, with adjustment, only annual income had a significant effect on breastfeeding initiation. Participants with an annual income of $25,000 or greater were 4.59 times as likely to initiate breastfeeding compared to those with an annual income less than $10,000. This finding is not a surprise as research shows women who have higher family incomes are more likely to initiate breastfeeding compared to women with lower family incomes (Heck, Braveman, Cubbin, Chavez, & Kiely, 2006).

Annual income is closely related to employment status as those who are working for pay would likely have a greater annual income than those who are not working. It is important to note women with a higher income who are employed may be employed at jobs which offer benefits like maternity leave and provide areas for mothers to pump and store breastmilk after returning work. Having a higher income is also related to having a higher level of education which has a powerful effect on breastfeeding initiation (Heck et al., 2006). Women of lower income who are working may work at jobs with irregular hours, limited or no maternity leave, and no area to pump and store breastmilk at work. Women who have lower income and do not breastfeed must rely on the more expensive alternative of formula feeding to feed their infant whereas breastfeeding is free. Yet, this finding is in line with current research showing women of lower SES are less likely to breastfeed (Heck et al., 2006).



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When data analysis was conducted on length of breastfeeding duration, we determined it would not be appropriate to display results based on the items previously identified. When conducting post-delivery surveys, many of the participants responded they were still breastfeeding their infant. The response "I am currently breastfeeding" does not provide a specific endpoint to determine length of breastfeeding duration, therefor analysis of this data would produce misleading results. We were able to analyze a portion of data from the infancy baseline survey for those participants who reported they had already stopped breastfeeding. This partial data analysis showed there were no significant differences in length of breastfeeding duration when women attended the HEAL pregnancy program, but those who breastfed longer than 12 weeks were about twice as likely to have attended HEAL pregnancy. This result is based on a small subset of a small sample and should not be interpreted as a strong indication of how antenatal breastfeeding education impacts length of breastfeeding duration. However, our results are in line with the results of similar studies.

A study conducted in Singapore in 2009, found that pregnant mothers who received individual counseling and educational breastfeeding materials practiced "exclusive and predominant" breastfeeding at 3 months, more often than mothers only receiving routine care (Matter, Chong, Chan, Chew, Tan, Chan, and Rauff, 2009) Although this study was conducted in a different country, the results demonstrate the importance of multicomponent breastfeeding interventions. As previously mentioned, a Cochrane review from 2016 detailed the importance of breastfeeding interventions having multiple components. The review found programs with a singular focus are often less successful at influencing breastfeeding behaviors than programs with a multicomponent approach (Lumbiganon, et al., 2016).



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Breastfeeding is a behavior influenced strongly by many different factors and antenatal breastfeeding education should reflect this principle. HEAL pregnancy meets the criteria of a multicomponent program by delivering antenatal breastfeeding education in multiple ways such as lactation consultant led group discussions, proper breastfeeding technique demonstrations, and providing mothers breastfeeding educational materials.

While this study looks at the importance of antenatal breastfeeding education and support, it would be remiss of us not to acknowledge the importance of ongoing breastfeeding support after birth. Fortunately, women who attend HEAL pregnancy also have the opportunity to attend HEAL infancy and can receive additional breastfeeding resources during infancy group sessions. Previous analysis of HEAL pregnancy data revealed women who completed the HEAL pregnancy program had improved breastfeeding intentions, but did not analyze actual breastfeeding behaviors (Durrani, 2017). This study takes the next step in looking at how the HEAL pregnancy program impacts breastfeeding behaviors.

HEAL was designed to reach women in need to improve both their children's health as well as their own health. The community linkages and networks formed by women who attend HEAL provide reliable resources and a support system to aid them during a vulnerable time in their lives. HEAL is an exemptional example of how programs can be designed to reach minority, low-SES women during pregnancy. Although this study focuses specifically on breastfeeding, there are many other behaviors HEAL impacts, such as physical activity and eating behaviors.



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## CONCLUSION

The results produced by this study can be viewed as an overall success in relation to the limited sample size analyzed. There is still a significant amount of work to be done to reach low-SES, minority women to impact their breastfeeding behaviors, but HEAL represents a step in the right direction. Programs such as HEAL are desperately needed to reach minority, low-SES pregnant women to improve national breastfeeding rates across all races and income levels.

Both Aim 1 and Aim 2 of this study were completed. Although our results were statistically not significant at $p<0.05$ (due to small sample size), the odds ratio of 1.57 and 2.06 for breastfeeding initiation and duration respectively, indicates a potential impact of HEAL on these behaviors. Although rates of breastfeeding initiation were higher among the intervention group compared to the control group and length of breastfeeding duration was greater in the intervention group compared to the control groups, differences were not significant.

One strength of this research is it measures and analyzes breastfeeding behavior rather than intention to breastfeed or breastfeeding self-efficacy. Antenatal breastfeeding interventions are often unable to follow and measure breastfeeding behaviors due to timing limitations of the interventions. Through the extension of the post-delivery survey, HEAL staff are able to follow and collect data on participants after they give birth. In this way, this study adds to a limited pool of research regarding antenatal breastfeeding education and breastfeeding behaviors. This study also demonstrates the need for HEAL and the importance of its continuation for not only breastfeeding behaviors but other imperative health behaviors.



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Finally, this study adds to the foundation of research conducted using HEAL data and allows stakeholders to better understand what changes need to be made to make the program better.

A major limitation of this study is that all data was self-reported. Self-report bias may be a factor and should be considered when analyzing the results of this study. The study also had a relatively small sample size. In future analysis of HEAL data, a larger sample size would be beneficial to detect significant differences in breastfeeding behavior between intervention and control groups. Another limitation was that survey questions measuring breastfeeding duration did not produce clear breastfeeding timelines. When working with mothers with infants, they may breastfeed for as long as desired by both mom and child. A retrospective measurement is important when analyzing breastfeeding behaviors. We were also unaware of any other breastfeeding education mothers may have received before or after participating in HEAL pregnancy. Finally, time was a limitation for this study as it was completed over the course of two semesters as a thesis project.

Results of this study lead us to several recommendations for future research and work. First, HEAL can serve as a model for other interventions to follow when targeting pregnant, low-SES, minority women. It revealed the need to follow moms for a longer period of time after they give birth to properly measure breastfeeding duration. In the future moms should be contacted at 6 months, 12 months, and 24 months after their delivery. Future studies should also aim to have a larger sample size. Finally, moms should receive continued support from HEAL after giving birth, even if they do not enroll in the infancy class.



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