

Exploring Connections Between Prenatal Physical Activity and Breastfeeding

A Thesis Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Emily Alexandria Tucker

August 2015

Abstract

Women who decide to engage in prenatal physical activity are giving themselves, and their child, an advantage over those who are not physically active during pregnancy; not only are there significant health benefits for mothers, but also there are great benefits for the unborn child. Breastfeeding is another important decision parents make that can impact the future health of their children. There has been extensive research on the benefits of both prenatal physical activity and breastfeeding, but the connection between the two is unclear. The purpose of this grounded theory study was to identify potential connections between factors influencing women's decisions to engage in prenatal physical activity and breastfeeding among mothers in a medium sized city in Tennessee. Responses from mothers revealed numerous themes related to both prenatal physical activity and breastfeeding. Among these themes, mothers spoke most frequently about the benefits involved with prenatal physical activity and breastfeeding for both the mother and infant. Connections between prenatal physical activity and breastfeeding were identified through several themes including: healthy lifestyles, benefits associated with prenatal physical activity and breastfeeding, knowledge and research evidence, and the naturalness of prenatal physical activity and breastfeeding. An over-arching theme that captured the women's collective experience and stories was determination.

Key words: prenatal physical activity, breastfeeding, health

Table of Contents

CHAPTER 1: Introduction.....	1
CHAPTER 2: Literature Review.....	4
Benefits of prenatal physical activity.....	4
Prenatal physical activity rates and recommendations.....	7
Factors influencing prenatal physical activity.....	9
Benefits of breastfeeding.....	11
Breastfeeding rates and recommendations.....	13
Factors influencing breastfeeding.....	16
Connections between prenatal physical activity and breastfeeding.....	19
CHAPTER 3: Manuscript.....	23
REFERENCES.....	65
APPENDICES.....	77
Flyer.....	78
Email recruitment.....	79
Screening interview.....	80
Informed consent form	81
Modifiable Activity Questionnaire.....	83
Demographic Survey.....	84
Interview questions.....	87
VITA.....	88

Chapter 1

Introduction

Parenting is one of the most influential relationships in which humans engage. As a parent there are many decisions that will be made, but one of the first decisions made is whether or not to breastfeed. Before a woman can have the opportunity to choose whether or not to breastfeed, a woman must first decide how she will take care of herself and the growing baby during pregnancy. Women who decide to engage in prenatal physical activity are giving themselves, and their child, a huge advantage over those who are not physically active during pregnancy; not only are there significant health benefits for mothers, but also there are great benefits for the unborn child (Field, 2011; Field, Diego, Hernandez-Reif, Medina, Delgado, & Hernandez, 2012). Breastfeeding is an important decision parents make that can impact the future health of their children (Bain, Awah, Geraldine, Kindong, Sigal, Bernard, & Tanjeko, 2013). There has been extensive research on the benefits of both prenatal physical activity and breastfeeding, but the connection between the two is unclear.

The purpose of this grounded theory study was to identify potential connections between factors influencing the decisions to engage in prenatal physical activity and breastfeeding among mothers in a medium sized city in Tennessee. The term prenatal physical activity is used throughout this thesis, rather than prenatal exercise, because the U.S. Department of Health and Human Services uses the term physical activity in their recommendations (US Department of Health and Human Services, 2008). Also, physical activity is used because it is a more general term that encompasses exercise. For the purposes of this study, physical activity included bouts of activity that require the individual to be moving for at least 10 minutes of time rather than sitting or being sedentary.

The focus of this study was to interview women who participated in physical activity an average of twice a week throughout at least two trimesters of their pregnancy and who were currently breastfeeding an infant. The connections between the factors influencing the decision to engage in physical activity during pregnancy and to breastfeed were explored through semi-structured interviews. Identifying connections behind the factors that influence these two decisions is important for mothers and their infants. Research has demonstrated that there are many unique benefits attached to both prenatal physical activity and breastfeeding. Identifying these connections may help researchers gain a better understanding about why some women are physically active during pregnancy and decide to breastfeed and others do not. A better understanding of what influences mothers to engage in both of these activities can aid in developing more effective intervention programs to increase the number of women engaging in both.

This study was rooted in a grounded theory approach. Specifically, constructivist grounded theory guided this study (Charmaz, 2006). Constructivist grounded theory was used because it is my ontological belief that multiple realities exist and are constructed through lived experiences and interactions with others. Also, in line with constructivist grounded theory, the individual's values were respected and reported through this research as a collaborative process. Emerging from interview data, a descriptive model was developed to depict the connections between factors influencing prenatal physical activity and breastfeeding. This theory was grounded in and emerged from the responses and viewpoints of the participants. Symbolic interactionism was used as a lens to guide this study. The aims of this study were in line with the tenants of symbolic interactionism, which are to understand the complex world we live in through the lived experiences and interactions with others (Schwandt, 1994). Through the lived

experiences of the participants, as revealed in their interview responses, a descriptive model was used to report the connections between factors influencing prenatal physical activity and breastfeeding.

Chapter 2

Literature Review

Benefits of prenatal physical activity

There are several benefits related to prenatal physical activity. In a systematic literature review, Field (2011) found that participating in yoga resulted in a lower heart rate and lower blood pressure, as well as reducing risks of complications such as pregnancy-induced hypertension. Field's (2011) review revealed that moderate level of physical activity, referred to as a moderate exercise routine in this review, was positively related to normal infant birth weight, but only if the mother's exercise level was decreased later in pregnancy. Furthermore, though benefits varied by type and intensity of physical activity, there were clear benefits for both women and children (for review see Field, 2011). The most consistent benefits for pregnant women have been associated with a low-to-moderate physical activity regiment, especially for those women with a higher than normal body mass index (Guendelman, Pearl, Kosa, Graham, Abrams & Kharrazi, 2013). For example, in a population-based case-controlled study which involved interviewing 344 women, Guendelman and colleagues (2013) found that women who participated in moderate physical activity during pregnancy were less likely to have preterm deliveries (i.e., less than 37 gestational weeks).

Lowering the risk of preterm delivery is very important as more than 500,000 infants in the U.S. are born preterm each year (Hamilton, Martin & Ventura, 2009; Behrman & Butler, 2007). Not only does this pose an increased risk of neonatal death, but also preterm deliveries have accounted for over one-third of infant deaths during the first year of life, which cost at least \$26 billion annually (Guendelman et al., 2013). Those children that survive preterm delivery, even as late as 35-36 weeks, were at a higher risk of experiencing developmental complications

such as physical and mental disabilities, cognitive, neurological and behavior impairments that become evident when they reach school age (Guendelman et al., 2013).

Furthermore, the mother's health during pregnancy has an impact on the fetus's health. Mothers who engage in prenatal physical activity provide benefits not only for themselves but also for their growing child. Engaging in light-to-moderate or vigorous prenatal physical activity has been associated with lower risks of gestational diabetes mellitus (GDM), abnormal glucose tolerance, and risks of pre-eclampsia (Marcoux, Brisson, & Fabia, 1989; Oken, Ning, Rifas-Shiman, Radesky, Edwards, & Gillman, 2007; Sorensen, Williams, Lee, Dashow, Thompson, & Luthy, 2003). Gestational diabetes mellitus is one of the most common complications pregnant women in the United States face (Oken et al, 2007). The number of women affected by GDM has continued to increase in conjunction with the growing numbers of obese women at reproductive age (Albrecht et al., 2004; Dabelea et al., 2005; Ferrara, Kahn, Quesenberry, Riley, & Hedderson, 2004). Additionally, pre-eclampsia is a serious maternal-fetal disease that involves consistent high blood pressure accompanied with proteinuria, which results in serious health risks for both mother and fetus (Weissgerber, Wolfe, Davies & Mottola, 2006).

Gestational diabetes mellitus has been associated with complications during pregnancy as well as long-term risks for both mother and child (Gestational diabetes, 2001; Oken & Gillman, 2003). GDM is associated with an increased risk for perinatal morbidity, impaired glucose tolerance and type-2 diabetes for the mother in the years following pregnancy; additionally, children whose mothers had GDM are more likely to be obese, have impaired glucose tolerance, and have diabetes in childhood and early adulthood (American Diabetes Association, 2004; McMahon, Ananth, & Liston, 1998). A systematic review and meta-analysis on the effect of treatments for GDM, showed that pharmaceutical interventions, diet changes, glucose

monitoring, and insulin, did not significantly reduce the risk for adverse perinatal and neonatal outcomes (Horvath, Koch, Jeitler, Matyas, Bender, Bastian, Lange, & Siebenhofer, 2010).

Results from a systematic review and meta-analysis found that greater total physical activity before pregnancy or during pregnancy was significantly associated with a lower risk of GDM (Tobias, Zhang, van Dam, Bowers & Hu, 2011). Prenatal physical activity appears to be a key factor in reducing GDM and risks associated with GDM for both the mother and child.

Pre-eclampsia has the potential to put both mother and child at an increased risk for several serious complications. Complications include, but are not limited to, pre-term birth, abruption placenta, renal failure, pulmonary edema, cerebral hemorrhage, circulatory collapse, eclampsia, and immediate delivery regardless of gestational age (Roberts and Lain, 2002; Weissgerber et al., 2004). A case-controlled study consisting of 201 pre-eclamptic and 383 normotensive pregnant women assessed the relationship between physical activity and pre-eclampsia (Sorensen et al., 2003). Sorensen and colleagues found an association between regular physical activity during pregnancy, at any intensity, and a 35% reduced risk of pre-eclampsia when compared to inactive women. Furthermore, light or moderate activity was associated with a 24% reduced risk of pre-eclampsia and a 54% reduction for women who engaged in vigorous activity when compared with inactive women (Sorensen, et al., 2003). Additionally, brisk walking was associated with a 30% to 33% reduced risk for pre-eclampsia when compared to women who did not walk at all (Sorensen et al., 2003). It appears that an inverse relationship between prenatal physical activity and risk for pre-eclampsia (Marcoux et al., 1989; Sorensen et al., 2003; Weissgerber et al., 2006).

Field and colleagues (2012) found that prenatal physical activity, referred to as exercise in their study, was associated with reduced anxiety and depression in pregnant women.

Furthermore, maternal anxiety and depression have been shown to affect fetal activity, as fetuses of more anxious and depressed women have been found to be more active in the womb, indicating that the psychological dynamics of the mother may influence the womb environment (Van den Bergh, Mulder, Mennes & Glover, 2005). Physical activity has been found to reduce both anxiety and depression in pregnant women, giving exercise an important role in keeping both the mother and the fetus healthy. Qi is an exercise technique comprised of three main components, stretching, breathing and meditation; it aims to facilitate the mind's ability to affect body functioning and health (Beddeo & Lee, 2008). Meditative physical activity practices such as Qi have been shown to reduce depressive and anxiety symptoms in mothers (Ji & Han, 2010). It has been suggested that participating in Qi helps create a stable environment for the fetus to develop as well as increasing the sensitivity of the mother to her fetus (Shin, Park, Ryu, & Seomun, 2008).

Prenatal physical activity rates and recommendations

The Department of Health and Human Services (DHHS) has stated that it is beneficial for healthy pregnant women to be physically active (US DHHS, 2008). According to the 2008 Physical Activity Guidelines for Americans, healthy women should to get at least 150 minutes (2 hours and 30 minutes) per week of moderate-intensity aerobic activity, with bouts of activity lasting for at least 10 minutes at a time (US DHHS, 2008). The DHHS recommends women spread this time throughout the week as long as women were active for at least 10 consecutive minutes at a time (US DHHS, 2008).

Currently the rates for prenatal physical activity are not clear. Results from a 28-item questionnaire completed by 211 patients at a private Obstetric and Gynecology group practice showed that the majority of women in the study were encouraged by doctors to engage in

prenatal physical activity (Krans et al., 2005). Krans and colleagues (2005) found that 92% of women who spoke with their doctors about prenatal physical activity were encouraged to engage in prenatal physical activity, but a review of the literature by Field (2011) revealed that only approximately 40% of women are typically physically active during pregnancy. In fact, several studies have reported that only 40% of women were active during pregnancy (for review see Field, 2011; for review see Poudevigne & O'Connor, 2006; Zhang & Savitz, 1996). This number appears to be accurate considering that the CDC reported only 42.6% of women living in the United States met the 2008 Physical Activity Guideline for aerobic activity (Center for Disease Control and Prevention (CDC), 2014). Non-Hispanic white adults, younger adults, adults with more education and those adults whose family income is above the poverty level were more likely to meet the 2008 Physical Activity Guideline for aerobic activity (CDC, 2014), but it is unknown whether this is true for pregnant women in particular.

The American College of Obstetricians and Gynecologists (ACOG) has provided a set of recommendations for physical activity during pregnancy. The ACOG recommended that women with low-risk pregnancies engage in moderate-intensity physical activity for 30 minutes or more each day on most (if not all) days of the week (American College of Obstetricians and Gynecologists, 2002). According to a study that consisted of telephone interviews with 1979 pregnant women between the ages of 18 and 44 years of age, 15.8% of pregnant women met the physical activity guidelines outlined by the ACOG (Evenson, Savitz, & Huston, 2004). Regardless of which recommendations are considered, it appears that pregnant women are falling short of meeting these requirements.

Factors influencing prenatal physical activity

A study by Krans and colleagues (2005) found a significant correlation between maternal beliefs about the benefits of prenatal physical activity, referred to as exercise in this study, and whether or not women chose to be physically active while pregnant. Responses from a 28-item questionnaire completed by 211 women revealed that though these women were encouraged to be physically active, few women were given help in creating a physical activity program (Krans, et al., 2005). This study found that the following factors encouraged pregnant women to be physically active: support from family and household members, availability of child care, and improved self-efficacy beliefs tied to physical activity (Koh, Miller, Marshall, Brown & McIntyre, 2010; Pereira et al., 2007). Studies examining prenatal physical activity have also found improvements in overall mood, increases in energy, and more effective weight control were major factors associated with women's physical activity level during pregnancy (Cioffi et al., 2010; Clarke & Gross, 2004).

Personal beliefs surrounding prenatal physical activity have appeared to be influential in women's decisions to be physically active during pregnancy. Examination of self-reported beliefs from 1,306 pregnant women about physical activity revealed that most women believed they could continue to be physically active during pregnancy and that they agreed that women who were never physically active before pregnancy could begin to be active during pregnancy (Evenson & Bradley, 2010). Though most women believed that being physically active during pregnancy was possible regardless of pre-pregnancy physical activity, very few women believed that pregnant women should continue to be active once they became fatigued (Evenson & Bradley, 2010). Women were also found to have differing opinions about the appropriate level of prenatal physical activity based on their stage of pregnancy and their intensity of involvement

in physical activities (Evenson & Bradley, 2010). Women that were physically active during their second trimester were much more likely to report that being physically active during pregnancy had positive benefits when compared to women who were not physically active during the second trimester (Evenson & Bradley, 2010). Believed benefits of prenatal physical activity also varied by vigor of activity (Evenson & Bradley, 2010). Most women sampled in study agreed that there were benefits associated with light activity while fewer believed that benefits were associated with moderate or vigorous activity (Evenson & Bradley, 2010). Furthermore, self-reported responses from 158 pregnant women revealed that women believed low intensity programs were generally considered safe during pregnancy, but many women had concerns about more than five sessions of activity per week (Duncombe, Wertheim, Skouteris, Paxton & Kelly, 2009).

Though there are many benefits to being physically active during pregnancy, barriers exist that deter women from deciding to engage in prenatal physical activity. Social, psychological and physical factors have been thought to deter pregnant women from being physically active (Clarke & Gross, 2004). Responses from 57 first-time pregnant women participating in semi-structured interviews revealed that many women were focused on the risks they thought were involved in prenatal physical activity, and tended to see sleep and rest as very important during pregnancy (Clarke & Gross, 2004). Responses from these women also revealed that a lack of access to facilities and a lack of knowledge and help implementing/creating programs also deterred women from being physically active during pregnancy (Clarke & Gross, 2004). Findings from 158 pregnant women participating in a self-report study at three time points during pregnancy also found that women were focused on the risks they thought were involved in prenatal physical activity and that this deterred them from

being physically active during pregnancy (Duncombe et al., 2009). Furthermore, responses from 74 postpartum women revealed that the following physical factors were seen as barriers to prenatal physical activity: tiredness/fatigue, physical limitations, or restrictions and gaining weight (Symons Downs & Hausenblas, 2004).

Benefits of breastfeeding

Breastfeeding provides immense benefits for both women and their children (for review see Stuebe, 2009). Breast milk is uniquely suited to the human infant's nutritional needs and produces unparalleled immunological and anti-inflammatory properties that protect against a host of illnesses and diseases for both mothers and children (Lawrence & Lawrence, 2010). The release of oxytocin caused by the suckling of the baby ignites uterine contractions that help prevent postpartum hemorrhaging and aid in involution (when the uterus returns to a non-pregnant state) (Lawrence & Lawrence, 2010). Consistent and exclusive breastfeeding also delays the return of menstrual periods, allowing the mother to conserve iron as well as perhaps aiding in a natural space between pregnancies (Kennedy, Rivera & McNeilly, 1989, for review see King, 2007).

Breast milk helps to build the immune system and thus protects infants from a host of health risks. Antibodies are present in breast milk that help protect against infections after birth (McDowell, Wang, & Kennedy-Stephenson, 2008). A meta-analysis revealed that children who were breastfed exclusively and for longer periods of time were at lower levels of risk than those who were never breastfed or breastfed for a short amount of time (for a review see Chung, Raman, Chew, Magula, DeVine, Trikalinos, & Lau, 2007). The decreased risks were for lower respiratory tract infections, asthma, obesity, type I and II diabetes, childhood leukemia, and Sudden Infant Death Syndrome (for a review see Chung et al., 2007).

Breast milk is a protective agent for infants, as it aids in the prevention of both malnourishment and obesity (Owen, Martin, Whincup, Smith & Cook, 2005). A review article by Owen and colleagues (2005) found breastfeeding to be associated with a reduced risk of obesity when compared to formula feeding. Of the sixty-one studies, twenty-eight comprised of 298,900 subjects, revealed that breastfeeding was associated with a reduced risk of obesity as compared to formula fed infants (Owen et al., 2005). This review article found that studies with fewer than 500 participants had a strong association with reduced risks of obesity in breastfed infants, but the association was still present in larger studies with more than 500 participants (Owen et al., 2005). Furthermore, the inverse relationship between breastfeeding and obesity appeared to be stronger for those infants that were breastfed for longer periods of time (Owen et al., 2005).

Formula feeding, when compared to exclusive breastfeeding, has been associated with short-term and long-term risks for both children and mothers. Some risks associations with formula feeding include common childhood infections, such as diarrhea and ear infections, as well as being at higher risk of chronic diseases such as type 2 diabetes, asthma, and childhood obesity than children who are breastfed (for review Arenz, Ruckerl, Koletzko & von Kries, 2004; Chien & Howie, 2001; Chung et al., 2007; Owen, Martin, Whincup, Smith & Cook, 2005). Women who have never breastfed are at a higher risk of breast cancer and are at a 27 percent higher risk of having ovarian cancer than those women who breastfed for a period of time (Bernier, Plu-Bureau, Bossard, Ayzac, & Thalabard, 2000; Collaborative Group on Hormonal Factors in Breast Cancer, 2002; Chung et al., 2007). The various risks associated with formula feeding underscore the importance and benefit of breastfeeding for both infants and mothers.

Breastfeeding rates and recommendations

Due to the immense benefits associated with breastfeeding, women are currently encouraged to breastfeed their infants. The World Health Organization (WHO) and the American Academy of Pediatrics (AAP) both recommend that mothers exclusively breastfeed their infants for 6 months (Eidelman, Schanler, Johnston, Landers, Noble, Szucs & Viehmann, 2012; U.S. Department of Health and Human Services, 2011). Mothers are considered to be exclusively breastfeeding when their child does not ingest any food or beverage besides breast milk (U.S. DHHS, 2011). While both organizations recommend supplemental feeding after 6 months, the WHO recommends that breastfeeding continue through at least 24 months of age, while the AAP recommends that mothers continue breastfeeding through at least 12 months of age (Eidelman et al., 2012; U.S. DHHS, 2011).

The U.S. Department of Health and Human Services has provided science-based, ten-year national objectives for improving the health of all Americans called “Healthy People.” The Healthy People 2020 breastfeeding objectives include increasing the number of children ever breastfed to 81.9%, increasing the number of children being breastfed at 6 months to 60.6%, increasing the number of children being breastfed at 1 year to 34.1%, increasing the number of children being breastfed exclusively for 3 months to 46.2%, and the number of children being exclusively breastfed for 6 months to 25.5% (U.S. Department of Health and Human Services 2010). Despite recommendations by the WHO and AAP and the many diverse benefits connected to breastfeeding, the national average of women breastfeeding in the U.S. is lower than the goals set by the U.S. Department of Health and Human Sciences. In 2007 the national average for initiating breastfeeding was approximately 76% and the proportion of women breastfeeding exclusively at 6 months is significantly lower at approximately 16% (U.S. DHHS,

2011; Lynch, Bethel, Chowdhury, & Moore, 2012). However, over the last few decades the breastfeeding rates in the United States have improved overall, but disparities in breastfeeding rates by race/ethnicity, socioeconomic characteristics and geography have persisted (U.S. DHHS, 2011). In the Surgeon General's Call to Action to Support Breastfeeding, the U.S. Department of Health and Human Sciences reported that black infants have about a 50% lower breastfeeding rate than white infants at birth, at six months, and at 12 months, even when controlling for income and education level (U.S. DHHS, 2011). On the other hand, the disparities in initiation between black and white mothers is less significant with only 18% more white mothers initiating when compared to black mothers (U.S. DHHS, 2011). A nationwide study showed that overall, mothers of non-Hispanic black children were less likely to initiate and maintain breastfeeding than were non-Hispanic white mothers (Li, Darling, Maurice, Barker, & Grummer-Strawn, 2005). Furthermore, this study found the greatest breastfeeding disparities between non-Hispanic black mothers when compared to both non-Hispanic white mothers and Hispanic mothers (Li et al., 2005).

Maternal employment is also thought to play a role in breastfeeding rates (Oyeku, 2003) and mothers who expect to return to work quickly may choose to never initiate breastfeeding. Research has shown that returning to work is related to an early discontinuation of breastfeeding, but supportive work environments can make a difference in whether or not mothers continue breastfeeding (Fein, Mandal, & Roe, 2008; Ortiz, McGilligan, & Kelly, 2004; Ryan, Wenjun, & Acosta, 2002). Though returning to work and working were associated with early discontinuation of breastfeeding, income level was also positively associated with breastfeeding. Research has shown that middle- and upper-income families are more likely to breastfeed than those families participating in income-based governmental assistant programs such as the U.S. Department of

Agriculture's (USDA) Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (CDC, 2007; Ryan et al., 2002). In conjunction with a positive relationship between income and breastfeeding rates, educational status was also positively associated with breastfeeding rates. In the Surgeon General's Call to Action to Support Breastfeeding, the U.S. Department of Health and Human Services reported that women with less than a high school education were less likely to breastfeed than those who have earned a college degree (U.S. DHHS, 2011).

Geographic location has also been linked to breastfeeding rates; women in the southeastern United States were less likely to initiate and continue breastfeeding than women living in other areas of the country (Centers for Disease Control and Prevention, 2013). Similarly, women living in rural areas were less likely to initiate and continue breastfeeding than women living in urban areas (CDC, 2007; Center for Disease and Control, 2008). According to the 2014 Breastfeeding Report Card provided by the National Center for Chronic Disease Prevention and Health Promotion, 74.9% of children were breastfed for some period of time (even if only once) in the state of Tennessee. Furthermore, within two days of birth 14.6% of all infants in Tennessee have had formula (CDC, 2014). Breastfeeding rates in Tennessee further drop at six months to 40.7% and even further at twelve months to 20.9% (CDC, 2014). When looking at exclusive breastfeeding rates, the numbers were even lower with only 39.1% percent of children being exclusively breastfed through 3 months and only 15.4% being exclusively breastfed through 6 months in Tennessee (CDC, 2014). Considering the many benefits of breastfeeding for both the mothers and the children, it continues to be important to increase understanding of what motivates women to breastfeed and what deters women from breastfeeding, and the connections breastfeeding decisions may have with other health promoting

behaviors.

Factors influencing breastfeeding

There are many factors that influence a mother's decision to breastfeed or formula feed. In fact, Earle's (2000) qualitative study of women in the UK, revealed that feeding practices were considered within the first few weeks of pregnancy. Earle (2000) also noted that women often made decisions about feeding practices on their own without consulting with their health care provider. Qualitative and quantitative responses about breastfeeding intentions from 230 first-time mothers revealed that personal, cultural, social and environmental contexts commonly influenced decisions about breastfeeding (Kong & Lee, 2004). Furthermore, when these first-time mothers were asked to report what factors influenced their breastfeeding decision the most, mothers reported their "own decision" as most important, followed by "husband's advice" as the second most influential aspect of the decision making process (Kong & Lee, 2004).

Several personal factors also have appeared to impact decisions about breastfeeding. Kong and Lee (2004) found that over 90% of women in their study felt that breastfeeding would make their baby closer to them and over 75% of mothers believed that breastfeeding would make them feel important. These findings suggested that a sense of self-worth was related to the breastfeeding process and impacted a woman's decision to breastfeed (Kong & Lee, 2004). In addition to the personal aspects of the breastfeeding decision, social factors also have been found to have an impact on breastfeeding decisions. First-time mothers from this study reported that perceived support from their husbands was a very important aspect of their breastfeeding experience (Kong & Lee, 2004). Mothers additionally signified that successful breastfeeding experiences were related to support from social networks (Kong & Lee, 2004). A longitudinal study with 562 women found that other personal components, such as convenience, enjoyment,

and the economic benefits of breastfeeding, were also been reported as influencing mothers' decisions to breastfeed (Brodrribb, Fallon, Hegney & O'Brien, 2007).

The decision to breastfeed was most often made in the first trimester of pregnancy and one of the top factors impacting mothers' decisions was the desire to bond with their child (Arora, McJunkin, Wehrer, & Kuhn, 2000; Kong & Lee, 2004). In a study exploring minority teen mothers' breastfeeding perceptions, Hannon and colleagues (2000) revealed that the choice to breastfeed or formula feed was based on multiple influences including the facilitation of maternal-child bonding. A systematic review of recent literature revealed that the mother-infant relationship starts to develop before the child is born and that the mother-infant relationship has a large impact both on the development of the child and the decision to breastfeed (For a review see Alhusen, 2008). Furthermore, results from 38 women between 32 and 38 weeks pregnant revealed that higher levels of maternal-fetal attachment, measured by the Maternal-Fetal Attachment (MFA) scale, have been positively associated with intentions to breastfeed (Foster, Slade & Wilson, 1996).

Responses from women in Earle's (2000) study revealed that regardless of their choice to breastfeed or formula feed, women were aware of the benefits of breastfeeding. Brodrribb and colleagues' (2007) study of 562 women revealed that knowledge of the benefits of breastfeeding was one of the most common reasons that women gave for breastfeeding. Furthermore, they found that beliefs about increased immunity against disease as well as allergies were major factors in the decision to breastfeed (Brodrribb et al., 2007). In a study of first-time mothers, Kong and Lee (2004) concluded that increased knowledge of it encouraged breastfeeding, while those women who knew less about breastfeeding were more likely to formula feed.

In Earle's (2000) study, women reported that they were aware of the benefits, but many

were unsure about their abilities to breastfeed. Common beliefs, held by both mothers and their community, about a mother's ability to breastfeed when potential problems occur have led some women to worry about whether or not they will be able to successfully breastfeed if problems do occur (e.g., Earle, 2000; Kong & Lee, 2004). Some common problems include beliefs about milk supply, latching issues, clogged ducts, and mastitis. In addition to the potential benefits of breastfeeding for the baby, many women from Earle's (2000) study described in their pregnancy interviews that breastfeeding would be beneficial for them as well as their baby.

Maternal characteristics and personal experiences also influenced breastfeeding decisions. For example, responses from 247 mothers revealed that differences in breastfeeding decisions have been associated with maternal age, socio-economic status, and educational attainment (Sloan, Sneddon, Stewart & Iwaniec, 2006). Responses from these mothers also indicated that women who initiated breastfeeding were significantly older than those who formula fed (Sloan, et al., 2006). The women with higher educational levels and income levels were more likely to breastfeed than mothers with less education and lower income levels (Sloan, et al., 2006). Responses from these women indicated that women with a higher socio-economic status (indicated by occupation group level) were more likely to breastfeed, with 81% of mothers in a higher occupational status group breastfeeding, 57% of those in intermediate groups, and 55% of those with lower occupational status breastfeeding (Sloan, et al., 2006). Furthermore, women who reported previous negative breastfeeding experiences were found to be less likely to breastfeed with their next child/children and first-time mothers were found to be more likely to breastfeed than mothers with more than one child (Sloan, et al., 2006).

Breastfeeding provides unique benefits for both mothers and infants. The current literature described a wide range of short-term and long-term health benefits for both mothers

and children. Based on the current breastfeeding rates in the United States, and specifically in Tennessee, it appears that there needs to be more attention given to what factors influence mothers to initiate and continue to breastfeed. Research suggests that mothers with more knowledge are more likely to breastfeed, as well as mothers who believe that breastfeeding is being beneficial to both themselves and their child. Breastfeeding decisions have implications for both the mother and the child; therefore, it is important to gain an understanding of what other lifestyle choices may influence this decision, like prenatal physical activity. Currently, there is a growing body of research focused on the benefits of prenatal physical activity for both the mother and child, which would suggest that perhaps both breastfeeding and prenatal physical activity could provide unique benefits to both mothers and their infants. More research is needed to determine if prenatal physical activity and breastfeeding practices are connected and what this connection entails.

Connections between prenatal physical activity and breastfeeding

Though direct connections between prenatal physical activity and breastfeeding have not been studied, both behaviors have been linked independently to maternal-fetal bonding and attachment. Women commonly consider mother-child bonding when deciding whether or not to breastfeed. For example, a study by Hannon and colleagues (2000) revealed that the choice to breastfeed or formula feed was based on multiple influences including the facilitation of maternal-child bonding. Maternal-fetal attachment and bonding begins during pregnancy and continues to develop after the child is born and it has been observed that mothers with a positive maternal-fetus relationship were more likely to choose breastfeeding (Hannon et al., 2000). Furthermore, responses from a study with 38 women between 32 to 38 weeks pregnant revealed that higher levels of maternal-fetal attachment were associated with intentions to breastfeed

(Foster, Slade & Wilson, 1996). Though there is little research on the implications of maternal-fetal attachment and intentions to breastfeed, the literature that does exist has suggested that those with a higher maternal-fetal attachment were more likely to breastfeed. Among the many factors that influence women to want to breastfeed, one influential factor was that they believe it would help foster an emotional bond with their child.

Research has shown that the mother-infant relationship begins to develop before the child is born and that the quality of the mother-infant relationship has an impact on the development of the child and the decision to breastfeed (Alhusen, 2008). Factors such as depression, anxiety, and substance abuse have been identified as threatening maternal-fetal attachment (Alhusen, 2008). Research has also shown that prenatal physical activity can help to reduce anxiety and depression among pregnant women (Field et al., 2012). Results from these studies suggested that women who were physically active during pregnancy had lower instances of anxiety and depression, therefore making them more likely to have a stronger maternal-fetal attachment.

Another study addressed the effects of Qi, an exercise rooted in yoga practices, on maternal-fetus interactions (Ji & Han, 2010). Women who participated in a Qi intervention were found to have both higher levels of maternal-fetal interactions and lower levels of depressive symptoms than those women who did not experience the Qi intervention (Ji & Han, 2010). This study found a positive association between frequency of maternal-fetus interactions and fetal development, emotional well-being of the mother, as well as mother-infant interactions after delivery (Ji & Han, 2010). It has also been suggested that participating in Qi helped create a stable environment for the developing fetus as well as increasing the sensitivity of the mother to her fetus (Shin et al., 2008).

Maternal psychological and physical well-being have been associated with maternal-fetal

interactions and has been shown to predict the nature of mother-child emotional relationship (Dieter et al., 2001). Furthermore, maternal anxiety and depression have been linked to fetal activity as revealed by ultra sounds (Van den Bergh et al., 2005). Fetuses of more anxious and depressed women have been found to be more active in the womb, indicating that the psychological issues of the mother may affect the fetus (Van den Bergh et al., 2005). This finding reveals the importance of the psychological and physiological well-being of the mother and the potential impact on the fetus.

Physical activity has been associated with reduced anxiety and depression in pregnant women, giving physical activity a potentially important role in keeping both the mother and the fetus healthy. These studies have revealed the many benefits of prenatal physical activity for both maternal and fetal health as well as mother-fetus bonding. Currently the only possible connection found between prenatal physical activity and breastfeeding is through maternal-fetal interaction and attachment. More research needs to be conducted to examine the possible connections between the factors that influence both prenatal physical activity and breastfeeding practices.

Prenatal physical activity has many physical and mental health benefits for both mothers and fetuses. Prenatal physical activity has been shown to aid in preventing several life threatening conditions for the infant, such as low birth weight and preterm delivery (Guendelman et al., 2013). Mothers also benefit from prenatal physical activity has been shown to aid in the reduction of many psychological challenges of pregnancy as well as many physical health risks mothers might experience during pregnancy (Field et al., 2012; Ji & Han, 2010). Both prenatal physical activity and breastfeeding appear to be protective practices for both the mother and the infant. Currently, the literature and research on prenatal physical activity and breastfeeding run

parallel to each other with no research examining how the two practices may be connected.

Finding factors that influence both prenatal physical activity and breastfeeding practices could provide a novel launching point for more effective intervention programs and thereby potentially enhance the health of mothers and infants

Chapter 3
Manuscript

University of Tennessee Knoxville
For submission to the journal of *Qualitative Health Research*

Abstract

Women who decide to engage in prenatal physical activity are giving themselves, and their child, an advantage over those who are not physically active during pregnancy; not only are there significant health benefits for mothers, but also there are great benefits for the unborn child. Breastfeeding is another important decision parents make that can impact the future health of their children. There has been extensive research on the benefits of both prenatal physical activity and breastfeeding, but the connection between the two is unclear. The purpose of this grounded theory study was to identify potential connections between factors influencing women's decisions to engage in prenatal physical activity and breastfeeding among mothers in a medium sized city in Tennessee. Responses from mothers revealed numerous themes related to both prenatal physical activity and breastfeeding. Among these themes, mothers spoke most frequently about the benefits involved with prenatal physical activity and breastfeeding for both the mother and infant. Connections between prenatal physical activity and breastfeeding were identified through several themes including: healthy lifestyles, benefits associated with prenatal physical activity and breastfeeding, knowledge and research evidence, and the naturalness of prenatal physical activity and breastfeeding. An over-arching theme that captured the women's collective experience and stories was determination.

Keywords

Breastfeeding, physical activity, grounded theory, health behavior, infants, semistructured interviews, mothers, parenting, perinatal health, pregnancy, social support, women's health

Prenatal physical activity and breastfeeding not only impact the first years of life, but also the long-term health of both the mother and her child (Bernier, Plu-Bureau, Bossard, Ayzac, & Thalabard, 2000; for a review see Chung et al., 2007; Collaborative Group on Hormonal Factors in Breast Cancer, 2002; Guendelman, Pearl, Kosa, Graham, Abrams & Kharrazi, 2013). The present study is one of the first studies aimed at identifying the connections between the decision to engage in prenatal physical activity and to breastfeed. Though there has been extensive research on the benefits associated with prenatal physical activity and breastfeeding for both mothers and infants, most women in the U.S. fail to meet both the prenatal physical activity and breastfeeding recommendations set forth by the United States Department of Health and Human Services (U.S. DHHS), the World Health Organization (WHO), the American College of Obstetricians and Gynecologists (ACOG), and the Academy of American Pediatrics (AAP) (American College of Obstetricians and Gynecologists, 2002; Eidelman, Schanler, Johnston, Landers, Noble, Szucs & Viehmann, 2012; Lawrence & Lawrence, 2010; Lynch, Bethel, Chowdhury, & Moore, 2012; for review see Stuebe, 2009; U.S. Department of Health and Human Services (U.S. DHHS), 2011).

Gaining a better understanding of why women engage in both of these activities and the connections between the two could help to inform existing programs and could aid in developing more effective interventions to increase the number of women engaging in prenatal physical activity and breastfeeding. Increasing the number of mothers who engage in prenatal physical activity and who breastfeed has the potential to boost the immune systems of subsequent generations, reduce the numbers of women afflicted with breast and cervical cancer, and reduce the number of obese and overweight children and mothers (for reviews see Owen, Martin, Whincup, Smith, & Cook, 2005; Stuebe, 2009). Considering the fact that obesity is one of the

leading health issues in the United States today, finding a way to increase the number of women engaging in both activities could potentially help reduce the severity of this health problem.

Parenting is one of the most influential relationships humans engage in and helping mothers make healthier decisions in the earliest phases of the parent-child relationship has the potential to make a lasting difference for both mother and child.

The present study was aimed at identifying the connections between the decision to engage in prenatal physical activity and the decision to breastfeed. The women included in this study were currently breastfeeding mothers who had also engaged in prenatal physical activity throughout their pregnancy. The connections between prenatal physical activity and breastfeeding were explored through semi-structured interviews. For the purpose of this study, the term prenatal physical activity was used, rather than prenatal exercise, because the United States Department of Health and Human Services uses the term physical activity in their recommendations (U.S. DHHS, 2008). Also, physical activity was used because it is a more general term that encompasses exercise. Moreover, in this study, physical activity included bouts of activity that required the individual to be moving for at least 10 consecutive minutes of time rather than sitting or being sedentary. Mothers were considered to be breastfeeding if their child (between 3 to 12 months of age) was getting a portion or all of their nutrients from breast milk, either through the breast directly or indirectly through pumped milk in a bottle.

Prenatal Physical Activity Benefits, Rates, and Recommendations

A variety of benefits for both mother and fetus have been associated with prenatal physical activity. The most consistent benefits for pregnant women have been associated with a low to moderate physical activity regiment, especially for those women with a higher than normal pre-pregnancy body mass index (BMI) (Guendelman et al., 2012). For example, in a

population-based case-controlled study interviewing 344 women from three Southern California counties, Guendelman and colleagues (2012) found that women who participated in moderate physical activity during pregnancy were less likely to have preterm deliveries (children who completed less than 37 gestational weeks) than women who were not physically active. The association between moderate prenatal physical activity and reduced risk of preterm delivery was strongest for women with above average BMIs and the association weakened as BMI decreased (Guendelman et al., 2012).

Lowering the risk of preterm delivery is very important as more than 500,000 infants in the U.S. are born preterm each year (Hamilton, Martin & Ventura, 2009; Behrman & Butler, 2007). Not only does this pose an increased risk of neonatal death, but also preterm deliveries account for over one third of infant deaths during the first year of life, which costs at least \$26 billion annually (Guendelman et al., 2012). Those children that survive preterm delivery, even as late as 35-36 weeks, were at a higher risk of experiencing developmental complications such as physical and mental disabilities, cognitive, neurological and behavioral impairments that became evident when they reached school age (Guendelman et al., 2012).

Furthermore, the mother's health during pregnancy has an impact on the fetus's health. Mothers who engage in prenatal physical activity provide benefits not only for themselves but also for their growing child. Engaging in light-to-moderate or vigorous prenatal physical activity has been associated with lower risks of gestational diabetes mellitus (GDM), abnormal glucose tolerance, and risks of pre-eclampsia (Marcoux, Brisson, & Fabia, 1989; Oken, Ning, Rifas-Shiman, Radesky, Edwards, & Gillman, 2007; Sorensen, Lee, Dashow, Thompson, & Luthy, 2003).

Gestational diabetes mellitus has been associated with complications during pregnancy as

well as long-term risks for both mother and child (Gestational diabetes, 2001; Oken & Gillman, 2003). GDM is associated with an increased risk for perinatal morbidity, impaired glucose tolerance and type-2 diabetes for the mother in the years following pregnancy; additionally, children whose mothers had GDM are more likely to be obese, have impaired glucose tolerance, and have diabetes in childhood and early adulthood (American Diabetes Association, 2004; McMahon, Ananth, & Liston, 1998). Results from a systematic review and meta-analysis found that greater total physical activity before pregnancy or during pregnancy was significantly associated with a lower risk of GDM (Tobias, Zhang, van Dam, Bowers & Hu, 2011). Pre-eclampsia has the potential to put both mother and child at an increased risk for several serious complications. Complications include, but are not limited to, pre-term birth, abruption placenta, renal failure, pulmonary edema, cerebral hemorrhage, circulatory collapse, eclampsia, and immediate delivery regardless of gestational age (Roberts and Lain, 2002; Weissgerber et al., 2004). Prenatal physical activity has been associated with a reduced risk for pre-eclampsia (Marcoux et al., 1989; Sorensen et al., 2003; Weissgerber et al., 2006).

The Department of Health and Human Services (DHHS) acknowledged that it is beneficial for healthy pregnant women to be physically active (US DHHS, 2008). According to the 2008 Physical Activity Guidelines for Americans, healthy women should get at least 150 minutes (2 hours and 30 minutes) per week of moderate-intensity aerobic activity, with bouts of activity lasting for at least 10 minutes at a time (US DHHS, 2008). The DHHS recommends women spread this time throughout the week as long as women are active for at least 10 consecutive minutes at a time (US DHHS, 2008). The ACOG recommends that women with low-risk pregnancies engage in moderate-intensity physical activity for 30 minutes or more each day on most (if not all) days of the week (American College of Obstetricians and Gynecologists,

2002).

Currently the rates for prenatal physical activity are not clear; several studies have reported that only 40% of women were active during pregnancy (for review see Field, 2011; for review see Poudevigne & O'Connor, 2006; Zhang & Savitz, 1996). This number appears to be accurate considering that the CDC reported that only 42.6% of women living in the United States meet the 2008 Physical Activity Guideline for aerobic activity (Center for Disease Control and Prevention (CDC), 2014). According to a study consisting of telephone interviews with 1,979 pregnant women between the ages of 18 and 44 years of age, only 15.8% of pregnant women met the physical activity guidelines outlined by the ACOG (Evenson, Savitz, & Huston, 2004). Non-Hispanic white adults, younger adults, adults with more education and those adults whose family income is above the poverty level are more likely to meet the 2008 Physical Activity Guideline for aerobic activity (CDC, 2014), but it is unknown whether this is true for pregnant women in particular.

Factors Influencing Prenatal Physical Activity

Women engage in prenatal activity for a variety of reasons. Results from a 28-item questionnaire completed by 211 patients at a private Obstetric and Gynecology group practice showed that the majority of women in the study were encouraged by doctors to engage in prenatal physical activity (Krans et al., 2005). Approximately 92% of women, who spoke with their doctors about prenatal physical activity, were encouraged engage in prenatal physical activity (Krans et al., 2005). Whether or not women follow this advice has been found to be related to maternal beliefs and knowledge about the benefits of prenatal physical activity, support from family and household members, the availability of child care, and improved self-efficacy beliefs tied to physical activity (Cannella, Lobel & Monheit, 2010; Cramp & Bray, 2009; Krans

et al., 2005; Pereira et al., 2007). Studies examining prenatal physical activity have also found that improvements in overall mood, increases in energy, and more effective weight control were major factors related to women's physical activity level during pregnancy (Cioffi et al., 2010; Clarke & Gross, 2004).

Though there are many benefits associated with being physically active during pregnancy, barriers exist that may deter women from being physical activity throughout pregnancy. Women have been found to have differing opinions on the appropriate frequency and intensity of prenatal physical activity; women tend to believe benefits are associated with low to moderately vigorous activity as opposed to intense activity (Duncombe, Wertheim, Skouteris, Paxton & Kelly, 2009; Evenson & Bradley, 2010). Perceived risks involved with prenatal physical activity, as well as social, psychological and physical factors have been found to deter women from being physically active (Cioffi et al., 2010; Clarke & Gross, 2004; Symons Downs & Hausenblas, 2004). A lack of access to facilities, tiredness/fatigue, a lack of knowledge, a lack of help implementing/creating programs, physical limitations or restrictions and natural weight gain associated with pregnancy also deterred women from being physically active during pregnancy (Cioffi et al., 2010; Clarke & Gross, 2004; Symons Downs & Hausenblas, 2004).

Breastfeeding Benefits, Rates and Recommendations

Breast milk is uniquely suited to human infants' nutritional needs and produces unparalleled immunological and anti-inflammatory properties that protect against a host of illnesses and diseases for both mothers and children (Lawrence & Lawrence, 2010). The World Health Organization (WHO) and the American Academy of Pediatrics (AAP) both recommend that mothers exclusively breastfeed their infants for 6 months (Eidelman et al., 2012; U.S.

DHHS, 2011). While both organizations recommend supplemental feeding after 6 months, the WHO recommends that breastfeeding continue through at least 24 months of age, while the AAP recommends that mothers continue breastfeeding through at least 12 months of age (Eidelman et al., 2012; U.S. DHHS, 2011).

Despite recommendations by the WHO and AAP and the many diverse benefits connected to breastfeeding, the United States national average for initiating breastfeeding is 76.5% and the proportion of women breastfeeding exclusively at 6 months is significantly lower at 16.4% (U.S. DHHS, 2011; Lynch et al., 2012). Geographic location has been linked to breastfeeding rates; women in the southeastern United States were less likely to initiate and continue breastfeeding than women living in other areas of the United States (CDC, 2014). According to the 2014 Breastfeeding Report Card provided by the National Center for Chronic Disease Prevention and Health Promotion, 74.9% of children were breastfed for some period of time (even if only once) in the state of Tennessee. Furthermore, within two days of birth 14.6% of all infants in Tennessee have had formula (CDC, 2014). Breastfeeding rates in Tennessee further drop at six months to 40.7% and even further at twelve months to 20.9% (CDC, 2014). When looking at exclusive breastfeeding rates, the numbers were even lower with only 39.1% percent of children being exclusively breastfed through 3 months and only 15.4% being exclusively breastfed through 6 months in Tennessee (CDC, 2014). Based on the current breastfeeding rates in the United States, and specifically in Tennessee, it appears that more attention needs to be given to what influences mothers to initiate and continue to breastfeed.

Factors Influencing Breastfeeding

There are many factors that influence infant feeding decisions, and women appear to make these decisions very early in pregnancy, in fact the decision was reportedly made most

often in the first trimester of pregnancy (Arora, McJunkin, Wehrer, & Kuhn, 2000; Kong & Lee, 2004). A systematic review of literature revealed that the mother-infant relationship starts to develop before the child is born and that the mother-infant relationship has a considerable impact both on the development of the child and the decision to breastfeed (for a review see Alhusen, 2008). The decision to breastfeed appears to be influenced by a variety of factors including: perceived benefits, support, personal beliefs, naturalness, cultural practices, social and environmental contexts, perceived support from husbands/partners, convenience, enjoyment, and economic benefits. Additionally, higher levels of maternal-fetal attachment have been positively associated with mothers' intentions to breastfeed (Arora et al., 2000; Brodribb, Fallon, Hegney & O'Brien, 2007; Dennis, Hodnett, Gallop & Chalmers, 2002; Foster, Slade, & Wilson, 1996; Kong & Lee, 2004). It appears that many mothers believe breastfeeding will make them feel closer to their child, that it will make them feel more important, and as a mother they will enjoy the experience (Arora et al., 2000; Brodribb et al., 2007; Kong & Lee, 2004).

Responses from women in Earle's (2000) study revealed that regardless of their choice to breastfeed or formula feed, women were aware of the benefits of breastfeeding. Furthermore, many women were unsure about their abilities to breastfeed. Societal and personal beliefs about a mother's ability to breastfeed have led some women to worry about whether or not they will be able to breastfeed their child if problems occur (e.g., Earle, 2000; Kong & Lee, 2004). Moreover, women who reported previous negative breastfeeding experiences have been found to be less likely to breastfeed with their next child and first-time mothers have been found to be more likely to breastfeed than mothers with more than one child (Sloan, Sneddon, Stewart & Iwaniec, 2006).

Connections between Prenatal Physical Activity and Breastfeeding

Both prenatal physical activity and breastfeeding appear to be protective practices for both the mother and the infant. Currently the literature and research on prenatal physical activity and breastfeeding run parallel to each other with no research examining how the two practices may be connected. The present study aimed to identify possible connections between women's decisions to engage in prenatal physical activity and to breastfeed. Finding factors that influence decisions about both prenatal physical activity and breastfeeding practices could provide a novel launching point for more effective intervention programs and thereby potentially enhance the health of mothers and infants. Specifically, the present study addressed the following research questions:

1. What factors influenced women to be physically active during pregnancy?
2. What factors influenced women to breastfeed?
3. Was there a connection between the factors and beliefs influencing women to engage in physical activity during pregnancy and breastfeeding patterns? If so, what were the connection(s)?

Methods

Participants

Participants were recruited from a medium-sized city in Tennessee where women fail to meet the recommendations of both the WHO and AAP with only 15.4% of mothers exclusively breastfeeding at 6 months (CDC, 2014). Recruitment flyers and emails were posted and sent out through various mediums including, local businesses, local community websites, Facebook, and email listservs. All but two of the participants were obtained through postings on Facebook. The flyer was posted on both public and private Facebook pages including personal pages and

various support groups. To be eligible to participate in this study, women had to be 18 years of age or older, breastfeeding an infant between the ages of 3 and 12 months, and reported engaging in physical activity on an average of twice a week during at least two trimesters of their pregnancy. For the purposes of this study being physically active included: walking, performing household labor, taking care of children, walking dogs, exercise classes, yoga, swimming, or anything that required the woman to be active rather than being sedentary such as sitting at a desk or watching TV. Both first time mothers and non-first time mothers were invited to participate in the study in an effort to maximize the number of eligible women.

Table 1: Participant Characteristics (n=19)

	N	%
Delivery Method		
Vaginal	17	89.5
Emergency c-section	2	10.5
Parenting/Birthing Class		
Parenting Class	2	16.7
Birthing Class	10	83.3
Marital Status		
Married	18	94.7
Divorced	1	5.3
Education Level		
Bachelor Degree	5	26.3
Graduate Degree	14	72.7
Work Status		
Dual Income	13	68.4
Single Income	6	11.6

Nineteen women participated in this study. The women in this study had an average age of 32 (range 24-38). Most women in this study could be classified as upper-middle or middle class. The majority of women reported annual household incomes higher than \$78,000 (n=10) with 7 of those women indicating a household income of \$91,000 or above. Additionally, there were three women with annual household incomes between \$77,000 and \$65,000, three between \$65,000 and \$52,000 and three below \$48,000. Table 1 highlights the delivery method experienced by mothers, attendance of parenting and birthing classes, marital status, education level, and work status.

Women in this study reported being highly active and participated in a variety of different activities. Activity was measured based on a self-report modifiable activity questionnaire (Bauer, Pivarnik, Feltz, Paneth & Womack, 2010). On average the women participated in 6 different physical activities 8 times per-month for an average of 44 minutes per-activity throughout their pregnancy. Only three women participated in three different activities or less throughout their pregnancy, and only two women participated in 12 activities or more throughout their pregnancy. The activities women participated in varied, but most all of the women walked. There was not much overlap in the types of activities women engaged in, but jogging, swimming, yoga, toning exercises/calisthenics, and weight training were the most common activities. While far less frequent, some women participated in hiking, gardening, biking, aerobic dance/step, rock climbing, water skiing, and snow skiing.

Procedures

Prior to data collection, this study was reviewed and approved by the Institutional Review Board at The University of Tennessee Knoxville. Semi-structured interviews with 19 breastfeeding mothers who were physically active during pregnancy were recorded with an

audio-recorder. Each potential participant went through a brief screening interview over the phone to ensure they were eligible to participate in the study. Eligible participants were invited to go through an in-depth interview at the location of their choice. The women who chose to participate in the study were asked guiding questions about their experiences during pregnancy, their activity during pregnancy, what influenced them to be physically active, their decision to breastfeed, what influenced them to breastfeed, and what connections, if any, they saw between their decision to be physically active during pregnancy and to breastfeed.

In addition to the guiding interview questions, women were asked follow-up probe questions to prompt them to elaborate or clarify their responses. At the end of each interview women were asked to complete a demographic survey and the Modifiable Activity Questionnaire (Bauer, Pivarnik, Feltz, Paneth & Womack, 2010). The demographic survey included questions about the father of the child, the household the infant lived in, what foods and/or formula the child had been introduced to, the household income, the educational level of both mother and father, parenting classes attended by the parents, and other questions pertaining to the health during pregnancy. The Modifiable Activity Questionnaire asked women to list all of the activities they did while they were pregnant, in which months they did those activities, on average how long they participated in these activities, and on average how many times per month they did the activity.

Analysis

Grounded theory was used to analyze the interview data. Grounded theory is often used when theories do not currently exist to explain or understand a specific process (Creswell, 2013). Additionally, grounded theory seeks to develop a theory grounded in the responses of participants (Creswell, 2013). Thus, a grounded theory approach was used because this study

was conducted in an effort to explore an area of research in which very little information is known. Furthermore, efforts were made to remain grounded in the responses from the participants and to describe the processes and stories of the women through the development of a descriptive model outlining the connections between prenatal physical activity and breastfeeding.

Symbolic interactionism was used as a theoretical lens in conjunction with constructivist grounded theory, as outlined by Charmaz (2006), to understand and identify the viewpoints of these women. Symbolic interactionism, as described by Blumer (1986), was used as a guiding lens to bring forth the personal meanings these women shared surrounding prenatal physical activity and breastfeeding and how these meanings have influenced their decisions. Interview data were coded, reported, and used to develop a descriptive model outlining the connections between the factors influencing the decision to be physically active during pregnancy and the decision to breastfeed.

Audio-recordings of the interviews were transcribed verbatim for the purpose of coding. Line-by-line coding, focused coding, and memo-writing guided the recursive coding process. First, line-by-line coding was completed on hard copies of every transcript in an effort to remain grounded in the beliefs and language of the participants. An important assumption of symbolic interactionism is that “self concepts, once developed, provide an important motive for behavior”; that is, self-values and self-beliefs affect an individual’s behavior (LaRossa & Reitzes, 1993, p. 144). Each line of every transcript was read and summarized by key terms and/or themes in the margins of transcripts. Line-by-line coding helped ensure that details were not over looked when reading the transcripts and to maintain the voice of participants in the coding process (Charmaz, 2006).

Once line-by-line coding was complete, focused coding took place. In this next phase the

main codes identified in line-by-line coding were recoded for each transcript. This second round of coding was used to identify and organize the most salient codes found in the line-by-line coding. Using line-by-line coding as a first step helped keep the coding process accurate by remaining grounded in the participants' language and reducing the chances of details going unnoticed or getting overlooked. Once these reoccurring codes and beliefs were identified, the transcripts and codes were imported into NVivo software.

Memo-writing was used to elaborate on processes, assumptions, and actions that were encompassed in coding/codes (Charmaz, 1996). Memo-writing was used to define categories of codes, derive meaning from the codes, and to identify underlying connections surrounding factors influencing prenatal physical activity and breastfeeding. Preliminary memo-writing was done before data was imported into NVivo. The final stages of memo-writing were completed once the data had been imported and coded. Raw data were used in the memo-writing process to aid in the authenticity of the analysis as well as making sure the work remained grounded in the responses of participants (Charmaz, 1996).

Trustworthiness

The primary researcher (the first author) of this study recognized personal biases existed surrounding the presented research questions. Physical activity is a key part of the primary researcher's daily life and is important to her for various reasons. Though the primary researcher is not a mother, the more she learned about breastfeeding the stronger her opinions about breastfeeding became. The first author believes that both physical activity and breastfeeding are two of the most important decisions women can make surrounding not only their own health but also their child(ren)'s health as well. As a way to bring awareness to the primary researcher's personal biases, the researcher went through a bracketing interview. In this interview the first

author realized that she thought knowledge, support, and lifestyle choices were the main influencing factors surrounding decisions about prenatal physical activity and breastfeeding practices. The researcher assumed that women would be more likely to engage in both activities if they had knowledge about the benefits for both the mother and the child. The first author also assumed that women would be more inclined to do both if they had a support system in place that encouraged them and helped them through the challenges they may encounter throughout the process. Lastly, the primary researcher assumed that women who had a more health conscious lifestyle would be more inclined to be both physically active during pregnancy and to breastfeed. Once these biases were identified, the first author had regular debriefing meetings with the second author to make sure the biases were not influencing the research or clouding the coding and analysis.

Once the primary researcher finished coding, a graduate student, who had experience with qualitative coding, was recruited to do blind reliability coding. This person coded 20% of the transcripts. A randomized number generator was used to identify the participants that would be coded for reliability. Once coding was completed, inter-coder agreement was assessed. Any disagreements about coding were discussed until both coders reached agreement on all codes. Once agreement was met changes in coding were made in NVivo as necessary, and themes were re-evaluated to ensure accuracy of results.

Results

Themes emerging from the interviews were organized into three areas: breastfeeding, prenatal physical activity, and the connections between breastfeeding and prenatal physical activity. In each of these areas, outlined next, the main themes that emerged from the interviews are described.

Prenatal Physical Activity

Women spoke less about prenatal physical activity than they did about breastfeeding. Mothers shared the following themes in their responses about prenatal physical activity: benefits, continuation of regular activity, personal values, and physiological influences.

Benefits. All mothers interviewed discussed benefits related to prenatal physical activity.

Though there are benefits for both mother and fetus, women largely focused on personal benefits:

“because I feel good when I am active, I know the health benefits, mind, body, all of that”

“I wanted to stay strong so that I guess I’ve heard that if you exercise though pregnancy umm you have a better time at delivery and you’re more likely to or less likely to need interventions at delivery and I was like well that sounds good”

“because you just feel so much better umm, and of course for the longevity of life. You know you want to prevent heart disease and keep good cardio aerobic capacity, respiratory capacity... but I really just have a very specific thought that I want to take good care of my body, steward my life well, and be as healthy as I am able to be”

The majority of women spoke about how prenatal physical activity helped them to feel better, to prepare for labor, and to prevent too much weight gain. Women saw physical activity as beneficial for themselves and their health in general, rather than having specific knowledge like they did about the benefits of breastfeeding. Though women spoke specifically about personal benefits, most women did believe that being healthy would be better for the baby:

“I thought if it’s good for me it’s good for the baby”

“Cardiovascular health maybe, but something along those lines that the baby benefits just

as much as the mother and that was kind of motivation too”

“I think it’s just good for general health and of course it’s good for the babies”

Even though the majority of mothers spoke about personal benefits, mothers also believed that the benefits they experienced from being physically active could be positive for their child as well. When compared to the statements made about breastfeeding, it appeared that these women had less specific knowledge about the benefits of prenatal physical activity for themselves and their baby.

Continuation of Regular Activity. The majority of women spoke about being active before their pregnancy. Prenatal physical activity was identified as part of these mothers’ regular life; that is, most women considered being physically active as a continuation of what they did prior to pregnancy:

“it was just part of who I was so it was, I mean it didn’t feel like I was doing anything different”

“that’s my personality I like to just constantly be active”

“I feel like I was naturally active beforehand”

The women in this study described physical activity as important and a healthy habit. The majority of women spoke about their prenatal physical activity as a continuation of their regular pattern of activity. The mothers with more than one child appeared to receive motivation from their older children. For example, women mentioned not being able to rest because they had to take care of their other children or they mentioned taking their other children to the park and walking while their child played. It appears that having other children encouraged some of these women to be active:

“I really value exercise and um, I value doing it in front of my kids and doing it with

them, and so just to set a good example for them and so, because of the stroller it really afforded us some freedom to do that”

“it was nice to have something to do out of my house with my their kids, they love to ride in their stroller, they love to go, you know for walks. We would go to the playground after work and so it was just like a fun sort of family thing for us to do”

“but she (daughter) of course loves to move and everything like that so it was nice to always have someone the second time around to kind of go with me and it seemed like more purposeful because it wasn’t just me walking in the park by myself alone, it was let’s go to the park and play and then I also got to um walk.”

The fact that these women continued to be physically active and prioritized physical activity throughout pregnancy shows how important physical activity was to them.

Personal Values. Women in this study appeared to have personal beliefs that encouraged them to remain active throughout their pregnancy. The majority of the women made a comment that physical activity was a part of their “personality,” something “they’ve always done,” or part of “who they are.” Many spoke about physical activity being a way to clear their mind or their way of staying stable during pregnancy:

“it’s just kind of like medicine to me, like I know I need to do it so I’ll do it”

“well I think knowing that it was something that I needed to do that was part of it I needed to for like my own physical health”

“that’s just my therapy, it’s the time to clear my head and get blood flow back to my brain”

Clearly these women prioritized physical activity. They saw physical activity as a way to maintain normalcy throughout their pregnancy and a way to remain stable throughout the

process. Physical activity appeared to be something that these women were committed to, regardless of pregnancy.

Physiological influences. The women in this study appeared to prioritize staying or becoming active and the majority of them were able to maintain pre-pregnancy routines in the early phases of pregnancy. As time went on, the majority of the women had to alter the types and intensity of the activities they engaged in for various reasons:

“so I actually got into swimming and I was doing a lot more running and I’m not a runner, at all like I hate it... unless someone is chasing me, and I don’t ever swim so I took on totally different work out practices than normal. So, it just seemed to be easier on me and my big belly.”

“you know when you get really big, yeah I mean my center of balance changed”

“I guess at about 7 and a half months I was getting so big at that point that I had to change things a little bit”

Even though these women experienced physiological changes that made physical activity more challenging, they were able to find alternative ways to remain active. Although not a major theme, some women reported facing other barriers such as lack of peers to engage in physical activity with, conflicting schedules with husbands, and a lack of advice from medical professionals. Many of the women spoke about doing activities they would have never done prior to becoming pregnant (such as swimming, running, and biking), which demonstrates their level of commitment to remaining physically active.

Overall, women identified many benefits to prenatal physical activity including preparation for labor and overall health for themselves and therefore their child. Women, as a group, were less enthusiastic about prenatal physical activity than they were about breastfeeding

and spoke about fewer topics related to prenatal physical activity. The main influencing factor encouraging these women to stay active were the personal benefits these mothers believed to be associated with prenatal physical activity.

Breastfeeding

Participants talked much more about breastfeeding than any other topic during their interviews. Seven breastfeeding themes were identified: benefits, breastfeeding support, challenges, commitment, the belief that breastfeeding was natural, the best option for feeding their infant, and the only option women considered for infant feeding. These theme names reflect the participants' words and were common throughout the interviews. Overall, the women had very distinct beliefs about their reasons for breastfeeding.

Benefits. The women spoke most often about the benefits involved with breastfeeding compared to other aspects of breastfeeding. They reported a wide range of specific benefits associated with breastfeeding for both themselves and their child:

“the antibodies and it’s just very good for them, you know there are different studies that say it increases their brain development and it helps with their bonding”

“I read one statistic, which is really crazy, but it talked about how women who breastfeed for so long decrease their chances of breast cancer and ovarian cancer”

“for me, quicker recovery, your uterus shrinks down faster, you lose weight faster because you’re burning more calories, umm for the baby, the baby gets good bacteria in their gut from my nipple, they get the colostrum in the beginning which is excellent or them, they get uhh better immune system”

Some women spoke more generally about the benefits of breastfeeding stating that it was “healthier” or provided “immunity” and “antibodies” for the child, but the vast majority of

women had knowledge about the more specific benefits involved with breastfeeding. The fact that these women spoke about less-known benefits such as the reduction of cancer risks, that it helped the uterus return to pre-pregnancy size, and knowledge about the benefits of colostrum showed that these women were well informed about breastfeeding.

Breastfeeding Support. Many women spoke about the resources and support systems that helped them endure various difficulties with breastfeeding. In particular, they spoke about the knowledge and support obtained from lactation consultants, research articles, friends, family and other medical professionals. Most women identified their support systems as helping them through challenges they encountered with breastfeeding:

“I think having a good support network was really key for me too, because most I mean a lot of people now formula feeding has been so prevalent a lot of people don't know somebody who's successfully breastfed”

“[local birthing center] has like a support group online on Facebook um and that's been really nice just to see um moms encouraging each other and asking questions about different breastfeeding problems and they post a lot of pictures of ah nursing in different places and you know it's noble to nurse in public and it's not something to be ashamed of. And um so that was encouraging too”

“I think people are generally supportive of it, definitely at the hospitals they try to encourage you to do it and doctors and nurses definitely try and encourage you to breastfeed.”

The responses about support indicated that friends, family, and additional support actively sought out by the women (such as lactation consultants) were the most important. Although support

systems appeared to be very important to women, most women reported that they were determined to breastfeed regardless of what other people thought or said.

There was a key variation identified within this sample. The women who delivered in hospitals or with OB/GYN's appeared to have differing levels of support than those women who delivered at a local birthing center with midwives. Many women that delivered in the hospital setting complained that medical professionals did not do enough to help them in their times of need, and instead of encouraging them to continue breastfeeding, many women were advised by medical professionals to supplement with formula:

"I think there's a lot of women who think they can't (breastfeed), but that's a problem with our education and support systems and pediatricians... they told me that I needed to supplement when he (baby) was little...so we switched pediatricians"

"being able to call my mom with any questions or umm and also to know that she would support me even, like we went to the doctor and the doctor was like you need to supplement, my mom was as mad as I was"

"I felt like I got as much as I searched for. I felt like the doctors could have done more, I felt like they could have given me more information"

While these discouraging experiences seemed to be upsetting to these women, they did not appear to affect the women's breastfeeding practices.

The women who delivered at the local birthing center or who had midwives present reported experiencing much support from professionals, such as lactation consultants, midwives, and resources accessed through a local birthing center:

"My midwife was a very good, I knew could call her with any questions and um she had

a lot of experience with helping moms too so that was helpful.”

“I delivered at [local birthing center] and certainly there it’s uhh most common for it (breastfeeding) to be really umm since they’re pretty natural minded anyways, it was, that culture certainly lends itself to being encouraging of breastfeeding as well and they had very good resources there. After you deliver they have nurses there that are lactation consultants... and then they have a really good breastfeeding center there...so there’s really good support for it”

“it was a challenge and I think had my mom not been staying here and supporting me to continue breastfeeding and then also the lactation consultants at [local birthing center] without them I would, I may not have given up but I would have been an emotional wreck which wouldn’t have been good for any of us”

This difference within this sample appeared to have had a serious impact on the type of support these women received from professionals. Women who delivered at the local birthing center appeared to have more support (through midwives, lactation consultants, and resources specific to the local birthing center) than those who delivered in the hospital setting. This difference in experiences identifies an important difference in the type of care women receive in different settings.

Challenges. All of the women referred to breastfeeding as a “positive” experience; however, the vast majority of these women also reported challenges they encountered. Though women spoke about the challenges and pain associated with breastfeeding, all of the women were determined to make breastfeeding work regardless of the struggles:

“in three months I had it (mastitis) 6 times and it was just crazy and my sister who’s an

OB nurse said ‘you know you may have to stop breastfeeding’...and that was something that’s not an option for me”

“I ended up at [local breast health center] with umm draining puss it was an absolute nightmare, I have scars, my nipples actually fell off like it was a mess, it was a total mess but the whole time I was like ‘I’m not going to leave any stone un-turned to try and make this work’”

“it’s been kind of hard he was tongue tied and lip tied like his upper lip was tied um so he had a hard time eating like he would eat a little bit and come off and fuss eat a little bit and come off and fuss umm which when we found out he was tongue tied they said that basically that he hasn’t been able to move the milk properly and so it feels like they feel like they’re being drowned in milk”

Overall, women viewed breastfeeding as a positive experience despite the many challenges they encountered. That is, no challenge or set of challenges proved to be greater than the perceived benefits and positive experience these mothers gained from breastfeeding.

Commitment. The women in this study appeared to be very committed to breastfeeding. Not all women explicitly identified as committed, but the majority of the women spoke about persisting through challenges because they had “made up their mind” or because “it’s just what you do.” In fact, all but four women made statements that were coded as committed, which was defined as “statements dealing with the mother’s dedication to breastfeeding and/or the perseverance needed to endure the possible challenges associated with breastfeeding”:

“I knew I was going to do it come hell or high water”

“it doesn’t matter what I come up against you can throw the worst situation at me and I’m

still going to do it, I will do whatever is necessary to accomplish the breastfeeding goal”

“I’m gonna breastfeed I actually pretty much resigned my position as a teacher so I could stay home and breastfeed her exclusively, because you cannot do that in the elementary school setting”

It is obvious that the women in this study were determined to breastfeed regardless of the issues they encountered.

Natural. Women expressed that breastfeeding was natural and that their bodies were made to produce milk to feed children. While some women specifically used the word “natural” when discussing their beliefs about breastfeeding, other women used statements saying it was the “way it is supposed to be,” that their bodies “were made that way,” or that it “wasn’t made in a factory”:

“I knew biologically, physically, evolutionarily, this is how our bodies have developed; I knew this is how we were supposed to feed our babies”

“it seems kind of like a very innate knowledge like that you would imagine the way the body was designed to do it would be healthier than something processed in factory”

“it is naturally designed for my child and I just like that part of it. I just feel like that's what my body was meant to do so I don't know.”

The Best Option. The majority of the women considered breastfeeding to be “the best” option for their child. Women identified breast milk as the best way to provide a healthy life for their infant as well as the best source of nutrition and the best possible start to life:

“that’s best for the baby, best for the mother and I therefore decided that was what I was going to do”

“in my opinion breast milk is your gold standard”

“we really believe it is far superior health wise”

Women in this study had strong beliefs about the quality and importance of breast milk for their infant. Women regularly referred to breast milk as “the best”, but they also recognized the importance of having alternative options for women who could not breastfeed:

“cause formula is good, like it’s totally fine, but I wanted to exhaust every opportunity not to have to go that route”

“you know there’s absolutely nothing wrong with formula and you know I’m glad it’s available for the people who use it and who need it”

Most participants believed formula was a good alternative for mothers but that they believed breast milk was “the best.”

The Only Option. When asked about their process of deciding to breastfeed, all of the women expressed that there wasn’t a process involved or that they never considered anything other than breastfeeding. Women expressed that they always knew they were going to breastfeed, for them breastfeeding was “the only option” and was seen as “a given”:

“Well there was no process for me, that was just a given”

“Um I never even considered another option”

“I don’t think it was a process I just knew from the beginning that that’s what I wanted to do”

“I always knew I was going to breastfeed”

It’s clear that participants believed breastfeeding was the only option when it came to feeding their infants. There appeared to be no known process behind these women’s decisions, instead they considered breastfeeding to be a “no brainer”.

In summary, women spoke very passionately about breastfeeding and their experiences

with breastfeeding. Women experienced an array of challenges while breastfeeding, but resources, support, and most of all commitment seemed to help these mothers endure whatever difficulties they encountered. These women saw many benefits to breastfeeding and these benefits outweighed any difficulties they endured.

Connections

Overall, mothers in this study believed an indirect connection existed between prenatal physical activity and breastfeeding decisions. Mothers reported that they did not breastfeed because they were physically active, and were not physically active because they planned to breastfeed. Instead, mothers believed that prenatal physical activity and breastfeeding were linked indirectly. The responses from mothers were organized into four main themes: healthy lifestyle, benefits, knowledge and research, and natural and normal.

Healthy lifestyle. The most common connection specifically stated by mothers was their belief that both prenatal physical activity and breastfeeding were part of a healthy life style. Specifically, mothers most frequently identified their desires for a healthy life for both themselves and their child as an indirect connection between their two decisions:

“my decision to breastfeed wasn’t related to the fact that I was active... directly, but both come from my mind set that health is worth perusing or like it’s important”

“both of those decisions, while not directly related to one another, they’re indirectly related in that they come from mine and my husband’s personal convictions that umm you should be as healthy as possible and both physical activity and breastfeeding are healthy decisions to make”

“I think all of it probably has to do with a mentality of being healthy and providing something good for myself and for my baby”

Mothers reported similar influencing factors for their decisions to be physically active during pregnancy and to breastfeed. Women were concerned with providing the best care possible for both themselves and their infant when making both of those decisions.

Benefits. Responses from mothers indicated that the benefits associated with both prenatal physical activity and breastfeeding was another factor that connected the two. When mothers were asked about the connections between the two decisions, only a few of the mothers mentioned the benefits associated with both. On the surface it would appear that women did not specifically identify “benefits” as a connection between their decision to engage in prenatal physical activity and to breastfeed. However, in taking a closer look at the responses of these mothers, when speaking about breastfeeding and parental physical activity more broadly, women cited benefits as a common reason for engaging in both:

“I mean working out there’s, you can’t even name all of the benefits to working out, there’s just so many of them and then breastfeeding they say it’s the best thing for them”

“it just uhh never was an option just because there’s so many benefits of breastfeeding for me and the baby uhh and I couldn’t overlook those”

“in fact there’s more and more out there right now that says just standing up more often and not sitting for long periods umm can have just good health benefits”

When reflecting on women’s responses, the perceived benefits of both prenatal physical activity and breastfeeding were motivating factors for these mothers to engage in both. In fact, all mothers spoke about benefits being an influencing factor behind their decision to engage in prenatal physical activity and to breastfeed.

Knowledge and Research. Responses from mothers revealed that knowledge and research evidence were an important factor that helped them stay dedicated to both prenatal physical activity and breastfeeding. Though the women did not specifically state this as a connection between the two, their responses to questions about why they breastfed and why they engaged in prenatal physical activity indicated that knowledge about benefits was a key factor when making their decisions. The women interviewed appeared to be very well informed about recommendations for both breastfeeding and prenatal physical activity; in fact, some women even spoke about going against their doctors because of their personal knowledge:

“I just get real irritated about that if the health care professionals seem to be more concerned about covering their butt then what’s best for mom and the baby, that’s pretty much what it was. The American Academy of Pediatrics says that it’s normal for babies to lose up to 10% of their birth-weight. He was at 7% and we had just come in and they were like ‘oh he needs to supplement’. Well, no you don’t.”

“I said well at this point they’re either gonna tell me to supplement or to nurse more often so why don’t I try nursing more often first”

“in the very beginning I mean I had to do a lot of reading and do a lot of research to make sure that you know me wanting to go ride my bike for instance wasn’t going to cause me to miscarry her”

Though most women did not directly address this as a specific connection, they certainly discussed how their knowledge impacted their decisions and experiences with both prenatal physical activity and breastfeeding. It is evident that these women sought out information and that this information helped keep them motivated to engage in both. Though this information helped these women make their decisions, it does not mean that their information was entirely

consistent with current medical recommendations.

Natural and Normal. Many women spoke about both prenatal physical activity and breastfeeding as natural and normal processes. They believed that their bodies were made to be active and that they were made to produce milk to feed their children. Women spoke about prenatal physical activity and breastfeeding as something they considered to be a normal part of life.

“they are natural normal processes and they’re, one flows from the other”

“breastfeeding is the natural healthy choice for us and so is working out and running”

“I think they both have to do with being very aware of myself ... and so I think that my desire to exercise is tied to my strong you know belief in that this is what my body was made to do... I think they’re tied together in that way”

“It’s all connected, so the way you eat and the way you exercise and the way you take care of yourself umm I wanted to do everything as close to natural as possible including breastfeeding her”

Less than half of the women specifically identified the belief that both prenatal physical activity and breastfeeding were natural and normal processes as a connection between their decisions to engage in both. However, all of the women indicated that prenatal physical activity and breastfeeding were natural and normal processes of life when speaking about each choice separately. Though some women did not identify this as a connection, this theme is a common thread between these two decisions for the majority of participants.

Mothers in this study spoke overwhelmingly more about their beliefs and experiences surrounding breastfeeding than they did about prenatal physical activity. While women were most enthusiastic about breastfeeding, all participants had personal beliefs surrounding prenatal

physical activity. Women spoke more frequently about the benefits involved with breastfeeding and prenatal physical activity than any other influencing factor. When considering the connections between prenatal physical activity and breastfeeding most women identified health as the connection between the two. While not all women spoke directly about connections between the two, all women addressed at least one of the same influencing factors when speaking exclusively about prenatal physical activity and breastfeeding. Furthermore, considering the women and their collective story, the women in this study were extremely determined in their efforts to maintain and provide as healthy of a lifestyle as possible for their family.

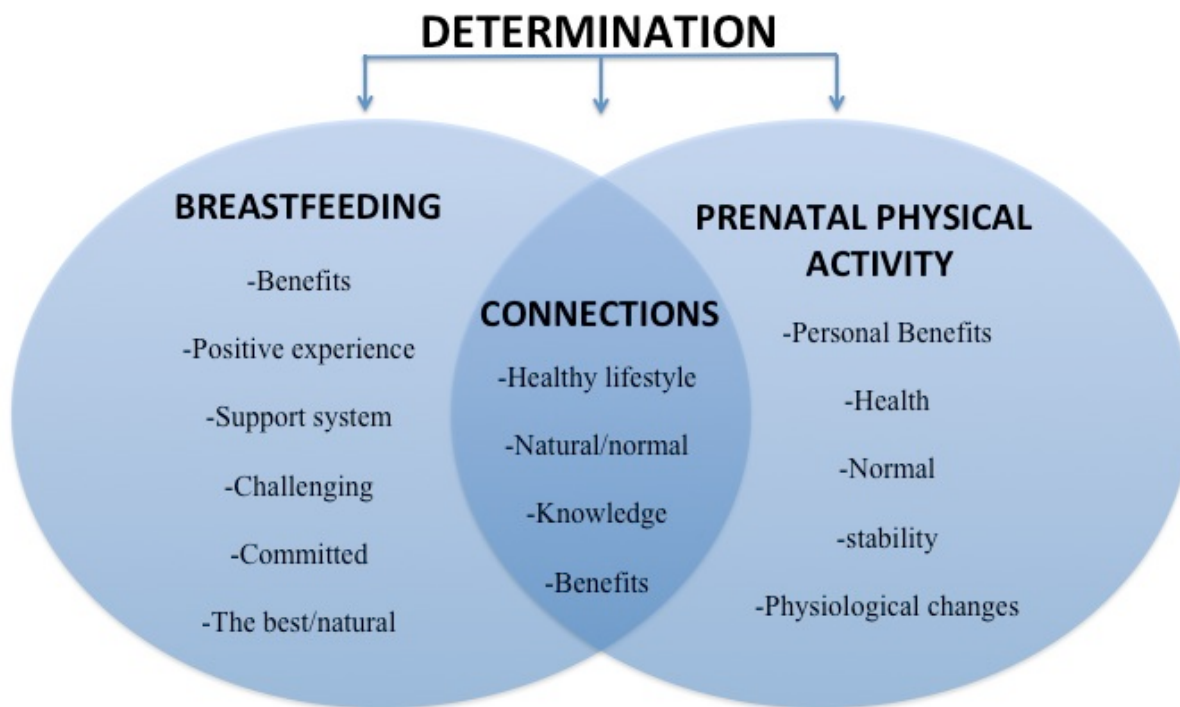


Figure 1: Connections between prenatal physical activity and breastfeeding

Determination

Figure 1 is a representation of the overall themes related to prenatal physical activity, breastfeeding, and the connections between the two as discussed by the women in this study. The two circles represent the main themes discussed when women were asked about their decisions to engage in prenatal physical activity and to breastfeed. The overlap in the circles represents the connections between prenatal physical activity and breastfeeding as discussed by the women interviewed. When looking at the combined story of all the women interviewed, these women were very determined to remain committed to their decisions. Through their determination these women also showed great perseverance in overcoming the challenges they faced. The word “determination” was used by several of the women from this study and it embodies the essence of all of the stories told by the women.

Determination was chosen as the over-arching theme that best represented the combined story of these women. Part of the determination displayed came with the ability to self-advocate and high levels of physical activity and breastfeeding self-efficacy. The women in this study had the resources and power needed to be able to advocate for what they believed in; many of them based their beliefs on information they had obtained doing research on their own. The fact that the women in this study were highly educated and middle-class meant that they had the skills and resources to conduct research independent from their medical professionals.

All of the women discussed a variety of challenges they faced while engaging in prenatal physical activity and breastfeeding. Every woman discussed having to change physical activity habits to accommodate to the challenges, as a result of their pregnancy. Women’s belief in their abilities seemingly helped them to stay determined and overcome the challenges they faced. While the majority of these women viewed prenatal physical activity and breastfeeding as

natural processes, it is clear that these two processes did not come easy to all of the women. The identified themes show that the beliefs these women had surrounding prenatal physical activity and breastfeeding were strong and likely motivated them to endure the challenges they faced.

Discussion

Overall women spoke less about prenatal physical activity than they did about breastfeeding. There are many reasons why this could be, but based on the responses from these women it appeared that they saw breastfeeding as beneficial for themselves and their baby, while they reported prenatal physical activity as primarily beneficial for themselves. This greater enthusiasm about breastfeeding could have been due to less knowledge about prenatal physical activity benefits within this particular sample, or it could have been due to the fact that all of the women were currently engaging in breastfeeding, whereas prenatal physical activity experiences were in their past. The women in this study showed some knowledge about physical activity (i.e., healthy for them and their baby), but very few women spoke about specific benefits for babies as they did with breastfeeding.

Responses from the women in this study suggested that personal reasons were the main factors that influenced their decision to be physically active during pregnancy. The literature has suggested differing motivating factors than the women in this study reported such as: support from family household members, the availability of child care, self-efficacy beliefs tied to physical activity, improvements in overall mood, increased energy, and more effective weight control (Cioffiet al., 2010; Clarke & Gross, 2004; Cramp & Bray, 2009; Pereira et al., 2007). Though these factors are different than the ones mentioned by the women in this study, it is clear that women who engage in prenatal physical activity most often cited personal motivating factors rather than factors related to their infant. Responses from this study and other studies would

suggest that personal benefits associated with prenatal physical activity are more widely known than benefits for both the mother and the infant.

Though physical activity was seen as beneficial, some women did report facing barriers such as physical factors (nausea, loss of balance, frequent need to urinate, fatigue, etc.), inconsistent information from doctors, scheduling conflicts with husbands, and a lack of peers with whom to engage in physical activity. Interestingly, these barriers are different than those reported in the literature, which suggested social, psychological and physical factors, tiredness/fatigue, physical limitations or restrictions, and lack of access to resources such as access to facilities, child care, and help implementing physical activity plans were the main barriers that discourage women from engaging in prenatal physical activity (Cioffi et al., 2010; Clarke & Gross, 2004; Symons Downs & Hausenblas, 2004). Though the barriers reported were different from previous studies, decreasing the impact of these barriers could help encourage more women to engage in prenatal physical activity. Increasing the number of women engaging in prenatal physical activity would be beneficial not only for the mother and child, but also for society because little is known about what could help reduce preterm delivery besides quitting smoking and prenatal physical activity (Guendelman et al., 2012). Reducing the risk of preterm delivery would help reduce a huge burden on society due to the fact that preterm delivery is one of the leading causes of infant death and provides a large emotional and economic burden on society (Guendelman et al., 2012; Hamilton et al., 2009; Behrman & Butler, 2007).

Despite the myriad of challenges reported in the literature such as, lack of support, uncertainty regarding quality of breast milk, returning to work, lack of pumping facilities at work and low confidence in breastfeeding abilities (Arora et al., 2000; Dennis, 2002), the women in this study primarily emphasized the physical challenges they encountered. Perhaps the women

in this study saw the physical challenges they faced as the most memorable or perhaps these women did not encounter some of these common barriers reported in previous studies. Minority mothers, low SES mothers, and mothers with less education are less likely to breastfeed than Caucasian mothers, middle-class mothers, and well educated mothers (CDC, 2007; Li et al., 2005; Ryan et al., 2002; U.S. DHHS, 2011). In particular, African American women tend to return to work earlier than white women and are also more likely to work in environments that do not support breastfeeding when compared to white women (Okeku, 2003; Satcher, 2001). Additionally, a study consisting of face-to-face interviews with 154 low-income mothers reported stress, crowding living space, returning to work or school, and lack of social support as common barriers to breastfeeding (Guttman & Zimmerman, 2000). Perhaps minority, low SES, and less educated mothers are more likely to encounter the common barriers reported in the literature when compared to mothers, like the women in this study, who are Caucasian, middle-class and highly educated.

The women in this study identified an important difference related to support from medical professionals based on birthing location. Many women in this study, who delivered in a hospital, complained that when they encountered challenges in their breastfeeding relationship their doctors were quick to recommend supplementing or formula rather than continuing to breastfeed. The literature has suggested that support for breastfeeding is one of the leading factors that encourages or discourages women to breastfeed (Arora et al., 2000; for review see Dennis, 2002; Dennis et al., 2002; Kong & Lee, 2004). This distinct difference in breastfeeding support based on delivery location is not surprising considering the differences in medical models followed by hospitals when compared to the local birthing center.

The medical model is most commonly followed by hospitals, while the midwife model is

more likely to be followed by birthing centers such as the one the women in this study used.

Traditionally the medical model has emphasized the importance of medical control/monitoring to ensure safety throughout the birthing experience (Teijlingen, 2005). The medical model emphasizes the need of medical intervention at the earliest signs of problems or complications (Teijlingen, 2005). On the other hand, the midwife model emphasizes the natural process of childbirth and the idea that the majority of women have normal and safe births with little to no medical intervention (Teijlingen, 2005). When considering the differences in the two models it could be suggested that these differing fields of thought played a large part in the experiences women had.

Specifically, the women in this study had troubling experiences in hospitals when it came to their breastfeeding struggles. The mothers who encountered complications in the hospital setting were encouraged to turn to formula and some of the women in this study reported that their child was given formula against their wishes. Comparatively, women who sought care from the local birthing center were encouraged to continue their breastfeeding efforts and were given resources to help them overcome these challenges instead of recommending supplementation. The differences in field of thought might help explain these experiences considering the medical model's emphasis on intervention at the earliest signs of problems or complications, while the midwife model assumes breastfeeding to be normative and natural even when challenges are present (Teijlingen, 2005).

The women in this study who delivered in the hospital or sought advice from pediatricians identified a disconnect between the recommendations of the AAP and the WHO and the advice they received. It is unclear why some medical professionals would recommend women breastfeed, but when challenges occur recommend formula feeding despite the known

recommendations from the AAP and WHO. Support for breastfeeding has been associated with increased exclusive breastfeeding, more positive breastfeeding experiences, and increased duration (Dennis et al., 2002). Women who delivered at a local birthing center or who sought the advice and help of lactation consultants and midwives at the center reported having more support than those who did not seek help outside of the initial visit from the lactation consultant in the hospital. If women received advice and support from medical professionals, regardless of where they delivered, perhaps women would be encouraged to breastfeed for longer.

The responses from the women in this study suggested that there was an indirect connection between prenatal physical activity and breastfeeding. These women had common beliefs surrounding both physical activity and breastfeeding. Their responses suggested that women who were more concerned about living and providing a healthy lifestyle for themselves and their family were inclined to engage in both activities.

Further research needs to be conducted in order to assess whether these connections are specific to the current sample or if they could be generalized to a larger population. Participants in this study were very similar in more ways than in just their beliefs. These women were highly educated (all were college educated and all but five had Master's degrees or higher), all but one was married and living with their husband, they were all in their late-twenties to early-thirties, and all but one participant self-identified as Caucasian. The fact that these women had so many similar characteristics makes it important for future research to address whether the homogenous nature of this sample explains the common belief systems that emerged.

Determining whether or not these connections can be generalized would be very important for policy and program implementation. Based on the literature, many barriers exist to both prenatal physical activity and breastfeeding, but support and increased self-efficacy towards

both increases the number of women initiating and maintaining both of these decisions (Cramp & Bray, 2009; Krans et al., 2005; for review see Dennis 2002; Dennis et al., 2002). Providing programming with educational and support group components could help provide women with the support needed to help build a stronger self-efficacy, which would encourage them to initiate and continue engaging in these activities more so than they otherwise would not have (Cannella et al., 2010; Cramp & Bray, 2009; for review see Dennis 2002; Dennis et al., 2002).

In terms of the importance of self-efficacy, Noel-Weiss, Bassett and Cragg (2006) have suggested that a mother's breastfeeding self-efficacy has a large impact on a mother's attitude and ability to successfully breastfeed. Furthermore, they suggested that the more support and knowledge a woman has about breastfeeding (nurses and lactation consultants) the more likely they are to have a positive self-efficacy, and will therefore positively impact their breastfeeding experience (Noel-Weiss et al., 2006). If intervention programs focused on providing education and resources in an effort to strengthen women's self-efficacy it could help increase the number of women engaging in breastfeeding. An intervention study providing women with educational materials and breastfeeding pre-and postnatal visits from trained assistants found higher breastfeeding self-efficacy in women who received the treatment when compared to the control group (Masters, Gijsbers, Bartholomew, Kottnerus, Van Schayck, 2013). If programs focused on educating women on what challenges they may encounter and how they can overcome them, women might be able to better break through common barriers they may face while engaging in both activities. Focusing on what women can do to overcome challenges might better equip mothers to be successful in their prenatal physical activity and breastfeeding decisions.

Limitations of this study included the size of the sample and the lack of diversity. The fact that women in this study were predominately middle class could have impacted their

responses. Middle-class parents have been described as feeling more comfortable advocating for themselves and their children when compared to lower-class and poor parents (Lareau, 2011). Lareau (2011) has suggested that a key difference exists because middle-class parents view professionals as peers rather than superiors. The fact that the women in this study were willing to go against medical professionals' advice based on their personal knowledge and/or beliefs suggests either a sense of entitlement or perhaps that these women did not feel inferior to medical professionals (Lareau, 2011). Though the sample size and homogenous nature of the sample could be seen as limitations, there is much to be learned from these women.

For this particular study it was important to only include women who engaged in both activities because the purpose of this study was to identify connections between these two activities. It would have been impossible to identify connections between these two decisions if participants had not actually made those decisions. Additionally, the inclusion criteria for this study led to a particular sample demographic. Though these women are very similar, it is important to note that their similarities provide an interesting insight into the importance of self-advocacy when it comes to the ability to successfully engage in prenatal physical activity and breastfeeding despite challenges. Feeling confident and comfortable advocating for personal beliefs and a strong self-efficacy about physical activity and breastfeeding appeared to help the women in this study continue engaging in prenatal physical activity and breastfeeding.

Further exploration of the connections between prenatal physical activity and breastfeeding is needed. It would be important to determine whether or not increasing the number of women engaging in prenatal physical activity might help increase the number of women breastfeeding. Increasing the number of women who engage in both prenatal physical activity and breastfeeding could provide many short-term and long-term health benefits for

mothers and children, which in turn could provide unparalleled health benefits for future generations. This study identifies key connections that exist between prenatal physical activity and breastfeeding, and provides researchers with a novel launching point for future research.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship and/or publication of this article.

References

- Albrecht, S. S., Kuklina, E. V., Bansil, P., Jamieson, D. J., Whiteman, M. K., Kourtis, A. P., Posner, S. F., & Callaghan, W. M. (2010). Diabetes trends among delivery hospitalizations in the U.S., 1994-2004. *Epidemiology Health Services Research*, 33(4), 768-773. doi: 10.2337/doc09-1801.
- Alhusen, J., (2008). A literature update on maternal-fetal attachment. *The Association of Women's Health, Obstetric and Neonatal Nurses*, 37, 315-328. doi: 10.1111/j.1552-6909.2008.00241.
- American College of Obstetricians and Gynecologists (2002). ACOG committee opinion #267: Exercise during pregnancy and the postpartum period. *Obstetrics and Gynecology*, 99(1), 171-173. doi: 10.1016/S0029-7844(01)01749-5.
- American Diabetes Association (2004). Gestational Diabetes Mellitus. *Diabetes Care*, 27(1). S88-S90.
- Arenz, S., Rückerl, R., Koletzko, B., & von Kries, R. (2004). Breast-feeding and childhood obesity—a systematic review. *International journal of obesity*, 28(10), 1247-1256.
- Arora, S., McJunkin, C., Wehrer, J., & Kuhn, P. (2000). Major factors influencing breastfeeding rates: Mother's perception of father's attitude and milk supply. *Pediatrics*, 106(5), e67-e67. doi: 10.1542/peds.106.5.e67.
- Bain, L., Awah, P., Geraldine, N., Kindong, P., Sigal, Y., Bernard, N., & Tanjeko, A., (2013). Malnutrition in Sub-Saharan Africa: Burden causes and prospects. *The Pan African Medical Journal*, 15 (120), 25-35. doi: 10.11604/pamj.2013.15.120.2535
- Bauer, P. W., Pivarnik, J. M., Feltz, D. L., Paneth, N., & Womack, C. J. (2010). Validation of an historical physical activity recall tool in postpartum women. *Journal of Physical Activity Health*, 7(5), 658-661.

- Beddoe, A. E., & Lee, K. A. (2008). Mind-body interventions during pregnancy. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, 37 (2), 165-175. doi: 10.1111/j.1552-6909.2008.00218.
- Behrman, R. E., & Butler, A. S. (Eds.). (2007). *Preterm birth: causes, consequences, and prevention*. National Academies Press.
- Bernier, M. O., Plu-Bureau, G., Bossard, N., Ayzac, L., & Thalabard, J. C. (2000). Breastfeeding and risk of breast cancer: a meta-analysis of published studies. *Human Reproduction Update*, 6(4), 374-386.
- Blumer, H. (1986). *Symbolic interactionism: Perspective and method*. University of California Press.
- Brodribb, W., Fallon, A. B., Hegney, D., & O'Brien, M. (2007). Identifying predictors of the reasons women give for choosing to breastfeed. *Journal of Human lactation*, 23(4), 338-344. doi: 10.1177/0890334407307540.
- Cannella, D., Lobel, M., & Monheit, A. (2010). Knowing is believing: Information and attitudes towards physical activity during pregnancy. *Journal of Psychosomatic Obstetrics & Gynecology*, 31(4), 236-242. doi: 10.3109/0167482X.2010.525269
- Centers for Disease Control and Prevention (CDC). (2014). Facts about Physical Activity: Some Americans are getting enough, but too many are not. *Retrieved May 2014*. From Center for Disease Control and Prevention website:
<http://www.cdc.gov/physicalactivity/data/facts.html>.
- Centers for Disease Control and Prevention (CDC). (2014). Breastfeeding report card—United States, 2014. *Retrieved April 2015*.

- Centers for Disease Control and Prevention (CDC.) (2008). Breastfeeding-related maternity practices at hospitals and birth centers—United States, 2007. *MMWR. Morbidity and mortality weekly report*, 57(23), 621-625.
- Centers for Disease Control and Prevention (CDC.) (2007). Breastfeeding trends and updated national health objectives for exclusive breastfeeding--United States, birth years 2000-2004. *MMWR. Morbidity and mortality weekly report*, 56(30), 760.
- Charmez, K. (1996). The search for Meanings—Grounded Theory. In J. A. Smith, R. Harre, & L. Van Langenhove (Eds.), *Rethinking Methods in Psychology* (pp. 27-49). London: Sage Publications.
- Charmez, K. (2006). *Constructing grounded theory*. London: Sage.
- Chien, P. F., & Howie, P. W. (2001). Breast milk and the risk of opportunistic infection in infancy in industrialized and non-industrialized settings. In *Advances in nutritional research* (pp. 69-104). Springer US.
- Cioffi, J., Schmied, V., Dahlen, H., Mills, A., Thornton, C., Duff, M., Cummings, J. & Kolt, G. S. (2010). Physical activity in pregnancy: women's perceptions, practices, and influencing factors. *Journal of Midwifery & Women's Health*, 55(5), 455-461.
- Clarke, P. E., & Gross, H. (2004). Women's behaviour, beliefs and information sources about physical exercise in pregnancy. *Midwifery*, 20(2), 133-141.
- Collaborative Group on Hormonal Factors in Breast Cancer. (2002). Alcohol, tobacco and breast cancer—collaborative reanalysis of individual data from 53 epidemiological studies, including 58 515 women with breast cancer and 95 067 women without the disease. *British journal of cancer*, 87(11), 1234-1245. doi: 10.1038/sj.bjc.6600596.

- Cramp, A. G. & Brawley, L. R., (2009). Sustaining self-regulatory efficacy and psychological outcome expectations for postnatal exercise: Effects of a group mediated cognitive behavioural intervention. *The British Psychological Society, 14*, 595-611. doi: 10.1348/135910708X383732.
- Creswell, J. W. (2012). *Qualitative inquiry and research design: Choosing among five approaches*. Sage.
- Dabelea, D., Snell-Bergeon, J. K., Hartsfield, C. L., Bischoff, K. J., Hamman, R. F., & McDuffie, R. S. (2005). Increasing prevalence of Gestational Diabetes Mellitus (GDM) over time and by birth cohort. *Epidemiology Health Services Psychosocial Research, 22*(3), 579-584. Doi: 10.2337/diacare.28.3.579.
- Dennis, C. (2002). Breastfeeding initiation and duration: A 1990-2000 literature review. *Journal of Obstetric, Gynecologic and Neonatal Nursing, 31*(1), 12-32.
- Dennis, C., Hodnett, E., Gallop, R., & Chalmers, B. (2002). The effect of peer support on breastfeeding duration among primiparous women: A randomized controlled trial. *Canadian Medical Association Journal, 166*(1), 21-28.
- Dieter, J. N., Field, T., Hernandez-Reif, M., Jones, N. A., Lecanuet, J. P., Salman, F. A., & Redzepi, M. (2001). Maternal depression and increased fetal activity. *Journal of Obstetrics and Gynaecology: The Journal of the Institute of Obstetrics and Gynaecology, 21*(5), 468-473. doi:10.1080/01443610120072009.
- Duncombe, D., Wertheim, E. H., Skouteris, H., Paxton, S. J., & Kelly, L. (2009). Factors related to exercise over the course of pregnancy including women's beliefs about the safety of exercise during pregnancy. *Midwifery, 25*(4), 430-438.

- Earle, S. (2000). Why some women do not breast feed: bottle feeding and fathers' role. *Midwifery*, 16(4), 323-330.
- Eidelman, A. I., Schanler, R. J., Johnston, M., Landers, S., Noble, L., Szucs, K., & Viehmann, L. (2012). Breastfeeding and the use of human milk. *Pediatrics*, 129(3), e827-e841.
- Evenson, K. R., & Bradley, C. B. (2010). Beliefs about exercise and physical activity among pregnant women. *Patient education and counseling*, 79(1), 124-129.
- Evenson, K. R., Savitz, D. A., & Huston, S. L. (2004). Leisure-time physical activity among pregnant women in the US. *Paediatric and Perinatal Epidemiology*, 16(6), 400-407. doi: 10.1111/j.1365-3016.2004.00595.x.
- Fein, S. B., Mandal, B., & Roe, B. E. (2008). Success of strategies for combining employment and breastfeeding. *Pediatrics*, 122(Supplement 2), S56-S62.
- Ferrara, A., Kahn, H. S., Quesenberry, C. P., Riley, C & Hedderson, M. M. (2004). An increase in the incidence of Gestational Diabetes Mellitus: Northern California, 1991-2000. *Obstetrics and Gynecology*, 103(3), 526-533. doi: 10.1097/01.AOG.0000113623.18286.20.
- Field, T., (2011). Review: Prenatal exercise research. *Infant Behavior and Development*, 35, 397-407. doi: 10.1016/j.infbeh.2011.10.001.
- Field, T., Diego, M., Hernandez-Reif, M., Medina, L., Delgado, J., & Hernandez, A., (2012). Yoga and massage therapy reduce prenatal depression and prematurity. *Journal of Bodywork & Movement Therapies*, 16, 204-209. doi: 10.1016/j.jbmt.2011.08.002.
- Foster, S., Slade, P., & Wilson, K., (1996). Body image, maternal fetal attachment, and breast feeding. *Journal of Psychosomatic Research*, 41 (2), 181-184. doi: 10.1016/0022-3999(96)00035-9.

- Guendelman, S., Pearl, M., Kosa, J., Graham, S., Abrams, B., & Kharrazi, M., (2013). Association between preterm delivery and pre-pregnancy body mass (BMI), exercise and sleep during pregnancy among working women in Southern California. *Maternal Child Health Journal*, 17, 723-731. doi: 10.1007/s10995-012-1052-5.
- Guttman, N. & Zimmerman, D. R. (2000). Low-income mothers' views on breastfeeding. *Social Science and Medicine*, 50(10), 1457-1473. doi: 10.1016/S0277-9536(99)00387.
- Hamilton, B. E., Martin, J. A., & Ventura, S. J. (2009). Births: preliminary data for 2009. *National vital statistics reports*, 59(3) 1-29.
- Hannon, P., Willis, S., Bishop-Townsend, V., Martinez, I., & Scrimshaw, S., (2000). African-American and Latina adolescent mothers' infant feeding decisions and breastfeeding practices: A qualitative study. *Journal of Adolescent Health*, 26 (6), 399-407.
- Horvath K., Koch, K., Jeitler, K., Matyas, E., Bender, R., Bastain, H., Lange, S., & Siebenhofer, A. (2010). Effects of treatment in women with gestational diabetes mellitus: Systematic review and meta-analysis. *British Medical Journal*, 340:c1395. doi:10.1136/bmj.c1395
- Ip, S., Chung, M., Raman, G., Chew, P., Magula, N., Trikalinos, T., & Lau, J. (2007). Breastfeeding and maternal and infant health outcomes in developed countries. *Evidence Report/Technology Assessment No.153*, 1-186.
- Ji, E., & Han, H.R., (2010). The effects of Qi exercise on maternal/fetal interaction and maternal well-being during pregnancy. *The Association of Women's Health, Obstetric and Neonatal Nurses*, 39, 310-318. doi: 10.1111/j.1552-6909.2010.01135.
- Kennedy, K. I., Rivera, R., & McNeilly, A. S. (1989). Consensus statement on the use of breastfeeding as a family planning method. *Contraception*, 39(5), 477-496.

- King, J. (2007). Contraception and lactation. *Journal Of Midwifery & Women's Health*, 52(6), 614-620. doi: 10.1016/j.jmwh.2007.08.012.
- Koh, D., Miller, Y. D., Marshall, A. L., Brown, W. J., & McIntyre, D. (2010). Health-enhancing physical activity behaviour and related factors in postpartum women with recent gestational diabetes mellitus. *Journal of Science and Medicine in Sport*, 13(1), 42-45.
- Kong, S. K., & Lee, D. T. (2004). Factors influencing decision to breastfeed. *Journal of advanced nursing*, 46(4), 369-379. doi: 10.1111/j.1365-2648.2004.03003.x.
- Krans, E. E., Gearhart, J. G., Dubbert, P. M., Klar, P. M., Miller, A. L., & Replogle, W. H. (2005). Pregnant women's beliefs and influences regarding exercise during pregnancy. *Journal of the Mississippi State Medical Association*, 46(3), 67-73.
- Lareau, Annette. *Unequal Childhoods: Class, Race, and Family Life*. Los Angeles: University of California Press, 2011. Print.
- LaRossa, R. & Reitzes, D. C. (1993). Symbolic interactionism and family studies. In *Sourcebook of Family Theories and Methods* (pp. 135-166). Springer US.
- Lawrence, R. A. & Lawrence, R. M. *Breastfeeding: A Guide for the Medical Professional-Expert Consult*. Elsevier Health Sciences, 2010. Print.
- Li, R., Darling, N., Maurice, E., Barker, L., & Grummer-Strawn, L. M. (2005). Breastfeeding rates in the United States by characteristics of the child, mother, or family: the 2002 National Immunization Survey. *Pediatrics*, 115(1), e31-e37. *Neonatal Nurses*, 39, 310-318. doi: 10.1111/j.1552-6909.2010.01135.
- Lynch, S., Bethel, J., Chowdhury, N., & Moore, J., (2012). Rural and urban breastfeeding initiation trends in low-income women in North Carolina from 2003-2007. *Obstetrics & Gynecology*, 28 (2), 226-232. doi: 10.1177/0890334411430086.

- Marcoux, S., Brisson, J., & Fabia, J. (1989). The effect of leisure time physical activity on the risk of pre-eclampsia and gestational hypertension. *Journal of Epidemiology and Community Health*, 43(2), 147-152. doi: 10.1136/jech.43.2.147.
- Masters, I., Gijsbers, B., Bartholomew, K., Knottnerus, J., Van Schayck, O. (2013). Social cognitive changed resulting from an effective breastfeeding education program. *Breastfeeding Medicine*, 8(1), 23-30. doi: 10.1089/bfm.2012.0011.
- McDowell MA, Wang C-Y, Kennedy- Stephenson J., (2008). Breastfeeding in the United States: Findings from the National Health and Nutrition Examination Surveys 1999– 2006. NCHS data briefs, no 5. Hyattsville, MD: National Center for Health Statistics. 2008.
- McMahon, M. J., Ananth, C. V., & Liston, R. M. (1989). Gestatioanl Diabetes Mellitus. Risk factors, obstetric complications and infant outcomes. *The Journal of Reproductive Medicine*, 43(4), 372-378.
- Noel-Weiss, J., Bassett, V., & Cragg, B. (2006). Developing a prenatal breastfeeding workshop to support maternal breastfeeding self-efficacy. *Journal of Obstertric Gynecologic and Neonatal Nursing*, 35(3), 349-357. doi: 10.1111/J.1552-6909.2006.00053.x
- Oken, E. & Gillman, M. W. (2003). Fetal origins of obesity. *Obesity A Research Journal*, 11(3), 496-506. doi: 10.1038/oby.2003.69.
- Oken, E., Ning, Y., Rifas-Shiman, S. L., Radesky, J. S., Rich-Edwards, J. W., & Gillman, M. W. (2006). Associations of physical activity and inactivity before and during pregnancy with glucose tolerance. *Obstetrics and Gynecology*, 108(5) 1200-1207. doi:10.1097/01.AOG.0000241088.60745.70.

- Ortiz, J., McGilligan, K., & Kelly, P. (2004). Duration of breast milk expression among working mothers enrolled in an employer-sponsored lactation program. *Pediatric Nursing*, 30(2), 111-119.
- Owen, C., Martin, R., Whincup, P., Smith, G., & Cooke, D., (2005). Effect on infant feeding on the risk of obesity across the life course: A quantitative review of published evidence. *Journal of the American Academy of Pediatrics*, 115 (5), 1367-1377. doi: 10.1542/peds.2004-1176.
- Oyeku, S. O. (2003). A closer look at racial/ethnic disparities in breastfeeding. Commentary on "Breastfeeding advice given to African American and white women by physicians and WIC counselors". *Public Health Reports*, 118(4), 377-378.
- Pereira, M. A., Rifas-Shiman, S. L., Kleinman, K. P., Rich-Edwards, J. W., Peterson, K. E., & Gillman, M. W. (2007). Predictors of change in physical activity during and after pregnancy: Project Viva. *American journal of preventive medicine*, 32(4), 312-319.
- Poudevigne, M. S. & O'Connot, P. J. (2006). A review of physical activity patterns in pregnant women and their relationship to psychological health. *Sports Medecine*, 36(1), 19-38.
- Roberts, J. M., & Lain, K. Y., (2002). Recent insights into the pathogenesis of Pre-Eclampsia. *Placenta*, 23(5), 359-372. doi: 10.1053/plac.2002.0819.
- Ryan, A. S., Wenjun, Z., & Acosta, A. (2002). Breastfeeding continues to increase into the new millennium. *Pediatrics*, 110(6), 1103-1109.
- Satcher, D. S. (2001). Department of Health and Human Services blueprint for action on breastfeeding. *Public Health Reports*, 116, 72-73.
- Schwandt, T. A. (1994). Constructivist, interpretivist approaches to human inquiry.

- Shin, H., Park, Y. J., Ryu, H., & Seomun, G. A. (2008). Maternal sensitivity: *A concept analysis*. *Journal of Advanced Nursing*, 64 (3), 304-314. doi: 10.1111/j.1365-2648.2008.04814
- Sloan, S., Sneddon, H., Stewart, M., & Iwaniec, D. (2006). Breast is best? Reasons why mothers decide to breastfeed or bottlefeed their babies and factors influencing the duration of breastfeeding. *Child Care in Practice*, 12(3), 283-297. doi: 1080/13575270600761743.
- Sorensen, T. K., Williams, M. A., Lee, I. M., Dashow, E. E., Thompson, M. L. & Luthy, D. A. (2003). Recreational physical activity during pregnancy and risk of preeclampsia. *Hypertension*, 41(6), 1273-1280. doi:10.1161/01.HYP.0000072270.82815.91
- Stuebe, A. (2009). The risks of not breastfeeding for mothers and infants. *Reviews in obstetrics and gynecology*, 2(4), 222-231. doi: 10.3909/riog0093.
- Symons Downs, D., & Hausenblas, H. A. (2004). Women's exercise beliefs and behaviors during their pregnancy and postpartum. *Journal of midwifery & women's health*, 49(2), 138-144.
- Teijlingen, E. v. (2005). A critical analysis of the medical model as used in the study of pregnancy and childbirth. *Sociological Research Online*, 10(2).
- Tobias, D. K., Zhand, C., van Dam, R. M., Bowers, K., & Hu, F. B. (2011). Physical activity before and during pregnancy and risk of Gestational Diabetes Mellitus. *Diabetes Care*, 34(1), 223-229.
- US Department of Health and Human Services. (2008). Physical activity guidelines for Americans.

U.S. Department of Health and Human Sciences. (2010). Maternal, infant, and child health.

Retrieved May 14, 2014, from Healthy People website:

<http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=2>

[6](#)

US Department of Health and Human Services. (2011). The Surgeon General's call to action to support breastfeeding.

Van den Bergh, B. R., Mulder, E. J., Mennes, M., & Glover, V. (2005). Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: *Links and possible mechanisms. A review*. Neuroscience and Biobehavioral Reviews, 29 (2), 237-258.

Weissgerber, T. L., Wolfe, L. A., Davies, G. A. L., & Mottola, M. F. (2006). Exercise in the prevention and treatment of maternal-fetal disease: A review of the literature. *Applied Physiology Nutrition and Metabolism*, 31, 661-674. doi: 10.1139/H06-060.

Zhang, J., & Savitz, D. A. (1996). Exercise during pregnancy among US women. *Annals of Epidemiology*, 6(1), 53-59. doi: 10.1016/1047-2797(95)00093-3.

Appendices

Appendix A

Breastfeeding Mothers Needed for a Research Study

The purpose of this study is to examine the possible connections between the factors influencing the decision to engage in prenatal physical activity and the decision to breastfeed.

If you choose to participate you will be interviewed and given the chance to express your beliefs, opinions, and experiences about prenatal physical activity and breastfeeding. To take part in this study you must be 18 years or older, currently breastfeeding an infant between 3 months and 12 months of age, and who were physically active during pregnancy.



Please contact Alex Tucker if interested

Etucker1@utk.edu

615-944-1209



Appendix B

Email Recruitment

Subject line: Seeking breastfeeding mothers for research

My name is Alex Tucker and I am a master's student at The University of Tennessee Knoxville in the Child and Family Studies Department. I am looking for women who are currently breastfeeding an infant between 3 and 12 months of age to participate in a study I am doing for my thesis. The purpose of this study is to investigate the possible connections between the factors influencing women to engage in prenatal physical activity and breastfeeding.

If you choose to be part of the study you will be interviewed and given the chance to express your beliefs, opinions, and experiences about prenatal physical activity and breastfeeding. If you are eligible you will be invited to a longer interview that will take place in your home or in the Early Experiences Research Center at The University of Tennessee Knoxville.

If you are interested in participating or have any questions about the study, please email me (Alex) at etucker1@utk.edu

Thank you for your consideration,
Alex Tucker

Master's Student
Department of Child and Family Studies

Appendix C

Screening interview questions:

1. Are you 18 years of age or older?
2. How old is your baby?
3. Are you currently breastfeeding?
4. Were you physically active during your pregnancy?
 - a. If yes, about how active were you? On average, how much would you say you were physically active throughout your pregnancy?

Appendix D

Informed Consent Form

Connections between factors influencing prenatal physical activity and breastfeeding

My name is Alex Tucker from the University of Tennessee, department of Child and family Studies. I am inviting you to participate in a research study on the possible connections between factors influencing prenatal physical activity and breastfeeding. You may participate in this study if you wish. Participation in this study is completely voluntary and you do not have to participate if you do not want to. If at any time you wish to discontinue participation in the study are free to do so at any time and all information collected from you will be destroyed.

In this study, I am interested in the connections between the factors influencing women to engage in prenatal physical activity and breastfeeding. If you choose to be a part of this study, you will first go through a short screening interview to make sure you are eligible to participate. If you are eligible to participate I would ask you questions in an interview about your physical activity during pregnancy, your breastfeeding experiences, factors that influenced you to be physically active during pregnancy and to breastfeed, and any connections between beliefs and influencing factors of both prenatal physical activity and breastfeeding. The interview will last about an hour and will be recorded with an audio recorder. If you want, I can give you examples of the types of things I will ask. At the end of the interview I will give you two surveys that will be used for descriptive purposes. One will be a demographic survey and the other will be a survey that will ask you questions about what types of physical activity you engaged in and at what frequency you participated in these activities.

If you participate in this study, the possible risks are very small and might include feeling uncomfortable answering questions in the interview. You are completely free to stop the interview at any time and are always free to stop participation in this study whenever you want to. All of the information I collect about you, including information from the screening interview, will be confidential. In other words, when I present what I learn from this study, no one will know your name or what you specifically said. All of the information collected from you and about you, including the recordings of the interview, will be stored securely at The University of Tennessee Knoxville.

If you agree to participate in this study, it will help researchers examine whether or not there are connections between the factors that influence women to be physically active during pregnancy and to breastfeed. This study will also help researchers further understand what factors influence prenatal physical activity and breastfeeding.

If you have any questions about the study you are free to ask before or after signing this consent form. If you have any questions after I leave you may contact me by email (etucker1@utk.edu) or by phone (615-944-1209)

CONSENT

I have read the above information. I have received a copy of this form. I agree to participate in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

Appendix E

Modifiable Activity Questionnaire

1. Please circle all activities listed below that you participated in during pregnancy.

- | | | |
|--|-------------------------------------|--------------------|
| 01 Jogging (outdoor, treadmill) | 15 Football/Soccer | 28 Stair Master |
| 02 Swimming (laps, snorkeling) | 16 Racquetball/Handball/Squash | 29 Fencing |
| 03 Bicycling (indoor, outdoor) | 17 Horseback riding | 30 Hiking |
| 04 Softball/Baseball | 18 Hunting | 31 Tennis |
| 05 Volley Ball | 19 Fishing | 32 Golf |
| 06 Bowling | 20 Aerobic Dance/Step Aerobic | 33 Canoeing |
| 07 Basketball | 21 Water Aerobics | 34 Water skiing |
| 08 Skating | 22 Dancing (Square, Line, Ballroom) | 35 Jumping Rope |
| 09 Martial Arts (karate, judo) | 23 Gardening or Yard work | 36 Snow skiing (X- |
| 10 Tai chi | 24 Badminton | 37 Snow skiing |
| (Downhill) | | |
| 11 Calisthenics/Toning exercises | 25 Strength/Weight training | 38 Snow shoeing |
| 12 Wood Chopping | 26 Rock Climbing | 39 Yoga |
| 13 Water/coal hauling | 27 Scuba Diving | 40 Other |
| 14 Walking for exercise (outdoor, indoor at mall or fitness center, treadmill) | | |

2. List each activity that you circled in the “Activity” box below, check the months you did each activity during your pregnancy and then estimate the average amount of time spent in that activity.

Activity	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Average # of Times Per Month	Average # of Minutes Each Time

3. In general, how many HOURS per DAY did you usually spend watching television?
 _____ hours

Appendix F

Demographic survey:

1.Date of birth of mother:

2.Date of birth of baby:

3.Gender of baby:

4.Is this your first child? YES NO

a. If no, how many children do you have?

5.Baby breastfed since birth? YES NO OTHER

a. If other please explain:

6.Have any other foods, formula, or liquids been introduced to your baby's diet?

YES NO

a.If yes, what have you introduced other than breast milk?

b.When did you introduce this to your baby?

7.Was the baby FULL TERM PREMATURE

a. If premature what was the gestational age?

8.Was your birth SPONTANEOUS INDUCED

a. VAGINAL C-SECTION

b. If C-section was it ELECTIVE EMERGENCY

9.Did you enroll and attend in any birthing classes? YES NO

a. If yes, what birthing class(es) and for how many sessions?

10. Did you enroll in any parenting classes during pregnancy? YES NO
- a. If yes, what parenting class(es) and for how long?
11. During pregnancy were you diagnosed with any health conditions YES NO
- a. If yes, what were you diagnosed with?
- b. Did this diagnosis affect your ability to engage in prenatal physical activity?
12. How many people live in your household including yourself?
- a. How are they related to you?
13. What is your marital status?
- a. Single
- b. Cohabiting
- c. Married
- d. Divorced
- e. Widowed
- f. Other (please specify)
14. Are the parents of the infant currently being breastfed currently married to each other?
15. Are the parents of the infant currently being breastfed currently living together?
16. What is your highest level of education?
17. Are you currently working?
- a. If yes, what is your occupation?

18. Is the father of the baby currently working?
- a. If yes, what is the father's occupation?
19. What is your current combined annual family income before taxes?
- a. Below \$10,000
 - b. Between \$10,000 and \$22,999
 - c. Between \$23,000 and \$35,999
 - d. Between \$36,000 and \$48,999
 - e. Between \$49,000 and \$51,999
 - f. Between \$52,000 and \$64,999
 - g. Between \$65,000 and \$77,999
 - h. Between \$78,000 and \$90,999
 - i. Above \$91,000

Appendix G

Interview questions:

1. Did your activity level change once you were pregnant? If yes, how so?
2. Tell me about your experiences with physical activity during pregnancy.
3. What factors influenced you to be physically active during your pregnancy?
4. Tell me about the process of deciding to breastfeed?
5. What factors influenced your decision to breastfeed?
6. What does your physical activity look like since you have had your baby?
7. Were your decisions to be physically active and to breast feed related in any way? If so, in what ways?

Vita

Emily “Alex” Tucker is an incoming doctoral student in the department of Child and Family Studies. She received a Bachelors of Science in Child and Family Studies and a Bachelors of Arts in Africana Studies from the University of Tennessee, Knoxville in 2013. Alex was awarded divisional recognition at the Exhibition of Undergraduate Research and Creative Achievement for her poster “Gender and Mother-Child Interaction in Informal Urban Settlements of Kenya”. As a Master’s student Alex was chosen as the Graduate Student Representative at the Family Impact Seminar for the State Legislature in Nashville created by the University of Tennessee Extension Family and Consumer Science and has served as the Child and Family Studies representative on the Deans Advisory Board for two years. She plans on continuing her research on health practices during pregnancy, breastfeeding, and development during early infancy, while pursuing her doctoral degree.