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Influence of Maternal Psychosocial Health on Infant Feeding Practices

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Abstract

Influence of Maternal Psychosocial Health on Infant Feeding Practices

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Epidemiology

Walden University

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Abstract

Choice of nutrition has a great effect on the early development of human growth. Despite increased knowledge on the benefit of breastfeeding to both mother and child, some mothers still choose to formula feed. The purpose of this study is to explain how maternal health contributes to feeding choices. The theory of maternal role attainment and the social cognitive theory are used to evaluate these feeding choices. This study tests for the association between maternal weight status and choice of infant feeding practices, the association between postpartum depression and choice of feeding and finally, if depression mediates the relationship between maternal weight gain and infant feeding choices. This retrospective cohort study employed a quantitative approach, utilizing secondary data with a sample size of 4902, retrieved from Infant Feeding Practices Study II. The data contained information on pregnant women in their third trimester until the first year of infants' life. Logistic regression was employed to answer these research questions. The result indicated that compared to those who are obese, mothers with normal weight are 29.6% more likely to breastfeed. Depressed mothers are 45.9% less likely to breastfeed. There is no possible mediation effect identified in this study. Further studies may need to collect mother's depression status prior to conception. Based on the outcome of this study, there is a need for caregivers to identify at-risk mothers prior to delivery while offering solutions that contribute to better feeding choices. For social change, mothers who are overweight or those experiencing depression prior to conception will make better feeding choices if they receive adequate support and counseling on the implication of their health condition on their infants.

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Chapter 1: Introduction to the Study

Introduction

Maternal health and infant feeding practices are significant public health challenges that impact the health of the next generation and are of great economic importance (Bonia et al., 2013). Maternal-infant feeding choices are determinants of infant well-being and a predictor of infant weight (Agbaere, 2015). For example, early barriers in cognitive development may result from maternal feeding practices due to nutritional content of infant feeding (Onah, Ignatius &Osuorah, et al., 2014). Furthermore, early choices and methods of infant feeding facilitate the development of food choices among children and can transcend through life (Scaglioni, Arrizza, Vechi &Tedeschi, 2011). There is evidence that breastfeeding can help reduce the risk of childhood associated diseases (Zhang, Himes, Guo, et al., 2013). Similarly, studies have identified infant feeding practices as a determinant of childhood obesity (Frederick, Williams, Sales, Martin & Killien, 2008; Olson, Strawderman & Dennison, 2009). Thus, there is an increased understanding that the first years of life are a critical period for the prevention of health complications later in life (Bonia, et al., 2013).

Obesity has been associated with several chronic conditions contributing to a wide range of infant morbidity and mortality (Jansen, et al., 2012). Some of those identified chronic conditions include cardiovascular diseases, type 2 diabetes mellitus, hypertension, osteoporosis and certain cancers (Jansen et al., 2012). These diseases are considered epidemics of the modern century due to increased prevalence that can reduce

the average life expectancy in both children and adults all around the world (Zhang et al., 2013).

Based on the available studies, it is still unclear why mothers resolve to substitute breast milk with formula feeding. Some studies have connected inability to choose the recommended infant feeding with socioeconomic issues, marital status and age, maternity conditions, health care and area of residence, level of education, occupation and media exposure (Kimani-Murage et al., 2011; Motee, Ramasawmy, Pugo-Gunsam, &Jeewon, 2013). Additionally, there is no clear evidence on the influence of maternal psychosocial factors in terms of postpartum depression and maternal weight status on choice of infant feeding. Considering lack of clarity on the factors that constitutes to inappropriate choice of infant feeding, this study will help to identify if maternal psychosocial health can influence choice of infant feeding. Using statistical analysis, this study assessed a potential association between maternal weight status and choice of infant feeding, and if there is a relationship between postpartum depression and choice of infant feeding.

This study constituted of five chapters. Chapter 1 discusses the topic to be researched, importance of the study and expresses the probable constructive public transformation or implications of the study. Chapter 1 also includes the summary of the study background, problem statement and purpose of study. Research questions, hypotheses, theoretical and conceptual frame work, scope of the study, limitation and significant of the study was discussed. Chapter 2 contains the theoretical foundation and the reviewed literature on infant feeding practices. Chapter 3 describes the research design and methodology. Chapter 4 discusses the methods of study, data collection,

analysis and the result. Chapter 5 discusses the study findings, limitations, recommendations, implication and conclusion.

Background

The nutrition-associated diseases of the past that focused on malnutrition have now shifted from under nutrition to over feeding leading to obesity (Roshita, Schubert & Whittaker, 2012). Choice of nutrition has a greater impact on the early development of human life (Karp, Lutenbacher & Dietrich, 2010). Maternal choice of feeding is of great economic importance (Ogden, Carroll, Kit & Flegal, 2012). Nutrition associated diseases are a global issue according to the World Health Organization (WHO, 2014); overweight and obesity among infants between ages 0 to 5 have increased tremendously from 32 million to 42 million from 1990 to 2013 (WHO, 2014). This obesity trend will eventually increase to 70 million by 2025 if nothing is done to mitigate the problem (WHO, 2014).

The impact of obesity for instance, in urban areas of China among preschool children, indicates an increase of 1.5% to 12.6% from 1989 to 1997(Zhang, Himes, &Guo, et al., 2013). A demographic and health study in Kenya identified up to a 22% increase in obesity among children between the ages of 3 and 5 years (Pawloski, Curtin,Gewa, &Attaway, 2012). The prevalence of obesity among Japanese female children increased from 7.1% between 1976- 1980 to 10.2% from1996-2000 (Shirasawa et al., 2012). Obesity also has a significant economic impact. For example, obesity-related medical expenses in America accounts for more than $75 billion since 2003 with the prevalence rate of 12.4% among children between the ages of 2-5 years, 17% among those between the ages of 6 to11years and 17.6% among adolescents (Sealy, 2010).

Despite these statistics, research has determined that obesity is a lifestyle related disease that may originate from infancy and transcend to adulthood (Andrew & Harvey, 2009).

Breastfeeding is recommended within the first 6 months of life due to its adequate nutritional constituent (Arusei, Ettyang & Esamai, 2011), whereas, choosing complementary infant feeding in place of breastfeeding has been associated with increased weight gain among children (Kimani-Murage et al., 2011). The choice of nutrition has a greater impact on the early development of human life and substitution of breastfeeding for formula feeding has been attributed to increased weight gain in the initial stages of life (Kimani-Murage et al., 2011). Conversely, exclusive breastfeeding has been associated with reduced health complications (Rossemet al., 2011). Breast milk was identified to contain protective micro and macro nutrients against infant gastroenteritis, respiratory tract infection and asthma, sudden infant death syndrome and atopic dermatitis (Bonia, Twelles & Halfyard et al., 2013).

The infant welfare study conducted in Nnamdi Azikiwe Teaching Hospital (NAUTH) identified 95.3% of women were aware of the benefits of exclusive breast feeding but only 33.5% complied with the recommendation (Onah et al., 2014). A Chinese study noted that a governmental incentive was introduced to encourage breastfeeding in mainland China, but statistics showed decreases in choice of breastfeeding among mainland Chinese women (Dai, Guan, & Li et al., 2013). In Japan, 90% of mothers preferred breastfeeding, but a postpartum study showed that only 34.7% choose breastfeeding (Nishioka et al., 2011). Another study in Turkey initiated maternal breastfeeding education to encourage the choice to breastfeed and the result showed no

positive changes in the selection of exclusive breastfeeding practices among these Turkish women (Aksu, Kucuk &Duzgun, 2010).

The issue that needs to be addressed in the body of literature has to do with the reason why mothers prefer alternative feeding choices other than breast feeding. Examining the reason for pitfall infant feeding choices, previous studies identified socio-demographic factors as impacting the choice of infant feeding practices. Other studies mentioned that delivery type, alcohol consumption, occupation, and education influenced choice of feeding (Motee, Ramasawmy, Pugo-Gunsam, & Jeewon, (2013). Infant weight gain was identified to be influenced by maternal depression and choice of feeding (Agbaere, 2015). Even with extensive literature review, there is lack of clarity on the factors that constitutes to pitfall choice of infant feeding. Wang, Anderson and Florence, (2011) suggested that depression after delivery may result to poor care taking ability. While Olson, Strawderman & Dennison, (2009) found that being overweight may result in maternal depression.

To my knowledge, there is no study on the influence of maternal psychosocial health on the choice of infant feeding. There is a need to bridge this gap in the body of literature by identifying the factors that impact choice of feeding. Therefore, the purpose of this study is to clarify if there is an association between maternal weight status and postpartum depression, and to identify their influence on choice of infant feeding. The outcome of this study could help to mitigate the barrier in making better infant feeding choices. This could further health education efforts by providing better explanations for why it is ideal to choose breastfeeding since breast milk has the ability to protect infant

from adverse health conditions. The knowledge gained from this study may encourage social change among pregnant mothers.

Problem Statement

Problems associated with infant feeding practices are of great economic importance and a significant public health challenge that threatens the health of next generations. There is an increased understanding that the first years of life are a critical period for the prevention of health complications later in life (Brown & Lee, 2012; Ludlow et al., 2012). Breastfeeding is an ideal infant feeding practice that provides protection for the child against diseases and improves cognitive function when compared with formula feeding (Bonia, Twelles & Halfyard et al., 2013). There is also evidence that breastfeeding can help reduce the risk of childhood diseases (DiSantis, Collins, Fisher & Davey, 2011). This information should be key in motivating maternal choice of infant feeding (Bartoc & Ventura, 2009). Nevertheless, in Japan, 90% of mothers preferred breastfeeding, but a postpartum study showed that only 34.7% actually chose to breastfeed after delivery (Nishioka, Haruna, Matsuzaki et al., 2011). Similarly, a governmental incentive was introduced to encourage breastfeeding in mainland China, but statistics show a decrease in choice of breastfeeding among mainland Chinese women (Guan, Dai and Li et al., 2013).

Some mothers choose to formula feed their children despite the public health guidelines or as recommended by the World Health Organization and American Academy of Pediatrics (Demirtus, Ergocmen and Taskin, 2011; Kuzma, 2013). This could be a result of depression, poor caretaking and weight status identified by Wang,

Anderson and Florence, (2011). Depression is a contributing factor in reducing caretaking ability and women have a 14% increased risk of depression during pregnancy and a 14.5% elevated risk after delivery (Wang, Anderson, & Florence, 2011). Maternal over weight was also associated with postpartum depression (Wang, Anderson, & Florence, 2011). Negative infant health outcome has been attributed to prolonged labor, administered labor pain medications, infant birth weight, nipple discomfort, nonvaginal delivery, inverted nipple, stressful labor and childbirth (Brownell, Howard, Lawrene, & Dozier, 2012; Matias, Dewey, Quesenberry & Gunderson, 2014; Scott, Binns, & Oddy, 2007). These identified psychosocial problems such as maternal weight status and depression may be influencing mothers and preventing them from choosing the ideal infant feeding practice.

Based on the available studies, it is still unclear why mothers resolve to substitute breast milk with complementary infant feeding. Others have connected poor choice of infant feeding with socioeconomic status and level of social support (Karp et al., 2010; Sealy, 2010; Wijlaars, Johnson, van- Jaarsveld & Wardle, 2011). There is no information on the effect of maternal psychosocial health in terms of postpartum depression and maternal weight status on choice of feeding. Considering lack of clarity on the factors that constitute to poor choice of infant feeding, this study will evaluate the association between postpartum depression and maternal weight gain on choice of infant feeding. The outcome could enlighten mothers on the importance of making better infant feeding choices and improve caregivers' ability to control any psychosocial condition that may have negative effect on maternal choice of infant feeding.

Purpose of study

Despite increased knowledge on the benefit of breastfeeding to both mother and child, several mothers still resolve to formula feed. Therefore, the purpose of this study is to explain how maternal psychosocial factor contribute to these choices. This study will also examine the association between maternal weight status and choice of infant feeding practices, the association between maternal depression and choice of infant feeding practices and finally identify to what extent postpartum depression mediates the relationship between maternal weight gain and infant feeding choice. The outcome of the research seeks to explain maternal and child health. This was done by identifying which of the maternal health conditions significantly influence a mother's decision to breastfeed, among women who took part in the Infant Feeding Practices Study II (IFPSII). The outcome of this study might improve care givers ability to focus on the strategies that will assist mothers in making good feeding choices. Secondly, it will help to identify at risk mothers prior to delivery while offering solutions that contribute to better feeding choices.

Research Questions

RQ1: Is there an association between maternal weight status and choice of infant feeding practices (breast or formula feeding)?

*H*0: Maternal weight status is not likely associated with choice of infant feeding practices (breast or formula feeding).

*H*A: Maternal weight status is likely associated with choice of infant feeding practices (breast or formula feeding).

RQ2: Is there any association between postpartum depression and choice of infant feeding practices (breast or formula feeding)?

*H*0: Postpartum depression is not likely associated with the choice of infant feeding practices (breast or formula feeding).

*H*A: Postpartum depression is likely associated with the choice of infant feeding practices (breast or formula feeding).RQ3 To what extent does postpartum depression mediate the relationship between maternal weight gain and infant feeding choice, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding?

*H*0: Postpartum depression and maternal weight status are not associated with choice of Infant Feeding Practices, after accounting for: Maternal Age, Level of education, Maternal Race/ Ethnicity, Household Income, Delivery type, and Pain while breastfeeding.

*H*A: Postpartum depression and maternal weight status are associates with choice of Infant Feeding Practices, after accounting for: Maternal Age, Level of education, Maternal Race/ Ethnicity, Household Income, Delivery type, and Pain while breastfeeding.

Theory of maternal role attainment (MRA)

This study will take into account the role maternal psychosocial health plays in the choice of infant feeding. Studies have shown that 50% of child bearing age women experience depression during pregnancy or after delivery (Wang et al., 2011). Women with increased prepregnancy weight might be at risk of developing depression

(LaCoursiere, Barrett-Connor, O'Hara, Hutton &Varner, 2010) this may impact their choice of feeding. The purpose of this study is to understand the role these two variables (postpartum depression and maternal weight status) play in choice of infant feeding. The nature of this study will be quantitative using secondary data from IFPS 1I. This longitudinal study consists of women in their third trimester through their infant first year of life and was retrieved from the Centers for Disease Control and Prevention (CDC).

The data will be used to evaluate the association between postpartum depression and choice of infant feeding (breast or formula), and to determine the association between maternal weight gain and choice of infant feeding practices (breast or formula). The outcome of this study could help to determine if the two independent variables (postpartum depression and maternal weight gain) are determinants of the outcome variable (choice of infant feeding).

This study considered maternal role attainment as the driving force to initiate infant feeding practices. The importance of this theoretical framework is to direct the operations of a construct pointing towards relevant variables and their association in crafting a study. Promoting health and preventing consequences in an ever-changing society requires several approaches. Instead of focusing on individual attitude towards improved behavior, it is essential to consider other factors that might affect behavioral change.

The theory for the study is focused on the expansion of interaction process that transpires between mother and child after delivery (Mercer, 2004). The overall

perception of self and birth experiences in the concept of maternal role attainment that includes personal satisfaction, acceptance, self-esteem and differences between reality and anticipated could explain the reason for maternal decision to breastfeed or not to breastfeed (Mercer, 2004). Some limitations in the assessment of maternal role attainment are associated with maternal depression that exists among women after delivery (Flykt et al., 2010). Depression is a contributing factor in reducing caretaking ability, and women have a 14% increased risk of depression during pregnancy and a 14.5% elevated risk after delivery (Wang, Anderson, & Florence, 2011). Similarly, difficulties in making right decisions have been attributed to depression (Ertel et al., 2011). Focusing interventions on preparing mothers for childbirth suggested in the construct need to incorporate effects on parenting behaviors and experience (McManus, & Poehlmann, 2011). To bypass this inadequacy, the social cognitive theory (SCT) is considered.

Social Cognitive Theory (SCT)

SCT suggests that a person's behavior is controlled by several factors including personal and external factors (Mercer, 2004). This theory explains the role of external factors on a person's decision making (Schiavo, 2007). SCT considers the unique way in which individuals acquire and maintain behavior and also considers the associated social environment (Schiavo, 2007). The theory takes into account a person's past experiences (Mercer, 2004) which have the ability to impact decision making, outcomes and expectancies, all of which shape whether a person will engage in a specific behavior and reasons for the behavior (Zimmerman, 1989). The assumption of SCT is that self-beliefs

often predict a person's thoughts, feeling and actions (Zimmerman, 1989). However, maternal identity is a whole personality that can fluctuate with time (Mercer, 2004). Considering the anticipated consequences of a person's behavior described in SCT, this anticipation of behavioral outcome prior to the actions could influence successful completion of behaviors (Schiavo, 2007).

Scope of the Study

This retrospective cohort study employed a quantitative research approach, utilizing secondary data from IFPSII, collected from the CDC. This data was retrieved prospectively across the nation among pregnant women from their third trimester until 1 year after delivery. The study involved about 4,000 female participants selected from a national consumer opinion panel consisting of 500,000 households across United States over a period of 1 year and 3 months (Gaffney, Kitsantas, Brito, & Swamidoss, 2014). This secondary data was used to identify if the psychosocial health of these women is associated with infant feeding patterns. The result will help elucidate on maternal health and how it influence mothers' feeding choices.

Descriptive analysis and inferential statistics were conducted in order to understand the role maternal psychosocial health plays on the choice of infant feeding. In order to test for an association between the variables, logistic regression was employed to establish if there was any significant association between postnatal depression and/ or maternal weight status and the choice of infant feeding. Considering that the outcome variable is a categorical variable, logistic regression helped to estimate the effect of postpartum depression and maternal weight status on choice of continuing

breastfeeding after childbirth. Logistic regression will be conducted to determine the impact of maternal weight status on choice of infant feeding among those who experienced depression and those without depression.

Significance and Summary

This study is significant because it will clarify the influence maternal depression and maternal weight status has on infant feeding choices. If these variables influence the choice of infant feeding practices, the study might help to identify at risk mothers prior to delivery. It may also signify new intervention strategies to improve caregivers ability to identify and encourage these mothers in making better feeding choices. This research seeks to contribute to the body of literature by identifying which of the maternal health conditions could influence a mother's decision to breastfeed and to determine if postpartum depression and maternal weight status are determinants of choice of infant feeding.

Summary

This chapter identified the existing gap in the literature with respect to maternal choices of infant feeding in contrast with public health recommendations. Several studies identified the benefit as well as the role of breastfeeding in preventing diseases among children. This chapter also identified the factors that affect mother's decision to adhere to the guidelines even with governmental incentives in some countries. The statistical techniques utilized in identifying the associations and relationship between postpartum depression and maternal weight status on infant feeding choices were outlined in this chapter. Finally, this chapter described the significance of the study as

well as the potential implications for positive social change. Chapter 2 contains a literature review that will give a detailed explanation on the previous studies that are consistent with the scope of the study. More emphasis on the importance of adhering to infant feeding guideline to prevent diseases and the associated morbidity will be detailed in Chapter 2.

Chapter 2: Literature review

Literature review

The focus of this section is to review the literature relevant to the development of the conceptual framework in regards to this study. The issue that needs to be addressed in the body of literature has to do with the reasons why mothers may select alternative feeding choices other than breastfeeding despite increased knowledge on the benefit of breastfeeding to both mother and child. Based on the available evidence, this chapter will review the effect of the two independent variables, maternal weight status and postpartum depression. The outcome variable, which is infant feeding practices (breastfeeding and infant formula), is reviewed as well. This chapter will also review related literature on the components of infant feeding and describe the nutritional constituent of breast milk. Maternal and other factors that delay initiation and cessation of breastfeeding, parental perception of child feeding and previously applied theoretical frameworks concerning maternal choice of feeding will be detailed in this chapter.

Reviewing infant feeding practices is vital in identifying the etiology of several chronic diseases that have been attributed to early life (DiSantis, Collins, Fisher & Davey, 2011).Studies have identified first years of life as a critical period for the prevention of health complications later in life. To prevent these complications, it is essential to explain the feeding practices among women and the consequences of their decision, especially those choices that may lead to developing unhealthy lives and reducing the overall life expectancy (Brown & Lee, 2012; Ludlow et al., 2012). Studies have documented several positive impacts of breastfeeding both for the mother and child

(Bonia, Twelles and Halfyard et al., 2013; Collado, Latinen, Salminen, & Isolauri, 2012; DiSantis, Collins, Fisher, & Davey, 2011). Breastfeeding has been identified as the ideal infant feeding practice that provides protection for the child against diseases and improves cognitive function when compared with formula feeding (Bonia, Twelles and Halfyard et al., 2013; DiSantis, Collins, Fisher, & Davey, 2011).

Human milk contains certain fats and more lactose that builds and supports function of the central nervous system and tissue development (Bartox& Ventura, 2009) Human milk was also identified to contain certain microbiomes that help in modulating infant metabolism and immune system (Cabrera-Rubio et al., 2012). Furthermore, breastfeeding supports immunological protection in the early stages of life when human defense mechanism is compromised (Collado et al., 2012).

Considering the impact of formula feeding on newborn babies, studies mentioned that the content of proteins present in the infant fare greater than the proteins in human milk (Bartox & Ventura, 2009; Brown & Lee, 2012).These proteins were associated with increased growth and weight gain (Makela, et al., 2014) and the acceleration of infant growth may contribute to the risk of obesity (Johnson, Jaarsveld, Llewellyn, Cole, & Wardle, 2014). Similarly, omega 6 to omega 3 ratios in the formula was associated with body inflammation (Bartox& Ventura, 2009; Makela et al., 2014). A study on infant feeding and obesity reported that infants who were predominantly formula-fed within the first 6 months of life were 2.5 times more likely to become obese at age 2 (Gibbs & Forste, 2013).

Breastfeeding is also associated with maternal birth and weight control, and mothers who breastfeed are more likely to have a reduced weight compared to those who did not breastfeed (Lovelady, 2011;Brandhagen,Lissner, & Brantsaeter, 2014; Sharrma, Dee,& Harden, 2014). Breastfeeding was also associated with reduced risk of breast cancer, type 2 diabetics and other chronic diseases in women (Bartoc and Ventura, 2009; Victora, et al., 2016). This information –could potentially be a key to motivating the maternal choice of infant feeding. A postpartum study on infant feeding showed that only 34.7% of mothers chose to breastfeed out of 90% who acknowledged being aware of the importance of breastfeeding in Japan (Nishioka et al., 2011). Even governmental incentives did not increase the rate of breastfeeding in mainland China (Guan, Dai and Li, 2013).

The infant welfare study conducted in Nnamdi Azikiwe Teaching Hospital (NAUTH) identified 95.3% of women were aware of the benefits of exclusive breastfeeding but the result shows only 33.5% complied with the recommendation (Onah, et al., 2014). Another study in Turkey initiated maternal childcare education to encourage the choice to breastfeed and the result showed no positive changes in the selection of exclusive breastfeeding practices among these Turkish women (Aksu, Kucuk, and Duzgun, 2010).Finally, a study on the reason for early breastfeeding cessation identified that out of the100% mothers who desired to breastfeed their infants; about 60% did not meet their desired goal (Odom,Li, Scanlon, Perrine &Grummer-Strawn,2013).

Therefore, despite an increased knowledge on the benefit of breastfeeding to both mother and child, some mothers still resolve to formula feed. Ayton, Hansen, Quinn, & Nelson (2012) suggested that infants born at less than 37 weeks gestation or late preterm birth is predictive of breastfeeding failure or not initiating breastfeeding after hospital discharge. A study conducted by Odom et al (2013) suggested that the reason for not breastfeeding may be associated with difficulties with lactation, needing to take medicine, and the effort associated with pumping milk. De-Jager, Broadbent, Skouteris, Amir, & Mellor (2013) suggested that psychosocial factors such as anxiety and social support may influence exclusive breastfeeding. This could be a result of certain factors that were identified by Wang, Anderson and Florence (2011).

Depression is a contributing factor in reducing caretaking ability, and women have a 14% increased risk of depression during pregnancy and a 14.5% elevated risk after delivery (Wang, Anderson, and Florence, 2011). Maternal excessive weight gain was also attributed to postpartum depression (Wang, Anderson, and Florence, 2011). These identified factors such as maternal weight status and depression may impact mothers and prevent them from choosing the ideal infant feeding practice.
Therefore, the purpose of this study is to explain how maternal psychosocial factor contributes to these choices. Literature related to the theory of maternal role attainment (MRA) and the Social Cognitive Theory (SCT) is used to evaluate previous research on theconceptualization and operation of the concept of choice of infant feeding.

This study also examined the association between maternal weight status and choice of infant feeding practices, the association between maternal depression and

choice of infant feeding practices, and finally investigated the difference in the choice of infant feeding practices between maternal weight status and postpartum depression. The choice of nutrition has a greater impact on the early development of human life, and substitution of breastfeeding for formula feeding has been attributed to increased weight gain in the initial stages of life (Kimani-Murageet al., 2011). Exclusive breastfeeding has been associated with reduced health complications (Rossem, Taveras & Gillman, et al., 2011). Breast milk was identified to contain protective micro and macro nutrients against infant gastroenteritis, respiratory tract infection and asthma, sudden infant death syndrome and atopic dermatitis (Bonia, Twelles and Halfyard et al., 2013). Breastfeeding was also recommended within the first 6 months of life, due to its adequate nutritional constituent (Arusei et al., 2011; WHO, 2011).

Theory of Maternal Role Attainment (MRA)

MRA is employed in this study to understand a mother's decision on infant feeding. According to Sheehan et al (2013), MRA helps in crafting intervention programs geared toward increasing maternal role in the caretaking of the infant, starting from initiation of breast milk and the duration. This conceptual framework is also used to identify the relevant variables and their relationships and to support in achieving complete maternal care and joy to the role of motherhood. The perception of the mother's ability to carry out the targeted behavior might act as a driving force in developing maternal and child's interaction over a period. According to (Liu, Chen, Yeh & Hseih, 2011), maternal competence for infant feeding practices influenced the ability to feed.

The interaction between mother and infant is shaped by maternal identity (Liu et al., 2011), and comfort or identity of a mother may influence her maternal skills and interaction or role in caring for her infant (Mercer 2004; Rubin, 1996).The inconsistency in the definition of maternal role affects the ability to generalize the accepted framework. Several studies conceptualized maternal role attainment as individual self-identity on the overall mothering processes (Liu, Chen, Yeh and Hsei, 2011; Mercer, 2004). The main focus of this study is to identify how maternal perception of role competence on infant feeding practices in relation to their knowledge, skills and attitudes towards motherhood might be influenced by maternal psychosocial factors (maternal weight status and depression).

Social cognitive theory (SCT)

Bandura's social cognitive theory is useful in identifying the impact of maternal psychosocial factors that may impact breast feeding. The theory has supported several constructsin breastfeeding interventions (Ahmed, 2008). SCT suggests that a person's behavior is controlled by several factors including personal and external factors (Mercer, 2004).Certain internal factors identified to influence breastfeeding initiation includes delivery type (cesarean or delivery), stressful or prolonged labor, birth outcome (low birth weight) and other maternal factors (gestational weight gain)that may affectthe mother's behavior towards breastfeeding (Hering et al., 2008; Makela, et al., 2013; Odom et al., 2013).The construct with respect to self-efficacy or strong beliefs often resulted in successful completion of desired goal (Mercer, 2004).

The SCT takes into account both the social, environmental factors and individual process of acquiring and maintaining a particular behavior (Mercer, 2004). The role of external factors in a person's decision making could be attributed to environmental, social support or perceived norms (Schiavo, 2007). SCT also considers past experiences and their effect on the decision, expectations, and outcome that may determine individual ability to engage in a particular behavior (Mercer, 2004; Zimmerman, 1989). Generally, constructs of SCT refer to the anticipated consequences of a person's behavior. This anticipation of the behavioral outcome before the actions could influence successful completion of the work which could be health-related or not (Schiavo, 2007).

Individuals with increased self-efficacy tend to have increased feelings, beliefs or the ability to perform a desired task or behavior even in stressful condition (Lakshman et al., 2015).Despite these challenges, the belief about the beneficial effect of breastfeeding and self-confidence could influence maternal consistency in carrying out the desired breastfeeding goal (Lakshman, et al., 2014). Expectations could also impact the ability to continue with the desired goal (Schiavo, 2007). Individual thought or belief concerning a particular behavior tends to affect the effectiveness of such behavior (Lakshman et al., 2015).Maternal feeding choices can be linked to feelingsabout how the child should be or perceived, for instance, the expectation of the benefit of breastfeeding, according to Hahn-Holbrook et al (2013), that children who are breastfed have increased cognitive development and protection against infectious disease. This information on the beneficial effect or outcomeof breastfeeding could result in positive

behavioral change. Opinions regarding infant feeding or feedbacks from others could also contribute to food choices.

Despite the fact that certain internal factors such as lactation, maternal postpartum health, and medication mayimpact mother's ability to breastfeed (Odom,et al., 2013). However, several women with the initial intention to breastfeed due to previous belief or those anticipating positive health outcomes might succeed through their will power (Mercer, 2004; Odom, et al., 2013). SCT deals with being motivated to affect change or to transform into expected behavior by translating motivation into action. This could be actualized by setting a breastfeeding goal and formulate an action plan, which is considered an implementation process (Lakshman et al., 2015). Through the application process, breastfeeding mothers could monitor their ability to adhere to the recommended breastfeeding guideline and also formulate a method to cope with breastfeeding associated challenges.

Intervention techniquesinvolving three different components such as goal setting, action plans, and self-monitoring according to SCT were employed by Lakshman et al (2015). SCT was formulated to empower or motivate a person to participate in a positive behavior, but the willingness to behave accordingly is not guaranteed. Factors outside individual choices that are not beyond control could impact a behavioral change (Schiavo, 2007).The intention of mothersto choose may be influenced when empowered to a particular course of action when suitable or environmental factors are in place. Social support like a support group, parents or grandparents, environmental or peer

pressure was a key component in the behavioral intervention to prevent increase weight gain among infants (Lakshman et al., 2015).

Breastfeeding

Understanding child's nutrition in the early stages of life is vital to improving infant wellbeing (Hamilton, Daniels, Murray, White & Walsh, 2011). Breast milk is the ideal source of nutrition for growth and vitality for babies in their first six months of life. According to WHO, breast milk provides infants with the required nutrient and energy required for physical and neurological development (WHO, 2011). Breast milk was also identified to contain essential nutrients for cognitive development and protection of infectious disease. Hahn-Holbrook et al (2013) mentioned that children who were breastfed have reducedrisk of developing chronic diseasessuch as sudden infant death syndrome, obesity and type II diabetics compared to others. This protective nature of breastfeeding and the risk of developing diseases may be associated with the amount of intake since infants who were breastfeed can regulate the amount of food intake through to babies' cues and satiety (Brown & Lee, 2012).

Breastfeed children develop the ability to regulate appetite, food intake and growth when compared to formula (DiSantis et al., 2011). Furthermore, exclusive breastfeeding has been associated with reduced health complications in both mother and child (Hahn-Holbrook et al., 2013; Merjonen et al., 2011; Rossem, Taveras & Gillman, et al., 2011).There is also evidence that breastfeeding can help reduce the risk of childhood obesity (DiSantis, Collins, Fisher & Davey, 2011). This could be attributed to the feeding style or the use of bottle due to impairment of infant's appropriate response

to the internal cues of hunger and satiation (Fisher, 2013). There is also an inverse relationship between breastfeeding and formula feeding on weight retention six months after delivery among low-income mothers (Krause et al., 2010).

Early breastfeeding termination was associated with lactation difficulties, nutrition and weight status of the infant, postpartum related illnesses and administered medications (Odom, et al., 2013). Other identified factors that contribute to breastfeeding initiation delay include gestational diabetics, maternal pre-pregnancy obesity, insulin treatment and higher gestational age (Matias et al., 2014). Delayed onset of lactogenesis has been attributed to prolonged labor, administered labor pain medications, infant birth weight, nipple discomfort, non-vaginal delivery, inverted nipple, stressful labor and childbirth (Scott, Binns, and Oddy, 2007; Brownell, et al., 2012; Matias et al., 2014).

Formula and other complementary feeding practices

Growth and habits are formed during the early stages of life and food contributes to infants weight gain. Children who were formula-fed gain more weight than those who were breastfed (Johnson et al., 2014). This makes it vital to control the rate and types of infant feeding to avoid metabolic disorder that may result in excessive weight gain (Lakshmanet al., 2015).The growth rate of children who were formula-fed was 6.8% greater than those who were breastfed (Johnson et al., 2014). Weight gain was associated with energy intake, and the WHO recommended a reduced energy intake of infants to 15%-20% in 2004 to control infant excessive weight gain (WHO, 2011). Infant formula

constitutes a higher energy intake than breast milk (Lakshman, et al., 2015). This might explain the reason for the increased weight among infants who were formula-fed.

In Europe, it is recommended that solid food should not be added to infant food earlier before 17-26 weeks after birth (Moorcroft, Marshall & McCormick, 2011) while the American pediatric association recommended no solid food earlier than 4-6months (Moorcroft, Marshall & McCormick, 2011). Early cessation, replacing breast milk for complementary feeding and the introduction of solid food may expose the children to malnutrition, gastrointestinal disease, nutritional related chronic illness, overfeeding, overweight, and overalladverse health outcome (Arden, 2009; Moorcroft, Marshall & McCormick, 2011).This poor nutrition originating during infancy may transcend through adulthood (Scaglioni et al., 2011). Another study reported an association between delayed introduction of solid foods with reduced odds of childhood obesity (Seach, Dharmage, Lowe, & Dixon, 2010).

Several studies have attributed the early introduction of solid food to the maternal knowledge of infant feeding practices, attitude towards weight gain and postpartum depression. Others considered maternal obesity and the belief of child achieving major milestones earlier than usual by holding cups or spoon (Brown and Lee, 2011; Karp et al., 2010). In this case, maternal knowledge of the nutritional constituents of breastfeeding and the guideline for infant feeding is essential in preventing unfavorable health outcome.

Influence of Maternal Factors on Infant Feeding

Several factors have been identified to affect both initiation and duration of breast feeding. Greater parental involvement supports better infant health outcomes during the

early stages of life and may transcend to later in life (Matias et al., 2014). Early gestational weight gain was associated with being overweight later in life (Cabrera-Rubio,et al., 2012). Delay in the initiation of breastfeeding after birth has been associated with a delay in the development of infant's first line of defense (Collado et al., 2012). Additionally, important hormones for the contraction of uterus and oxytocin hormones that can reduce stress have also been identified to be impacted with delay in the initiation of breastfeeding after birth (Mahmood et al., 2012; Light et al., 2000).Initiation of breastfeeding a few minutes after birth and duration could positively influence the risk of developing chronic diseases (Cabrera-Rubio et al., 2012; Hahn-Holbrook et al., 2013; Lakshman et al., 2015).

Apart from feeding habits, some maternal factors may predict infant feeding choices (Hahn-Holbrook et al., 2013). A study mentioned that pre-pregnancy obesity may be associated with postpartum depression which may reduce care taken ability (Field, 2010; LaCoursiere, et al., 2010). Delivery type and weight status may delay maternal lactogenesis and thereby delay breastfeeding initiation (Matias et al., 2014). Obese mothers are less likely to have vaginal delivery (Thompson, 2013), which is important since caesarian and other birth out comes can impede maternal ability to initiate breastfeeding after childbirth (Makela, et al., 2014).Furthermore, maternal pre-pregnancy overweight, pregnancy excessive weight gain and anxiety may alter the immunological composition of breast milk and impair appropriate maternal role (Collado, et al., 2012; Adedinsewo et al., 2014).

Early breastfeeding cessation, introduction of formula milk, less feeding interactions and maternal attachment may impact infant health outcome (Ertel et al., 2011; Haycraft et al., 2013; Makela, et al., 2014). Previous studies identified socio-demographic factors such as the mother's social circle and support system to impact the choice of infant feeding practices (Sheehan et al., 2013). Other studies mentioned that delivery type, alcohol consumption, occupation, and education can influence choice of feeding (Motee, A., Ramasawmy, D., Pugo-Gunsam, P., & Jeewon, R., 2013). Depression has been identified as a potential risk factor for non-adherence to infant feeding guideline (WHO, 2011; Gaffney, et al., 2014; Agbaere, 2015)especially, since it has adverse effects between mother and child and may interfere with parenting behavior (Field, 2010).

Even with extensive literature review, there is a lack of clarity on the factors that constitutes infant feeding choices. A study conducted by the Australian Ministry of Family identified that up to 96% of mothers initiated breast feeding after delivery but dropped to 15% within 5months (Australian Institute of Health and Welfare [AIHW], 2011).Wang, Anderson, and Florence (2011) suggested that depression after delivery may result in inadequate caretaking ability but this has yet to be decided. Studies on infant feeding practices identified maternal choice of feeding to impact infants weight gain (Agbaere, 2015; Gaffney, 2014), but there are no studies on the determinants of maternal choice of feeding.

Several studies have also identified some factors like gestational stress, traumatic situations, depression and negative perception of self that may impact mother's ability to

adhere to infant feeding recommended guideline (Ertel et al., 2011; Hahn-Holbrook et al., 2013; Goulding et al., 2014). Studies have identified that increased stress or depressive symptoms experienced by mothers may create significant risks for disorganization of maternal-infant interaction (Wang, Wu, Anderson & Florence, 2011; Hahn-Holbrook et al., 2013; Goulding et al., 2014).Some mothers who experience trauma are more likely to develop disorganized infant feeding practices with high risk of delayed cognitive and language development (Freed et al., 2012). Since mothers understand the importance of breastfeeding but resolve to formula feed after delivery (Nishioka, Haruna, Matsuzaki et al., 2011), it is essential to identify if particular psychosocial variable, aside from trauma, influence these choices.

Attitude toward infant feeding and weight

Even though breastfeeding is universally accepted due to the beneficial component of breast milk, what constitutes to a healthy child and what is appropriate to feed a child still varies among parents. Several parental perception of their child weight has been identified to impact mother's ability to breastfeed. Some parents believed that increased weight means healthier, and they rather choose formula feeding (Kroke, Strathmann, and Gunther, 2006; Jimenez-Cruz et al., 2010). It was also identified that due to disbelief some low-income parents do not adhere to infant feeding guideline or the growth chart which defined the normal weight, overweight and obesity structured by the CDC (Jimenez-Cruz et al., 2010). Problems associated with the right time for solid food introduction also reduce breastfeeding duration (Anzman, Rollins, and Birch, 2010; Brown, Raynor, and Lee, 2011).

Some mothers suggested that infant growth was believed to be influenced fundamentally by the parental genetic make-up and food play a little role (Bentley, Gavin, Black & Teti, 1999). Some mothers no matter the benefit attributed to breastfeeding will not adhere due to perceived convenience of formula and that control feeding choices (Bonia, at al.; 2013). Another study identified maternal intentions and attitudes towards breastfeeding could be influenced by the perception of other people and subjective norms (Lawton, Ashley, Dawson, Waiblinger and Conner, 2012). Maternal attitude toward feeding can be influenced by parental expectations (Lakshman et al., 2014). Also, breastfeeding knowledge, attitude and intentions may affect practices and breastfeed decision is influenced by the level of social support received (Mbada et al., 2013)

Maternal intention and self-efficacy

The choice of infant feeding is generally influenced by maternal expectation, confidence, believe and support system (Pridham et al., 2010; Liu et al., 2011; Sheehan et al., 2013; Lakshman et al., 2014). In a British study that compared breastfeeding intention and initiation among British and South-Asian women in Bradford, the researchers identified an association between strong intentions to breastfeeding and higher rates of breastfeeding among the South-Asian women. This intention to breastfeed was attributed to emotions and moral beliefs (Lawton, Ashley, Dawson, Waiblinger & Conner, 2012). Maternal intention to breast-feed their infant could be accompanied by short or long time positive attributes such as proteins, lipids, carbohydrates, minerals, vitamins and trace

elements that are contained in breast milk and this balanced nutrient ensure growth, developments and good health later on (Agostoni et al., 2009).

Intention to breastfeed is determined by a mother in some cases before delivery, and behavioral intentions often control the actual behavior (Sheehan et al., 2013). Considering that maternal nourishment of infant begins right from conception through delivery and maternal natural nutrients may continue after delivery only by maternal determined feeding style. This decision to continue to nourish a child through natural maternal nutrient may continue or be intercepted by maternal choices which may include bottle feeding, the amount of food and other non-milk substances associated with infant feeding (Arden, 2009; Gage et al., 2012). However, intention to breast feed may be impacted negatively by certain maternal factors such as lactation difficulties, nutrition, and weight status, postpartum related illnesses and administered medications (Odom, et al., 2013).

Self-efficacy or individual self-confidence to actualize a particular task can facilitate the successfully completion of that work (Lakshman et al., 2014). Negative perception of self in a compromised health condition may contribute to maternal feeling of incapable of providing appropriate care for her infant (Swanson, et al., 2012). Such feeling may prompt improper infant feeding choices which may result in health challenges in future (Haycraft et al., 2013). A study mentioned that maternal increased self-efficacy tends to have increased feeling, belief and ability to perform a desired task even in a stressful condition (Lekshan et al., 2014). Still, even with great intention to breastfeed, obese mothers are yet to be successful with breastfeeding (Thompson, 2013).

Similarly, in a study by Field (2010), depressed mothers reported lower levels of breastfeeding self-efficacy with difficulties in breastfeeding. This is consistent with the study by Holland et al (2011) which identified that maternal self-efficacy could mediate between maternal depressive symptoms and child hospitalization. This was also consistent with the association reported between maternal reports of being unsatisfied with breastfeeding and lower levels of breastfeeding self-efficacy (Dennis & McQueen, 2009).

Demographic, social and economic factors that affect breastfeeding

Several factors have been identified to influence breastfeeding initiation and early introduction of solid food. Some of those identified factors includes maternal age, education, self-esteem, maternal mental heal, social support, maternal health and moral norms (Kimani-Murage et al., 2011; Dyson, 2010). The decision of infant choice of feeding was associated socio-demographic, biomedical factors, psychosocial factors and maternal mental health. These factors are considered based on maternal characteristics, cultural contexts, or infant factors (Sheehan et al., 2013). Even though infant breastfeeding decision is termed an individual mother's responsibility, the mother's social circle and support system often play a major role (Sheehan et al., 2013; Larsen, Hall, & Aagaard, 2008).

Poor knowledge of breast feeding benefits could influence infant feeding choices. Studies mentioned that increased awareness and additional incentives to motivate mothers to breastfeed could not yield expected outcome (Aksu, Kucuk & Duzgun, 2010; Guan et al., 2013; Nishioka et al., 2011; Onah, et al., 2014). Some of the reasons were

associated with lack of support, public breastfeeding discomfiture, the convenience of formula feeding, pain, sore nipples and some personal factors (Bonia et al., 2013; Henderson, McMillan, Green & Renfrew, 2010). A recent qualitative study mentioned that some mothers considered formula milk a modern way of feeding a child and breastfeeding is old fashioned traditional motherhood pattern (Bonia et al., 2013).These perceived norms influence the adoption of breastfeeding cessation and preference of formula feeding. Culture, belief system and socioeconomic status (SES) also have influence on how mothers perceive the care of their children (Dyson et al., 2010; Jimenez-Cruz et al., 2010).

Among the low-income population, some mothers prefer to adhere to their traditional method of feeding learned from parents and grandparents. Some of these behaviors involve early introduction of solid food or adding cereal to infant's bottle (Lindsay et al., 2009; Dyson et al., 2009). Kalinowski et al (2012) mentioned that infants from lower socio-economic status are more likely to be heavier when compared to infants from higher socio-economic status. Olson, Horodynski, Brophy-Herb & Iwanski (2010) mentioned that some mothers account their feeding practices from family members, community health, and nutrition educators, while others perceived infant formula to contain sufficient nourishment for proper growth of their infants. Among this low income group, this perception often results to poor adherence to feeding guidelines and excessive infant weight gain (Lindsay et al., 2009; Kalinowski et al., 2012).

A qualitative study conducted by Jimenez-Cruz et al. (2010) in Baja California observed that out of the 813 Mexican women, 43% underestimate their child's weight,

and this assumption was observed among women of low social economic group. Studies have identified that poor feeding habits were mostly found among women with low social economic status (Jimenez-Cruz et al., 2010; Kalinowski et al., 2012). Another study mentioned that most Mexican women have negative perception of their child's weight and to them heavy is healthy (Wardle, Carnell and Cooke, 2005). This literature identified findings that support the complex nature of maternal attitudes towards infant feeding choices, thereby making it essential to consider these factors and calling for additional studies into the factors that may influence future development of infant feeding practices.

Maternal weight change

Breastfeeding is essential during the early stages of child's life due to the nutritional and bioactive component of breast milk (Cabrera-Rubio et al., 2012). A study by Herrig et al (2008) mentioned that women with higher pre-pregnancy weight tend to have more weight gain during pregnant, and this weight gain during pregnancy predicts maternal and child postnatal health outcome. Laitenen et al., (2012) suggested that early gestational excessive weight gain might have an adverse effect on fetal growth and development, and babies born to mothers who gained too much weight during the first 20 weeks of gestation were more likely to be obese at teenage. A population-based cohort study by Langford et al (2008) revealed that maternal weight status was associated with delivery complication such as stillbirth, preeclampsia, and cesarean, macrosomia and increase neonatal hospitalization that may delay breastfeeding initiation.

Apart from the associated health complication that may occur due to excessive pregnancy weight gain, studies have suggested that a mother who gained too much weight during pregnancy may also experience difficulties with following the breastfeeding guideline (WHO, 2011). Breast milk was associated with active stimulation of infant immune system, but higher pre-pregnancy BMI was attributed to the aberration of several microbial constituent of breast milk (Collado, et al., 2014). (Cabrera-Rubio, et al., 2012) identified an association between gut macrobiotic and obesity among women with excess body weight during or prior to pregnancy. Mothers who gained excessive weight during pregnancy had less than half of Bifidobacterium groups compared to mothers who gained healthy weight, and higher Bifidobacterium was associated with increased competency of the inherent immune system (Collado, et al., 2014).

Maternal excess body weight has been attributed to reduced active microbial composition of the early breast milk (Collado, et al. 2012). Pre-pregnancy obesity and maternal pregnancy weight gain have also been associated with delayed lactation resulting in early initiation of formula feeding (Matias, et al., 2014). Lower levels of transforming growth factor (TGF-B2) and soluble CD14 were associated with high BMI and increased weight after one month of breastfeeding (Collado, et al. 2012). Maternal overweight and obesity have been attributed to stillbirth, macrosomia and increase admission to the neonatal intensive unit with increased risk of overweight in children (Poston, 2012; Rooney & Ozanne, 2011). Lower level of breastfeeding, overfeeding and intake of high energy fat foods were associated with maternal overweight (Thompson, 2013).

There is also an association between shorter duration of breastfeeding and early introduction of formula among women who were overweight or obese before pregnancy than mothers with a healthy weight (Makala et al., 2013). Despite the conclusion that maternal overweight might be transferred to an offspring through genetic composition, Makala et al (2013) suggested that the early breastfeeding termination and early complementary feeding may result to increase overweight among obese children.

Depression

Depression is a serious mental health and one of the major psychosocial factors that impacts women during or after pregnancy with several associated negative consequences on both mother and child (O'Hara and McCabe, 2013). Within the first six months after delivery, some women experience increased rate of depression. Wang, Anderson, and Florence, (2011) suggested that depression after childbirth may result in inadequate care, and women have a 14% increased risk of depression during pregnancy and a 14.5% elevated risk after delivery. This maternal health condition has been associated with duration of breastfeeding and women who are asymptomatic are likely to wean their children less than the recommended duration compared with mothers who do show depressive symptoms during pregnancy (Han-Holbrook, 2013).

Breastfeeding was demonstrated by Figueiredo et al., (2013) to have protective ability against depression after delivery. To determine this breastfeeding benefit, Han-Holbrook et al., (2013) suggested that mothers who do not breastfeed their babies exhibit a higher level of depression when compared with those breastfeed. Depressed mothers presented with impaired parenting practices, maternal hostility, withdrawal and lower

parental self-efficacy (Haycraft and Farrow, 2013; Field, 2010). A cross-sectional study that investigated the relationship between depression and self-efficacy among older mothers identified those 22.7% woman who partially breastfeed or those who mixed breastfeeding and infant formula reported high depression scores (Zubaran and Foresti, 2012).This may explain the reason why studies identified depression as a potential risk factor for non-adherence to infant feeding guidelines.

Recent studies on infant feeding practices have identified depression and choice of feeding to impact infant weight gain (Gaffney, et al., 2014; Agbaere, A., 2015). Some other problems associated with maternal depressive risks were delayed cognitive and language development, mental health concerns, suboptimal physical growth, and other behavioral problems (Eriksen et al., 2011). Other discordance like negative cognitive function, emotional and behavioral discordances due to depression may disrupt relation (Field, 2010).A study by Manson et al., (2011), reported poor infant social-emotional development due to maternal depression and disorganized infant feeding practices as a result of nutritional complication. Reviewed literature identified that when some other factors like maternal increased body mass index and lower socioeconomic status co-exist with depression, it mostly led to less sensitive feeding styles (Ertel et al., 2011; Flykt et al., 2010). More controlling habits and increased hospitalizations may occur among infants (Holland et al., 2011; Sejourne et al., 2012).

The rate of depression among women of childbearing age is still relatively high. According to Wang et al. (2011) up to 200,000 women between the age 18- 44 were diagnosed with depression and 7% out of all hospitalization among young women were

associated with depression. Early identification of maternal depression requires urgent attentionin address the risks of delayed cognitive functions and language development, improve maternal health, andprevent unhealthy infant growth originating from inappropriate feeding practices. Based on the reviewed literature, it is essential to manage maternal depressive symptoms in relation to infant feeding practices to prevent complications by screening all postpartum women for depressive symptoms (McManus & Poehlmann, 2011).

Summary of the literature

Breastfeed is a universally accepted method of breastfeeding with a recommended early infant feeding duration of six months (Sharma, Dee, and Harden, 2014; WHO, 2011). This important feeding method encourages the first line of defense to the infant (Aaltonen, et al., 2011; Collado, et al., 2012; Cabrera-Rubio, et al., 2012). Studies also showed that children who are exclusively breastfed have increased mental health development when compared to infants who were otherwise fed (Brown and Lee, 2012; Belfort, et al., 2013; Victora, et al., 2016). Several factors were associated with breastfeeding initiation, duration and some of these identified factors include maternal health and infant health condition, anxiety, stress, non-vaginal delivery and delayed lactation (Krause and Lovelady, 2011; Thompson, 2013; Odom, et al., 2013; Adedinsewo et al., 2014).

Infant formula is a source of rapid weight gain during infancy, and early weaning, and formula feeding was attributed to obesity (Gibbs and Forste, 2013; Laksham et al., 2014; Agbaere, 2016).Based on the reviewed literature studies have

indicated that maternal depressive symptoms and high maternal BMI are significantly associated with changes in infant weight status (Sealy, 2010; Wijlaars et al., 2011). Maternal depression was identified to impact infant cognitive development (Galler, J.R., et al., 2000). Reviewed literature identified that overweight and obese mothers experienced difficulties with breastfeeding (Matias, et al., 2014; Makela et al,2014; Krause and Lovelady, 2011) and overweight mothers are less likely to breastfeed longer than normal weight women (Merewood, 2014;Thompson, 2013; Makela, et al., 2014).

Fetal growth, early cessation of breastfeeding, and introduction of solid food were also associated with maternal pregnancy weight gain (Laitinen, et al., 2012; Gibbs and Forste, 2013). A study mentioned that lack of awareness on the importance of breastfeeding resulted in maternal poor choice of feeding (Mahmood, et al., 2012), while other studies revealed that infant feeding choices did not change even with greater awareness and governmental incentive with detailed information on the beneficial aspect of breastfeeding in delay of disease and proper growth and development for both mother and child (Wisner, et al., 2013; Guan, Dai and Li et al., 2013). Several mothers' still resolve to formula feed their children. Considering these identified factors this study attempts to explain the reason why mothers resolve to choose alternative breastfeeding by studying the association between maternal weigh and depression on the choice of infant feeding. Finally, in this chapter, the reviewed literature gave a detailed explanation on the previous studies that are consistent with the scope of the study. More emphasis on the importance of adhering to infant feeding guideline to prevent diseases and the associated morbidity were also detailed. In chapter three, the relevant

methodology and statistical techniques utilized in identifying the associations and relationship between postpartum depression and maternal weight status on infant feeding choices were outlined.

Chapter 3: Research Design and Methods

This chapter consists of relevant methodology that will be used to investigate the association between maternal weight status and choice of infant feeding practices among women who took part in the Infant Feeding Practices Study II. Second, the association between maternal depression and choice of infant feeding practices will be considered. Finally, I determine the extent of postpartum depression and maternal weight status impact on infant feeding choice. The research methodology utilized in this study is further explained in detail. This retrospective cohort study made use of IFPS II, a dataset collected by the CDC over a period of 15 months, among pregnant women who were in their third trimester until the first year of the infant life (Fein et al., 2008).

A retrospective study design is used since the study is conceived after the participants already developed the outcome of interest from the original study. A retrospective study may introduce bias because it uses pre-existing data that was not precise or preplanned to answer the current research questions. The arrangement of this chapter includes the research questions and hypotheses, the research study design, description of the research sample and setting, data collection measures, and the procedure for data analysis.

Research Questions and Hypothesis

The purpose of this study is to discover whether maternal weight status and maternal depression is associated with the choice of infant feeding practices and to investigate the relationship between maternal weight gain and postpartum depression. The outcome of the research seeks to explain maternal and child health, and to identify

the factors that lead to poor infant choice of feeding despite increased knowledge of the benefit of breastfeeding for both mother and child. The outcome of this study might improve a caregiver's ability to focus on the strategies that will assist mothers in making better feeding choices. Secondly, it will help to identify at-risk mothers before delivery while offering solutions that contribute to better feeding choices. Other variables that will be taken into account for potential confounding and interaction effect on the outcome variable includes maternal age, level of education, maternal race/ ethnicity, household income, postpartum smoking status, delivery type, mothers with a medical condition, mothers with breast pain and low milk supply.

Research Questions and related hypothesis guiding this study

RQ1: Is there an association between maternal weight status and choice of infant feeding practices (breast or formula)?

*H*0: Maternal weight status is not associated with choice of infant feeding practices (breast or formula)

*H*A: Maternal weight status is associated with choice of infant feeding practices (breast or formula)

RQ2: Is there any association between postpartum depression and choice of infant feeding practices (breast or formula)?

*H*0: Postpartum depression is not associated with the choice of infant feeding practices (breast or formula)?

*H*A: Postpartum depression is associated with the choice of breast feeding and initiation of formula feeding.

RQ3: To what extent does postpartum depression mediate the relationship between maternal weight gain and infant feeding choice, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding?

*H*0: Postpartum depression does not mediate the relationship between maternal weight status and choice of Infant Feeding Practices, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding

*H*A: Postpartum depression mediates the relationship between maternal weight status and choice of Infant Feeding Practices, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding

Research Design

I used a quantitative approach for this research in order to assess if there is an association between maternal weight status, maternal postpartum depression, and infant feeding practices utilizing secondary data retrieved from the CDC. The data set, IFPSII, contains information on pregnant women in their third trimester until the first year of life of the infants (CDC, 2009). This longitudinal study was collected through a survey with a

total number of 500,000 participants across the nation. The study was designed to obtain information concerning maternal and child health, infant feeding practices within the first year of life, problems associated with infants feeding practices and maternal diet (Watkins et al., 2011).

The participants of this study were chosen from a national consumer opinion panel across the United States over the course of 15 months. The study was conducted by eight different department consisting of The US Food and Drug Administration (FDA), CDC, Department of Health and Human Services, National Institute of Child Health and Human Development, Office of Dietary Supplements, National Cancer Institute of Health, The Maternal and Child Health Bureau, and Department of Agriculture (Gaffney et al., 2014).

Sample and Setting

This study utilized a secondary dataset from IFPSII. This was a national survey involving mothers in their third trimester. These women, with no related health complications, were followed for one year. The purpose of the study was to retrieve feeding-related information about their infants and information on maternal health during this period. The initial sample included more than 500,000 depressed and nondepressed United States-based women surveyed from the national distributed consumer opinion panel. The data was collected through a survey that was mailed on monthly basis starting from 2 months after delivery until 7 months. Afterwards the questionnaire was mailed every 7 weeks until the child turned 1 year old. The entire questionnaire lasted 18

months. Out of the estimated 500,000 women who started the study, about 2,250 continued through the child first birthday.

To determine the adequate sample size, a G* Power analysis was employed, and a total number of 111 was determined as the sample required for the effect size of 80% with 95% confidence interval. The number of total participants in IFPSII help bypass the typical increased number of missing data that may influence the outcome of the study as mentioned in another recent study (Agbaere, 2015).Based on the survey numbers, this study had an adequate sample size to power the study. After the approval of the research by the Walden University Institutional Review Board, that data set was retrieved from the CDC.

Rationale for using secondary data

Secondary data is mostly used in research studies because of easy access with little or no cost associated with collecting the data. Apart from being cost effective, secondary data is also less time consuming when compared to primary data (Thomas & Heck, 2001). Lack of psychological constraints associated with primary data collection and the readiness of secondary data source makes it essential for this study. This will help to limit the cost and time spent on the entire research. Despite these identified benefit of using a secondary source, there are also several limitations (Burstein, 1984). The constraint of the data is associated with the format of the initial study, data selection, inclusion and exclusion criteria, and quality, and the method of data collection may be designed in a format that may not be suitable for subsequent users. If any inaccuracy

exists in the primary data, it is likely that such error binds the following user or any secondary user.

Several types of error may originate from a poorly designed questionnaire-interviewer bias, measurement or instrumentation and such error may result in poor data quality. Secondly, sample size or incorrect data entry from the primary study may impact the credibility of the secondary user. On the other hand, the validity of secondary data is often a concern since the main sample may not be representative of the desired population. Nevertheless, precision, accuracy, and validity concern that may originate from data are considered to be minimal with this study. These factors can be considered minimal since the IFPSII data to be used for this study was collected by the collaborative effort of (CDC), (FDA), (DHHS), National Institute of Child Health and Human Development, Office of Dietary Supplements, National Cancer Institute of Health, The Maternal and Child Health Bureau, and Department of Agriculture (Gaffney et al., 2014).

The organizational capacity of the source of the primary data confidentiality and ethical concerns associated with IFPSII is also minimal since the data was coded before distributing for further use. Secondly, the CDC mentioned that rigorous approval procedures were encountered before the collection of the data, and the validated and quality of this data have been verified by several researchers(Gaffney et al., 2014; Fein et al., 2014; Li, Scanlon, May, Rose and Birch, 2014; Agbaere, 2015).

Inclusion and exclusion criteria

To be included in the study the participants had to be pregnant women in their third trimester and without any health complication between mother and child and in the

United States. The birth had to be a single infant delivered at 35 weeks gestation, with weight of 5 lbs or more. Exclusion criteria included mother and child who failed the screening procedure administered by the physician or pediatrician, mothers who delivered twin babies and those unable to provide informed consent. Children who were delivered before 35 weeks of gestation and those who weighed less than 5lbswere excluded. Children with a particular need or specialized feeding methods were excluded. Women who could not receive mail due to difficulties from their zip code were also excluded. The primary reason for excluding women who could not provide informed consent was to ensure that ethical standards were maintained. To also avoid confounding in the study, children with lower gestational age were excluded to avoid health complications that may trigger certain behaviors from mothers trying to ensure survival and growth of their infant according to (Feldman and Eidelman, 2007).Mothers who are 33not included in the national consumer opinion panel were excluded to avoid inconsistency with research response.

Independent Variables

The independent variables considered in this study include maternal weight status and depression. On the prenatal questionnaire, mothers reported their pre-pregnancy weight and height. These values will be used to calculate maternal body max index (BMI) which will be categorized as (19.8 to 26, normal; > 26 to 29, overweight and > 29, obese). Recent studies that utilized IFPSII mentioned that a10-item Edinburgh Postpartum Depression Scale (EDPS) which was collected two months after delivery was integrated in the IFPS II data (Gaffney et al., 2014; Agbaere, 2015). Through the

information provided in response to maternal feelings over the past 7 days, postpartum depression was measured to determine maternal depression score. EDPS score that ranged from 0 to 30 were used to identify women at higher risk of postpartum depression lower scores signify lower risk of postpartum depression. Meanwhile, mothers with EDPS greater than 10 was considered depressed and those with EDPS reading equal to or less than 10 will be considered not depressed. This cutoff score has been incorporated in several studies that screen depressive symptoms (Hansua, Scholle, Haskett, Spadaro and Wisner, 2008; Watson, et al 2011).

Dependent Variable

Infant Feeding Practices is the dependent variable that was considered as a dichotomous categorical variable to be accessed as breastfeeding and formula feeding. According to Gaffney et al. (2014) the data for infant feeding was collected at three different levels, low was defined as <20% and between 20% and 80% was considered medium while >80% mainly breastfed was considered high. Since this research is interested in the effect of a mothers decision to breastfeed or not breastfed her infant, we create a dichotomous variable where Mothers who fed their infant with more than 50% breast milk within the first 7 months after birth was classified as having breast fed, otherwise, they are classified as formula fed. Data for classifying infant feeding practices was obtained from birth to month 7 (Sara et al. 2008). The study method described in Sara, et al (2008) indicated that survey for this variable was last administered to mothers in the 7^{th} month after birth. In each month's survey, mothers reported percent of milk

feeds for the months that are breast milk. Average of these were taken and if greater than 50, infant was classified as having been breastfed

Co-variables

Apart from the dependent and independent variables, the study analyzed nine other potential confounders that may have an effect on the result of the study, and to identify their contribution to the dependent variable. These covariates to be considered in this study were selected based on previous research on infant feeding practices. Those covariates include maternal age (18 to 24, 25 to 34, and >34), level of education (high school, some college, and bachelor's degree or more), maternal race/ ethnicity(Black, White, or Hispanic), household income from the 2006 published poverty guidelines by US Census Bureau (2009), postpartum smoking status (Yes/No)delivery type, (cesarean or delivery) mothers with medical condition, mothers with breast pain and Low milk supply (Matias et al., 2014; Stuebe et al, 2014; Gaffney et al., 2012;Kim and Peterson,2008; Taveras, et al., 2010).

Data analysis procedures

Basic descriptive of all variables of interest was presented first. Subsequently each research question was addressed with appropriate procedures as follows:

RQ1: Logistic regression was performed to identify if there is any significant associations between maternal weight status and infant feeding practices

RQ2: Logistic regression was performed to estimate the effect of depression on infant feeding practices.

RQ3: Logistic regression analyses was performed to estimate the extent that postpartum depression mediates the relationship between maternal weight gain and infant feeding choice, after controlling for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding.

Ethical Considerations to Protect Human Subject

To ensure a high level of confidentiality and to preserve the identity of the participants, the infant feeding practices data were coded by the CDC before releasing the information to prospective researchers. During the initial study, informed consent was obtained, and those without the consent later were excluded in the study before the codification and release of the data.

In conclusion

In this study, quantitative techniques were used to investigate the association between maternal weight status and choice of infant feeding practices among women who took part in IFPS II. Secondly, the association between maternal depression and choice of infant feeding practices was considered and finally investigate if postpartum depression and maternal weight status determine infant feeding choice after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, postpartum smoking status, delivery type, mothers with a medical condition, mothers with breast pain and low milk supply? This quantitative study made use of IFPS II, a dataset collected by the center for disease control. In the first research question, Logistic Regression helped to identify if there is any significant association between maternal weight status and infant feeding practices. For the second question, Logistic Regression

helped to estimate the effect of depression on infant feeding practices. For the third research question, Logistic Regression was performed. Chapter four will consists of description of study samples and the report of statistical analysis findings, organized by research questions and hypotheses.

Chapter 4: Findings

Introduction

The purpose of this study is to discover whether maternal weight status and maternal depression is associated with the choice of infant feeding practices. This chapter consists of description of study samples and the report of statistical analysis findings, organized by research questions and hypotheses. The three research questions were answered using logistic regression analysis as it yields more information, like odds ratios, which quantifies and defines direction of association. This analysis is most appropriate since the variables are dichotomous categorical and binary which helped to investigate the association between maternal weight status classified into three categories (*Normal*, *Overweight* and *Obese*) and choice of infant feeding practices (*Breastfeeding* or *Formula Feeding*). Secondly, the association between maternal depression and choice of infant feeding practices (*Breastfeeding* or *Formula Feeding*) and finally determine the extent of postpartum depression and maternal weight status impact on infant feeding choices.

Other variables that were taken into account for potential confounding and interaction effect on the outcome variable includes maternal age, level of education, maternal race/ ethnicity, household income, postpartum smoking status, delivery type, mothers with a medical condition, mothers with breast pain and low milk supply. This retrospective cohort study made use of IFPS II, a dataset collected by the CDC between May and December 2005 among pregnant women who were in their third trimester (Fein et al., 2008).

Research sample characteristics

In this study, I employed a quantitative approach to assess if there is an association between maternal weight status, maternal postpartum depression, and Infant Feeding Practices utilizing secondary data retrieved from the CDC. The data set, IFPSII, contains information on pregnant women in their third trimester until the first year of life of the infants (CDC, 2009). This longitudinal study was collected through a survey between May and December 2005 with a total number of 5000 participants across the nation. The study was designed to obtain information concerning maternal and child health, infant' feeding practices within the first year of life, problems associated with infants feeding practices and maternal diet (Watkins et al., 2011).

Inclusion and Exclusion Criteria

The following 12 variables were used initially intended to be used in this research: feeding practices, maternal weight status, postpartum depression, maternal age, mothers' level of education, mothers' race, household income, postpartum smoking, delivery type, mothers' health status, low milk supply and pain while breastfeeding. Though IFPSII was a large dataset (4902 observations), there were pronounced instances of missing data that necessitated an analysis to determine extent, pattern and type of missing data (see appendix C for detailed missing data analysis report).

Consequently, in addition to the initial inclusion/exclusion criteria set out by the primary researchers who collected the data, which were presented earlier in Chapter 3, the following inclusion/exclusion criteria were further employed:

- Variable level criteria: Variables of interest which were found to have a high percentage of missingness or variables with values *Not Missing at Random* (MNAR) were excluded from this analysis. Hence, a decision was made to exclude the variables Health Status, Low Milk Supply and Post-Partum Smoking from the analysis. These variables, apart from having high percentage of missing response (over 90%), also have most of their values missing not at random (MNAR).
- Analysis level Criteria: Analysis was conducted in two stages for each research question. First, all participants without complete data sets for all variable of interest in a given research question were excluded from the initial analysis of each research question. Hence, only observations without missing data were included at this stage. The outcome of analysis here was labeled "Complete case analysis." But in order to ensure increased confidence in validity and generalizability of the study, a second analysis was also conducted for each research question after imputing values for missing variables for all participants who met the variable level inclusion criteria. The outcome of this second analysis for each research question was labelled "Multiple Imputation."

Research Question 1

Is there any association between maternal weight status and choice of infant feeding practices (breast breastfeeding vs. formula feeding)?

*H*0: Maternal weight gain is not associated with choice of feeding practices (breast breastfeeding vs. formula feeding).

*H*A: Maternal weight gain is likely associated with choice of feeding practices (breast breastfeeding vs. formula feeding).

See Table 1 below and Appendix A-tables 1 & 5 for frequency distribution of respondents with respect to mothers' weight status and choice of feeding practice.

Table 1

Descriptive Data of Mothers' Weight Status and Choice of Feeding Practices (Complete Cases)

Parameter	Feeding Practices (n=1899)	
	Breast fed	Formula fed
Number of participants	1036	863
%	54.56	45.44
Mean percentage of breast milk fed*	84.78	20.38
sd	15.97	13.84

Parameter	Mothers' BMI classification (n=1899) **		
	Normal Weight	Overweight	Obese
Number of participants	1017	314	568
%	53.55	16.54	29.91
Mean weight for each classification	22.86	27.57	34.69

Note. *mothers who fed their infants 50% or more breast milk within the first seven months after birth were classified as breastfed otherwise the infant was classified as formula fed.** Pregnancy BMI was used in this classification. 19.8 to 26 normal, > 26 to 29 overweight, and > 29 obese

Binary Logistic regression procedure was used to test *H*0: Maternal weight is not associated with choice of feeding practices (breast breastfeeding vs. formula feeding).

The following model was used:

$\log\left[\frac{p}{1-p}\right] = b_0 + b_1(BMI)$, where *p* is the probability that infant was fed breast milk.

The result indicated that there is an association between maternal BMI and choice of infant feeding practice ($X^2_{(1)}$ =7.3586, P= 0.0067). The odds of choosing to breast feed instead of formula feed decreases by a multiplicative effect of 0.981 (0.968, 0.995) for every 1unit increase in maternal BMI. Maternal BMI was classified into three categories: *19.8 to 26 normal*, *> 26 to 29 overweight*, and *> 29 obese* and further analysis was conducted. The result indicated that compared to those who are obese, mothers with normal weight are 29.6 % more likely to breastfeed than formula feed their infants (odds ratio= 1.296, 95% CI= 1.054, 1.592). While mothers who were classified as overweight are 10.4% more likely to breastfeed than formula feed their infant compared to those who were classified as obese (odds ratio=1.104, 95% CI=0.838, 1.456). Due to large percentage of missing data (See tables 10), multiple imputation was used to increase sample size and the analysis was repeated. Roughly, similar result but a slightly lower value with stronger evidence was obtained. The result of analysis from imputed data set indicated that compared to those who are obese, mothers with normal weight are 26.8 % more likely to breastfeed than formula feed their infants (odds ratio= 1.268, 95% CI = 1.106, 1.455). While mothers who were classified as overweight were 16.2% less likely to breastfeed than formula feed their infant compared to those who were classified as obese (odds ratio= 0. 838, 95% CI= 0.719, 0.978). See table 2 below.

Table 2

Odds ratios and 95% Confidence Intervals for the Association of Maternal BMI and Choice of Infant Feeding Practice

Criteria	**Complete Case Analysis (n=1899)**	**Multiple Imputati (n=4902)**
Maternal Weight Status		
Obese (reference category)		
Normal	1.296 (1.054, 1.592)*	1.268 (1.106, 1.45
Overweight	1.104 (0.838, 1.456)	0.838 (0.719, 0.97

p <0.05 **p* <0.01 ***p* <0.001

BMI here was used as an interval variable

Maternal Weight Status Classified as normal (19.8 to 26), overweight (> 26 to 29), & Obese (> 29)

Research Question 2

Is there any association between postpartum depression and choice of infant feeding practices (breast breastfeeding or formula feeding)?

*H*0: Postpartum depression is not associated with the choice of feeding practices (breast breastfeeding or formula feeding).

*H*A: Postpartum depression is associated with the choice of feeding practices (breast breastfeeding or formula feeding).

See table 3 below and Appendix A, tables 3 & 4 for frequency distribution of respondents regarding mothers' Post-partum depression status and choice of feeding practice.

Table 3

Descriptive of Post-Partum Depression and Choice of Feeding practices

Parameter		**Feeding Practices (n=1850)**	
		Breast fed	Formula fed
Number of participants		1125	725
	%	60.81	39.19
Mean percentage of breast milk fed*		85.36	22.29
	sd	15.73	14.30
Parameter		**Post-Partum Depression -PPD(n=2548)**	
		Depressed	Not Depressed
Number of participants		426	1424
	%	23.03	76.97
Mean PPD for each classification**		13.07	4.62
	sd	3.23	2.65

 Refers to classification based on Edinburgh Post-Partum Depression Scale (>=10 classified as depressed while < 10 is classified as Not Depressed (See code book – Appendix B on details about how the score for each respondent was computed)
**mothers who fed their infants 50% or more breast milk within the first seven months after birth were classified as breastfed otherwise the infant was classified as formula fed. Every infant was fed breast milk but Quantity of breast milk fed differed and was used as the basses for classification. So, 84.89(15.84) are the mean and SD of the quantity of breast milk all infant classified as "Breast fed" received during the period of the study. Similarly, 20.51(13.85) are the mean and SD of the quantity of breast milk received by all infant classified as "Formula fed".*
***Mean Edinburgh Post-Partum Depression Scale (EPDS)represent the mean percentage of EPDS score for all participants classified as depressed or not depressed*

Binary Logistic regression procedure was used to test H0: Postpartum depression (PPD) is not associated with the choice of feeding practices (breast breastfeeding Vs. formula feeding). The following model was used: $\log\left[\frac{p}{1-p}\right] = b_0 + b_1(PPD)$,

Where*p* is the probability that infant was fed breast milk.

The result indicated that compared to those who are Not Depressed, mothers who are Depressed are 45.9% less likely to breast feed than formula feed their infant (odds ratio= 0.541, 95% CI = 0.435, 0.673) . Analysis of imputed dataset showed roughly similar result without strong evidence. The result of analysis from imputed data set indicated that compared to those who are Not depressed, mothers who are Depressed are 10.8% less likely to breastfeed than formula feed their infant (odds ratio=0.892,) See table 4 below for more details.

Table 4

Odds Ratios and 95% Confidence intervals for the Association of Maternal Post-Partum Depression Statuses and Feeding Practice.

Criteria	**Complete Case Analysis (n=1850)**	**Multiple Imputation (n=4902)**
Post-partum depression		
Not Depressed (Reference category)		
Depressed	0.541 (0.435, 0.673) ***	0.892 (0.785, 1.013)
Test (Global Null	Complete Case Analysis	Multiple Imputation

*p <0.05 **p <0.01 ***p <0.001

 Refers to classification based on Edinburgh Post-Partum Depression Scale (>=10 classified as depressed while < 10 is classified as Not Depressed (See code book – Appendix B on details about how the score for each respondent was computed)

Research Question 3

To what extent does post partum depression mediate the relationship between maternal weight gain and infant feeding choice, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding?

*H*0: post-partum depression does not mediate the relationship between maternal weight status and choice of Infant Feeding Practices, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding

*H*A: post-partum depression mediates the relationship between maternal weight status and choice of Infant Feeding Practices, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding

See table 5 below for frequency distribution of respondents regarding all listed variables.

Table 5

Number and Percentage of Responses for all Variables

Variable		**Multiple Imputation**
Feeding Practices		
Breast feeding	1167 (54.46%)	2933 (59.83%)
Formula Feeding	976 (45.54%)	1969 (40.17%)
Post-partum Depression		

Depressed	628 (24.65%)	1337 (27.27%)
Not Depressed	1920 (75.35%)	3565 (72.73%)
Mothers' Weight _status		
Normal Weight	2249 (52.96%)	2263 (46.16%)
Overweight	660 (15.54%)	1261 (25.72%)
Obese	1338 (31.50%)	1378 (28.11%)
Delivery Type		
	2174 (71.84%)	3527 (71.95%)
Caesarian	852 (28.16%)	1375 (28.05%)
Pain while breast feeding		
Yes	1930 (75.36%)	3424 (69.85%)
No	631 (24.64%)	1478 (30.15%)
Mothers' Level of Education		
No College Education	1056 (24.68%)	1283 (26.17%)
1-3 years of College Education	1757 (41.07%)	2022 (41.25%)
Bachelor's Degree or more	1465 (34.24%)	1597 (32.58%)
House Hold Income		
Low Income	2204 (44.96%)	2204 (44.96%)
Median Income	1686 (34.39%)	1686 (34.39%)
High Income	1012 (20.64%)	1012 (20.64%)
Race Ethnicity		
White	3863 (81.26%)	3884 (79.23%)
Black/African American	300 (6.31%)	302 (6.16%)
Hispanic	335 (7.05%)	336 (6.85%)
Asian Pacific Islander	136 (2.86%)	223 (4.55%)
Other	120 (2.52%)	157 (3.20%)
Age group		
Mothers' aged 18 to 24yrs	1379 (28.20%)	1383 (28.21%)
Mothers' aged 25 to 34yrs	2799 (57.24%)	2806 (57.24%)
Mothers' older than 34yrs	712 (14.56%)	713 (14.55%)

As a follow up to analysis in research question 1 and 2, mediation was investigated in two stages: first, the expected mediating variable (Post-partum depression) was regressing on Maternal Weight Status. Second, choice of infant feeding was regressed on both post-partum depression and maternal weight status (separate in the model as independent variables):

$$\log\left[\frac{p}{1-p}\right] = b_0 + b_1(PPD) + b_2(Mothers'Weight\ Status)$$

Where *p* is the probability that infant was fed breast milk.

For the first stage, there was weak evidence of association between post-partum depression and maternal weight status. Mothers who were overweight or obese are 14% more likely to be depressed compared to those with normal weight (odds ratio = 1.140, 95% CI=0.941, 1.380). For the second stage, results indicate that mothers who were depressed are 45.1% less likely to breast feed their infant compared to those who were not depressed (odds ratio =0.549, 95% CI=0.436,0.692). Also, compared to those who were overweight/obese, mothers with normal weight are 25.9% more likely to breastfeed than formula feed their infants (odds ratio = 1.259, 95% CI=1.030, 1.539). These results were consistent with imputed data sets.

The result of investigation of possible mediation effect therefore indicates that postpartum depression does not mediate the relationship between choice of feeding practice and maternal weight status. Analysis also indicated that, the reverse is not also true - that is maternal weight status does not mediate the relationship between choice of feeding practice and postpartum depression. Mediation effect would have been present if:

1) There was evidence of strong association between the hypothesized mediator (PPD) and the predictor (Maternal weight status). The result in this regard showed a weak evidence of association.

2) The estimated odds ratios changes significantly in stage two above. The result obtained here indicates otherwise (see table 6 below)

Table 6

Odds Ratios and 95% Confidence Intervals for the Association of Maternal BMI,Post-Partum Depression and Choice of Infant Feeding Practice, Probability Modelled

Criteria	**Baseline model***	**Adjusted model†**
Maternal Weight Status		
Overweight (Reference category) ††		
Normal Weight	1.253[1.099, 1.425]	1.259[1.030, 1.539]
Post-Partum Depression		
Not Depressed (Reference category)		
Depressed	0.541[0.435, 0.673]	0.549[0.436, 0.692]

*Log odds of (feeding choice) = b_0+ b_1(mothers weight status)

†Log odds of (feeding choice) = b_0+ b_1 (PPD) + b_2(mothers weight status)

††Here overweight as a class was used to represent all mothers who were either overweight or obese. The result of analysis, (ref. research Question1) indicated that difference in effect of overweight and obese were not significant but became marginally significant after multiple imputation. In other to ensure a stable comparison here, BMI was classified into two: Normal Weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26). This reclassification is also supported by the descriptive in table 2 (page 46) above, which indicated that among all participants, 53.55% has normal weight while a total of 46.45% represented those who were Overweight & Obese combined. Binning Overweight & Obese as one class therefore enhanced precision.

Subsequently, Binary Logistic regression procedure was used to test the relationship between choice of Infant Feeding Practices (as response variable) and both maternal weight status and post-partum depression (as separate main predictors of

interest); after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding. The following model was used:

$$\log\left[\frac{p}{1-p}\right] = b_0 + b_1(PPD) + b_2(Mothers'Weight\ Status) + b_3(Delivery\ Type) + b_4(Pain\ While\ Breast\ Feeding) + b_5(Mothers\ Level\ of\ Education) + b_6(House\ Hold\ Income) + b_7(Race/Ethnicity) + b_8(Mothers'Age\ Group)$$

,

Where *p* is the probability that infant was fed breast milk.

The model was assessed for adequacy and was found to be a good fit for the data (Hosmer and Lemeshow$X^2_{(1)}$ =7.2647, P <0.5084). The result of the analysis indicated that Post-Partum Depression and Maternal Weight Status remained significantly associated with choice of Infant Feeding Practices after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding. The outcome of analysis of complete cases showed that, for main variables of interest:

a. compared to those who are Not Depressed, mothers who are Depressed are 44.8% less likely to breast feed than formula feed their infant (odds ratio = 0.552, 95% CI=0.430, 0.710). Similar result was obtained with multiple imputation dataset (see table 8 or 9 below).
b. Mothers Weight Status classified into three categories (Normal, Overweight and Obese) were not significantly associated with Feeding Practices. However, taking a clue from the result of analysis in research question 1 where it was found that

the difference between Overweight and Obese were not significant, Mothers' Weight Status was reclassified into two categories: Normal Weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26). Using this new classification, it was found that compared to those who were Overweight or obese, mothers with normal weight were 25.7 % more likely to breastfeed than formula feed their infant (odds ratio =1.257, 95% CI=1.007, 1.569) Similar result was obtained with multiple imputation data set (see table 8 or 9 below).

For the Covariates:

a. **Maternal Age:** Mothers aged 25 to 34 are more likely to choose to breastfeed their infants compared to any other age group. Mothers within this age group (25-34) are 2.056 times more likely to breast feed their infants compared to mothers aged 18 to 24 (odds ratio = 2.056, 95% CI=1.507, 2.806). Compared to those who are 35years or older, mothers aged 25 to 34 are 1.118 times more likely to breast feed than formula feed their infants. This difference was however not statistically significant (odds ratio =1.118, 95% CI=0.833, 1.501). On the other hand, compared to those who are older than 34yrs, mothers aged 18 to 24 were found to be 45.6% less likely to breastfeed than formula feed their infants (odds ratio = 0.544, 95% CI=0.368, 0.804). After multiple imputation, analysis indicated that compared to those who are 35 or older, mothers aged 25 to 34 are 35.3 % less likely to breast feed than formula feed their infants (odds ratio = 0.647, 95% CI = 0.537, 0.779). Other age group comparisons were similar to the results obtained from the complete case analysis.

b. **Maternal Level of Education:** Less educated mothers are more likely to formula feed than breast feed their infants. Compared to those with Bachelor's Degree or more education, mothers with no college education are 52.7% less likely to breastfeed than formula feed their infant (odds ratio = 0.473, 95% CI=0.333, 0.673). Similarly, mothers with 1 to 3 years of college education but without bachelor's degree are 42.9% less likely to breastfeed than formula feed their infant compared to those with Bachelor's degree or more education (odds ratio = 0.571, 95% CI=0.442, 0.738). There was also an indication that mothers with 1 to 3 years of college education are 20.7% more likely to breastfeed than formula feed their infants compared to those with no college education. But this difference is not statistically significant (odds ratio = 1.207, 95% CI=0.873, 1.668). Similar results were obtained with multiple imputation data set (see table 9).

c. **Race/Ethnicity:** When effect of race was considered based on five categories (White, Black/African American, Hispanic, Asian Pacific and Others), the result indicated that race was not significantly associated with choice of infant feeding practices. However, the descriptive of dataset showed that about 80% of the respondents are white, 3% of data were missing or invalid responses, and 17% representing all other race/ethnicity combined. In view of this, race was reclassified into two: White and Non-White. Analysis with race in two categories indicated that compared to all other races/ethnic group, whites are 2.066 times more likely to breastfeed than formula feed their infants (odds ratio =2.066, 95%

CI=1.529, 2.793). Similar result was obtained with multiple imputation data set (see table 9 below).

d. Household Income: Analysis indicated that choice of breastfeeding against formula feeding infants decreases with increasing income. Mothers from families with median household income are 24.8% less likely to breastfeed their infants than formula feed compared to mothers with poor household income (odds ratio =0.752, 95% CI= 0.578, 0.980). Also, compared to those from poor household income, mothers from high income household are 36.8% less likely to breastfeed than formula feed their infants (odds ratio = 0.632, 95% CI=0.462, 0.865). Similar results were obtained with multiple imputation data set (see table 9 below).

e. Type of birth: Mothers who gave birth through Caesarian session are 11.6% less likely to breastfeed their infants compared to those who had vaginal delivery. This difference was however not statistically significant (odds ratio = . Similar result was obtained with multiple imputation data set (see table 9 below).

f. **Pain while breastfeeding:** Mothers who experienced pain during breastfeeding within the first two weeks are 25.4 % more likely to be classified as having breastfed their infant after seven months compared to mothers who did not report breast pain as a reason for choosing not to breastfeed (odds ratio = 1.254, 95% CI=0.964, 1.632). Similar result but with stronger evidence was obtained with multiple imputation data set (odds ratio = 1.914, 95% CI=1.619, 2.264). see table 7 below.

*p <0.05 **p <0.01 ***p <0.001

Table 7

Odds Ratios and 95% Confidence Intervals for theAassociation of Maternal BMI,Post-Partum Depression and Choice of Infant Feeding Practice (Breast feeding vs. Formula feeding). Probability Modelled: The Odds of Mothers Choosing to Breastfeed

Criteria	**Baseline model‡**	**Adjusted model**	
Maternal Weight Status		*Complete Case Analysis*	*Multiple Imputation*
Overweight (Reference category)			
Normal Weight	1.253[1.099, 1.425]	1.257 [1.007, 1.569] *	1.160 [1.004, 1.341] *
Post-Partum Depression			
Not Depressed (Reference category)			
Depressed	0.541[0.435, 0.673]	0.552 [0.430, 0.710]	0.404 [0.342, 0.476]

‡Log odds of (feeding choice) = b_0+ b_1(mothers weight status) or

Log odds of (feeding choice) = b_0+ b_1(Post-partum Depression)

Log odds of (feeding choice) adjusted for PPD, Mothers' weight status, Delivery type, Pain while breastfeeding, mothers level of education, Household income, Race/Ethnicity, and Mothers age.

BMI was classified into two: Normal Weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26).*p <0.05 **p <0.01 ***p <0.001

Refers to classification based on Edinburgh Post-Partum Depression Scale (>=10 classified as depressed while < 10 is classified as Not Depressed (See code book – Appendix B on details about how the score for each respondent was computed)
Mothers' Weight Status was classified in two categories here – Normal Weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26)

Table 8

Odds Ratios and 95% Confidence Intervals for the Association Between Mothers' Choice of Feeding Practice (Breast Feeding vs. Formula Feeding) and all Variables of Interest (Probability Modelled: The Odds of Mothers Choosing to Breastfeed

Variables/Categories	**Odds Ratio-Complete Case Analysis (n=1532)**	**Odds Ratio-Multiple Imputation (n=4902)**
Race/Ethnicity (Reference category = Non-White)		
White	2.066 (1.529, 2.793) ***	1.762 (1.436, 2.161) ***
Household Income (Reference category = Poor)		
High	0.632 (0.462, 0.865) **	0.741 (0.606, 0.907) **
Median	0.752 (0.578, 0.980) *	0.864 (0.730, 1.022)
Household Income (Reference category = High)		
Median	1.191 (0.896, 1.582)	1.166 (0.967, 1.404)
Type of Delivery (Reference category = Vaginal)		
Caesarian	0.884 (0.691, 1.131)	0.943 (0.806, 1.104)
Pain While Breastfeeding (Reference category = No pain)		
Pain	1.254 (0.964, 1.632)	1.914 (1.619, 2.264) ***

Test (Global Null Hypothesis)	**Complete Case Analysis (n=1850)**	**Multiple Imputation (n=4902)**
Likelihood Ratio -Global Null Hypothesis (df)	124.635 (11) ***	729.1816 (11) ***

Hosmer and Lemeshaow-Goodness of fit (df)‡	7.2647 (8)	7.3702 (8)

‡The p-values here are 0.5084 and 0.4973 for Complete Case and Multiple Imputation Analysis respectively.

Summary

After analysis of missing data, the following 9 variables were used in addressing all three research questions: Feeding practices (formula fed vs. breast fed), maternal weight status, post-partum depression, maternal age, mothers' level of education, mothers' race, household income, delivery type and pain while breastfeeding. With reference to research question 1: Is there any association between maternal weight status and choice of infant feeding practices (breast breastfeeding Vs. formula feeding)? It was found that the odds of choosing to breast feed instead of formula feed decreases by a multiplicative effect of 0.981 (0.968, 0.995) for every 1unit increase in maternal BMI. When further analysis was conducted with Maternal BMI classified into three categories: 19.8 to 26 normal, > 26 to 29 overweight, and > 29 obese. The result indicated that compared to those who are obese, mothers with normal weight are 29.6 % more likely to choose breastfeeding than formula feeding (odds ratio= 1.296, 95% CI=1.054, 1.592) While mothers who were classified as overweight are 10.4% more likely to choose breastfeeding than formula feeding compared to those who were classified as obese (odds ratio=1.104, 95% CI=0.838, 1.456). Similar result was obtained after multiple imputations.

For research question 2: Is there any association between postpartum depression and choice of infant feeding practices (breast breastfeeding Vs. formula feeding)? The

result indicated that compared to those who are Not Depressed, mothers who are Depressed are 45.9% less likely to choose breastfeeding than formula feeding (odds ratio=0.541, 95% CI=0.435, 0.673). Analysis of imputed dataset showed roughly similar result without strong evidence.

Finally, research question 3 examined – (1) whether Post-Partum depression mediates the relationship between Mothers weight status and Infant feeding choice. (2) Subsequently seeks to define the strength of association between post-partum depression and maternal weight status (as two separate variables) with choice of Infant Feeding Practices, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding. For the main Variables of interest, the result is as follows:

g. Compared to those who are Not Depressed, mothers who are Depressed are 44.8% less likely to choose breastfeeding than formula feeding (odds ratio = 0.552, 95% CI=0.430, 0.710). Similar result was obtained with multiple imputation data set (see table 7 below).
h. Mothers' Weight Status classified into two categories: Normal Weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26) showed that compared to those who were Overweight or obese, mothers with normal weight were 25.7 % more likely to breastfeed than formula feed their infant (odds ratio =1.257, 95% CI=1.007, 1.569). Similar result was obtained with multiple imputation data set.

For the covariates analysis indicated that:

a. Mothers aged 25 to 34 are more likely to choose to breastfeed their infants compared to any other age group (18-24, or above 34).
b. Less educated mothers are more likely to formula feed than breast feed their infants.
c. Compared to all other races/ethnic group, whites are 2.066 times more likely to breastfeed than formula feed their infants.
d. Choice of breastfeeding against formula feeding infants decreases with increasing income.
e. Mothers who experienced pain during breastfeeding within the first two weeks are 25.4 % more likely to breastfeed their infant compared to mothers who did not report pain.
i. Pared to vaginal delivery, mothers who gave birth through caesarian session are 11.6% less likely to breastfeed their infants. This difference was however not statistically significant (odds ratio = 0.884, 95% CI=0.691, 1.131). Compared to those who are not depressed, mothers who are depressed are 44.8% less likely to choose breastfeeding than formula feeding (odds ratio = 0.552, 95% CI=0.430, 0.710). Similar result was obtained with multiple imputation data set (see table 7 below).

j. Mothers' weight status classified into two categories: normal weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26) showed that compared to those who were overweight or obese, mothers with normal weight were 25.7 % more likely to breastfeed than formula feed their infant (odds ratio =1.257, 95% CI=1.007, 1.569). Similar result was obtained with multiple imputation data set (see table 7 below).

For the covariates analysis indicated that:

f. Mothers aged 25 to 34 are more likely to choose to breastfeed their infants compared to any other age group (18-24, or above 34).

g. Less educated mothers are more likely to formula feed than breast feed their infants.

h. Compared to all other races/ethnic group, whites are 2.066 times more likely to breastfeed than formula feed their infants.

i. Choice of breastfeeding against formula feeding infants decreases with increasing income.

j. Mothers who experienced pain during breastfeeding within the first two weeks are 25.4 % more likely to breastfeed their infant compared to mothers who did not report pain.

k. Pared to vaginal delivery, Mothers who gave birth through Caesarian session are 11.6% less likely to breastfeed their infants. This difference was however not statistically significant (odds ratio=0.884, 95% CI=0.691, 1.131).

This chapter consists of description of study samples and the report of statistical analysis findings, organized by research questions and hypotheses. The three research questions were answered using logistic regression analysis as it yields more information, like odds ratios, which quantifies and defines direction of association. This statistical analysis helped to investigate the association between maternal weight status classified into three categories (*Normal*, *Overweight* and *Obese*) and choice of infant feeding practices (*Breastfeeding* or *Formula Feeding*). Secondly, the association between maternal depression and choice of infant feeding practices (*Breastfeeding* or *Formula Feeding*) and finally determine the extent of postpartum depression and maternal weight status impact on infant feeding choices.

Other variables that were taken into account for potential confounding and interaction effect on the outcome variable includes maternal age, level of education, maternal race/ ethnicity, household income, postpartum smoking status, delivery type, mothers with a medical condition, mothers with breast pain and low milk supply. Chapter five discussed the overview of the problems, the purpose of the study and the main findings of this study alongside with previous literature on the impact of infant feeding practices and maternal health condition. The chapter also discussed the strengths, limitations of the study, recommendation and implication of this study.

Chapter 5: Main Findings of the Analysis

Introduction

In this chapter, I discuss the overview of the problems, the purpose of the study and the main findings of this study along with previous literature on the impact of infant feeding practices and maternal health condition. Maternal pregnancy health condition and infant feeding practices are significant public health challenges that threaten the life of the next generation and are of great economic importance (Bonia et al., 2013). Maternal-infant feeding choices are determinants of infant well-being and a predictor of infant weight (Agbaere, 2015). For example, early barriers in cognitive development may result from maternal feeding practices due to nutritional component of infant feeding (Onah, Ignatius & Osuorah, et al., 2014). Furthermore, early choices and method of infant feeding facilitate the development of food choices among children and can transcend all through life (Scaglioni, Arrizza, Vechi&Tedeschi, 2011).

There is evidence that breastfeeding can help reduce the risk of childhood associated diseases (Zhang, Himes, Guo, et al., 2013). The purpose of this research is to contribute to the body of literature by identifying which of the maternal health conditions could influence a mother's decision to breastfeed. This study also addressed the reason why mothers may select alternative feeding choices despite increase knowledge on the benefit of breastfeeding to both mother and child.

Data Set

This retrospective cohort study made use of IFPS II, a dataset collected by the CDC between May and December 2005 among pregnant women (Fein et al., 2008). The

data set, IFPSII, contains information on pregnant women in their third trimester until the first year of life of the infants (CDC, 2009). This longitudinal study was collected through a survey between May and December 2005 with a total number of 4902 participants across the nation. The study was designed to obtain information concerning maternal and child health, infant' feeding practices within the first year of life, problems associated with infants feeding practices and maternal diet (Watkins et al., 2011).

The participants of this study were chosen from a national consumer opinion panel across the United State over the course of 15 months. The study was conducted by eight different departments consisting of The US Food and Drug Administration (FDA), (CDC), Department of Health and Human Services, National Institute of Child Health and Human Development, Office of Dietary Supplements, National Cancer Institute of Health, The Maternal and Child Health Bureau, and Department of Agriculture (Gaffney et al., 2014). Based on the available information on the dataset, Binary Logistic regression procedure was used to test if there is any association between maternal weight status and choice of infant feeding practices (breast breastfeeding vs. formula feeding)? In this study, I found that the odds of choosing to breast feed instead of formula feed decreases by a multiplicative effect of 0.981 (0.968, 0.995) for every 1unit increase in maternal BMI.

When further analysis was conducted with Maternal BMI which was classified into three categories: *19.8 to 26 normal*, *> 26 to 29 overweight*, and *> 29 obese*, the result indicated that compared to those who are obese, mothers with normal weight are 29.6 % more likely to breastfeed than formula feed their infants (odds ratio= 1.296, 95%

CI=1.054, 1.592) While mothers who were classified as overweight are 10.4% more likely to breastfeed than formula feed their infant compared to those who were classified as obese (odds ratio=1.104, 95% CI=0.838, 1.456). Similar results were obtained after multiple imputation with slightly lower values indicating that compared to those who are obese, mothers with normal weight are 26.8 % more likely to breastfeed than formula feed their infants (odds ratio=1.268, 95% CI = 1.106, 1.455). While mothers who were classified as overweight were 16.2% less likely to breastfeed than formula feed their infant compared to those who were classified as obese (odds ratio= 0. .838, 95% CI= 0.719, 0.978).

Binary Logistic regression procedure was used to test if there is any association between postpartum depression and choice of infant feeding practices (breast breastfeeding vs. formula feeding)? The results indicated that compared to those who are *Not Depressed*, mothers who are *Depressed* are 45.9% less likely to breast feed than formula feed their infant (odds ratio= Odds ratio=0.541, 95% CI=0.435, 0.673). Analysis of imputed dataset showed roughly similar result without strong evidence. The result of analysis from imputed data set indicated that compared to those who are Not depressed, mothers who are Depressed are 10.8% less likely to breastfeed than formula feed their infant (odds ratio=0.892, 95% CI= 0.785, 1.013)

Binary Logistic regression procedure was used to examine to what extent does post partum depression mediate the relationship between maternal weight gain and infant feeding choice, after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding. As a follow up

to analysis in research question 1 and 2, mediation was investigated in two stages. For the first stage, there was weak evidence of association between post-partum depression and maternal weight status. Mothers who were overweight or obese are 14 % more likely to be depressed compared to those with normal weight (odds ratio = 1.140, 95% CI=0.941, 1.380). For the second stage, results indicates that mothers who were depressed are 45.1% less likely to breast feed their infant compared to those who were not depressed (odds ratio =0.549, *95*% CI=0.436,0.692). Also, compared to those who were overweight/obese, mothers with normal weight are 25.9% more likely to breastfeed than formula feed their infants (odds ratio = 1.259, 95% CI=1.030, 1.539). These results were consistent with imputed data sets.

The results of investigation of possible mediation effect therefore indicate that postpartum depression does not mediate the relationship between choice of feeding practice and maternal weight status. Analysis also indicated that, the reverse is not also true - that is maternal weight status does not mediate the relationship between choice of feeding practice and postpartum depression Subsequently, Binary Logistic regression procedure was used to test the relationship between choice of Infant Feeding Practices (as response variable) and both maternal weight status and post-partum depression (as separate main predictors of interest); after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding.

The result of the analysis indicated that Post-Partum Depression and Maternal Weight Status remained significantly associated with choice of Infant Feeding Practices after accounting for: maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding. The outcome of analysis of complete cases showed that, for main variables of interest:

a. Compared to those who are Not Depressed, mothers who are Depressed are 44.8% less likely to breast feed than formula feed their infant (odds ratio = 0.552, 95% CI=0.430, 0.710). Similar result was obtained with multiple imputation data set
b. Mothers Weight Status classified into three categories (Normal, Overweight and Obese) were not significantly associated with Feeding Practices. However, taking a clue from the result of analysis in research question 1 where it was found that the difference between Overweight and Obese were not significant, Mothers' Weight Status was reclassified into two categories: Normal Weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26). Using this new classification, it was found that compared to those who were Overweight or obese, mothers with normal weight were 25.7 % more likely to breastfeed than formula feed their infant (odds ratio =1.257, 95% CI=1.007, 1.569) Similar result was obtained with multiple imputation dataset.

For the Covariates:

- Maternal Age: Mothers aged 25 to 34 are more likely to choose to breastfeed their infants compared to any other age group. Mothers within this age group (25-34) are 2.056 times more likely to breast feed their infants compared to mothers aged 18 to 24 (odds ratio = 2.056, 95% CI=1.507, 2.806). Compared to those who are 35years or older, mothers aged 25 to 34 are 1.118 times more likely to breast feed than formula feed their infants. This difference was however not statistically significant (odds ratio =1.118, 95% CI=0.833, 1.501). On the other hand, compared to those who are older than 34yrs, mothers aged 18 to 24 were found to be 45.6% less likely to breastfeed than formula feed their infants (odds ratio = 0.544, 95% CI=0.368, 0.804). After multiple imputation, analysis indicated that compared to those who are 35 or older, mothers aged 25 to 34 are 35.3 % less likely to breast feed than formula feed their infants (odds ratio = 0.647, 95% CI = 0.537, 0.779). Other age group comparisons were similar to the results obtained from the complete case analysis.
- Maternal Level of Education: Less educated mothers are more likely to formula feed than breast feed their infants. Compared to those with Bachelor's Degree or more education, mothers with no college education are 52.7% less likely to breastfeed than formula feed their infant (odds ratio = 0.473, 95% CI=0.333, 0.673). Similarly, mothers with 1 to 3 years of college education but without

bachelor's degree are 42.9% less likely to breastfeed than formula feed their infant compared to those with Bachelor's degree or more education (odds ratio = 0.571, 95% CI=0.442, 0.738). There was also an indication that mothers with 1 to 3 years of college education are 20.7% more likely to breastfeed than formula feed their infants compared to those with no college education. But this difference is not statistically significant (odds ratio = 1.207, 95% CI=0.873, 1.668). Similar results were obtained with multiple imputation dataset.

- Race/Ethnicity: When effect of race was considered based on five categories (White, Black/African American, Hispanic, Asian Pacific and Others), the result indicated that race was not significantly associated with choice of infant feeding practices. However, the descriptive of dataset showed that about 80% of the respondents are white, 3% of data were missing or invalid responses and 17% representing all other race/ethnicity combined. In view of this, race was reclassified into two: White and Non-White. Analysis with race in two categories indicated that compared to all other races/ethnic group, whites are 2.066 times more likely to breastfeed than formula feed their infants (odds ratio =2.066, 95% CI=1.529, 2.793). Similar results were obtained with multiple imputation dataset.
- Household Income: Analysis indicated that choice of breastfeeding against formula feeding infants decreases with increasing income. Mothers from families with median household income are 24.8% less likely to breastfeed their infants than formula feed compared to mothers with poor household income (odds ratio =0.752, 95% CI= 0.578, 0.980). Also, compared to those from poor household

income, mothers from high income household are 36.8% less likely to breastfeed than formula feed their infants (odds ratio = 0.632, 95% CI=0.462, 0.865

- Type of birth**:** Mothers who gave birth through Caesarian session are 11.6% less likely to breastfeed their infants compared to those who had vaginal delivery. This difference was however not statistically significant (odds ratio=0.884, 95% CI=0.691, 1.131). A similar result was obtained with multiple imputation datasets.
- Pain while breastfeeding: Mothers who experienced pain during breastfeeding within the first two weeks are 25.4 % more likely to be classified as having breastfed their infant after seven months compared to mothers who did not report breast pain as a reason for choosing not to breastfeed (odds ratio = 1.254, 95% CI=0.964, 1.632). Similar result but with stronger evidence was obtained with multiple imputation dataset (odds ratio = 1.914, 95% CI=1.619, 2.264).

RQ1: Is there any association between maternal weight status and choice of infant feeding practices (breast or formula)? Binary Logistic regression procedure was used to test if there is any association between maternal weight status and choice of infant feeding practices (breast breastfeeding Vs. formula feeding)? The result shows that the odd of choosing to breastfeed instead of formula feed decreases with an increase in maternal BMI. Further analysis with Maternal BMI classified into three categories: 19.8 to 26 normal, > 26 to 29 overweight, and > 29 obese. The result shows that mothers with normal weight are more likely to choose to breastfeed than formula feeding compared to those who were classified as overweight or obese. This is consistent with the study by

Stuebe, et al., (2014) that utilized infant feeding practices study II to identify the prevalence and risk factor of early infant weaning attributed to lactation dysfunction.

The study also found increased odds of disrupted lactation among overweight mothers (odd ratio 1.6, 95% CI 1.1-2.3) compared to mothers with normal weight. Maternal pre-pregnancy obesity was associated with breastfeeding initiation delay (Matias et al., 2014). Similarly, Makela, et al., (2014) suggest that children of overweight/obese women had a higher body mass index at two years compared to children of normal weight women and this was attributed to a short duration of breastfeeding and early introduction of formula feeding. This study was in line with the outcome of a study by Laitinen, et al., (2012) that suggested that maternal weight gain (>7.0 kg) was associated with infant weight gain due to early infant feeding. Weight retention after delivery was associated with less adherence to breastfeeding recommendations among overweight and obese women in another study that made use of infant feeding study II (Sharma, Dee and Harden 2014). Delivery type and weight status were identified to delay maternal lactogenesis and thereby delay breastfeeding initiation (Matias et al., 2014).

RQ2: Is there any association between postpartum depression and choice of infant feeding practices (breast or formula)? Binary Logistic regression procedure was used to test if there is any association between postpartum depression and choice of infant feeding practices (breast breastfeeding vs. formula feeding). The result indicated that depressed mothers are 45.9% less likely to choose breastfeeding than formula feeding (odds ratio= 0. 541, 95% CI = 0.435, 0.673). The outcome of this study is in

agreement with several studies that utilized infant feeding practices study II (Fein et al., 2008; Gaffney et al., 2014; Stuebe et al., 2014). According to Gaffeny et al., (2012), mothers with postpartum depression were 1.57 times (95% confidence interval 1.16, 2.13) associated with less intensity to breastfeed and early introduction of solid food. The findings are inconsistent with one of the studies that utilized infant feeding study II (Agbaere, 2015).

This study indicated no relationship between depression and infant feeding practices, however, the outcome of the study could be attributed to the percentages of missing data experienced in the study since they considered a homogeneous group of mothers predominantly African American and Hispanics whose infants were full term and in good health. In a study by Field (2010), depressed mothers reported lower levels of breastfeeding self-efficacy with difficulties in breastfeeding. Goulding et al, (2014) identified that elevated depressive symptoms impact mothers responsive feeding practices when compared with mothers with less depressive symptoms. The appearance of depressive symptoms was attributed to discontinuation of breastfeeding (Nishioka et al., 2011).

RQ3: To what extent does postpartum depression mediate the relationship between maternal weight gain and infant feeding choice, after accounting for maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding? Binary Logistic regression procedure was used to examine this. Based on research question 1 and 2, mediation was investigated in two stages: first, the expected mediating variable (Post-partum depression) was regressing on Maternal

Weight Status. Second, choice of infant feeding was regressed on both post-partum depression and maternal weight status (separate in the model as independent variables): For the first stage, there was weak evidence of association between post-partum depression and maternal weight status. Mothers who were overweight or obese are 14 % more likely to be depressed compared to those with normal weight (odds ratio = 1.140, 95% CI=0.941, 1.380). For the second stage, results indicate that mothers who were depressed are 45.1% less likely to breastfeed their infant compared to those who were not depressed (odds ratio =0.549, *95*% CI=0.436,0.692). Also, compared to those who were overweight/obese, mothers with normal weight are 25.9% more likely to breastfeed than formula feed their infants (odds ratio = 1.259, 95% CI=1.030, 1.539).

Therefore, there is no possible mediation effect identified in this study. Based on the evidence, postpartum depression does not mediate the relationship between choice of feeding practice and maternal weight status. Similarly, maternal weight status does not also mediate the relationship between choice of feeding practice and postpartum depression. Mediation effect would have been present if: There was evidence of a strong association between the hypothesized mediator (PPD) and the predictor (Maternal weight status). The estimated odds ratios change significantly in stage two and the result obtained indicates otherwise.

Another study mentioned that even with great intention to breastfeed, obese mothers are yet to be successful with breastfeeding (Thompson, 2013). Considering the Covariates, mothers within age (25-34) are 2.056 times more likely to breastfeed their infants compared to mothers aged 18 to 24 (odds ratio = 2.056, 95% CI=1.507, 2.806).

Compared to those who are 35years or older. Another study that considered younger mothers between the ages of 15-22, identified that these young women were less likely to follow breastfeeding guideline due to the associated psychosocial factors like social support and depression (Karp & Lutenbacher, 2010). Higher gestational age was associated with breastfeeding initiation delay (Matias et al., 2014). For maternal education, mothers with no college education are 52.7% less likely to breastfeed than formula feed their infant (odds ratio = 0.473, 95% CI=0.333, 0.673), compared with those with Bachelor' degree or more. Delivery type and education were identified to influence the choice of feeding (Motee, A., et al., 2013). When the effect of race was considered based on five categories (White, Black/African American, Hispanic, Asian Pacific and Others), the result indicated that race was not significantly associated with the choice of infant feeding practices. This is consistent with another study that described main effect of Race as not been significant F (1,134) = 1.259, p = 0.264, nor the main effect of postpartum depression F (1,134) = 0.976, p = 0.325 and complete factorial interactions of Infant feeding practice, Race and postpartum depression were not significant at alpha level 0.05 (Agbaere, 2015).

For income, mothers from high-income household are 36.8% less likely to breastfeed than formula feed their infants (odds ratio = 0.632, 95% CI=0.462, 0.865), compared to those from poor household income. According to another study, there is an inverse relationship between breastfeeding and formula feeding on weight retention six months after delivery among low-income mothers (Krause et al., 2010). It was also identified that due to disbelief some low-income parents do not adhere to infant

feeding guideline or the growth chart which defined the normal weight, overweight, and obesity structured by the CDC (Jimenez-Cruz et al., 2010). For delivery type, mothers who gave birth through Caesarian session are 11.6% less likely to breastfeed their infants compared to those who had a vaginal delivery.

This difference was however not statistically significant. According to (Makela, et al., 2014), caesarian was identified to impede the maternal ability to initiate breastfeeding after childbirth. Finally, Mothers who experienced pain during breastfeeding within the first two weeks are 25.4 % more likely to be classified as having breastfed their infant after seven months compared to mothers who did not report breast pain as a reason for choosing not to breastfeed. The overall outcome of this study is consistent with several studies that suggested that maternal health outcome plays a major role on the choice of infant feeding and overweight mothers are less likely to breastfeed longer than normal weight women (Merewood, 2014; Thompson, 2013; Makela, et al., 2014).

Reviewed literature identified that overweight and obese mothers experienced difficulties with breastfeeding (Matias, et al., 2014; Makela et al,2014; Krause and Lovelady, 2011) Wang, Anderson, and Florence, (2011) suggested that depression after childbirth may result in inadequate care, and women have a 14% increased risk of depression during pregnancy and a 14.5% elevated risk after delivery. This maternal health condition has been associated with duration of breastfeeding and women who are asymptomatic are likely to wean their children less than the recommended duration compared with mothers who do show depressive symptoms during pregnancy (Han-Holbrook, 2013).

Considering maternal role attainment as the driving force to initiate infant feeding practices, promote health while preventing consequences in an ever-changing society requires several approaches. Instead of focusing on individual attitude towards improved behavior, it is essential to consider other factors that might impact behavioral change. The construct focused on the expansion of the interaction process that transpires between mother and child after delivery (Mercer, 2004). The overall perception of childbirth, birth experiences and differences between reality and anticipated could explain the reason for maternal decision to breastfeed or not to breastfeed (Mercer, 2004). Based on the outcome of this study, it is consistent to say that part of the limitations in the assessment of maternal role attainment are associated with maternal depression that exists among women after delivery (Flykt et al., 2010).

The result of the present study identified that depressed mothers are 45.9% less likely to choose to breastfeed than formula feeding. Also, an increase in maternal weight status may result to decrease in the ability to choose to breastfeed among the classified overweight and obese women. Therefore, considering that overweight mothers could be depressed after delivery and women have a 14% increased risk of depression during pregnancy and a 14.5% elevated risk after delivery makes it essential to identify and educate mothers during the early stage of conception(Wang et al, 2011). Focusing interventions on preparing mothers for childbirth suggested in the construct need to incorporate effects on behaviors and experience (McManus, & Poehlmann, 2011).

Mercer, (2004) suggest in SCT that a person's behavior is controlled by personal and external factors and the unique way in which individuals acquire and maintain

behavior can be traced into current and past experiences. Such experiences have the ability to impact decision, outcome, and expectancies (Zimmerman, 1989). Considering the anticipated consequences of a mother's behavior in terms of choosing formula feeding and the attributed health consequences associated with formula feeding, it is essential to create awareness among women. The anticipation of behavioral outcome prior to the actions could influence successful completion of the behavior, especially those identified in this study.

Strengths and Limitations of the Study

This study has added to a wealth of knowledge on what is known in maternal and infant feeding studies by identifying the existing gap in the literature with respect to maternal choices of infant feeding in contrast with public health recommendation. The research contributes to the body of literature by identifying which of the maternal health conditions could influence a mother's decision to breastfeed and to determine if postpartum depression and maternal weight status are determinants of choice of infant feeding. This is one of the studies to assess the role of maternal health characterized by depression and weight status on the choice of infant feeding. The study explained possible early predictors of childhood diseases by evaluating the extent to which post-partum depression and maternal prenatal weight status are separately or jointly associated with the choice of Infant Feeding.

Since these variables influence the choice of infant feeding practices, the study will help to identify at-risk mothers prior to delivery and serve as new intervention strategies to improve caregiver's ability to identify and encourage these mothers in

making better feeding choices. Other strengths have to do with sample size, quality of data used in the study and detailed information from the questions on infant feeding pattern that addressed most topic areas essential to affect feeding practices.

Despite the above-mentioned strength of the study, several limitations exist in the study. For example, the validity of secondary data is often a concern since the main sample may not be representative of the desired population. In this case, despite IFPSII data used for this study was collected by the collaborative effort of (CDC), (FDA), (DHHS) and the data was distributed throughout the United State. Yet, the sample was not a representative of the US population since the samples contain over 80% of white/Caucasian mothers (Agbaere, 2015). However, African American and Hispanic mothers were underrepresented in the study population. Another limitation encountered in this study has to do with the sample been drawn from a self-selected consumer panel, choosing women at their third trimester of pregnancy instead of a random sample of pregnant women from all race and ethnicity which would have been more representative of the population.

Other limitations have to do with the method of data collection, report on infant feeding practices were self-reported with an incidence of missing data among the study populations relative to some co-variables of interest which could bias the study. Therefore, there is a need to further investigate these variables utilizing a different data that represent different races and ethnic groups in the United States. Finally, inability to obtain mother's depression status at the baseline limits this study from relatively assesses

the effect of depression due to pregnancy, opposed to mothers with a chronic case of depression (Agbaere, 2015).

Recommendation

This retrospective cohort study employed a quantitative research approach, utilizing secondary data from Infant Feeding Practices Study II (IFPSII). The sample was drawn from a self-selected consumer panel, choosing women at their third trimester of pregnancy across the nation. The sample contains over 80% of white/Caucasian mothers between the ages of 25 and 34 years, employed and educated. These group of mothers mostly represented in the study could influence the rating on mother's choice and duration of feeding. Since the represented white/Caucasian population was well educated, employed with increased income when compared to other African American and Hispanic mothers who were underrepresented in the study population.

Social status or social desirability of these women could influence their decisions. However, in the quest to understand the reason for non-adherence to infant feeding guideline as recommended, requires a comprehensive representation of the general population. Therefore, there is a need to further investigate these variables utilizing a different data set that is generalizable and will represent different races and ethnic groups in the United States. Secondly, depression reported in this data did not include information on the status of depression of these women prior to conception or those that are on medication which may impact the outcome of the study. Effect of depression was identified in the literature to affect caretaking ability and can impact a mother's ability to adhere to the intended decisions as well as self-esteem. Therefore, mothers who may

have been experiencing depression prior to conception should have been exempted from this study.

Therefore, further studies that include information on the mother's depression status at baseline is required to assess the effect of depression due to pregnancy vs mothers with a chronic case of depression. Finally, maternal age played a role in the ability to make right feeding choices as identified in this study. Mothers between the ages of 18-24years and those above age 34 were identified to choose formula feeding when compared with mothers between the ages 25 to 34years in contrast to the suggested feeding guideline. Taking into account that maternal age mostly represented in this study (25 and 34years) could impact the ability to generalize this study. There is a need to include women of all childbearing age to ascertain the impact of maternal weight status and depression on the choice of infant feeding practices.

Implications for Research

It is essential to identify maternal health condition as a major factor that influenced infant feeding practices. In the quest to understand the reason for non-adherence to infant feeding guideline as recommended, it is vital to consider maternal health condition. Based on the outcome of this study, postpartum depression and maternal weight status are determinants of choice of infant feeding. Having identified the effect of depression in the literature to affect caretaking ability and may impact a mother's ability to adhere to the intended decisions to breastfeed. Therefore, to implement social change, there is a need to consider the status of depression in women prior to conception or those

that are on medication which may impact their children. In this case, mothers who may have been experiencing depression prior to conception should be given adequate support, treatments, guidance, and counseling on the implication of their health condition on their infants.

Creating this support system will generally improve the health outcome of an infant as their parent implements the adequate steps to ensure proper feeding practices. Studies mentioned that several mothers who made a decision to breastfeed do not actualize their goal and without clear understanding for the bridge in their decision. Based on the available literature and the outcome of this study, maternal weight status was identified as a contributing factor to non-adherence to infant feeding guideline as recommended. Considering the anticipated consequences of a mother's behavior in terms of acquiring and maintaining behavior can be attributed to the health condition (Mercer, 2004). It is essential to create awareness among women since anticipation of behavioral outcome prior to the actions could influence successful completion of the behavior.

This will help to mitigate the barrier in making better infant feeding choice since mothers now understood their weight status as a contributing factor to non-adherence to infant feeding guideline as recommended. For health education prior to or during antenatal, this will help better explain why it is essential to choose to breastfeed since breast milk has the ability to protect the infant from an adverse health condition. The knowledge gained from this study will encourage social change among caregivers to improve their abilities to control any psychosocial condition that may have a negative effect on the maternal choice of infant feeding.

Conclusions

This retrospective cohort study utilized secondary data from Infant Feeding Practices Study II (IFPSII), collected from the Center for Disease Control and Prevention (CDC). This data was retrieved prospectively across the nation among pregnant women from their third trimester until one year after delivery. This secondary data was used to identify if the psychosocial health of these women is associated with infant feeding patterns. Descriptive analysis and inferential statistics were conducted to understand the role that maternal psychosocial health plays on the choice of infant feeding. Logistic regression was employed to establish if there is any significant association between postnatal depression and maternal weight status and the choice of infant feeding. Considering that the outcome variable is a categorical variable, logistic regression helped to estimate the effect of postpartum depression and maternal weight status on the choice of infant feeding practices.

After analysis of missing data, the following 9 variables were used in addressing all three research questions: Feeding practices (formula fed vs. breast fed), Maternal Weight Status, Post-Partum Depression, Maternal Age, Mothers' Level of Education, Mothers' Race, House Hold Income, Delivery Type and Pain while breastfeeding. With reference to research question 1: Is there any association between maternal weight status and choice of infant feeding practices (breast breastfeeding Vs. formula feeding)? The outcome of this study adds to my understanding of the association between maternal weight and choice of infant feeding. Identifying that a large number of women do not follow the recommended standard of breastfeeding even when they desired to do so, this

shortcoming can be attributed to the maternal health outcome. Based on the findings of this study, the odds of choosing to breastfeed in place of formula feeding reduces for every unit increase in maternal weight.

This study identified that mothers with excessive weight tend not to choose to breastfeed compared to mothers with normal BMI. Mothers who are obese also tend not to increase the rate of breastfeeding when compared with overweight mothers. Therefore, controlling maternal weight is essential to the feeding choices and the development of a child. Modest weight gain during pregnancy is beneficial to both mother and child who should be encouraged during hospitals or antenatal visits.

For research question 2: Is there any association between postpartum depression and choice of infant feeding practices (breast breastfeeding Vs. formula feeding)? This data received from pregnant women during their third trimester till one year after delivery found that mothers who reported depressive symptom according to the EPDS scale exhibited different infant feeding practices when compared to those with no depressive symptoms. Based on the findings, mothers who are Depressed are 45.9% less likely to choose breastfeeding than formula feeding (odds ratio= 0.541, 95% CI = 0.435, 0.673) compared to mothers who are Not Depressed. Analysis of imputed dataset showed roughly similar result without strong evidence. Finally, research question 3 examined the mediation effect of post-partum depression and maternal weight status on the choice of Infant Feeding Practices, after accounting for maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding?

For main Variables of interest, the result is as follows: mothers who are Depressed are 44.8% less likely to choose breastfeeding than formula feeding (odds ratio = 0.552, 95% CI=0.430, 0.710) when compared to those who are Not Depressed. Mothers' Weight Status classified into two categories: Normal Weight (BMI >= 19.8 and =< 26) and Overweight or Obese (BMI > 26) showed that compared to those who were Overweight or obese, mothers with normal weight were 25.7 % more likely to breastfeed than formula feed their infant (odds ratio = 1.259, 95% CI=1.030, 1.539). A similar result was obtained with multiple imputation dataset (see table 7).

For the covariates, the analysis indicated that: Mothers aged 25 to 34 are more likely to choose to breastfeed their infants compared to any other age group (18-24, or above 34). Less educated mothers are more likely to formula feed than breastfeed their infants. Compared to all other races/ethnic group, whites are 2.066 times more likely to breastfeed than formula feed their infants. Choice of breastfeeding against formula feeding infants decreases with increasing income. Mothers who experienced pain during breastfeeding within the first two weeks are 25.4 % more likely to breastfeed their infant compared to mothers who did not report pain. Compared to vaginal delivery, Mothers who gave birth through Caesarian session are 11.6% less likely to breastfeed their infants. This difference was however not statistically significant (odds ratio = 0.884, 95% CI=0.691, 1.131).

The overall outcome of this study is consistent with several studies that suggested that maternal health outcome plays a major role on the choice of infant feeding. Similarly, overweight mothers are less likely to breastfeed longer than normal weight

women (Merewood, 2014; Thompson, 2013; Makela, et al., 2014). Reviewed literature identified that overweight and obese mothers experienced difficulties with breastfeeding (Matias, et al., 2014; Makela et al,2014; Krause and Lovelady, 2011). Wang, Anderson, and Florence, (2011) suggested that depression after childbirth may result in inadequate care, and women have a 14% increased risk of depression during pregnancy and a 14.5% elevated risk after delivery. This study is significant because it helps clarify the influence maternal depression and maternal weight status has on infant feeding choices. The study will help to identify at-risk mothers prior to delivery. It may also signify new intervention strategies to improve caregivers ability to identify and encourage these mothers in making better feeding choices.

This research contributes to the body of literature by identifying which of the maternal health conditions could influence a mother's decision to breastfeed. The study identified postpartum depression and maternal weight status as determinants of choice of infant feeding. The outcome of this study will help to mitigate the barrier in making better infant feeding choices. Since mothers now understand their weight status as a contributing factor to non-adherence to infant feeding guideline as recommended. This will further health education efforts at better explanations why it is essential to choose to breastfeed since breast milk has the ability to protect the infant from an adverse health condition. The knowledge gained from this study will encourage social change among pregnant mothers as it enlightens them on the importance of making better infant feeding choices. Improve the caregiver's ability to control any psychosocial condition that may have a negative effect on the maternal choice of infant feeding. Other strengths have to

do with sample size, quality of data used in the study and detailed information from the questions on infant feeding pattern that addressed most topic areas essential to affect feeding practices.

Some of the limitations of this study were attributed to the validity of secondary data which is often a concern since the main sample may not be representative of the desired population. In this case, despite IFPSII data used for this study was collected by the collaborative effort of (CDC), (FDA), (DHHS) and the data was distributed throughout the United State. Yet, the sample was not a representative of the US population since the samples contain over 80% of white/Caucasian mothers (Agbaere, 2015). Other limitations have to do with the method of data collection, report on infant feeding practices were self-reported with an incidence of missing data among the study populations relative to some co-variables of interest which could bias the study.

Therefore, there is a need to further investigate these variables utilizing a different data that represent different races and ethnic groups in the United States.
Lastly, inability to obtain mother's depression status at the baseline limits this research. The study failed to explain depression due to pregnancy, as opposed to mothers with a chronic case of depression. This study explored how maternal psychosocial factors contribute to the choice of infant feeding by examining the association between maternal weight status and choice of infant feeding practices.

Secondly, the association between maternal depression and the choice of infant feeding practices were considered. Finally, identified mediation effect between postpartum depression and maternal weight gain on infant feeding choice after

accounting for maternal age, level of education, maternal race/ ethnicity, household income, delivery type, and pain while breastfeeding. The outcome of the research explained maternal and child health by identifying which of the maternal health conditions significantly influence a mother's decision to breastfeed.

World health organization recommended that mothers should breastfeed their infant at least six months. However, several studies showed a lack of clarity on the contributing factors of non-adherence to recommended infant feeding choices. Based on the outcome of this study, it is essential to note that an increase in maternal weight status may reduce the choice of infant feeding. Depressed mothers may not also maintain the feeding recommended guideline due to their psychosocial health condition. Therefore to implement social change, there is a need to consider the status of depression in women prior to conception or those that are on medication which may impact their children. In this case, mothers who may have been experiencing depression prior to conception should be given adequate support, treatments, guidance, and counseling on the implication of their health condition on their infants.

This study identified the first year of an infant's life as a critical period for the prevention of health complications later in life. Breast milk was identified to contain essential nutrients for cognitive development and protection from infectious disease. Considering the protective nature of breastfeeding to a child and the reduced risk of developing diseases, mothers who understand the benefit of breastfeeding will have a healthy baby. Breastfeeding supports maternal emotional satisfaction, reduced rates of breast and ovarian cancer and the ability to return the uterus to its regular size. In

addition, mothers who breastfeed their infants, experience a decreased rate of postpartum bleeding and fast recovery after childbirth. The benefit of breastfeeding is not limited to the mother's experience after a child’s birth rather it may lead to developing healthy lives. Overall, breastfeeding supports the increase in the average life expectancy to both mother and child due to the ability to prevent them from an adverse health condition.

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Appendix

Table A1

Descriptive Table Showing Selected Characteristics of Study Participants (Complete Cases)

		Formula Fed (n=564)	Breast Fed (n=968)	Whole Sample (n=1532)
Post-partum Depression				
Depressed	no.	169	184	353
	%	29.9	19.0	23
Not Depressed	no.	395	784	1179
	%	70.0	80.9	76.9
Total	**no.**	**564**	**968**	**1532**
Mothers' Weight _status				
Normal Weight	no.	285	544	829
	%	50.5	56.1	54.1
Overweight	no.	99	152	251
	%	17.5	15.7	16.3
Obese	no.	180	272	452
	%	31.9	28.0	29.5
Total	**no.**	**564**	**968**	**1532**
Delivery_Type				
Caesarian	no.	171	262	433
	%	30.3	27.0	28.2
	no.	393	706	1099
	%	69.6	72.9	71.7
Total	**no.**	**564**	**968**	**1532**
Pain while breast feeding				
Yes	no.	428	780	1208
	%	75.8	80.5	78.8
No	no.	136	188	324
	%	24.1	19.4	21.1
Total	**no.**	**564**	**968**	**1532**
Mothers' Level of Education				
No College Education	no.	110	118	228
	%	19.5	12.1	14.8
1-3 years of College Education	no.	251	342	593
	%	44.5	35.3	38.7
Bachelor's Degree or more	no.	203	508	711
	%	35.9	52.4	46.4
Total	**no.**	**564**	**968**	**1532**

Table A2

Descriptive Table Showing Selected Characteristics of Study Participants (Complete Cases)

		Formula Fed (n=564)	**Breast Fed (n=968)**	**Whole Sample (n=1532)**
House Hold Income				
Low Income	no.	207	343	550
	%	36.7	35.4	35.9
Median Income	no.	216	376	592
	%	38.2	38.8	38.6
High Income	no.	141	249	390
	%	25.0	25.7	25.4
Total	**no.**	**564**	**968**	**1532**
Race/Ethnicity				
White	no.	444	863	1307
	%	78.7	89.1	85.3
Black/African American	no.	38	19	57
	%	6.7	1.9	3.7
Hispanic	no.	59	45	401
	%	10.4	4.6	6.7
Asian Pacific Islander	no.	10	28	38
	%	1.7	2.8	2.4
Other	no.	13	13	26
	%	2.3	1.3	1.6
Total	**no.**	**564**	**968**	**1532**
Age group				
Mothers' aged 18 to 24yrs	no.	134	106	240
	%	23.7	10.9	15.6
Mothers' aged 25 to 34yrs	no.	336	687	1023
	%	59.5	70.9	66.7
Mothers' older than 34yrs	no.	94	175	269
	%	16.6	18.0	17.5
Total	**no.**	**564**	**968**	**1532**

Appendix B

Influence of Maternal Psychosocial Health on Infant Feeding Practices

Code Book

s/n	Variable Name & Description/Role	Variable name and coding format in IFPS II	Data Type	Format as used in this work -Number in parenthesis indicates digitized coding
1	**Maternal Weight Status**(BMI)**:** Computed from mother's prenatal weight & height **Independent variable**	Weight: P7, Height(ft.): P8FT, Height(inches): P8IN	Categorical	Ordinal: 19.8 to 26 normal (1), > 26 to 29 overweight (2), and > 29 obese (3)
2	**Postpartum Depression:** EPDS score (0 to 30). **Independent variable**	10 item questionnaire: M2A29A M2A29B M2A29C M2A29D M2A29E M2A29F M2A29G M2A29H M2A29I M2A29J	Likert Scale	Nominal >= 10 was considered depressed (0) and < 10 not depressed (1).
3	**Feeding practices:** Breastfeed vs. formula feed. **Dependent variable.**	NPCTBM NEXBFM2PCTBM M2EXBF M3PCTBM M3EXBF M4PCTBM M4EXBF M5PCTBM M5EXBFM6PCTBM M6EXBF M7PCTBM M7EXBFM9PCTBM M9EXBFMXPCTBM MXEXBF MWPCTBM MWEXBF*[1]	Categorical	Nominal: <50% breast milk is classified as formula feeding (0) and >=50% or exclusively fed breast milk, classified as breastfed (1)
4	**maternal age/ covariate**	P9	Interval/ Categorical	Interval/Ordinal: 1:18 to 24 (1), 2: 25 to 34 (2), and 3: >34 (3)

[1] Data for classifying infant feeding practices was obtained from birth to month 7. The study method described in Sara B. et al (2009) indicated that survey for this variable was last administered to mothers in the 7th month after birth.

5	**Mothers Level of Education** ranges from 1-7 **/Covariate**	EDUC, format 1: 1-7 years of grade 2: "8 years of grade school" 3: "1-3 years of high school"; 4: "High school graduate"; 5: "1-3 of years college"; 6: "College graduate"; 7: "Post graduate";	Categorical	Ordinal: 1-4 = No college education (1), 5= 1-3 years of college (2) and >=6 Bachelor's degree or more*[2](3)
6	Maternal Race/ Ethnicity **Covariate**	RACE_ETH	Categorical	Nominal 1: White 2: Black/African American 3: Hispanic 4: Asian/Pacific Islander 5: Other
7	**Income:** Household income using 2006 poverty guideline. **Covariate**	PIRLEVEL	Categorical	Ordinal: 1: poor<185% (1) 2: median>=185 but =<349 (2) 3: high> 349% (3)
8	**Postpartum smoking** as reason for not breast feeding*[3] **Covariate**	N19K, Format: 1: Not at all important 2: Not very important 3: Somewhat important 4: Very important	Likert Scale	Nominal: No =1&2- (1) Yes =3&4 - (0)
9	**Delivery type (**Caesarian or delivery)	N7, format: 1: Vaginally and not induced 2: Vaginally and induced 3: A planned Caesarian section 4: An unplanned or emergency Caesarian section	Categorical	Nominal: Delivery =1&2 –(1) Caesarian section =3&4 –(0)
10	Mothers with medical condition as	Medical reasons: N19C, Mom sick: N19D. Format: 1: Not at all important 2: Not very important 3: Somewhat important 4: Very important	Likert Scale	Nominal: Not sick =1&2 on both N19C and N19D – (1) Sick = 3&4 on both N19C and N19D-(0)

[2] It is assumed here that every participating mother has some years of schooling since all participants were screened for their ability to read and respond appropriately to the survey

[3] No direct question regarding weather mothers smoked or not with a YES/NO response. The neonatal survey is being used as proxy variable here

	reason for not breast feeding*[4] **Covariate**			
11	Low milk supply as reason for not breast feeding **Covariate**	N19B. Format: 1: Not at all important 2: Not very important 3: Somewhat important 4: Very important	Likert Scale	Nominal: No = 1&2 – (1) Yes = 3&4 – (0)
12	Pain while breastfeeding 1st 2 wks*[5]	N34, 1: YES 2: No	Categorical	Nominal YES – (0) /NO – (1)

Computed Variables

1. **Mothers BMI** was computed by dividing weight with the square of height (in inches) and multiplying the result by 703. Mothers Pregnancy BMI classification was as follows: < 19.8- underweight; 19.8 to 26-normal; > 26 to 29-overweight; and > 29-obese. A second variable "Mothers Weight Status (mw status) was created as a binary variable where BM I= <29 was classified as Normal and BMI>29 was classified as overweight. The latter binary classification was aimed at reducing extent of missingness.

2. **EPDS Score** was computed as follows: QUESTIONS 1, 2, & 4 (without an *) are scored 0, 1, 2 or 3 with top box scored as 0 and the bottom box scored as 3. While QUESTIONS 3, 5-10 (marked with an *) are reverse scored, with the top box scored as a 3 and the bottom box scored as 0.

Maximum score: 30
Possible Depression: 10 or greater (10 denotes suicidal thoughts)

[4] No direct question regarding mother's medical condition. The neonatal survey question regarding reason for not breastfeeding is being used as proxy variable here. A mother is defined as Sick if, she answers "Somewhat" or "very important" to questions N19C and N19D

[5] Suggest using this as a separate Covariate since it has reasonable response rate and because response was collected separately and in different format from question referencing low milk supply

Appendix C

Analysis of missing data

The following 12 variables were used in this research (feeding practices, maternal weight status, post-partum depression, maternal age, mothers' level of education, mothers' race, house hold income, postpartum smoking, delivery type, mothers' health status, low milk supply and pain while breastfeeding). Though IFPS II was a large dataset (4902 observations), there were pronounced instances of missing data that necessitated an analysis to determine extent, pattern and type of missingness.

When responses are missing not at random (MNAR), it suggests that survey participants did not systematically respond to certain questions for certain reasons. Inferences drawn from the analysis of such data set has a high likelihood of yielding misleading results (Rubin, 1996; Schafer, 1997; Horton and Lipsitz, 2001; Barnard and Meng, 1999). Multiple imputation is a generally accepted procedure for dealing with missing data. This procedure replaces missing values with most likely values generated from several regression iterations. However, multiple imputation work best when data are missing at random (Rubin, 1996; Schafer, 1997; Horton and Lipsitz, 2001; Barnard and Meng, 1999).

In the IFPS II data set, missing values were coded in eight ways:

Q=respondent did not return questionnaire

N=respondent was supposed to answer question but did not

S=respondent gave a conflicting response

F= fathers demographic information not available

"."=Missing without any designated reason.

99 =respondent do not know (e.g., Age of other household members)

88 =not specified for verbatim data (e.g., follow up specific was not)

999=used for inconsistent coding (e.g.,"0"servings for infant feeding)

Missing data analysis of the IFPS II data set with respect to the variables included in this research indicated that one variable (household income) out of the 12 variables has 100% response. The remaining 11 variables have missing values ranging from 0.2% (Mothers' Age) to 91.8% (Mothers' Health Status). Pattern analysis indicated that three variables: Health Status (missing 98.1%), Low Milk Supply (missing 91.6%) and Post-Partum Smoking (missing 91.6%) has contiguous missingness. This is a strong indication that data values missing with respect to these variables are not missing at random (See fig 1 & 2 and Table below for details).

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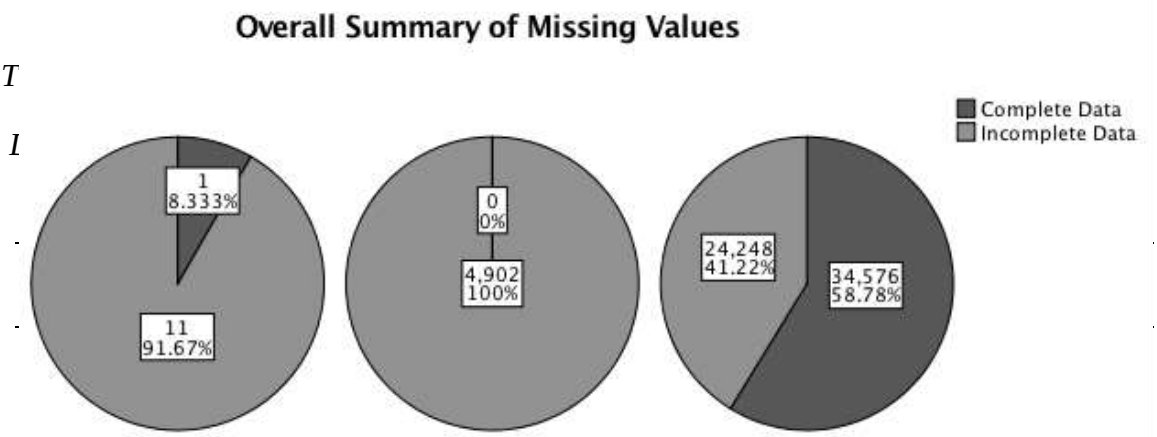

Variables	Cases	Values	
Post partum Depression	2554	48.0%	2548

Figure 1. Overall summary of missing variables, cases, and values

Delivery Type	1876	38.3%	3026
Mothers' Weight _status	655	13.4%	4247
Level of Educ	624	12.7%	4278
Race Ethnicity	148	3.0%	4754
Age group	12	0.2%	4890

a. Maximum number of variables shown: 25

b. Minimum percentage of missing values for variable to be included: 0.0%

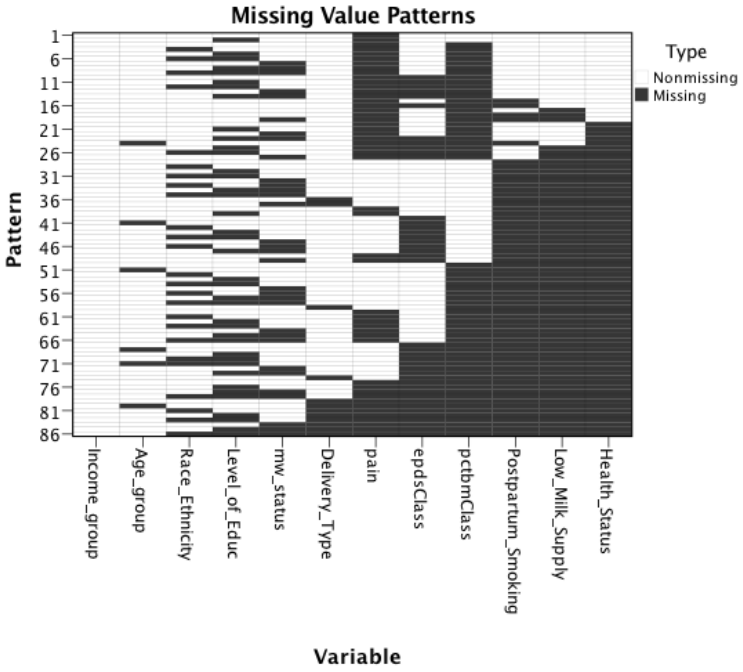

Figure 2. Missing Value Patterns

Overall, fig. 2 above indicates that about 41% of all values are missing due to any one of the eight reasons for missingness stated earlier. Decision was made to exclude - Health Status, Low Milk Supply and Post-Partum Smoking from the analysis. These variables apart from having high percentage of missing response (over 90%), also have most of these values missing not at random (MNAR). But even with the exclusion of these three variables, there is still high level of missingness among key variables of interest (Feeding practices: 56.3%, Post-Partum Depression: 48% and Mothers' Weight Status:13.4%). Among the remaining variables, feeding practices, Post-Partum Depression, and Pain While Breastfeeding displayed partially contiguous pattern that

suggested week evidence of data Not Missing at Random(MNAR). These data were however retained in the research since two out of the three are key variables of interest in this research.

Multiple imputation was used to generate replacement values for missing data. To ensure validity of result obtained, two separate analyses was conducted: Complete case and Multiple Imputation Dataset analysis. A conservative interpretation of the result will be employed in all instances especially whenever analysis of imputed data involves the three that showed some evidence of MNAR: Feeding practices, Postpartum Depression, and Pain While Breastfeeding. Since multiple imputation does not work well when data are not missing at random (MNAR), the report of findings will defer to the outcome of complete case analysis whenever there is inconsistent result between the multiple imputation data set and the complete case data set -especially if the listed three variables (Feeding practices, Postpartum Depression, and Pain While Breastfeeding) which are partly MNAR, are involved.