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Parental Self-Efficacy, Feeding Practices, And Weight Gain During Infancy: A Secondary Analysis

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PARENTAL SELF-EFFICACY, FEEDING PRACTICES, AND WEIGHT GAIN DURING INFANCY: A SECONDARY ANALYSIS

by

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ABSTRACT

Mechanisms contributing to childhood obesity begin during early life, including infant feeding practices and an excessive rate of infant growth. Parental decisions regarding their infant contribute to these mechanisms. Parental self-efficacy (PSE) is the belief parents have in their ability to accomplish the tasks of parenting and is associated with infant outcomes. A high sense of PSE, breastfeeding self-efficacy, or self-efficacy for feeding has been found to be associated with healthy infant feeding practices. However, this research is limited in scope and has not been conducted in populations at greatest risk for childhood obesity such as low-income or African-American infants. Therefore, more research is needed to examine associations among PSE, infant feeding practices, and infant growth, particularly in high risk populations.

The purpose of this dissertation was to examine associations among PSE, infant feeding practices, and infant weight gain. This purpose was accomplished through three manuscripts. The first was an integrative review that examined associations among these concepts in diverse samples across the globe. Two additional studies were secondary analyses of the Infant Care, Feeding, and Risk of Obesity (Infant Care) dataset. These data were collected in low-income, African-American mother-infant dyads. The second manuscript focused on the association between PSE and infant feeding practices, and the third on the association between PSE and infant weight-for-length z-score (WLZ) trajectories.

The resulting body of work contributes to literature examining early life factors placing an infant at risk for later childhood obesity. Findings from the integrative review suggest that mothers with a high sense of breastfeeding self-efficacy are more likely to initiate breastfeeding and breastfeed longer. Using the Infant Care data, the association between PSE and infant feeding practices was not supported. Cultural and sociodemographic characteristics of this sample may contribute to findings. The data did support an association between PSE and infant WLZ trajectories. Infants of mothers with a higher sense of PSE at infant age of three months, followed an excessive WLZ trajectory. This trajectory has previously been demonstrated to be predictive of later obesity risk. More research is warranted, but these findings yield important insight into infant growth trajectories.

Keywords: infant feeding practices, infant weigh-for-length z-scores, parental self-efficacy

DEDICATION

To the Research Team in the Children's Center at TMH – Donna, Becky, Betsy, Catherine, and Kendal. Their hard work, excitement for research, and thirst for knowledge inspired me to pursue a PhD to advance research and be a leader to pediatric nurses everywhere.

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ABBREVIATIONS

AAP	American Academy of Pediatrics
ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
BFSE	Breastfeeding self-efficacy
BMI	Body mass index
CDC	Centers for Disease Control and Prevention
CESD	Center for Epidemiologic Studies Depression Scale
FTT	Failure to thrive
GEE	Generalized estimating equation
GLMM	Generalized linear mixed model
IRB	Institutional Review Board
KPCS	Karitane Parenting Confidence Scale
MeSH	Medical Subject Heading
NAAL	National Assessment of Adult Literacy
NDSR	Nutrition Data System for Research
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PSE	Parental self-efficacy
PSOC	Parenting Sense of Competence Scale
SD	Standard deviation
SES	Socioeconomic status

U.S.	United States
UNC	University of North Carolina at Chapel Hill
WHO	World Health Organization
WIC	Supplemental Nutrition Program for Women, Infants, and Children
WLZ	Weight-for-length z-score

INTRODUCTION

Rates of obesity in children in the United States (U.S.) have risen dramatically over the past 30 years. The most recent data indicate that 35.1% of children aged 2-19 years are either overweight or obese (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018). While causation is believed to be multifactorial, mechanisms that contribute to childhood obesity may begin during the first two years of life (American Academy of Pediatrics [AAP] Committee on Nutrition, 2014; Birch & Anzman, 2010; Birch & Doub, 2014; DiSantis, Hodges, Johnson, & Fisher, 2011; Mennella, 2014; Saavedra, Deming, Dattilo, & Reidy, 2013; Thompson, 2012; Thompson & Bentley, 2013). What and how infants are fed as well as weight gain during infancy are factors correlated with later weight status (Baird et al., 2005; Gaffney, Kitsantas, & Cheema, 2012; Ong & Loos, 2006; Thompson, 2013; Weng, Redsell, Swift, Yang, & Glazebrook, 2012). For instance, infants who experience an excessive rate of weight gain, comparative to length, through the first year of life are at greater risk for childhood obesity compared to infants who grow as expected (Druet et al., 2012; Ong & Loos, 2006).

An understanding of how parents make decisions in feeding their infant requires continued exploration in an effort to promote healthy infant growth. One concept that may influence parental decisions is that of parental self-efficacy (PSE) (Grossklaus & Marvicsin, 2014; Redsell et al., 2016). PSE is the belief a parent has to complete the

tasks of parenting (De Montigny & Lacharité, 2005). PSE may influence parental decisions regarding infant feeding which could impact the infant's weight gain, but further exploration is needed.

The purpose of this dissertation is to examine associations among PSE, infant feeding practices, and infant weight gain. This introductory chapter outlines the problem, background and significance, purpose, aims, and research questions for this dissertation. The supporting theoretical framework and research methodology are also introduced. A list of definitions used throughout this dissertation can be found in Appendix A.

Background and Significance

According to data from the 2015-2016 National Health and Nutrition Examination Survey (NHANES), 18.5% of children in the U.S. (ages 2 to 19 years) were obese, triple the rate from 30 years prior (Centers for Disease Control and Prevention [CDC], 2014; Skinner et al., 2018). An additional 16.6% of children were classified as overweight (Skinner et al., 2018). Obesity in childhood often continues into adulthood and is a predictor for cardiometabolic health conditions (AAP, 2003; AAP Committee on Nutrition, 2014; Hodges, 2003; World Health Organization [WHO], 2017). Obese children are at risk for developing conditions such as hypercholesterolemia, hypertension, and type 2 diabetes as well as depression and complications of the pulmonary, orthopedic, and gastrointestinal systems (AAP, 2003; AAP Committee on Nutrition, 2014). According to the National Collaborative on Childhood Obesity Research (2009), it is estimated that $14 billion is spent on direct health expenses for obese children each year in the U.S. Finkelstein, Graham, and Malhotra (2014) estimate a direct increase in

medical costs for obese children over normal weight children of $19,000 throughout a lifetime. Additionally, children insured by Medicaid are about six times more likely to be diagnosed and treated for obesity (National Collaborative on Childhood Obesity Research, 2009; Thomson Medstat, 2006).

Due to the high rates and ensuing costs of childhood obesity, governmental agencies, researchers, and pediatric health care practitioners are contributing a significant amount of time and funds to halt this alarming trend. In 2010, President Barack Obama established a task force on childhood obesity to outline a plan to end the epidemic within a generation (Let's Move, 2010). The goal devised by the task force was to decrease the childhood obesity rate from 17% to 5% by 2030 (Let's Move, 2010). As part of this initiative, the *Let's Move!* campaign was launched by Michelle Obama the same year (Let's Move, 2010). These initiatives and others have primarily focused on the preschool (ages 3-5 years), school-aged (ages 6-12 years), and adolescent (ages 13-18 years) populations. However, a growing body of evidence suggests that childhood obesity may begin during the first two years of life (Birch & Doub, 2014; DiSantis et al., 2011; Mennella, 2014; Thompson, 2012; Thompson & Bentley, 2013; Weng et al., 2012). Therefore, ongoing research efforts should include this young population.

Weight gain during the first year of life has been strongly correlated with childhood obesity (Druet et al., 2012; Monteiro & Victora, 2005; Ong & Loos, 2006; Weng et al., 2012). Infants with excessive weight gain compared to other infants of the same sex and length, have been found to be at greater risk of being obese later in childhood (Farrow & Blissett, 2006; Karaolis-Danckert et al., 2006; Ong, Ahmed, Emmett, Preece, & Dunger, 2000). As with weight gain at other points of life, if not due

to a genetic or metabolic abnormality, the excessive gain is typically due to more energy consumed than expended (AAP Committee on Nutrition, 2014). Given that parents are the primary determinants of infant nutrition, the amount of energy consumed is controlled by the feeding practices that parents chose to employ with their infant. Infants are dependent on parents and other caregivers to provide nourishment, therefore, infant feeding practices are the what, when, and how parents and caregivers feed their infants (Birch & Anzman, 2010; Birch & Doub, 2014; Grote, Theurich, & Koletzko, 2012; Thompson, Adair, & Bentley, 2013). Recommendations for feeding infants are provided by organizations such as the AAP, the WHO, the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition, and the Australian Department of Health and Ageing (AAP Committee on Nutrition, 2014; Australian Government, 2013; Fewtrell et al., 2017; WHO, 2016). Feeding practices which have been associated with excessive weight gain in infancy include: formula feeding only, shortened duration of breastfeeding, early introduction of complementary foods or liquids, introduction of foods inappropriate for an infant (foods that provide excessive carbohydrate, sugar, fat, salt, yet lack nutrient value), using food or drinks to soothe, distracted feeding (i.e., bottle propping), and pressuring or indulgent parental feeding styles (DiSantis et al., 2011; Li, Magadia, Fein, & Grummer-Strawn, 2012; Robinson & VandeVusse, 2011; Stifter, Anzman-Frasca, Birch, & Voegtline, 2011; Thompson et al., 2013).

In additional to feeding practices, sociodemographic factors such as lower household income, lower parental education, and increased parental body mass index (BMI) have been associated with excessive infant weight gain (Dubois & Girard, 2006; Gibbs & Forste, 2014; Stettler, Zemel, Kumanyika, & Stallings, 2002; Watt, Appel,

Roberts, Flores, & Morris, 2013; Weng et al., 2012). Additionally, research on maternal age has indicated that older mothers have infants or children with increased food variety and adherence to recommended feeding practices as compared to younger mothers (Betoko et al., 2013; Hendricks, Briefel, Novak, & Ziegler, 2006; Scott, Chih, & Oddy, 2012). To promote healthy weight gain, reasons that parents do not follow infant feeding recommendations and the impact of sociodemographic factors on infant feeding practices require further exploration.

Race, ethnicity, and cultural practices have also been shown to play a role as beliefs and traditions of one's cultural contribute to decisions parents make regarding feeding (Dennison, Edmunds, Stratton, & Pruzek, 2006; Gibbs & Forste, 2014; Taveras, Gillman, Kleinman, Rich-Edwards, & Rifas-Shiman, 2010). For example, in the Hispanic and African-American cultures, heavier infants are viewed as healthier than slender infants (Cartagena et al., 2014; Schafer, Williams, Digney, Hare, & Ashida, 2016; Thompson, Adair, & Bentley, 2014). Cartagena and colleagues (2014) found that the Hispanic population identifies feeding as a source of gratification and a way to express caring and nurturing. It is also seen as a sign of good parenting when an infant or child is satisfied after eating (Cartagena et al., 2014).

Additionally, many parents have a skewed perception of their child's weight status. Parents see a healthy weight child, when in fact, the child is overweight, or parents see an underweight child when the child is actually of a healthy weight. In samples of Hispanic mothers, up to 61% were found to have a skewed perception of their preschoolers' (2-5 years) weight status (Hackie & Bowles, 2007; Myers & Vargas, 2000), and 70% of a sample of African-American mothers were inaccurate in assessing their

toddler's (12-32 months) weight status (Hager et al., 2012). The majority of research conducted on parents' perception of their child's weight status has been with parents of older children. Two studies have focused on the period of infancy. Findings from each study revealed that parents' perception about weight status was skewed even during infancy (Brown et al., 2016; Kroke, Strathmann, & Gunther, 2006). This skewed perception of infant weight status, whether due to culture or other factors, may influence the decisions parents make regarding feeding practices during infancy.

Parental knowledge of infant development and nutrition, along with social constraints and other competing time demands, can also affect parents' decisions about what and how to feed their infant. PSE has been associated with parental decision-making during infancy and been shown to affect emotions, motivation, cognition, and responses to infant behaviors in a parent (Coleman & Karraker, 1997; Salonen et al., 2009). Therefore, PSE is an important concept to consider when studying parental decision-making about infant feeding practices and infant growth (Grossklaus & Marvicsin, 2014; Redsell et al., 2016). Factors that contribute to the development of one's sense of PSE include: a parents' prior experience parenting; parenting experiences of others close to the individual; social support; and psychological state (i.e., anxiety, depression, self-esteem) (Bandura, 1997; De Montigny & Lacharité, 2005; Kendall & Bloomfield, 2005; Salonen et al., 2009).

Research examining PSE as it relates to infant feeding practices, dietary intake, or feeding behaviors in infants and young toddlers exists, yet is minimal. Measurement across studies has varied making comparisons difficult; some measure PSE, some self-efficacy for breastfeeding, and some self-efficacy for infant feeding practices. However,

findings are consistent in that parents with a low sense of self-efficacy tend to have feeding practices that place their child at risk for poor health outcomes including excessive infant weight gain or childhood obesity (Anzman-Frasca, Stifter, Paul, & Birch, 2013; Barrett, Thompson, & Bentley, 2016; Koh et al., 2014; McGarvey et al., 2006; Stifter et al., 2011; Stifter & Moding, 2015; Taveras, Mitchell, & Gortmaker, 2009). Individuals with a low sense of PSE do not have confidence in their parenting ability, and therefore, tend to give up on an initiative (in this case following recommended infant feeding guidelines) prior to task completion (Bandura, 1997; De Montigny & Lacharité, 2005; Salonen et al., 2009; Teti & Gelfand, 1991). This is seen when examining breastfeeding practices. A woman may know breastfeeding is best for her infant but may not initiate breastfeeding or only be successful for a few weeks if breastfeeding self-efficacy is low (Glassman, McKearney, Saslaw, & Sirota, 2014; McQueen, Dennis, Stremler, & Norman, 2011; Robinson & VandeVusse, 2011). However, mothers with a strong sense of breastfeeding self-efficacy may have the ability to overcome barriers and continue to breastfeed for much longer periods of time.

It has also been demonstrated that mothers with a higher sense of PSE tend to have toddlers with feeding practices that more align with dietary recommendations. This includes a higher intake of fruit and vegetables as well as a decreased intake of sweets and sugar-sweetened beverages (Campbell, Hesketh, Silverii, & Abbott, 2010; Spence, Campbell, Crawford, McNaughton, & Hesketh, 2014; Xu, Wen, Rissel, Flood, & Baur, 2013). It is unknown whether this same association holds true during infancy. A study by Koh and colleagues (2014) examined mother-infant dyads at infant age of six months. Findings indicated that the infants were offered more variety of foods, including

vegetables, and were more willing to try new foods if their mother reported a higher sense of PSE (Koh et al., 2014). However, six months of age is when complementary foods are first recommended to be introduced, this relationship between quality of dietary intake and PSE must be examined over the six to 12 month period of infancy.

Along with the positive association between PSE and infant feeding practices that has been suggested in the literature, PSE has been associated with other health outcomes. Successful transition to parenthood is seen in parents with a high sense of PSE (Salonen et al., 2009), and in children, improvement in academic success, behavior, and social and emotional adjustment (Coleman & Karraker, 1997; Crncec, Barnett, & Matthey, 2008; Jones & Prinz, 2005; Leahy-Warren, McCarthy, & Corcoran, 2012). Additionally, parents with a high sense of PSE are more ready to make changes and overcome barriers to promote a healthy lifestyle (including nutrition and physical activity initiatives) for their family (Kahlor, Mackert, Junker, & Tyler, 2011; Taveras et al., 2009; Willis et al., 2014). Considering these findings, it is plausible that an association between PSE and infant weight gain may exist, however, only one study is identified that examined this association. Stifter and colleagues (2011) reported a positive, albeit non-significant association ($r = 0.2$, $p > 0.05$) between PSE and infant BMI z-score in a group of primarily well-educated, Caucasian-American mother-infant dyads. Mothers self-reported infants' weight and length, then BMI z-score was examined at one time point (Stifter et al., 2011). Examining a trajectory of growth over a period of time is more reflective of the infant's growth pattern and provides a better indication of their future weigh status (Ong & Loos, 2006). Therefore, examining the association of PSE with

infant growth trajectory warrants further examination, especially in a sample at high risk for an excessive rate of weight gain.

Conclusion

Finding ways to reverse the epidemic of childhood obesity is of primary importance for individuals working with children and families in healthcare and beyond. Research has indicated that contributing factors may begin at the onset of life, therefore, study during infancy is necessary. An excessive rate of weight gain during infancy may be a precursor to childhood obesity, therefore, factors that influence parents' decisions regarding infant feeding practices are of high importance for ongoing research. PSE has been shown to be associated with positive child outcomes such as improved behavior, socio-emotional adjustment, and academic achievement (Coleman & Karraker, 1997; Crncec et al., 2008; Leahy-Warren et al., 2012; Salonen et al., 2009). Preliminary research indicates that PSE may be associated with positive infant feeding practices as well. African American children have higher rates of obesity than Caucasian children. Parents of these children tend to engage in infant feeding practices, such as a lack of breastfeeding and early introduction of complementary foods that contribute to an excessive rate of weight gain. For these reasons, this at-risk population is of importance for ongoing study. It is anticipated that findings from this dissertation will provide an avenue for future research by identifying ways to assist healthcare providers intervene to prevent childhood obesity early in life.

Purpose

The purpose of this dissertation was to explore the associations among PSE, infant feeding practices, and infant weight-for-length z-score (WLZ) trajectories between three and 12 months. This purpose was accomplished through three manuscripts. The first was an integrative review of literature examining the associations among self-efficacy, infant feeding practices and infant weight gain. The review included studies published throughout the world, in samples from all racial and ethnic groups. The second and third manuscripts were secondary data analyses of the Infant Care, Feeding, and Risk of Obesity (Infant Care) dataset which included first-time, low-income, African-American mother-infant dyads who were followed from infant age of three to 18 months. These data were collected between 2003 and 2007 in Chapel Hill, North Carolina and the surrounding counties. Covariates for each of these analyses were chosen from variables available in the Infant Care dataset and that have been previously shown to be associated with PSE, infant feeding practices, or infant WLZ trajectories. These covariates included: maternal age, education level, marital status, BMI, depression score, and perception of infant weight status. Additionally, infant sex and birthweight were included as covariates. The study aims and research questions (RQ) are presented below.

Aims and Research Questions

Aim 1: Examine whether PSE is associated with infant feeding practices in a group of first-time, African-American mother-infant dyads throughout the infant's first year of life.

RQ 1.1: Is PSE associated with milk feeding type (formula only or mixed feeding [breastmilk and formula])?

RQ 1.2: Is PSE associated with duration of any breastfeeding?

RQ 1.3: Is PSE associated with age at complementary food introduction?

RQ 1.4: Is PSE associated with the introduction of inappropriate foods during infancy?

RQ 1.5: Considering PSE and covariates simultaneously, what are the strongest predictors of each feeding practice?

Aim 2: Examine whether infant feeding practices are associated with infant WLZ trajectories between three and 12 months of age in a cohort of African-American infants.

RQ 2.1: Is the infant's milk feeding type (formula only or mixed feeding [breastmilk and formula]) associated with infant WLZ trajectory?

RQ 2.2: Is the duration of any breastfeeding associated with infant WLZ trajectory?

RQ 2.3: Is the age at which complementary foods are introduced associated with infant WLZ trajectory?

RQ 2.4: Is the introduction of foods inappropriate for an infant during the first year of life associated with infant WLZ trajectory?

RQ 2.5: Considering the feeding practices and covariates simultaneously, what are the strongest predictors of WLZ trajectory?

Aim 3: Examine whether PSE is associated with infant WLZ trajectories between three and 12 months of age in a group of African-American infants.

RQ 3.1: Is a mother's self-reported PSE associated with infant WLZ trajectory?

RQ 3.2: Considering PSE and covariates simultaneously, what are the strongest predictors of WLZ trajectory?

Research Methodology

The research methods utilized in each manuscript were different. The first manuscript followed the methods suggested by Whittemore, Chao, Jang, Minges, and Park (2014) to guide the integrative review. Additionally, aspects of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist were used for guidance, and the PRISMA flow diagram was utilized to outline the search conducted (Moher et al., 2015). The two secondary analyses were correlational studies. The first addressed Aim 1 and used generalized estimating equations (GEE) and generalized linear mixed models (GLMM) to examine the associations between PSE and infant feeding practices. The final manuscript addressed Aim 3 using analysis of covariance (ANCOVA) to examine the association between PSE and infant WLZ trajectories. Effect sizes for all analyses were calculated. Further description of the research methods will be presented in each manuscript.

Conceptual Framework

The conceptual framework used to guide the proposed secondary data analysis was informed by the health belief model and the self-efficacy theory. The health belief model was designed to explain health behavior in an effort to improve use of preventative health services and is comprised of six concepts: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy

(McEwen & Wills, 2011; Rosenstock, 1974). The self-efficacy theory was first conceptualized in the 1970s. Self-efficacy is defined as the belief one has in his/her ability to complete a given task (Bandura, 1977). Concepts that define the self-efficacy theory include: performance accomplishments, vicarious experiences, verbal persuasion, and emotional arousal (Bandura, 1977). Neither theory alone is sufficient to guide the proposed study, therefore, concepts from each theory were used to inform the conceptual framework for the proposed study (Figure 1).

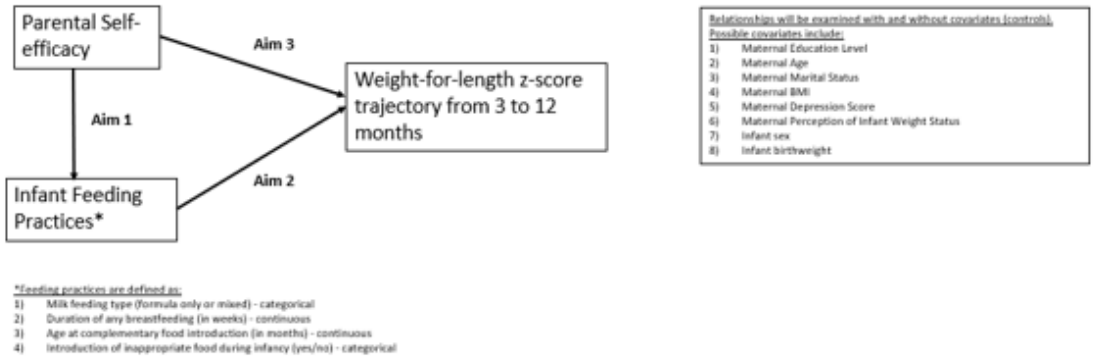

Figure 1. Conceptual framework used to guide this dissertation

Summary

Finding ways to halt the epidemic of childhood obesity is of vital importance to the health and wellbeing of the U.S. population. Researchers continue to strive to find effective interventions for preventing and reversing factors that may be contributing to obesity in childhood. The first two years of life have received significant attention in recent years as evidence indicates mechanisms contributing to obesity may begin during this time, possibly even prenatally. The trajectory of WLZ between birth and 12 months is one factor that has been correlated with weight status later in childhood. What infants

are fed during infancy contributes to the infant's WLZ trajectory. As parents are primarily responsible for what and how infants are fed, understanding their decisions is important for future develop of interventions targeting this population. Research to date indicates that an individual's sense of PSE may influence the parental decisions regarding infant feeding, yet more research is needed especially in populations at high risk for infant feeding practices that do not align with recommendations and/or an excessive rate of infant growth. Therefore, this dissertation examined the associations among self, infant feeding practices, and infant WLZ trajectories.

SELF-EFFICACY, INFANT FEEDING PRACTICES, AND INFANT WEIGHT GAIN: AN INTEGRATIVE REVIEW

by

JESSICA S. BAHORSKI, GWENDOLYN D. CHILDS, ANDRES AZUERO, PAULA C. CHANDLER-LANEY, LORI A. LOAN, ERIC A. HODGES, SHANNON A. MORRISON, MARTI RICE

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PAPER 1

SELF-EFFICACY, INFANT FEEDING PRACTICES, AND INFANT WEIGHT GAIN: AN INTEGRATIVE REVIEW

Abstract

It has been suggested that self-efficacy specific to parenting or feeding may influence the decisions parents make regarding infant feeding, however, a review of this topic has not been conducted. The purpose of this integrative review is to synthesize the literature regarding the potential role of self-efficacy in infant feeding practices or infant weight gain. A total of 43 articles were used to guide this review which were classified into three categories examining an association with self-efficacy and: 1) breastfeeding; 2) infant feeding practices such as parental feeding style and dietary quality; and 3) infant weight gain. Evidence regarding breastfeeding self-efficacy and breastfeeding is extensive; mothers with a higher sense of breastfeeding self-efficacy more often initiate breastfeeding and breastfeed for longer durations. The evidence regarding self-efficacy and the association with infant feeding practices other than breastfeeding is sparse. However, several studies report that mothers who have a higher sense of self-efficacy are more likely to follow infant feeding practices which align with recommendations. Authors have speculated an association between self-efficacy and infant weight gain, yet to date, no study has found a significant association. More research is needed on the topic, particularly in diverse populations and with fathers and mothers.

Keywords: self-efficacy, parental self-efficacy, breastfeeding, infant feeding practices, infant weight gain

Introduction

Childhood obesity has become epidemic in many developed countries throughout the world (World Health Organization [WHO], 2017). In the United States (U.S.) approximately 35% of children aged 2-19 years are either overweight or obese (Skinner, Ravanbakht, Skelton, Perrin, & Armstrong, 2018). Accumulating evidence suggests factors contributing to childhood obesity begin at the onset of life, if not before, and that modification of risk factors during the prenatal and infancy periods is important to establish healthy dietary practices and prevent obesity (American Academy of Pediatrics [AAP] Committee on Nutrition, 2014; Birch & Doub, 2014; Thompson & Bentley, 2013). One such risk factor is the total amount of weight gained and/or the rate at which the infant gains weight over the first year of life. Infants who exhibit excessive weight gain in comparison to length, or gain weight at a rapid rate, are at risk for childhood obesity (Druet et al., 2012; Ong & Loos, 2006).

Infant weight gain is largely determined by the amount and composition of energy consumed. Given that parents are the primary determinants of infant nutrition, the amount of energy consumed is at least partially attributable to the feeding practices parents choose to employ with their infant. Understanding how parental decisions are made regarding feeding their infant is important to establish healthy dietary practices and growth. It has been suggested that a parent's sense of self-efficacy may contribute to these decisions (Redsell et al., 2016). For this reason, the influence of self-efficacy on infant feeding practices and/or infant weight gain is worthy of investigation.

Background

Self-efficacy, first conceptualized by Albert Bandura in the 1970s, is defined as "beliefs in one's capabilities to organize and execute the courses of actions required to produce given attainments" (Bandura, 1997, p.3). In other words, self-efficacy is an individual's belief in his or her ability to accomplish a certain task. Those who believe they have this ability will work hard until task completion. These individuals are considered to have a high sense of self-efficacy. Individuals with a low sense of self-efficacy often give up prematurely because they doubt their ability to successfully complete the task. Factors that contribute to self-efficacy include: an individuals' prior experiences (successes and failures); similar experiences of others close to the individual (also known as vicarious experiences); social support; and psychological state (i.e., anxiety, depression, self-esteem) (Bandura, 1997).

Self-efficacy can be applied to roles or tasks. For example, parental self-efficacy (PSE) refers to the belief or confidence parents hold in their ability to accomplish the tasks of parenting (Table 1) (De Montigny & Lacharité, 2005). PSE is associated with parental decision-making during infancy and has been shown to affect parents' emotions, motivation, cognition, and responses to infant behaviors (Salonen et al., 2009). Additionally, PSE may play a role in infant feeding practices parents choose such as breastfeeding and/or types of foods offered.

Infant feeding practices contribute to the amount of weight gained during infancy as well as an individual's dietary preferences and control mechanisms regarding hunger and satiety (Birch & Doub, 2014; Thompson & Bentley, 2013). Infant feeding practices

Table 1

Definitions of parental self-efficacy

Author/Year	Definition
Coleman & Karraker, 1997: p. 58	"one's perceived ability to exercise positive influence on the behavior and development of one's children."
De Montigny & Lacharité: 2005, p. 390	"Beliefs or judgements a parent holds of their capabilities to organize and execute a set of tasks related to parenting a child"
Grossklaus & Marvicsin, 2014: p. 72	"Self-efficacy is the central cognitive core to parenting competence in which parents look within themselves to decide whether they can influence their child's well-being."
Teti & Gelfand, 1991	Parent's expectations about the degree to which he or she is able to perform competently and effectively as a parent

include the types and quantity of foods offered, the time and setting in which the foods are offered, and the style parents use during feeding (AAP Committee on Nutrition, 2014; Birch & Doub, 2014). Recommendations for feeding infants are provided by organizations such as the AAP and the WHO. Exclusive breastfeeding is recommended until infants are six months of age, with formula being the alternative if breastfeeding is not possible. Complementary foods (any liquid or food other than breastmilk or formula) should be introduced around six months of age. Foods that provide nutrients lacking in breastmilk (primarily iron and zinc) should be offered first, followed by other foods with nutritional value yet no added salt or sugar. Food from all groups should be provided by the time an infant is about eight to nine months of age. Juice and sugar sweetened beverages should be avoided as well as foods that are calorically dense yet lack nutritional value (i.e., desserts) (AAP Committee on Nutrition, 2014; WHO, 2016).

Parental feeding style is included in infant feeding recommendations from all organizations. Parental feeding style is the attitudes and quality of interaction used by parents when feeding (Thompson, Adair, & Bentley, 2013). A responsive feeding style,

in which a parent responds to infant cues regarding hunger and satiety during feeding, is recommended (AAP Committee on Nutrition, 2014; WHO, 2016). Four additional feeding styles are thought to exist (Table 2). Along with the responsive style, Thompson and colleagues (2013) identified the restrictive feeding style to be associated with feeding practices that align with recommendations and healthy growth. In contrast, pressuring/controlling and the indulgent parental feeding styles were associated with feeding practices such as decreased breastfeeding and increased odds of inappropriate feeding (i.e., calorically dense, low nutrient foods) which do not align with recommendations (Thompson et al., 2013).

Table 2

Parental feeding styles

Style	Definition
Indulgent	The parent sets no limits on the quantity or quality of the food consumed by the child.
Laissez-faire	The parent does not place limits on the quality or quantity of the child's diet and there is little interaction between parent and child during feeding.
Pressuring/controlling	The parent is concerned regarding increases in the amount of food that is taken by the child, demonstrating practices such as adding cereal to a bottle to help with sleep and using food to soothe.
Responsive	The parent provides structure yet is attentive to the hunger and satiety cues the child exhibits, the quality of the food is also monitored.
Restrictive	The parent is concerned regarding decreasing the amount of food that is taken by the child, food may be limited to healthful options and quantities.

Note: From "Pressuring and restrictive feeding styles influence infant feeding and size among a low-income African-American sample," by A. L. Thompson, L. S. Adair, and M. E. Bentley, 2013, *Obesity*, *21*, 562-571.

Parental knowledge of infant development, nutrition and infant feeding recommendations, along with social constraints and other competing time demands, can affect parents' decisions about what and how to feed their infant (Birch & Doub, 2014; Thompson & Bentley, 2013). Additionally, sociodemographic factors including cultural

practices have been identified as contributors to the decisions parents make regarding feeding their infant (Gibbs & Forste, 2014; Taveras, Gillman, Kleinman, Rich-Edwards, & Rifas-Shiman, 2010). Self-efficacy has also been identified as an important concept in the study of infant feeding practices (Redsell et al., 2016), however, to date, there has been no comprehensive review of research regarding the associations among self-efficacy, infant feeding practices, and infant weight gain. A comprehensive review will identify what is known regarding self-efficacy and infant feeding practices and/or infant weight gain. This knowledge will assist with strategies to implement into clinical practice. Additionally, gaps identified in the review will guide future research. Therefore, the purpose of this integrative review is to synthesize the literature regarding the potential role of self-efficacy in infant feeding practices or infant weight gain.

Methods

Design and Search Strategy

This integrative review followed the guidelines provided by Whittemore, Chao, Jang, Minges, and Park (2014). A search was conducted using PubMed, Embase, Cochran, PsychINFO, and the Cumulative Index to Nursing and Allied Health Library (CINAHL) databases. All searches were conducted using Boolean logic. Search terms included: “parental self-efficacy,” “maternal self-efficacy,” “self-efficacy,”, “breastfeeding self-efficacy,” “infant feeding practices,” “infant feeding,” “feeding practices,” “breastfeeding,” “formula feeding,” “artificial milk,” “artificial feeding,” “infant weight gain,” “infant weight,” “weight gain,” and “nutrition.” The term “nutrition” was only used when searches using “infant feeding practices” yielded

minimal results. With each search, limits were set to examine studies conducted with humans and written in the English language. Limits were also set to only include studies which examined the infancy period (birth to 12 months); in some databases this included ages up to 23 months. Due to the abundance of literature regarding breastfeeding self-efficacy, searches including this term were limited to 2006 to present and excluded dissertations. In the Cochran database, the search was limited to include only "Cochran Reviews" and "other reviews." For the remainder of searches, no limit was set on the history of publication date nor the type of article (i.e., review, clinical trial, observational, dissertation). Research examining the association between variables as well as any intervention studies were included. Articles identified were published prior to December 2017.

Data Extraction and Synthesis

After duplicates were removed, and titles and abstracts screened for relevance to self-efficacy and infant feeding practices or infant weight gain, 120 articles remained. Studies focused on infancy and those that followed infants into the second year, as relevant, were included. Articles were excluded if the focus was on children beyond the age of 24 months with no inclusion of the infancy period, infants born prematurely, development or validation of tools, an aspect of parenting other than self-efficacy, or maternal mental health (Figure 1). Following the method of data analysis suggested by Whittemore and colleagues (2014), categories were identified, and articles sorted based on these categories. Additionally, the articles were appraised and the level of evidence

and grade of each was assigned based on the recommendations provided by the Joanna Briggs Institute (Joanna Briggs Institute, 2014).

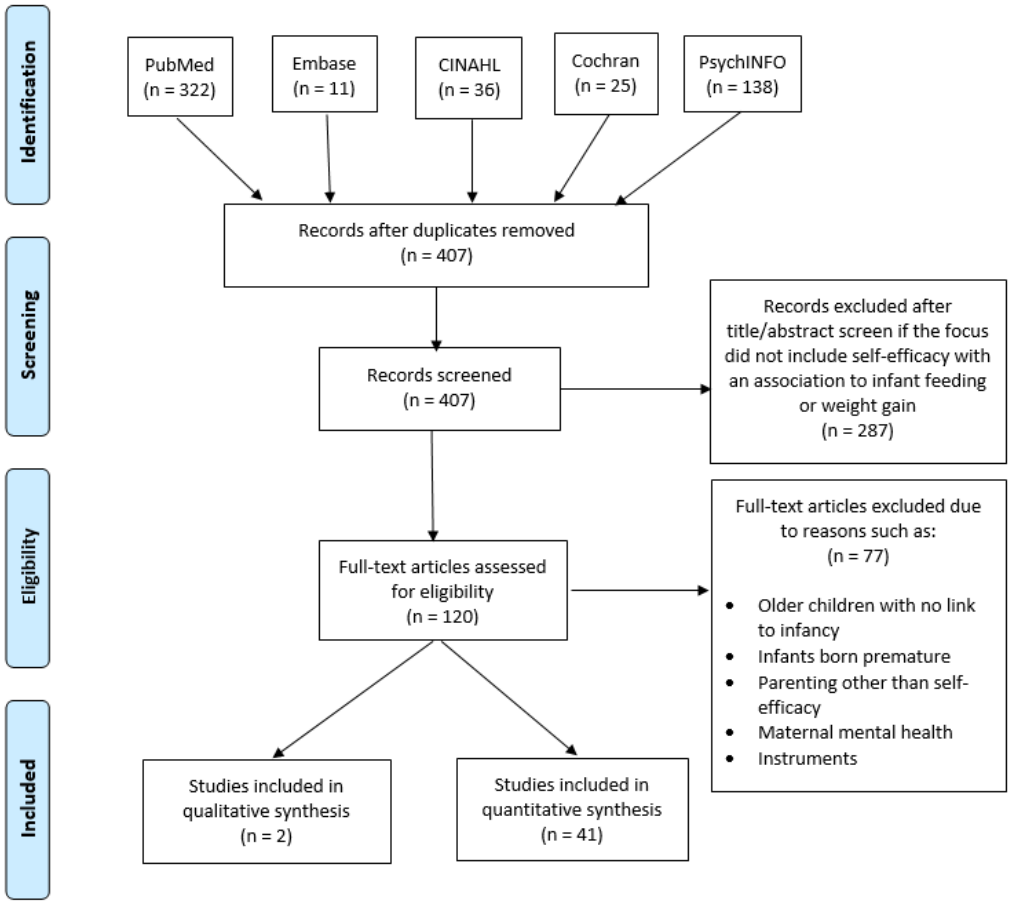

Figure 1. PRISMA flow diagram of search. *From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Results

A total of 43 articles were included to guide this review (Tables 3-7, Appendix A). These studies used populations from a variety of geographic areas including the U.S., Australia, Canada, Brazil, Turkey, Europe, and Asia. Articles were included if the topic of self-efficacy and infant feeding practices or infant weight gain was addressed regardless of the race, ethnicity, or sociodemographics of the population studied

including both first-time and experienced parents. Self-efficacy was measured in a variety of ways: self-efficacy in general, self-efficacy specific to parenting, self-efficacy specific to breastfeeding, and self-efficacy to maternal feeding. Results of this review are classified into three categories of articles that examined an association with self-efficacy: 1) breastfeeding; 2) infant feeding practices such as parental feeding style and dietary quality; and 3) infant weight gain. A limited number of the articles addressed associations of self-efficacy with more than one category. The following sections provide an overview of findings.

Breastfeeding

Evidence suggests that women with a higher sense of breastfeeding self-efficacy (BFSE) have higher rates of breastfeeding initiation, longer durations of any breastfeeding, and longer durations of exclusive breastfeeding, as compared to women who report a lower sense of BFSE (Table 3) (Gercek, Sarikaya Karabudak, Ardic Celik, & Saruhan, 2017; Henshaw, Fried, Siskind, Newhouse, & Cooper, 2015; Karall et al., 2015). Additionally, two qualitative studies that examined mothers' decisions to breastfeed, identified self-efficacy as an important theme (Barbosa, Masho, Carlyle, & Mosavel, 2017; Furman, Banks, & North, 2013). From these findings, several interventions have been developed and tested to determine the impact on a mother's sense of BFSE (Table 5) (Abbass-Dick et al., 2017; Dodt, Joventino, Aquino, Almeida, & Ximenes, 2015; Joshi, Amadi, Meza, Aguire, & Wilhelm, 2016; Liu, Zhu, Yang, Wu, & Ye, 2017).

Interventions targeting BFSE have been varied. Some have included BFSE as a part of the intervention (Dodt et al., 2015; McQueen, Dennis, Stremler, & Norman, 2011) and others have tested an intervention on a mother's sense of BFSE (Abbass-Dick et al., 2017; Liu et al., 2017). Interventions included electronically accessible resources, face-to-face sessions, or workbooks, offered prenatally and/or postnatally, in groups or individual sessions (Table 5). Regardless of the type of intervention, most studies found that the intervention increased a mother's sense of BFSE and contributed to higher rates of either breastfeeding initiation or duration of any or exclusive breastfeeding. Only one study found no difference in BFSE between the intervention and control groups in a cohort of Australian mothers; however, all of the participants (intervention and control group) attended a prenatal breastfeeding workshop (Hauck, Hall, & Jones, 2007). Recognizing that BFSE is an important predictor for breastfeeding success, Yang and colleagues (2016) identified six constructs which increase a mother's sense of BFSE: breastfeeding intention, partner support, nurse/midwife support, attending a prenatal breastfeeding class, time to initiation of breastfeeding in the immediate post-partum period, and prior experiences breastfeeding. Additionally, Bartle and Harvey (2017) found that prior personal and vicarious experiences influenced a mother's sense of BFSE, as well as the decision to breastfeed or provide formula.

General self-efficacy or PSE and the association with breastfeeding have also been examined, though to a lesser extent (Table 4). General self-efficacy (not specific to breastfeeding or parenting) was examined in a group of mothers from rural China finding that those with higher reported self-efficacy were more likely to exclusively breastfeed (Shi, Zhang, Wang, & Guyer, 2008). Separate systematic reviews examining support for

breastfeeding suggest interventions that increase a mother's sense of self-efficacy, while being tailored to individual needs, are most beneficial to successful breastfeeding (Demirtas, 2012; Hannula, Kaunonen, & Tarkka, 2008). The researchers did not indicate whether this was general self-efficacy, PSE, or BFSE. Hernandez's study (2014) is the only one identified which examined an association between PSE and breastfeeding. This study was conducted in the U.S. in a population of Mexican-American women using the Parent's Expectation Survey to measure PSE. PSE was measured in the 48 hours postpartum and negatively correlated (r = -0.23, p = 0.01) with breastfeeding at infant age of six weeks. The negative correlation between PSE and breastfeeding is contradictory to most findings examining BFSE, however, three observations were noted by the researchers: (1) cultural differences in the Mexican-American population could influence feeding practices; (2) 80% of the mothers were experienced, there was no differentiation with first-time mothers; and (3) this study was the first time the Parent's Expectation Survey was translated to Spanish for use in a study.

Infant Feeding Practices

Self-efficacy and infant feeding other than breastfeeding have also been examined (Table 6). Barrett and colleagues (2016) reported that PSE is associated with parental feeding styles. PSE was measured using the Parenting Sense of Competence scale and found to be positively associated (r = 0.20, $p < 0.05$) with the restrictive feeding style in a sample of first-time African-American mother-infant dyads. Mothers who reported a higher sense of PSE tended to demonstrate the restrictive feeding style, which has previously been linked with lower caloric intake, increased breastfeeding, and decreased

inappropriate feeding (i.e., using food to soothe or providing high sugar foods with low nutrient value) (Thompson et al., 2013). The pressuring feeding style has been associated with inappropriate infant feeding (Stifter & Moding, 2015; Thompson et al., 2013), but no significant correlation with PSE was seen in the study by Barrett and colleagues (2016). The researchers conclude that strengthening of PSE along with maternal self-esteem may be targets for future intervention studies (Barrett, Thompson, & Bentley, 2016).

Three studies conducted in Australia examined mothers' sense of self-efficacy and dietary preferences in toddlers. All indicated that mothers who reported a higher sense of self-efficacy had toddlers with greater intake of fruit and vegetables and less intake of soft drinks and sweets (Campbell et al., 2010; Spence, Campbell, Crawford, McNaughton, & Hesketh, 2014; Xu, Wen, Rissel, Flood, & Baur, 2013). Koh and colleagues (2014) examined maternal feeding self-efficacy, maternal psychological symptoms, parenting confidence, and infant feeding behavior in a group of Australian mother-infant dyads at infant age of six months. Similar to the findings above with mother-toddler dyads, mothers who reported a higher sense of self-efficacy offered an increased variety of vegetables to their infant compared to mothers who reported a lower sense of self-efficacy ($R^2 = 0.14$, $p < 0.05$). Maternal feeding self-efficacy was also positively correlated with how often the mother offered new foods ($r = 0.64$, $p < 0.001$) and the frequency of offering a food ($r = 0.52$, $p < 0.001$). The authors concluded that a higher sense of self-efficacy contributes to healthy infant feeding practices and dietary habits of infants, and that modification of the antecedents to maternal feeding self-

efficacy, such as familial feeding practices , may be important interventions to target (Koh et al., 2014).

An intervention study conducted in China demonstrates that enhancing PSE may contribute to infant feeding practices that better align with recommendations (Zhang, Shi, Chen, Wang, & Wang, 2009). Mothers-infant dyads were enrolled in this study at infant age of two to four months (Table 7). The intervention group received training on child nutrition and infant feeding practices every three months. PSE was measured at baseline and again at study completion when the infants were 10-11 months of age. Post-intervention, mothers in the intervention group had higher PSE scores (M = 11.3 [SD = 5.6] vs. M = 6.0 [SD = 5.7], $p < 0.001$), higher intentions to adopt recommended infant feeding practices (M = 6.7 [SD = 1.7] vs. M = 4.0 [SD = 2.0], $p < 0.001$), and PSE was positively correlated with intention to adopt recommended infant feeding practices (Standardized $\beta = 0.21$, $p < 0.001$) (Zhang et al., 2009). Additionally, the infants in the intervention group were breastfed longer and received complementary foods around six months of age, consistent with infant feeding recommendations (Zhang et al., 2009). A separate study conducted in the United Kingdom had similar findings with parents of children (infants through preschoolers) (Willis et al., 2014). These parents received eight weeks of educational sessions regarding health, exercise, and nutrition; PSE scores rose significantly ($d = 0.6$, $p < 0.001$) from baseline to study completion as did family dietary practices such as eating as a family and increased consumption of fruits and vegetables (Willis et al., 2014). This research provides examples of how impacting PSE may have a positive influence on infant and child feeding practices.

Infant Weight Gain

Studies examining the association between self-efficacy and infant weight gain are lacking. Stifter, Anzman-Frasca, Birch, and Voegtline (2011) examined the correlation between PSE and infant and toddler weight status; a positive, yet non-significant correlation was seen ($r = 0.20$, $p > 0.05$). This study was conducted in the northeastern region of the U.S. in a sample of Caucasian mother-child dyads (ages 3-34 months) with 49% of families having an income of at least $60,000 and mothers who were primarily well educated (65% with a college degree). Child weight status at a single visit was calculated by body mass index (BMI) z-score using WHO standards (Stifter et al., 2011). Despite this null finding, researchers suggest that the practice of using food to soothe an infant, may mediate the relationship between PSE and infant weight gain (Stifter et al., 2011; Stifter & Moding, 2015). Mothers who reported a low sense of PSE were more likely to use food to soothe their infant, which in turn was associated with a higher BMI z-score (Stifter et al., 2011) or a rapid rate of infant weight gain (Stifter & Moding, 2015).

Infant temperament may also mediate or moderate the relationship between PSE and infant weight gain. Infants reported as having a negative temperament were more likely to exhibit higher BMI z-score (Stifter et al., 2011) or rapid weight gain through infancy (Anzman-Frasca, Stifter, Paul, & Birch, 2013). Anzman-Frasca and colleagues (2013) found this association between negative infant temperament and rapid weight gain was only seen when mothers reported a low sense of PSE; the relationship was opposite in mothers reporting a high sense of PSE. Further exploration is needed, but these findings imply low PSE and/or negative infant temperament may work independently or

together to trigger a mother to use food to soothe her infant, and thereby inadvertently promoting increased weight gain.

Shah and colleagues (2016) conducted an intervention study that examined whether dietary behaviors and/or infant/toddler weight differed in a group of mother-infant dyads who received infant well care in a group setting (experimental) versus an individual setting (control). The experimental arm received infant well care (over the first year of life) focused on maternal-infant attachment and PSE in a group setting with other mothers and infants. In this sample, no statistically significant differences were observed between groups regarding dietary practices or child weight up to 36 months of age, however, the experimental group had less incidence of ever being overweight (Shah et al., 2016). A limitation of the study was that PSE of the mothers was not measured, therefore, differences between groups could not be examined nor pre/post intervention differences. However, these findings lend further support to the need for future investigation of the association of PSE and infant weight gain.

Discussion

This review has outlined the literature regarding the association of self-efficacy with infant feeding practices and infant weight gain. In sum, mothers who exhibit a higher sense of self-efficacy engage in infant feeding practices that better align with recommendations, such as breastfeeding and providing nutrient dense foods to infants. Research regarding BFSE and the association with breastfeeding initiation and duration is abundant. However, the dearth of literature regarding other feeding practices is evident. Specifically, there are minimal studies that examine an association between self-efficacy

and parental feeding style or types and quality of foods offered. Additionally, the majority of research has been conducted in Caucasian mothers, fathers and mothers of other racial and ethnic groups have not often been studied. Finally, only one study examined the association between self-efficacy and infant weight gain limiting conclusions.

Mothers who reported a higher sense of BFSE had higher rates of breastfeeding initiation and a longer duration of any breastfeeding including exclusive breastfeeding (Gercek et al., 2017; Henshaw et al., 2015; Karall et al., 2015). The association of self-efficacy with breastfeeding was also supported by studies describing how interventions that increase a mother's sense of BFSE are successful at increasing the duration and exclusivity of breastfeeding (Abbass-Dick et al., 2017; Liu et al., 2017). Joshi and colleagues (2016) found that six weeks and three months post-partum were key time points when breastfeeding intervention and support was needed. The association between BFSE and breastfeeding is important as breastfeeding has been associated with a lower rate of weight gain during infancy compared with formula fed infants (Li, Magadia, Fein, & Grummer-Strawn, 2012). Rapid weight gain during infancy is associated with pediatric obesity, therefore an important modifier to consider during infancy (Druet et al., 2012; Ong & Loos, 2006). Additionally, breastfeeding has been associated with healthy dietary practices later in childhood, such as increased intake of fruits and vegetables and less intake of sugar sweetened beverages (Perrine, Galuska, Thompson, & Scanlon, 2014).

Despite the abundance of literature showing an association between BFSE and breastfeeding, there were some contradictory findings. Bartle and Harvey (2017) found

the association between BFSE and breastfeeding to be significant in experienced mothers only, not in first time mothers. The additional finding regarding the influence of vicarious experiences on BFSE and breastfeeding practices may contribute to the differences seen between the experienced and first-time mothers (Bartle & Harvey, 2017). Vicarious experience is known to contribute to the development of one's self-efficacy (Bandura, 1997), however, the study by Bartle and Harvey (2017) may be the first to examine this association in the context of breastfeeding. Additional research is needed to elucidate the role of vicarious experiences on BFSE and breastfeeding.

Hernandez (2014) is the only study identified in this review that did not support an association of self-efficacy with improved breastfeeding in a cohort of primarily experienced mothers. Although the reasons for this discrepancy are unknown, the study was conducted in a cohort of Mexican-American women which raises the possibility that there may be cultural influences on the association of self-efficacy with breastfeeding that have yet to be fully explored. Consequently, it would be useful for future research to explore cultural, social, and economic influences on the association of self-efficacy with breastfeeding among more diverse mother-infant dyads.

The evidence regarding an association between self-efficacy and infant feeding practices other than breastfeeding is minimal. However, findings from existing studies are concordant; mothers who reported a higher sense of self-efficacy tended to choose infant feeding practices that aligned with infant feeding recommendations resulting in a better quality of dietary intake (i.e., more fruits and vegetables, less sugar sweetened beverages) (Koh et al., 2014; Zhang et al., 2009). Additionally, these mothers were more likely to use a restrictive or responsive parental feeding style when self-efficacy was high

(Barrett et al., 2016; Koh et al., 2014), and less likely to use food to soothe their infant (Stifter & Moding, 2015). Consequently, it is possible that self-efficacy could impact infant weight gain via infant feeding practices, but these studies did not address this question. Additionally, the studies examining self-efficacy and infant feeding did not follow the cohorts beyond infancy to know whether the associations between self-efficacy and feeding practices were persistent, or whether there was an association with childhood weight status. Examining infants during the first year of life is important for establishing healthy dietary practices, however, without following the cohorts longitudinally, the findings cannot be extrapolated to older ages.

There is also a lack of intervention studies to examine whether self-efficacy plays a causal role in infant feeding practices. Only one study was identified in which self-efficacy was a focus in the intervention (Shah et al., 2016). Of note, there are two intervention studies reported in the literature (Paul et al., 2014; Wasser et al., 2017) that measure self-efficacy as an outcome following interventions aimed at reducing infants' risk for obesity but neither has reported self-efficacy results as of the date of this review. While not conclusive, findings to date indicate that self-efficacy, specifically PSE or self-efficacy for infant feeding, is important to include in further research.

Weight gain during infancy has important implications for future childhood weight status (Druet et al., 2012). Therefore, it is vital for research to examine modifiable contributors to the rate at which infants gain weight. To date, few studies have examined this association despite evidence that PSE could be a mediator or moderator of the association between infant feeding practices and weight gain (Anzman-Frasca et al., 2013; Barrett et al., 2016; Furman et al., 2013; Shah et al., 2016; Stifter &

Moding, 2015). It is plausible that an association between self-efficacy and infant weight gain may exist, but further research is needed.

Conclusion

Additional findings from this review must be noted. First, the majority of populations studied were Caucasian. In the U.S., African-American and/or Hispanic infants are at greatest risk for rapid weight gain and feeding practices that do not align with infant feeding recommendations (Gibbs & Forste, 2014; Taveras et al., 2010). As cited above, studies of breastfeeding included a diverse group of populations from across the world including African-American and Hispanic mother-infant dyads, however, these groups are underrepresented in the other studies. The cohort studied by Barrett and colleagues (2016) was a group of African-American mothers and their infants, otherwise, all studies were conducted primarily with Caucasian participants. Second, the inconsistent measurement of self-efficacy based on whether it relates to BFSE, PSE, or maternal feeding self-efficacy in these studies impairs our ability to make direct comparisons of findings. As a result, the question arises whether general self-efficacy or PSE is an adequate measurement or whether a tool that assessed self-efficacy specific to infant feeding practices is needed. Individual researchers have developed tools to measure self-efficacy specific to infant feeding for use in specific studies (Campbell et al., 2010; Koh et al., 2014; Spence et al., 2014; Zhang et al., 2009). Although some of these tools have been used in multiple studies, little is known about the validity of these instruments. Additionally, due to the impact of vicarious experiences identified by Bartle and Harvey (2017), the researchers suggest the development of a self-efficacy tool which

addresses formula feeding to be used in addition to the BFSE Scale. Consequently, there is a need to develop a tool to measure self-efficacy specifically with respect to infant feeding practices, and preferably that can be applied across diverse populations.

Limitations

There are limitations to this review that should be noted. The literature search was conducted by a single author which could impact the totality of the review. Using the Boolean method, many search terms and a variety of databases were used in an effort to conduct a thorough search, however, the possibility remains that articles were missed. Additionally, not all search terms were Medical Subject Heading (MeSH) vocabulary; for example, "self-efficacy" is a MeSH term but neither "parental self-efficacy" nor "breastfeeding self-efficacy" are MeSH terms. This could have resulted in overlooking articles in the PubMed database. There is also a limitation of generalizability. Due to the limited number of articles published on the topic of self-efficacy and infant feeding practices, articles from all over the world, in populations of various race, ethnicity, socioeconomic status, and culture were included. This makes it difficult to generalize the findings to a particular population.

Implications for Practice

Clinicians who care for infants and their parents should be aware of the role self-efficacy may have in parent decisions regarding infant feeding practices, particularly breastfeeding. The abundance and quality of evidence demonstrating the benefit of BFSE in successful initiation and longer durations of breastfeeding is such that clinicians

can feel confident in using these findings in practice. BFSE can be screened by clinicians in the prenatal and/or postnatal periods using the self-report Breastfeeding Self-Efficacy Scale – Short Form. Identification of mothers with low BFSE is important to assist clinicians in providing additional education and support to these mothers who are at risk for low breastfeeding initiation and/or short duration of breastfeeding, and hence, whose infants are at increased risk for rapid weight gain.

Although more research is needed regarding the impact of self-efficacy on other infant feeding practices, the few studies to date suggest that feeding practices are healthier and more likely to align with recommendations if parents have a high sense of self-efficacy. Strategies to increase a parent's sense of self-efficacy could be incorporated into clinic visits and parenting classes, with the ultimate goal of improving an overall sense of self-efficacy which may improve infant nutrition and wellness. Self-report questionnaires to measure a parent's sense of PSE are available. A review by Wittkowski, Garrett, Calam, and Weisberg (2017) identified 34 such instruments. The Karitane Parenting Confidence Scale (KPCS) and Perceived Maternal Parenting Self-Efficacy Scale received the highest overall scores in this review. However, the authors caution that no tool received a perfect score and with so many tools, a practitioner should consider the tool in the context of the population and setting to determine the most appropriate for the circumstances (Wittkowski et al., 2017). The KPCS is available free of charge for use in clinical and research settings.

Future Research

The positive outcomes of interventions to address BFSE support the importance of self-efficacy for infant feeding practices in general. However, there is a dearth of research regarding other feeding practices such as the age of complementary food introduction, types of complementary foods offered during infancy, formula feeding, and the parental feeding style used. There is also a lack of longitudinal research examining self-efficacy and child dietary habits and growth. Research has shown that a parent's sense of PSE increases over time (De Montigny & Lacharité, 2005; Salonen et al., 2009), but it is unknown whether PSE changes as a child becomes independent with eating. In addition, most research to date has examined a maternal sense of self-efficacy, but research of fathers and other caregivers is warranted. In the U.S., approximately 59% of mothers with infants work outside the home (Bureau of Labor Statistics, 2017) with fathers and grandmothers being the most common non-maternal familial caregivers. It is also important to recognize that despite their high risk for childhood obesity (Taveras et al., 2010), minority populations are often understudied, warranting more study of diverse populations. Finally, despite the abundance of tools available to measure PSE, none specific to self-efficacy to infant feeding are available for use. Researchers should consider the need for a tool to measure self-efficacy specific to feeding practices other than breastfeeding.

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TABLES OF ARTICLES INCLUDED IN THE REVIEW

Table 3

Breastfeeding self-efficacy and breastfeeding studies

First author (year)	Study Design & Location	Variables (Tools)	Sample Size & Participants	Findings	Level of Evidence	Grade
Baghurst (2007)	Cohort Study (followed from late pregnancy to 6 months PP) Adelaide, Australia	IV: BF Self-efficacy (BFSE Short Form) DV: BF Duration	N=317 primiparous mothers & infants 88% Caucasian	BFSE at 1 week PP was an important predictor for BF duration	3.e	A
Barbosa (2017)	Qualitative, focus groups Richmond, Virginia, U.S.	NA	N=25 mothers (any parity) Low-income, African-American	Group of mothers who breastfed for longer than 4 months exhibited higher levels of general self-efficacy as well as BFSE.	3*	A
Bartle (2017)	Prospective questionnaire study England	IV: BF Self-efficacy (BFSE Short Form) (32 weeks Gestation) DV: BF initiation and any BF at 6 weeks PP	N=149 mothers (n=77 primiparous, n=72 multiparous) 87% Caucasian	BFSE associated with BF at 6 weeks only in the multiparous group of mothers (r=0.36, p<0.01). No association in primiparous mothers (r=0.09, p>0.05).	3.e	A
Furman (2013)	Qualitative, focus groups Cleveland, Ohio, U.S.	NA	N=20 pregnant or PP women Inner city African-American	Themes of self-efficacy & self-esteem identified as barriers or facilitators to BF	3*	A

Gercek (2017)	Cross-sectional, descriptive Turkey	IV: BF Self-efficacy (BFSE Short Form) DV: BF success (LATCH BF Assessment Tool)	N=303 mothers & infants (any parity) Primarily Turkish	High BFSE was associated with higher LATCH scores PP	4.b	A
Glassman (2014)	Prospective cohort study New York City	IV: BF Self-efficacy (BFSE Short Form) DV: Initiation & continuation of BF through 1 month PP	N=209 (156 at 1 month) mothers & infants (any parity) Low income, Latina	Higher BFSE resulted in higher rates of BF at 1 month PP Only BFES was associated with exclusive BF	3.e	A
Henshaw (2015)	Prospective cohort study Ohio	IV: BF Self-efficacy (BFSE Short Form) DV: BF exclusivity	N=142 primiparous mothers & infants 85% Caucasian, 10% African-American	BFSE at 2 days PP was significant predictor of BF exclusivity at 6 months PP but not 6 weeks PP	3.e	A
Karall (2015)	Prospective cohort study (followed first 24 months of infant's life) Tyrol, Austria	IV: Open ended questions regarding reason for weaning (no tool provided) DV: BF duration	N=555 mothers & infants (any parity) Primarily Austrian	Low BFSE is risk for early weaning	3.e	B
Ku (2010)	Non-experimental, cross-sectional design Hong Kong	IV: BF Self-efficacy (BFSE Scale) DV: BF patterns & exclusivity	N=82 primiparous mothers & infants Primarily Chinese	Higher BFSE is associated with higher odds of exclusive BF (OR 1.104, $p<0.001$)	4.b	A
Loke (2013)	Descriptive, correlation study Hong Kong	IV: BF Self-efficacy (BFSE Scale) DV: BF duration and exclusivity	N=199 mothers (any parity) Primarily Chinese	High BFSE was associated with exclusive BF at 6	3.e	A

				weeks PP (OR 7.776, $p<0.001$)		
McCarter-Spaulding (2009)	Descriptive, longitudinal cohort study New England	IV: BF Self-efficacy (BFSE Scale) DV: BF duration and pattern	N=125 mothers (any parity) African decent (32% African-American, 25% Carbbean, 10% African, 8% Cape Verdean, 25% Other)	Higher BFSE associated with longer duration and more exclusive BF at 1 and 6 months PP ($p<0.01$)	3.e	A
McQueen (2015)	Prospective Cohort study Ontario, Canada	IV: BF Self-efficacy (BFSE Short Form) DV: BF outcomes at 4 and 8 weeks PP	N=130 mothers & infants (any parity) Aboriginals of North America (Indians [First Nations], Metis, & Inuit)	Higher BFSE in the immediate PP period associated with higher probability of any BF for at least 8 weeks	3.e	A
Nommsen-Rivers (2010)	Cross-sectional (prenatally) California, U.S.	IV: BF Self-efficacy (BFSE Short Form) DV: BF intention	N=532 primiparous mothers White non-Hispanic 41%, Hispanic 26.7%, African-American 14.1%, Asian 12%, Other 6.2%	Higher BFSE positively associated with BF intention ($p < 0.0001$) Higher comfort with formula feeding inversely associated with BF intention ($p < 0.0001$)	4.b	A
Otsuka (2008)	Cross-sectional Japan (Tokyo & Kusatsu)	IV: BF Self-efficacy (BFSE Short Form) DV: Perception of Breastmiilk Supply (Perception of Insufficient Milk Questionnaire)	N=262 mothers & infants (any parity) Primarily Japanese	BFSE and perception of insufficient breastmilk supply were negatively correlated ($r = -0.45$, $p<0.001$)	4.b	A

				BFSE explained 21% of variance in maternal perception of breastmilk supply		
Robinson (2011)	Mixed Methods Midwest U.S.	IV: BF Self-efficacy (BFSE Short Form) DV: Intention to BF	N=59 (quantitative portion), 17 (qualitative portion) mothers & infants (any parity) African-American	BFSE was different between those intending to BF and those not (p=0.001), higher BFSE associated with higher intention to BF	4.b	A
Semenic (2008)	Prospective, correlational (followed from birth to 6 months PP) Montreal, Quebec, Canada	IV: BF self-efficacy (BFSE Short Form) DV: Exclusive BF at 6 months	N=189 primiparous mothers intending to BF English Canadians, French Canadians, & immigrants	Higher BFSE associated with longer duration of exclusive BF (p=0.03)	3.e	A
Tsai (2015)	Prospective, longitudinal design Taiwan (Taipei & Yi-Lan)	IV: BF self-efficacy (BFSE Scale) DV: BF practice	N=300 Primiparous mothers Primarily Taiwanese	BFSE was significantly associated with exclusive BF in the immediate PP period as well as 1 month and 3 months PP	3.e	A
Yang (2016)	Cross-sectional descriptive Guangzhou, China	IV: Network Support for Breastfeeding Scale DV: BF Self-efficacy (BFSE Short Form)	N=571 mothers (any parity) Chinese	Six predictors of BFSE in the immediate PP period: intention to BF, husband support, nurse/midwife support, attendance	4.b	A

				of prenatal BF classes, time from birth to initiation of BF, and previous BF experience

Table 4

Self-efficacy and breastfeeding studies

First author (year)	Study Design & Location	Variables (Tools)	Sample Size & Participants	Findings	Level of Evidence	Grade
Hernandez (2014)	Prospective, cross-sectional study (unpublished dissertation) Tampa, FL, U.S.	IV: PSE (Parent's Expectation Survey), measured at birth, General Self-efficacy (General Self-Efficacy Scale) DV: Exclusive BF at 6 weeks PP (breastfeeding index)	N=110 mothers (80% multiparous, 20% primiparous) Mexican-American (Hispanic)	Higher PSE significantly associated with decreased BF intensity (p=0.01). General self-efficacy not associated with BF	4.b	B
Shi (2008)	Cross-sectional survey Rural China	IV: General self-efficacy (4 questions developed by researchers for use in the study) DV: BF exclusivity or fully BF (breastmilk plus small quantity of other liquids)	N=599 mothers-infant dyads (parity not provided) Primarily Chinese (Han)	Higher self-efficacy associated with mothers being more likely to fully breastfeed (OR 1.06, p<0.01)	4.b	B

Table 5

Breastfeeding self-efficacy intervention studies

First author (year)	Study Design & Location	Variables (Tools)	Sample Size & Participants	Findings	Level of Evidence	Grade
Abbass-Dick (2017)	Pre/post test experimental study (phase II of the study) Ontario, Canada	IV: Intervention – An eHealth breastfeeding and co-parenting resource, interactive with multimodal delivery of information (developed based on feedback from Phase I) DV: BF Self-efficacy (BFSE Short Form)	N=31 mothers & N=35 fathers (primiparous) Race/ethnicity not provided	Maternal & paternal BF self-efficacy scores rose post-test	2.d	A
Chan (2016)	Experimental design with random assignment Hong Kong	IV: Intervention – 2 hour BF workshop prenatally & 30-60 minute telephone session at 2 weeks PP. Control – standard care DV: BF exclusivity, BF Self-efficacy (BFSE Short Form)	N=71 primiparous mothers (35 intervention, 36 control) 95% Chinese	BFSE scores significantly higher in intervention group from prenatal to 2 weeks PP (p<0.01) & higher than control group at 2 weeks PP (p<0.01) Exclusive BF in intervention group higher at each time point to 6 months, on significant at 8 weeks PP (p=0.02)	1.d	A
Dodt (2015)	Experimental, pre/post- test design, interventional & control groups	IV: Intervention – flip chart containing education on BFSE during PP period in	N=201 mothers (100 intervention, 101 control) (any parity) Primarily Brazilian	Intervention group had higher change in BFSE scores from immediate	2.d	A

	Brazil	hospital (between 6 hours PP and hospital discharge). Control – no flip chart DV: BF Self-efficacy (BFSE Short Form), BF rates		PP period to 2 months PP (p=0.032). Exclusive BF at 2 months PP: intervention group, 100%, control group 41%.		
Hauck (2007)	Experimental study Australia	IV: Intervention – Breastfeeding journal with education material provided at approximately 36 weeks gestation. Control – No journal provided DV: BF Self-efficacy (BFSE Scale)	N= 276 primiparous mothers (136 intervention, 140 control) Primarily Australian *Both groups attended a prenatal BF workshop	No statistically significant differences between the intervention and control groups in BFSE during the immediate PP period (p=0.23) or the 12 weeks PP period (p=0.75)	2.c	B
Joshi (2016)	Two-group, repeated measures quasi-experimental study Nebraska	IV: Intervention – Computer based BF educational support program administered last 6 weeks of pregnancy. Control – printed educational material on BF. DV: BF exclusivity, BF Self-efficacy (BFSE Short Form)	N=46 mothers (any parity) Rural, Hispanic	Intervention group at higher intent to BF 1 week PP Not significant but BFSE scores decreased from 6 weeks to 6 months in the control group, and increased in the intervention group	2.c	A
Liu (2017)	Comparative, quasi-experimental study China	IV: Intervention – 1 hour prenatal BF workshop & 1 hour BF counseling session	N=130 (65 each group) primiparous mothers Primarily Chinese	Intervention group had significantly higher BFSE scores at 4 weeks PP ($p < 0.0001$) & 8	2.c	A

		within 24 hours of birth. Control – standard care. DV: BF exclusivity at 8 weeks PP, BF Self-efficacy (BFSE Short Form)		weeks PP ($p < 0.0001$) than the control group At 8 weeks PP 24.6% of intervention infants were exclusively BF, compared to 1.5% of control group infants ($p < 0.0001$)		
McQueen (2011)	RCT (pilot study) Ontario, Canada	IV: Intervention – Individual BFSE enhancing sessions, 2 PP in hospital and 1 a week after birth. Control – standard care. Provided 3rd trimester. DV: BF Self-efficacy (BFSE Short Form), BF duration and exclusivity. 4 weeks PP	N=150 (69 intervention, 81 control) primiparous mothers 81% Caucasian, 14% Aboriginals of North America	Mothers in the intervention group had higher rates of BF self-efficacy, duration, and exclusivity at 4 and 8 weeks PP, but not significant Intervention was feasible	1.c	A
Nichols (2009)	Experimental study Queensland, Australia	IV: Intervention – BFSE interactive workbook. Control – Workbook on parenting, no mention of BF. DV: BF duration and exclusivity, BF self-efficacy (BFSE Scale)	N=90 (number in each group not provided) mothers (any parity) Primarily Australian	Mothers in the intervention group at higher BFSE (p=.03)	2.c	A
Noel-Weiss (2006)	RCT Canada	IV: Intervention – delivered prenatally, after 34 weeks gestation, a 2.5 hour BF workshop based on	N=110 primiparous mothers Race/ethnicity not provided	BFSE higher in intervention group Exclusive BF higher in intervention group at 4 and 8 weeks PP	1.c	A

		Bandura's self-efficacy theory and adult learning. Control – standard care DV: BF Self-efficacy (BFSE Short Form), duration of BF				
Wu (2014)	Experimental, pre/post test, 2 group design Wuhan, China	IV: Intervention – 3 phase (2 face-to-face in the immediate PP period, 1 via telephone 1-week after hospital discharge) individual sessions focused on self-efficacy and BF. Control – Standard care. DV: BF self-efficacy (BFSE Short Form),	N=74 primiparous mothers (37 each group) Primarily Chinese	Intervention group had significantly higher BFSE at 4 weeks (R^2=0.74, p<0.001) and 8 weeks PP (R^2=0.74, p<0.001)	2.d	A

Table 6

Self-efficacy and feeding practices, feeding style, or weight gain studies

First author (year)	Study Design & Location	Variables (Tools)	Sample Size & Participants	Findings	Levels of Evidence	Grade
Anzman-Frasca (2013)	Correlational study Pennsylvania	IV: PSE (Parenting Sense of Competence Scale), Infant Temperament (Infant Behavior Questionnaire-Revised) DV: Infant Weight (measured at 1 year BMIz and residual weight gain from 1-3 years)	N=110 mother-toddlers (1 year of age) (primiparous), subset n=75 mother-toddlers (3 years of age) 91% Caucasian	Low PSE and negative infant temperature predicted greater weight gain from 1-3 years of age (β= -0.35, p<0.01), the relationship was opposite when mothers had high PSE	3.e	B
Barrett (2016)	Secondary data analysis of the Infant Care, Feeding, and Risk of Obesity Study; correlational study Chapel Hill, NC	IV: PSE (Parenting Sense of Competence Scale) DV: Maternal Feeding Style (Infant Feeding Style Questionnaire)	N=160 mother-infant dyads (primiparous) African-American	Self-efficacy was correlated with the restricted feeding style (r=0.20, p<0.05)	3.e	B
Campbell (2010)	Cross-sectional study Sydney, Australia	IV: Maternal Feeding Self-efficacy (9 item questionnaire developed by the researchers) DV: Child dietary habits at 1 and 5 years of age (Eating and Physical Activity Questionnaire)	N=140 mother-child dyads (n=60 at 1 years, n=80 at 5 years) (parity not provided) Primarily Australian	Maternal feeding self-efficacy associated with vegetable intake in 1 year old children (r=0.31, p<0.05), inversely associated with cake intake (r= -0.34, p<0.0005)	4.b	B

Koh (2014)	Cross-sectional study, first time point of the South Australian Infants Dietary Intake study South Australia	IV: Maternal Feeding Self-efficacy (5 items from the self-efficacy questionnaire used in the Nutrition Education Aimed at Toddlers) DV: Dietary intake (dietary recalls and food records	N=277 mother-infant dyads (infant age 6-7 months) (any parity) Primarily Australian	Maternal feeding self-efficacy was significantly related to vegetable variety (β=0.61, p<0.05) and was influenced by maternal confidence (β=0.36, p<0.01), how often mothers offered new foods (β=0.26, p<0.05), frequency a new food was offered before deciding a child doesn't like it (β=0.40, p<0.01), and child willingness to eat new food (β=0.70, p<0.01)	4.b	B
Spence (2014)	Secondary data analysis of the Mebourne Infant Feeding Activity and Nutrition Trial (InFANT) Program; correlational study (tested mediation affect on the intervention arm) Melbourne, Australia	IV: Maternal Feeding Self-efficacy (same tool used by Campbell, 2010) DV: Child Diet (Comprehensive Feeding Practices Questionnaire & dietary recalls)	N=528 mother-child dyads (child age 18 months) (primiparous) Primarily Austrailian	Maternal feeding self-efficacy associated with child diet quality, but was not a mediator to the intervention arm of the InFANT Program	3.e	B
Stifter (2015)	Cohort, correlational study Pennsylvania	IV: PSE (Parenting Self-efficacy Questionnaire) DV: Use of food to soothe (at 6 months, question asked of the mother, at 12 & 18	N=160 mother-infant/toddler dyads (infants from 6-18 months) (any parity) 95% Caucasian	PSE associated with using food to soothe the infant at 6 months, parent report (β=0.21, R^2=.31, p<0.05) and lab	3.e	B

		months the Food to Soothe Questionnaire; also observed in the lab)		findings (β=1.61, OR=5, p<0.01) Using food to soothe at 6 months was associated with increased weight gain from 6-18 months (β=0.3, R^2=.15, p<0.001)		
Stifter (2011)	Cohort, correlational study Pennsylvania	IV: PSE (Parenting Self-efficacy Questionnaire) DV Use of food to soothe (Baby Basic Needs Questionnaire); Infant weight and length (BMIz)	N=78 mother-infant/toddler dyads (ages 3-34 months) (any parity) Caucasian	PSE associated with using food to soothe the infant (r= -0.29, p=0.04) PSE not associated with child weight status (r= 0.2, p>0.05)	3.e	B
Xu (2013)	Cross-sectional study, secondary analysis from the Health Beginnings Trial control group Sydney, Australia	IV: PSE (Used questions from the "Growing up in Australia: The Longitudinal Study of Australian Children") DV: Child dietary habits (questions from the NSW Child Health Survey 2011)	N=242 mother-toddler dyads (age 2 years) (primiparous) Primarily Australian	PSE associated with fruit (p=0.002) and vegetable (p=0.003) consumption in toddlers, and inversely associated with soft drink consumption (p=0.003).	4.b	B

Table 7

Self-efficacy and feeding practices, feeding style, or weight gain intervention studies

First author (year)	Study Design & Location	Variables (Tools)	Sample Size & Participants	Findings	Level of Evidence	Grade
Shah (2016)	2-year follow-up of a RCT, retrospective chart review New Haven, CT	IV: Intervention – Group well care (focus on maternal/infant relationships and PSE) for the infant's first year; Control – Standard individualized care for the infant's first year DV: Nutrition Behaviors, Child weight at 24, 30, & 36 months	N=63 mother-infant dyads (n=40 intervention, n=23 control) (any parity) African-American, Caucasian, Hispanic (percentage of each not provided)	No statistical differences in nutrition or weight between groups, however a trend seen in the intervention group for ever being overweight	1.c	A
Willis (2014)	Pre/post test experimental study (not control group) England	IV: Heath, Exercise, Nutrition for the Really Young (HENRY) 8-week program DV: PSE (Parenting Self-Agency Measure), Family dietary habits (Food Frequency Questionnaire, Family Eating & Activity Habits Questionnaire)	N=60 parents and children (average age 3.3 years, 22% had an infant) (any parity) 86.7% Caucasian	PSE significantly increased after the program and remained high at the 8-week follow time point (p<0.001) Children's intake of vegetables, fruit, and legumes all showed a significant increase	2.d	A
Zhang (2009)	Cluster-randomized control trial, blinded Beijing, China	IV: Intervention – Education sessions & home visits every 3 months on infant nutrition; Control –	N=485 mother-infant dyads (n=251 intervention, n=234 control) (enrolled at	Maternal feeding self-efficacy significant rose post-intervention (p<0.001) and significantly differed	1.c	A

	Routine counseling on infant feeding DV: Maternal knowledge of infant feeding, attitudes, subjective norms, self-efficacy on feeding, intention to adopt optimal feeding practices (tool developed by researchers)	infant age of 2-4 months) (any parity) Primarily Chinese (Han)	from control group (p<0.001) Maternal feeding self-efficacy was also associated with mothers' intention to use optimal feeding behaviors at baseline (p=0.002) and post-intervention (p<0.001)

ASSOCIATIONS OF PARENTAL SELF-EFFICACY WITH INFANT FEEDING PRACTICES IN A GROUP OF FIRST-TIME, LOW-INCOME, AFRICAN-AMERICAN MOTHER-INFANT DYADS

by

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PAPER 2

ASSOCIATIONS OF PARENTAL SELF-EFFICACY WITH INFANT FEEDING PRACTICES IN A GROUP OF FIRST-TIME, LOW-INCOME, AFRICAN-AMERICAN MOTHER-INFANT DYADS

Abstract

Introduction: Low-income, African-American infants are fed formula more often than breastmilk, are breastfed for short durations, and are given complementary foods earlier than recommended. Given that early feeding practices have implications for dietary practices and weight status later in life, it is important to understand contributing factors. Parental self-efficacy (PSE) has been found to be associated with infant feeding practices, however, this association has not been examined in samples at risk for unhealthy practices. The purpose of this study was to test the hypothesis that PSE is associated with infant feeding practices in a group of low-income, African-American mother-infant dyads.

Methods: Data were drawn from the Infant Care, Feeding, and Risk of Obesity study (N=217). Mother-infant dyads were followed every 3 months from infant age of 3-12 months. At each visit, PSE was measured using the Parenting Sense of Competence Scale and infant diet gathered through dietary histories and dietary recalls. Dietary data was organized into four variables: 1) whether the infant was ever breastfed; 2) if breastfed, how long; 3) the age of first complementary foods; and 4) if foods considered inappropriate for an infant were provided. Using generalized estimating equations and generalized linear mixed models, crude and covariate-adjusted relationships between PSE and each feeding practice were examined. Covariates included infant sex and

birthweight, as well as maternal age, body mass index, education level, marital status, and depression score.

Results: No significant associations were seen between PSE and each infant feeding practice, even after adjusting for covariates. Married mothers and those with a college education level were more likely to breastfeed and breastfeed longer.

Discussion: Prior research has suggested that PSE is associated with infant feeding practices, however, this association was not supported in the current sample. Difference in findings may be contributed to cultural and sociodemographic differences of the current sample compared to prior samples. Additionally, tools used to measure PSE varied among studies. Future research should consider the influence of culture on feeding practices and the development of a tool that measures PSE specific to infant feeding practices.

Keywords: infant feeding practices, parental self-efficacy

Introduction

Infant feeding practices are the what, when, and how parents and caregivers feed their infants, including the types and quantity of foods offered, the time and setting in which the foods are offered, and the approach parents use during feeding (Birch & Anzman, 2010; Birch & Doub, 2014; Grote, Theurich, & Koletzko, 2012; Thompson & Bentley, 2013). The World Health Organization (WHO), the American Academy of Pediatrics (AAP), the European Society of Paediatric Gastroenterology, Hepatology and Nutrition, and the Australian Department of Health and Ageing recommend exclusive breastfeeding for six months, followed by breastfeeding with complementary feeding, until the infant/toddler is one to two years of age (AAP, 2017; Australian Government, 2013; Fewtrell et al., 2017; WHO, 2016). Complementary foods are any foods given in addition to breastmilk or formula (AAP Committee on Nutrition, 2014). These organizations offer guidance regarding the types of complementary foods to first introduce to an infant along with suggested foods to continue throughout the first year of life to promote appropriate growth. Despite recommendations, breastfeeding rates are low, only 18.8% infants in the United States (U.S.) are exclusively breastfed for six months (Centers for Disease Control and Prevention [CDC], 2014) and early introduction of complementary food is common (Clayton, Li, Perrine, & Scanlon, 2013; Saavedra, Deming, Dattilo, & Reidy, 2013). Infant feeding practices have long lasting impact on the individual's future dietary practices and preferences as well as weight status (Birch & Doub, 2014; Thompson, 2012). Therefore, understanding factors which may influence parental decisions regarding infant feeding practices is important to promote healthy infant growth and prevent childhood obesity.

Multiple factors influence parental decision regarding infant feeding practices. Traditional feeding practices evolved over many years when food was scarce and involved practices such as feeding to soothe an infant when distressed, feeding frequently and in large portions when food was available, and pressuring to finish foods when offered (Birch & Doub, 2014). These practices often continue today despite the fact that food is no longer as scarce for many. Feeding practices are also shaped by cultural and familial practices, a parent's likes and dislikes, a parent's prior experiences with infant feeding, food marketing, costs of foods, competing time demands, education level, and food availability (Birch & Anzman, 2010; Castro, Layte, & Kearney, 2014; Taylor et al., 2011; Wahlqvist et al., 2015). Although mothers tend to make the majority of decisions regarding infant feeding practices, fathers and grandmothers are influential as well, especially when the mother works outside the home and/or when the grandmother resides with the family (Birch & Doub, 2014; Wasser et al., 2013; Zhang, Shi, Chen, Wang, & Wang, 2009). Additionally, the concept of self-efficacy has been identified as a factor that influences infant feeding practices (Redsell et al., 2016).

Existing research suggests that parental self-efficacy (PSE) or self-efficacy specific to feeding (i.e., breastfeeding self-efficacy) is associated with feeding practices used by parents (Barrett, Thompson, & Bentley, 2016; Campbell, Hesketh, Silverii, & Abbott, 2010; Koh et al., 2014; McGarvey et al., 2006; Redsell et al., 2016; Xu, Wen, Rissel, Flood, & Baur, 2013). A higher sense of self-efficacy has been associated with positive feeding practices such as increased initiation and duration of breastfeeding (Glassman, McKearney, Saslaw, & Sirota, 2014; McQueen, Dennis, Stremler, & Norman, 2011; Robinson & VandeVusse, 2011), greater intake of fruit and vegetables,

less intake of soft drinks and sweets (Campbell et al., 2010; Koh et al., 2014; Spence, Campbell, Crawford, McNaughton, & Hesketh, 2014; Xu et al., 2013), and less tendency to use food to soothe an infant (Stifter, Anzman-Frasca, Birch, & Voegtline, 2011; Stifter & Moding, 2015). These results highlight the importance of self-efficacy as a concept in the study of infant feeding. However, measurement of self-efficacy among studies has varied which makes comparisons across studies difficult. PSE is the belief parents have in their ability to parent and has been shown to be associated with positive outcomes in infants and children (Coleman & Karraker, 1997; De Montigny & Lacharité, 2005; Salonen et al., 2009). Therefore, the association between PSE and infant feeding practices warrants further examination.

In the U.S., low-income, African-American infants are at high risk for feeding practices which do not align with recommendations such as low rates of breastfeeding initiation, short durations of breastfeeding, early introduction of complementary foods, and consuming foods not recommended during infancy (Gibbs & Forste, 2014; Taveras, Gillman, Kleinman, Rich-Edwards, & Rifas-Shiman, 2010). Prior research regarding breastfeeding self-efficacy and breastfeeding rates has been conducted in African-American samples, however, research regarding self-efficacy and infant feeding practices other than breastfeeding has primarily been conducted in Caucasian samples. Examining an association between PSE and infant feeding practices in low-income, African-American mother-infant dyads would contribute to existing research and provide valuable information to guide future interventions.

The purpose of this study was to examine whether PSE is associated with infant feeding practices in a group of first-time, low-income, African-American mother-infant

dyads in the southeastern U.S. Infant feeding practices included: initiation of breastfeeding, duration of breastfeeding, age at introduction of complementary food, and whether inappropriate foods were provided during infancy. Sociodemographic variables such as maternal age, education level, marital status, and body-mass-index (BMI), have previously been found to be associated with infant feeding practices (Clayton et al., 2013; Hendricks, Briefel, Novak, & Ziegler, 2006; Wen, Kong, Eiden, Sharma, & Xie, 2014; Weng, Redsell, Swift, Yang, & Glazebrook, 2012), and therefore, were included as covariates. Maternal depression was also included because depression is predictive of PSE (Bandura, 1997). In these analyses, it was hypothesized that mothers who reported a higher sense of PSE would be more likely to initiate breastfeeding and would breastfeed for longer durations, would introduce complementary foods after the age of four months, and be less likely to provide foods inappropriate to their infant.

Methods

Data

Data for the current study were obtained from the Infant Care, Feeding, and Risk of Obesity (Infant Care) dataset (NIH R01 HD042219-02, Bentley, 2003). The aim of the Infant Care study was to identify the constellation of household, caregiver, and child characteristics associated with the risk of childhood obesity (Bentley et al., 2003). Participants were first time, low-income, African-American mothers (ages 18 to 35 years) and their infants, recruited from Supplemental Nutrition Program for Women, Infants, and Children (WIC) centers in central North Carolina between 2003-2007. Dyads were eligible if the infant was born at 35 weeks gestation or greater, weighed between 2,500

and 4,500 g at birth, and was healthy without any medical complications (i.e., Down Syndrome, cerebral palsy, congenital heart disease). Infants diagnosed with failure to thrive or any condition that would interfere with feeding or growth (i.e., cleft lip/palate, severe food allergy) were excluded. The dyads (N = 217) participated in research visits in their home every three months between the infant ages of three and 12 months and again at 18 months. Each mother provided consent for herself along with consent for her infant at study enrollment. The University of North Carolina at Chapel Hill (UNC) Institutional Review Board (IRB) approved the Infant Care study.

Data from all time points during infancy (3 to 12 months) were used for the current study. The 18-month time point was excluded because this age is beyond the period of infancy. Variables necessary to answer the aims of the current study were extracted from the Infant Care dataset to create a subset of data. These variables included: all dietary data (both infant dietary histories and infant dietary recalls), PSE scores, and sociodemographic information. The University of Alabama at Birmingham IRB deemed the study exempt.

Measures

Infant feeding practices. At each study time point, mothers completed a 24-hour dietary recall for their infant along with a three-month infant diet history. The infant dietary history tool was created by the Infant Care researchers for use in the study but was modeled after the tool used in the Infant Feeding Practices Study II (Fein et al., 2008). In the diet history, mothers were asked how often a food was given to their infant each month. Two additional 24-hour dietary recalls were collected via random telephone

calls on nonconsecutive days within two weeks of each home visit. To assist in the estimation of portion sizes, food models and pictures were provided to the participants at the first home visit to use during subsequent dietary recalls via the telephone. Data were entered into the Nutrition Data System for Research (NDSR) (version 2005 Nutrition Coordination Center, University of Minnesota, Minneapolis) for analysis. An NDSR certified staff member from the UNC Clinical Nutrition Research Unit trained study personnel on the use of the database. Both the infant dietary history and the three dietary recalls were used to extract variables for the current study.

Breastfeeding. As part of the infant dietary history at the first visit, mothers were asked if they ever breastfed their infant and if they were still breastfeeding their infant. For those who had breastfed but stopped prior to three months, mothers were asked how old the infant was when breastfeeding was discontinued. This question continued at each subsequent time point for the mothers who continued to breastfeed. From these questions, outcomes for breastfeeding initiation (yes/no) and duration (in months) were derived.

Complementary food introduction. The infant dietary history was reviewed to determine the age at which the first complementary food was provided to the infant. Each food given was reported by infant age in months, therefore, this variable was reported as a continuous variable in months. It is unknown if the water reported was used to mix formula or if amount consumed was significant to replace calories in the infant's

diet, therefore, water was excluded as a complementary food for the purposes of this study.

Inappropriate food introduction. The infant dietary recalls were used to extract the variable regarding inappropriate foods. To determine which foods were inappropriate, a pediatric nurse practitioner (JB) and registered dietician (HW) reviewed current infant feeding recommendations from 2017 as well as those from 2003 when data collection began from organization such as the AAP and the WHO as well as others throughout the world. The variable was dichotomized into "yes," the infant received inappropriate foods, or "no," the infant did not receive inappropriate foods.

At infant age of three months, all foods except breastmilk and formula were deemed inappropriate. For the remaining time points, foods that contained added sugar or those which were calorically dense yet lacked nutritional value were considered inappropriate (Table 1). From the available data, it was unknown how foods were prepared or where they were purchased, therefore, foods that could potentially be highly processed and hence contain excessive amounts of sodium were not considered inappropriate (i.e., fried chicken, French fries). Limiting fat is not a recommendation for infants, therefore, foods high in fat were considered appropriate (i.e., cheese, butter, oils). Changes regarding juice and allergenic foods were the only significant changes between current recommendations and those from 2003. Allergenic foods have not been shown to contribute to obesity, therefore, current recommendations were followed. Although current recommendations are to avoid juice during the first year of life, small quantities after six months of age were previously considered appropriate. Therefore, two variables

were created, one with juice as appropriate at nine and 12 months, and one with juice as inappropriate at each of these time points. Analyses were conducted with each of these variables.

Table 1

Number of infants who received each inappropriate food at each time point

	6 months n (%)	9 months n (%)	12 months n (%)
Juice	100 (62.1%)	131 (78.9%)	135 (90%)
Cakes, cookies, pies, etc.	25 (15.5%)	72 (43.4%)	79 (52.7%)
Cow's milk*	21 (13%)	67 (40.4%)	97 (64.7%)
Sweetened fruit drinks & soft drinks	4 (2.5%)	30 (18.1%)	64 (42.7%)
Artificially sweetened drinks	2(1.2)	27(16.3)	59 (39.3)
Sugar	10 (6.2%)	26 (15.7%)	41 (27.3%)
Syrup, honey, jam, jelly, preserves	4 (2.5%)	16 (9.6%)	45 (30%)
Sweetened cereal	3 (1.9%)	11 (6.6%)	29(19.3%)
Snack chips	2 (1.2%)	10 (6%)	30 (20%)
Baby food dessert	17 (10.6%)	26 (15.7%)	10 (6.7%)
Cream (coffee creamer, whipping cream, sour cream)	2 (1.2%)	7 (4.2%)	21 (14%)
Chocolate & non-chocolate candy	0	8 (4.8%)	17 (11.3%)
Pudding and other dairy dessert	2 (1.2%)	4 (2.4%)	10 (6.7%)
Sweet tea	3 (1.9%)	7 (4.2%)	9 (6%)
Meal replacement drinks and sport drinks	3 (1.9%)	9 (5.4)	7 (4.7)
Flavored milk	0	1 (0.6%)	5 (3.3%)
Frozen nondairy dessert	3 (1.9%)	4 (2.4%)	5 (3.3%)
Misc. dessert	0	1 (0.6%)	4 (2.7%)
Wine	0	2 (1.2%)	3 (2%)
Popcorn	1 (0.6%)	0	1 (0.7%)
Nuts and seeds	0	0	1 (0.7%)

*Cow's milk (full fat) considered inappropriate until age 12 months

Parental self-efficacy. At each time point of the Infant Care study, mothers completed the Parenting Sense of Competence Scale (PSOC). Only the PSE subscale was used for the current analyses which measures "parents' perception of the degree to which they have the acquired skills and understanding to be a good parent" (Gibaud-Wallston, 1977, p. 39). The tool has previously been validated and deemed reliable

(alpha coefficients ranged from 0.78 to 0.8) in parents of infants (Gibaud-Wallston, 1977; Rogers & Matthews, 2004). In the current sample of mothers, the alpha coefficient was 0.71 demonstrating internal consistency of the PSE subscale. The eight-item PSE subscale (Table 2) has six possible responses scored with a Likert-type scale ranging from strongly disagree (scored 1) to strongly agree (scored 6). The responses from all questions are totaled to provide an overall score ranging from eight to 48. Lower scores are indicative of a lower sense of PSE, whereas higher scores indicate a higher sense of PSE; there is no cut-off point for the PSOC. The PSOC and instructions for scoring are available for public use.

Table 2

Efficacy subscale of the PSOC

1. The problems of taking care of a child are easy to solve.
2. I would make a fine model for a new mother.
3. Any problems of being a parent are easily solved.
4. I think I do a good job caring for my child.
5. If anyone can find the answer to what is troubling my baby, I am the one.
6. Considering how long I've been a mother, I know what I am doing.
7. I have all the skills to be a good mother.
8. Being a good mother is rewarding.

Adapted from: Gibaud-Wallston, J. (1977). *Self-esteem and situational stress: Factors related to sense of competence in new parents.* (Unpublished doctoral dissertation), Vanderbilt University, George Peabody College for Teachers.

Covariates. Covariates for the current study were chosen based on prior literature. Variables which have previously been shown to be associated with infant feeding practices or PSE and were available in the Infant Care data were included. Infant sex and birthweight were chosen as covariates, as were maternal age, marital status, education level, BMI, and depression score. At the first time point of the Infant Care study, mothers reported infant sex and birthweight along with her age, marital status, and

education level. Also, at the first visit, trained research personnel measured maternal height and weight. These measurements were converted to a BMI. At each time point of the study, maternal depression score was gathered using the Center for Epidemiologic Studies Depression Scale (CESD). The CESD has been previously validated and found to be reliable in women post-partum (Tandon, Cluxton-Keller, Leis, Le, & Perry, 2012). This 20-question tool, measures an individual's risk of depression by asking how many days over the past seven days an individual has felt a certain way. Responses are summed for a possible total score ranging from zero to 60. Scores totaling 16 or more indicate that an individual is at risk for depression, whereas scores less than 16 indicate low risk (American Psychological Association, 2017). Mothers completed the CESD at each time point and all scores were used in the current study. The alpha coefficient at the 3 month time point was 0.86.

Data Analysis

Generalized estimating equations (GEE) and generalized linear mixed models (GLMM) were used to determine if the data supported an association between infant feeding practices (as the outcome) and maternal PSE scores. Available data from all time points were used in the analyses. PSE scores were reported as a continuous variable at each time point. Introduction of inappropriate foods was a binary indicator at each time point. Being ever breastfed, duration of breastfeeding, and age at introduction of complementary foods were constant variables over time. Crude and covariate-adjusted relationships were examined. Covariates included were infant sex, infant birth weight, maternal age, maternal BMI, maternal education level, maternal marital status, and

maternal depression score. GEE was used for some models with outcomes constant over time due to numerical stability of the estimation.

The estimated model coefficients, and odds ratios, when appropriate, were used for interpretation of the magnitude of the associations. Analyses were conducted in R version 3.4.3 (RStudio Team, Boston, MA, 2016) and SAS version 9.4 (SAS Institute, Cary, NC). Significance was held at 0.01 level to account for multiple inferences, although p-values between 0.05 and 0.01 were considered suggestive.

Results

Descriptive statistics for this sample can be found in Table 3. This sample (N = 217) of first-time, low-income, African-American mothers was primarily young (*M* = 22 years), single (89%), and most had a BMI indicative of overweight or obese weight status (*M* = 30). Less than half (43.3%) had completed any college and 26% did not have a high school degree. In general, the mothers were not at risk for depression (*M* = 11.7) and reported a high sense of PSE (*M* = 38.7). The infants averaged 3.227 kg at birth (7 lbs, 1.8 oz) and there were slightly more (53.5%) female than male infants in this sample.

Infant feeding practices for this sample are presented in Table 4. More than half (69.6%) of mothers initiated breastfeeding, but only 32.5% were still breastfeeding at three months. The mean duration of breastfeeding was 3.27 months with the duration ranging from one day to 20 months. The average age at which infants were first given complementary food was 2.5 months. Twelve percent of infants received complementary foods in the first month of life, and 14.2% of infants received their first complementary food at four months of age or later. All infants in this sample received an inappropriate

food at some point during the first year of life. The breakdown by month is reported in Table 4.

Table 3

Descriptive Statistics (N = 217)

Continuous Variables	Mean + SD	Range
Maternal PSE[a]	38.7 ± 4.5	21-48*
Maternal Age (Years)	22.7 ± 3.8	18-35
Maternal BMI	30.1 ± 7.6	15-59
Maternal Depression[b]	11.7 ± 8.6	0-44**
Infant birth weight (kg)	3.23 ± 0.48	1.84-5.02
Categorical Variables	**n**	**%**
Maternal Marital Status[c]		
Single	193	90.2
Married	21	9.8
Maternal Highest Education Level[c]		
No college education	123	56.7
Any College	91	43.3
Infant Gender		
Male	101	46.5
Female	116	53.5

[a]n = 212
[b]n = 213
[c]n = 214
*total possible range, 8 to 48
**total possible range, 0 to 60

Association Between PSE and Infant Feeding Practices

The data did not support an association between a mother's sense of PSE and any of the infant feeding practices examined in this study. Using GEE, there was no significant association between the duration of breastfeeding (β = -0.005, SE = 0.01, p = 0.51) or the age of complementary food introduction (β = -0.000, SE = 0.00, p = 0.79). The association between ever breastfeeding was tested using GLMM; no significant

Table 4

Descriptive statistics of infant feeding practices (N = 217)

Continuous Variables	Mean ± SD	Range
Breastfeeding Duration (months)[a]	3.27 ±3.9	0.03-20
Age first complementary foods (months)[b]	2.51 ± 1.1	1-6
Categorical Variables	**n**	**%**
Ever Breastfed		
Yes	151	69.6
No	66	30.4
Given inappropriate foods		
3 months	169	77.9
6 months[c]	118	69.8
9 months[d]	139	83.7
12 months[e]	134	89.3

[a]n = 145 (151 who ever breastfed, 6 missing)
[b]n = 212
[c]n = 161
[d]n = 166
[e]n = 150

association with PSE was seen (*OR* = 1.01, CIs [0.77, 1.34], *p* = 0.93). Controlling for month of the visit, GLMM was also used to test the association between PSE and introduction of inappropriate foods, also showing non-significance (*OR* = 1.02, CI [0.97, 1.07, *p* = 0.51). Covariate-adjusted associations results in the same conclusions of no relevant association between PSE and each of the feeding practices (Tables 5, 6, 7, 8).

Association Between Covariates and Infant Feeding Practices

In the multivariate analyses, significant associations were seen between some of the covariates and infant feeding practices. These results are presented here.

Ever breastfed. Using a linear GEE model, relevant, significant associations were seen between mothers who ever breastfed and education level as well as marital status. Mothers with a college education had a higher proportion of breastfeeding by 0.20 (β = 0.20, $p = 0.005$); and married mothers had a higher proportion of breastfeeding by 0.23 (β = 0.23, $p < 0.001$). The data did not support an association of ever breastfeeding with any of the other covariates (infant sex, infant birthweight, maternal age, maternal BMI, or maternal depression score) (Table 5).

Table 5

Association between PSE and ever breastfed controlling for all covariates (n = 206)

Predictor	β	SE	p
PSE	0.0002	0.00	0.57
Infant sex, female	-0.045	-0.17	0.46
Infant birth weight	0.04	0.06	0.51
Mom age	-0.001	-0.02	0.89
Mom BMI	-0.002	-0.01	0.57
Mom education college, yes	0.2	0.06	0.005
Marital status, married	0.228	0.12	<0.001
Depression	-0.0001	-0.00	0.35

Notes: GEE model with robust standard errors for the proportion of ever breasted (coded as 1 or 0). For continuous predictors, coefficients are expected change in proportion for unit increases, while for binary predictors, coefficients are between-group differences in proportions. Even though the outcome is binary, a logit model was not fitted due to quasi-complete separation.

Duration of breastfeeding. A significant association was also seen between the duration of breastfeeding and maternal education level as well as marital status using a GEE model. Mothers with a college education breastfed for approximately one and a half months longer than mothers without a college education (β = 1.55, $p = 0.008$). Similarly, mothers who were married breastfed three months longer than single mothers (β = 3.03, $p = 0.007$). Also significant was the association between a mothers' reported

level of depression and duration of breastfeeding, however, the effect of this association was very small (β = 0.007, approx. standardized β = 0.015, p = 0.008). The data did not support an association between duration of breastfeeding and the remaining covariates (infant sex, infant birth weight, maternal age, or maternal BMI) (Table 6).

Table 6

Association between PSE and duration of breastfeeding (in months) controlling for all covariates (n = 203)

Predictor	β	SE	p
PSE	-0.009	0.01	0.21
Infant sex, female	0.263	0.45	0.56
Infant birth weight	0.606	0.38	0.11
Mom age	0.106	0.09	0.22
Mom BMI	-0.004	0.02	0.87
Mom education college, yes	1.55	0.58	0.008
Marital status, married	3.03	1.11	0.007
Depression	0.007	0.003	0.008

Notes: GEE model

Age at complementary food introduction. Also, using a GEE model, a suggestive association was seen between infant sex and age at first complementary food introduction. Female infants received complementary foods one third of a month sooner than male infants (β = 0.3, p = 0.04). Maternal depression showed a significant association; those who reported a higher depression score, on average, provided complementary foods later than those with a lower depression score, however, the effect of this association was very small (β = 0.001, approx. standardized β = 0.007, p = 0.02). No association with the other covariates was seen (infant birthweight, maternal age, maternal BMI, maternal education level, maternal marital status, or maternal depression score) (Table 7).

Table 7

Association between PSE and age of first complementary food introduction (in months) controlling for all covariates (n = 204)

Predictor	β	SE	p
PSE	-0.000	0.00	0.78
Infant sex, female	-0.299	0.15	0.04
Infant birth weight	0.007	0.13	0.96
Mom age	0.02	0.02	0.38
Mom BMI	-0.015	0.01	0.12
Mom education college, yes	0.13	0.17	0.45
Marital status, married	0.23	0.33	0.48
Depression	0.001	0.00	0.02

Note: GLMM

Introduction of inappropriate foods. Controlling for the month of the visit, using GLMM, a suggestive association was seen between maternal education level and infants who received inappropriate foods. An increasing trend was seen over time, as infants aged, there was increased odds of introduction of inappropriate foods (*OR* = 1.1, CI [1.04, 1.19], *p* = 0.002). Mothers with a college education had decreased odds of introducing inappropriate foods to their infant (*OR* = 0.5, CI [0.3, 0.9], *p* = 0.03). There was a trend toward an association between maternal BMI and introduction of inappropriate foods, however, the magnitude was small (*OR* = 1.03, CI [0.999, 1.07], *p* = 0.06; approx. OR for a SD increase = 1.25). The data did not support an association between any of the other covariates (infant sex, infant birth weight, maternal age, maternal marital status, or maternal depression level) (Table 8). This result did not change when including juice as an inappropriate food at time points of nine and 12 months.

Table 8

Association between PSE and inappropriate foods controlling for all covariates and month of visit (n = 206)

Predictor	β	SE	p
Month of visit	0.104	0.03	0.002
PSE	0.014	0.03	0.61
Infant sex, female	-0.006	0.25	0.98
Infant birth weight	0.263	0.26	0.31
Mom age	0.026	0.04	0.5
Mom BMI	0.033	0.02	0.06
Mom education college, yes	-0.63	0.29	0.03
Marital status, married	-0.66	0.41	0.11
Depression	0.017	0.02	0.28

Notes: GLMM in the logit scale

Discussion

Findings from the current study did not support the hypothesis that an association between PSE and infant feeding practices exists in a group of first-time, low-income African-American mothers. These results are inconsistent with prior research that has found a positive, significant association between PSE and infant feeding practices (Koh et al., 2014; Xu et al., 2013). Reasons for this difference are unknown but could be attributed to differences in the sample characteristics, cultural beliefs and traditions, or the tool used to measure PSE.

Consistent with prior reports on the infant feeding practices of low-income, African-American mothers-infant dyads (CDC, 2015; Gibbs & Forste, 2014; Taveras et al., 2010), the feeding practices of the current sample did not align with recommendations provided by organizations such as the AAP. Although 69.9% of mothers initiated breastfeeding, only 14% of infants were receiving any breastmilk at six months of age. Additionally, 85.9% of infants received complementary foods prior to four months of

age, and all received a food considered inappropriate at some point during infancy. These infant feeding practices, however, are different from those of other studies that examined the association between PSE and infant feeding practices. In a study by Koh and colleagues (2014), 72% of infants were receiving breastmilk at six months of age and 11.2% of infants received complementary foods prior to 17 weeks of age. This comparison highlights the different pattern of infant feeding practices which occurred among studies; this difference could account for the variation in findings. Although it is unknown why the pattern of infant feeding practices observed in the current study differed from prior research, it could be explained by different cultural beliefs regarding feeding, familial influence, lack of knowledge on recommendations, or other variables yet to be determined. Had a larger portion of the current sample followed infant feeding recommendations, not only would it make comparisons among studies more feasible, it may have provided insight into why different infant feeding practices were observed among studies.

The current sample was culturally different than prior samples that were studied for an association between PSE and infant feeding practices. Most prior studies were conducted in Australia or the northeastern U.S. and included mothers that were primarily Caucasian, partnered, and had a college education. Beliefs and traditions of one's culture have strong influence on parenting practices including infant feeding decisions (Bornstein, 2012; Swick, 1985). Reasons for the low breastfeeding rate in African-American mothers in the U.S. have been studied extensively and are at least partially attributed to cultural factors that go back many generations; African-American mothers often do not receive familial or partner support for breastfeeding, have expressed

discomfort with breastfeeding in front of others including family members, and may lack knowledge on the benefits breastmilk can provide to an infant (DeVane-Johnson, Woods-Giscombe, Thoyre, Fogel, & Williams, 2017; McGarvey et al., 2006; McKinney et al., 2016; Radzyminski & Callister, 2016; Robinson & VandeVusse, 2011; Schafer, Williams, Digney, Hare, & Ashida, 2016). It is also common in the African-American culture to begin complementary foods early, often even in the first few weeks of life (McGarvey et al., 2006; Taveras et al., 2010). This early introduction of complementary foods has been practiced for a long time with reasons cited as it will help the infant sleep and helps the infant grow stronger (Clayton et al., 2013; Gibbs & Forste, 2014; McGarvey et al., 2006; Schafer et al., 2016; Thompson & Bentley, 2013).

In contrast, according to the Australian National Infant Feeding Survey, breastfeeding rates are much higher in Australian mother-infant dyads than in African-American mother-infant dyads in the U.S., and complementary food introduction by four months of age is about 35% which is lower than that reported in African-American samples (Australian Government, 2011; Clayton et al., 2013). The feeding practices of the current study and prior studies were consistent with the traditions and practices of each culture. The lack of association between infant feeding practices and PSE in the current sample suggests that a cultural influence is a stronger predictor of infant feeding practices, however, more research is needed, especially with samples of African-American mothers of various sociodemographic classes.

Along with the homogenous infant feeding practices of the current sample, there was also little variation in the sense of PSE reported by mothers in the sample. In general, mothers reported a high sense of self-efficacy in their parenting ability. Although no cut-off point for the efficacy subscale of the PSOC has been established, higher scores indicate a higher sense of PSE. The median score for this subscale is 20, mothers in the current study self-reported PSE scores higher than that value at each time point (range 21 – 48) and scores remained consistent throughout the study (Figure 1). Due to the variation in measurement tools, it is difficult to discern if this pattern was seen in the other studies which looked at the association between PSE and infant feeding practices. For the current study, response bias should be considered. The PSOC is a self-report instrument which was completed by mothers at each visit. Interpretation of questions and responses vary based on factors such as participant education level, desire to participate, or feelings of expected results. Additionally, much of prior research regarding the development of PSE has been conducted in Caucasian populations (Coleman & Karraker, 1997; Mercer & Ferketich, 1995; Salonen et al., 2009), it is unknow if a sense of PSE develops differently in African-American parents. Once again, a comparison group of mothers whose sense of PSE varied, may have changed the significance of the association between PSE and infant feeding practices. A

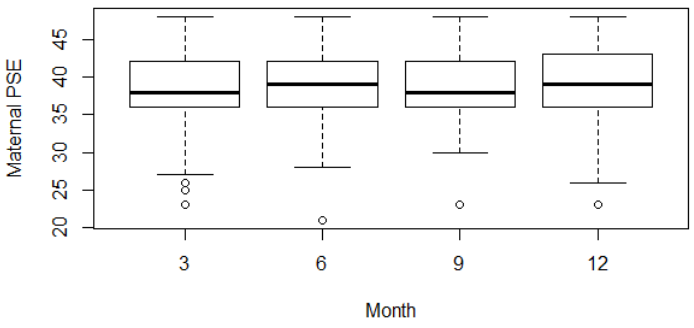

Figure 1. Boxplot of PSE scores at each time point.

comparison group would have also provided clues to the high sense of PSE reported by mothers in the current study.

The tools used to measure a mother's sense of PSE in prior research varied and were often different from the PSOC used in the current study. Most of the prior research which found a significant association between PSE and breastfeeding, measured self-efficacy specific to breastfeeding as opposed to global measure of PSE (McQueen et al., 2011; Robinson & VandeVusse, 2011). Breastfeeding self-efficacy was not measured in the current study which makes comparison difficult. Two studies are identified which measured PSE and breastfeeding, albeit, with contradictory findings. In a sample of mothers from rural China, a higher sense of PSE was associated with longer durations of exclusive breastfeeding as opposed to mothers who reported a lower sense of PSE (Shi, Zhang, Wang, & Guyer, 2008). However, findings from an unpublished dissertation regarding the association between PSE and breastfeeding in a sample of Mexican-American mothers found no association (Hernandez, 2014). Each study was conducted in a culturally different sample from the current study, lending further support for the influence of cultural beliefs and traditions on infant feeding practices as opposed to PSE. Finally, the Australian studies examining PSE and infant feeding, used tools that measured PSE specific to infant feeding as opposed to a global measure of PSE. Once again, this made comparison with the current study difficult.

In the multivariate analyses, being married and having a college education were associated with breastfeeding initiation and these mothers breastfed for longer durations than the single mothers or those without a college education (Tables 5 and 6). These findings are consistent with prior research (Hendricks et al., 2006; Rossiter & Evers,

2013; Sharps, El-Mohandes, El-Khorazaty, Kiely, & Walker, 2003). It has been hypothesized that greater social support and knowledge of breastmilk benefits likely contributes to these associations. However, even controlling for these two variables, the association between PSE and breastfeeding remained insignificant. This could suggest that a global measure of PSE may not be the best measure for predicting breastfeeding rates in low-income, African-American mothers; a measure of breastfeeding self-efficacy would likely be a better measure.

Implications for Future Research

Despite the null findings in this study, numerous implications for future research are apparent. The study could be repeated in a sample of first-time African-American mothers from a variety of sociodemographic populations. This would include those from middle and high incomes, more married (or partnered) mothers, and those whose education level varied. Although there is no way to know if the feeding practices would be different, it may elucidate how cultural influences or sociodemographic factors influence infant feeding practices. Research is also needed to identify factors associated with PSE in African-American mothers as the majority of research in this area has been conducted in samples of Caucasian or Asian mothers (Gross, Rocissano, & Roncoli, 1989; Mercer & Ferketich, 1995; Shorey, Chan, Chong, & He, 2015). Some qualitative research exists to understand decisions regarding feeding practices in African-American mothers (McGarvey et al., 2006; Radzyminski & Callister, 2016; Robinson & VandeVusse, 2011), however, more is needed. Qualitative studies in mothers from a

variety of backgrounds would be valuable in development of interventions that promote infant feeding practices that align with recommendations and healthy infant weight gain.

Development of tools to measure PSE specific to infant feeding as well as tools to assess maternal knowledge of infant feeding recommendations is necessary. Prior research in Australia described tools to measure self-efficacy specific to infant feeding but information regarding validity and reliability of these tools are not available nor has the same tool been used in multiple studies. To our knowledge, no tool exists to measure maternal knowledge of infant feeding recommendations. The Infant Feeding Style Questionnaire was validated with the Infant Care dataset, but this tool measures mothers' feeding beliefs and behaviors (Thompson et al., 2009). A tool is needed to measure knowledge of feeding practices so that associations among a mother's sense of self-efficacy, knowledge of feeding practices, and actual feeding practices can be examined.

Strengths and Limitations

Strengths and limitations exist for the current study. The ability to use data that followed dyads across the first year of life was a strength. It allowed for observance of any changes in infant feeding which occurred. It also allowed the researcher to examine trends in PSE scores between infant age of three and 12 months. Another strength is limiting the sample to first-time mothers only. Prior parenting experience alters a mother's perception of her sense of PSE. This confounding variable was eliminated by including only first-time mothers in this sample.

The primary limitation to this study was the use of existing data. The lack of a measurement tool specific to self-efficacy for infant feeding was a limitation as much of

prior research measured self-efficacy specific to feeding rather than a global measure of PSE. Additionally, no measure of PSE prior to infant age of three months was a limitation. A mother's sense of PSE has been demonstrated to increase the longer she has parented. For this study, there is no way to know if a mother's sense of PSE changed during the first three months of parenting. Another limitation is the lack of a variable in the Infant Care dataset to measure a mother's social support. An individual's social support has been demonstrated to influence her sense of PSE. Although marital status was available, it is unknown if the single mothers were living with their partner even though not married, if the married mothers were satisfied in their marriage, or what other methods of social support were received (i.e., from other family members such as mothers and grandmothers). Also lacking from the dataset was a measure of mothers' knowledge of infant feeding practices. The high sense of PSE reported by mothers in this sample along with feeding practices that do not align with recommendations, suggests that these mothers may not have been knowledgeable of infant feeding recommendations. Finally, although extensive infant dietary data was available, there was some unknown information the influenced the development of the complementary food variable and the introduction of inappropriate foods variable. For example, data on the amount of water given to infants as well as how foods were prepared or where purchased would have provided more information on dietary quality, enhancing the development of the dietary variables.

Conclusion

It is important to understand factors that influence maternal decisions regarding infant feeding to promote healthy weight gain during infancy and ultimately prevent childhood obesity. Results from the current study do not support the findings from prior studies that PSE could be an influencing factor. Notable differences are seen between prior studies and the current study including the pattern of infant feeding practices and the variability in tools used to measure PSE. Additionally, prior studies included samples with different cultural beliefs and traditions, representative of different sociodemographic populations than the current sample of first-time, low-income, African-American mother-infant dyads. African-American infants from low socioeconomic families are at high risk for infant feeding practices which do not align with recommendations from organizations such as the AAP (Gibbs & Forste, 2014; Taveras et al., 2010). More research is needed to understand how decisions are made by parents in this population so that interventions can be developed to assist parents in adhering to current infant feeding recommendations. Findings from the current study that mothers with a college education were more likely to breastfeed, breastfed for longer durations, and were less likely to introduce inappropriate foods suggests that interventions aimed at increasing a mother's knowledge regarding feeding practices may be beneficial.

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ASSOCIATIONS BETWEEN PARENTAL SELF-EFFICACY AND WEIGHT-FOR-LENGTH Z-SCORE TRAJECTORIES IN A GROUP OF AFRICAN-AMERICAN MOTHER-INFANT DYADS

by

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PAPER 3

ASSOCIATIONS BETWEEN PARENTAL SELF-EFFICACY AND WEIGHT-FOR-LENGTH Z-SCORE TRAJECTORIES IN A GROUP OF AFRICAN-AMERICAN MOTHER-INFANT DYADS

Abstract

Introduction: Infants who experience an excessive rate of weight gain are at risk for childhood obesity. It is important to understand contributors to excessive weight gain during infancy to inform the development of interventions to prevent it. Parental self-efficacy (PSE) has been associated with healthy feeding practices; however, it is unknown whether PSE is associated with infant growth trajectories. The purpose of this study was to test the hypothesis that PSE is associated with infant weight-for-length z-score (WLZ) trajectories.

Methods: Data were drawn from the Infant Care, Feeding, and Risk of Obesity study that was conducted with first-time, low-income, African-American mothers-infant dyads (N=127). At infant age of 3 months, PSE was measured using the Parenting Sense of Competence Scale. Infant weight and length were measured at 3, 6, 9, and 12 months by research personnel. WLZ was calculated from this data based on World Health Organization references. WLZ change from 3 to 12 months was calculated and infants stratified into 3 trajectories: 1) expected (change < 0.67 and > -0.67); 2) excessive (change > 0.67); or 3) slow (change < -0.67). Infant birthweight was reported by mothers. Analysis of covariance were used to determine if the data supported an association between PSE scores and WLZ trajectories. Multiple regression and a post-hoc comparison test was calculated to examine differences among groups.

Results: Controlling for infant birthweight, the mother's sense of PSE at 3 months was associated with infant WLZ trajectory (η^2=0.05, p=0.04). PSE reported by mothers of infants with an excessive growth trajectory was three points higher than that of mothers whose infants followed a slow growth trajectory (Tukey-adjusted p=0.03).

Discussion: This is the first study to examine the association between maternal PSE and infant WLZ trajectory. Mothers with a higher sense of PSE had infants with an excessive trajectory of growth across the first year of life, which could increase the infant's risk of obesity. Future research should examine the associations among PSE, infant feeding practices, and infant WLZ trajectory among a more diverse cohort including assessment of maternal perception of infant weight status and maternal knowledge of expected growth.

Keywords: parental self-efficacy, infant growth, childhood obesity

Introduction

Infant weight gain is monitored closely by healthcare providers by following the growth trajectory of an infant between birth and 12 months of age. Traditionally, the primary concern of providers was the infant whose weight fell off the growth curve (i.e., failure to thrive [FTT]); however, pediatricians and other pediatric healthcare providers are becoming increasingly aware that infants whose growth exhibits an upward crossing of percentiles have greater risk for childhood obesity (Druet et al., 2012; Gaffney, Kitsantas, Brito, & Kastello, 2014; Karaolis-Danckert et al., 2006; Ong & Loos, 2006; Taveras et al., 2011; Thompson, 2012; Weng, Redsell, Swift, Yang, & Glazebrook, 2012). Some factors contributing to this excessive growth pattern are clear in the literature. For example, formula fed infants and those from low socioeconomic status (SES) families tend to experience a greater rate of weight gain compared to breastfed infants or those from middle or high SES families (Gibbs & Forste, 2014; Li, Magadia, Fein, & Grummer-Strawn, 2012). In addition, African-American infants tend to experience rapid weight gain as compared to Caucasian infants (Taveras, Gillman, Kleinman, Rich-Edwards, & Rifas-Shiman, 2010). However, there are likely to be other factors that contribute to infant growth trajectory.

An understudied factor that may be associated with infant weight gain is parental self-efficacy (PSE). PSE is the belief a parent has in their ability to accomplish the tasks of parenting and has been demonstrated to be an important predictor of parental decision making during infancy (De Montigny & Lacharité, 2005; Salonen et al., 2009). Parents with a higher sense of PSE are more likely to make a successful transition to parenthood, be more confident in their parenting decisions, and be better emotionally adjusted (Coleman & Karraker, 1997; De Montigny & Lacharité, 2005; Salonen et al., 2009).

Research has demonstrated that infants and toddlers of parents with a higher sense of PSE are more likely to have healthier dietary practices such as increased intake of fruits and vegetables, and decreased intake of sugar sweetened beverages (Campbell, Hesketh, Silverii, & Abbott, 2010; Koh et al., 2014; Spence, Campbell, Crawford, McNaughton, & Hesketh, 2014; Xu, Wen, Rissel, Flood, & Baur, 2013). Further, a sense of PSE in parents of older children has been associated with obesity prevention strategies. Parents with a higher sense of PSE are more ready to make lifestyle changes (Taveras, Mitchell, & Gortmaker, 2009) and overcome barriers (Kahlor, Mackert, Junker, & Tyler, 2011) to prevent obesity in their children as compared to those with a lower sense of PSE. For these reasons, it is plausible that an association between PSE and infant weight gain may exist.

To our knowledge, no prior study has examined the assocation between PSE and infant growth trajectory. Only one study has reported a trend for PSE to be positively associated with infant body-mass-index score (BMI) in a group of well-education, middle SES, Caucasian-American mother-infant dyads, but this association did not reach statistical significance (Stifter, Anzman-Frasca, Birch, & Voegtline, 2011). It is possible that PSE will be more closely associated with infant growth trajectories among infants who are at greatest risk for excessive weight gain. The purpose of this study was to test the hypothesis that PSE is associated with infant weight-for-length z-score (WLZ) trajectories in a group of low-income, African-American mother-infant dyads.

Methods

Data

This secondary data analysis was conducted with data from the Infant Care, Feeding, and Risk of Obesity Study (Infant Care) (NIH R01 HD042219-02, Bentley, 2003). These data were collected between 2003 and 2007 from first-time, low-income, African-American mothers and their infants. The aim of the Infant Care study was to identify the constellation of household, caregiver, and child characteristics associated with the risk of childhood obesity (Bentley et al., 2003). All participants were recruited from Supplemental Nutrition Program for Women, Infants, and Children (WIC) centers in central North Carolina. First time, African-American mothers between the ages of 18 and 35 years and their infants were eligible if the infant was born greater than 35 weeks gestation with a birthweight between 2,500 and 4,500 g and without any medical complications (i.e., Down Syndrome, cerebral palsy). Infants diagnosed with FTT or conditions that may interfere with feeding or growth (i.e., cleft lip/palate, severe food allergy) were ineligible. The cohort of mother-infant dyads (N = 217) was followed from infant age of three months to 18 months. The University of North Carolina at Chapel Hill Institutional Review Board (IRB) approved the Infant Care study. Each mother provided consent for herself and her infant at study enrollment.

The current study used a subset of the Infant Care data; mother-infant dyads with infants who had complete weight and length measurement from each of the first four time points (infant age of 3, 6, 9, and 12 months) were included (N = 128). Permission for use of the Infant Care data was obtained from the principal investigator. The University of Alabama at Birmingham IRB deemed the study exempt.

Measures

Infant weight-for-length z-scores. Infant Care trained study personnel conducted home visits with the dyads at each time point. Study personnel were trained in anthropometric techniques, which included weight and length measurement of the infants. Infants were weighed in a dry diaper on a digital scale (Tanita BD-585 Digital Baby Scale) with weight measured to the nearest 10 g. Recumbent length was measured using a portable length board (O'Leary Length Board) to the nearest 0.1 cm by a two-person team. All measures were performed in triplicate at each visit and the mean was used in analyses.

For the current analysis, the method suggested by Ong, Ahmed, Emmett, Preece, and Dunger (2000) was used to determine infant growth from three to 12 months. In this method, standard deviation (SD) scores are calculated for weight-for-age or weight-for-length at each time point, and then the change in the SD between two points in time is calculated. A gain greater than 0.67 SD score is considered excessive growth as this value represents the width of a major percentile band on a growth chart. A gain equal to or greater than -0.67 but equal to or less than 0.67 is considered expected growth, and a gain less than -0.67 is considered slow growth (Ong et al., 2000). Many studies have used this method to stratify infants into those who exhibited excessive growth, expected growth, or slow growth. Prior studies have consistently shown that infants who exhibited excessive growth, according to this definition, have greater risk for obesity later in childhood (Ekelund et al., 2006; Karaolis-Danckert et al., 2006; Kinra, Baumer, & Davey Smith, 2005; Monteiro, Victora, Barros, & Monteiro, 2003; Ong et al., 2000; Zhou et al., 2016). Due to these findings demonstrating that this method may be used to predict a

child's future risk for obesity, it was chosen for the current study as a measure of infant WLZ trajectories through the first year of life.

Parental self-efficacy. The Parenting Sense of Competence scale (PSOC) was used in the Infant Care study to measure maternal PSE and satisfaction with parenting. Mothers completed this tool at the first study time point, infant age of three months. Developed by Gibaud-Wallston and Wandersman in the 1970s, the PSOC consists of two subscales, efficacy and satisfaction (Gibaud-Wallston, 1977). For the current study, only the eight-question efficacy subscale was used (Table 1) which measures "parents' perception of the degree to which they have the acquired skills and understanding to be a good parent" (Gibaud-Wallston, 1977, p. 39). Each question had a Likert-type scale with six responses that ranged from strongly disagree (given a score of 1) to strongly agree (given a score of 6). The score from each question was summed providing a total score ranging from eight (indicative of a low sense of PSE) to 48 (indicating a high sense of PSE). No cut-off score for high versus low PSE has been identified for the PSOC. The scale has been deemed valid and reliable for use in mothers of infants with an alpha coefficient ranging from 0.78 to 0.8 in each sample it was tested (Gibaud-Wallston, 1977; Rogers & Matthews, 2004). In the subset of the Infant Care data used in the current study, the alpha coefficient demonstrated internal reliability ($\alpha = 0.70$).

Covariates. Variables were included as potential covariates if prior research suggested that the variable may be important when examining infant WLZ trajectories,

and if the variable was available in the Infant Care dataset. Covariates included: infant birthweight, maternal sociodemographic factors (age, marital status, education level),

Table 1

Efficacy subscale of the PSOC

1. The problems of taking care of a child are easy to solve.
2. I would make a fine model for a new mother.
3. Any problems of being a parent are easily solved.
4. I think I do a good job caring for my child.
5. If anyone can find the answer to what is troubling my baby, I am the one.
6. Considering how long I've been a mother, I know what I am doing.
7. I have all the skills to be a good mother.
8. Being a good mother is rewarding.

Note: Adapted from Gibaud-Wallston, J. (1977). *Self-esteem and situational stress: Factors related to sense of competence in new parents.* (Unpublished doctoral dissertation), Vanderbilt University, George Peabody College for Teachers.

maternal BMI, maternal depression level, and maternal perception of infant weight status. At the first Infant Care study visit, mothers self-reported her infant's birthweight as well as her age, marital status, and education level. Also, at the first visit, maternal height and weight were measured by the Infant Care trained research personnel and used to calculated BMI. Maternal risk for depression was collected via self-report using the Center for Epidemiologic Studies Depression scale (CESD). Mother's perception of her infant's weight status at three months of age was reported in one of the following categories: very overweight, overweight, normal weight, underweight, and very underweight. For the current study, this response was compared to the infant's weight-for-length percentile based on age and sex per the World Health Organization (WHO) growth charts. Infants whose weight-for-length > 90^{th} percentile were considered overweight, infants between the 10^{th} and 90^{th} percentile were considered appropriate, and infants < the 10^{th} percentile were considered underweight. A dichotomous variable was

created indicating whether the mother's perception of the infant's weight-for-length was concordant with the infant's percentile, coded as "yes" it was concordant, or "no" it was not concordant.

Data Analysis

Sample Size

A detectable effect size computation (G*Power Version 3.1.9.2) was conducted given the sample size available in the Infant Care dataset with complete infant WLZ data (N = 128). Assuming a linear regression model for the numerical outcome of PSE, three coefficients (WLZ trajectories [3 trajectories] and birthweight), a significance level of 0.05, and with 80% power, the detectable effect size is 0.08 (R^2), a small-to-medium effect (Cohen, 1988). With additional covariates (maternal BMI, maternal education level, marital age, depression score, and concordance of perception with infant weight-for-length – marital status was not included due to the skewed sample) the number of predictors increases to eight, and the detectable effect size is 0.11(R^2). Considering a ratio of at least 15 observations per coefficient a sample size of 120 should be sufficient to obtain reliable estimates for these models under the assumption of random sampling in the subpopulation of interest (Harrell, 2015).

WLZ Trajectories

WLZ were calculated for each infant at each time point using the mean weight and length measures from the Infant Care data. The method provided by the Centers for Disease Control and Prevention (CDC) for calculating z-scores based on the WHO

growth charts was used (CDC, 2015). These calculations were performed using SAS Software Version 9.4 (SAS Institute, Cary, NC). The WLZ at three months was subtracted from the WLZ at 12 months, then this change value was stratified into three groups based on the recommendations from Ong and Loos (2006): infants who exhibited excessive growth (WLZ change > 0.67), infants who exhibited expected growth (WLZ change < 0.67 and > -0.67), and infants who exhibited slow growth (WLZ change < -0.67).

Analyses

Initial bivariate analyses were conducted to determine which covariates to control for in overall models testing the association between PSE and WLZ trajectories. For continuous variables, analysis of variance (ANOVA) and partial eta square were calculated and for categorical variables, chi-square tests and Cramer's V were calculated. To test the hypothesis that PSE is associated with WLZ trajectories, analysis of covariance (ANCOVA) was calculated, adjusting for any covariates that were significant in the initial analyses. If the overall model was significant, follow-up multiple regression analyses will be calculated to determine which WLZ trajectories were different while adjusting for significant covariates. Partial eta square was used as a measure of effect size. R and R Studio version 3.4.3 were used for all analyses (RStudio Team, Boston, MA, 2016).

Results

Of the 128 infants with complete WLZ data, one maternal PSE score at three months was missing. Therefore, analyses were conducted on the 127 mother-infant dyads with complete data. Descriptive statistics of the sample are presented in Table 2. This subsample was, in general, similar to the full Infant Care sample, however, mother-infant dyads with complete data included slightly more married mothers (13.3% compared to 9.9%) and more male infants (52.3% compared to 45.8%). PSE scores of

Table 2

Descriptive statistics (N=128)

Continuous Variables	Mean ± SD	Range
Maternal PSE[a]	38.5 ± 4.6	23-48
Maternal Age (Years)	22.7 ± 3.8	18-35
Maternal BMI	30.5 ± 7.2	18-51
Infant birth weight (kg)	3.26 ± 0.49	1.84-5.02
Categorical Variables	**n**	**%**
Maternal Marital Status		
Single	111	86.7
Married	17	13.3
Maternal Highest Education Level		
No college education	65	50.8
Any College	63	49.2
Maternal Depression Risk[b]		
Not at risk (CESD < 16)	93	73.2
At risk (CESD ≥ 16)	34	26.8
Infant Gender		
Male	67	52.3
Female	61	47.7
Maternal Perception Concordance 3 months[b]		
Yes	79	66.4
No	40	33.6

[a]n = 127
[b]n = 119
[c]n = 123

mothers at infant age of three months ranged from 23 to 48 (M = 38.5, SD = 4.6). Infant WLZ trajectories were as follows: 46.1% followed an expected trajectory, 35.9% followed an excessive trajectory, and 18.0% followed a slow trajectory (Table 3).

Table 3

Trajectories of WLZ change from 3-12 months and PSE (n = 127)

Category	n	%	PSE M ± SD	Range
Excessive	46	35.9	39.4 ± 5.2	38.1 – 40.9
Expected	59	46.1	38.5 ± 3.8	37.3 – 39.7
Slow	23	18	36.4 ± 4.9*	34.4 – 38.3

*When compared to the excessive trajectory, p <0.05

Association between WLZ Trajectories and Covariates

All covariates (infant birthweight, maternal age, BMI, education level, marital status, depression score, and concordance of perception with infant weigh percentile) were analyzed individually for an association with WLZ trajectories. Infant birthweight was the only covariate to be significantly associated with the WLZ trajectories; a medium association was seen (η^2 = 0.1, p = 0.001). Average birthweight for the infants who followed an excessive WLZ trajectory was 3.45 kg which was significantly greater than the birthweight of infants in the slow WLZ trajectory group (M = 3.03 kg) or the expected WLZ trajectory group (M = 3.21 kg). Maternal perception of infant's weight status at three months showed a small to medium effect on infant WLZ trajectories, but was not significant (V = 0.21, p = 0.07). No relevant associations were observed with the remaining covariates.

Association between PSE and WLZ Trajectories

The ANCOVA model showed that PSE was associated with infant WLZ trajectory while controlling for infant birthweight with a small to medium association (η^2 = 0.05, p = 0.04). Results of the multiple regression analysis and post-hoc comparison showed that the significant difference in PSE at three months was between mothers of infants with an excessive growth trajectory as compared to mothers of infants with a slow growth trajectory. Mothers of infants with an excessive growth trajectory reported a sense of PSE approximately three points higher than that of mothers with infants who followed a slow growth trajectory (Tukey-adjusted p = 0.03) (Table 3 and Figure 1). PSE scores of mothers of infants with an excessive growth trajectory were, on average, one point higher than that of mothers with infants with an expected growth trajectory, and PSE scores of mothers of infants who followed an expected growth trajectory were two points higher than those of mothers who followed a slow growth trajectory. However, these results were not statistically significant.

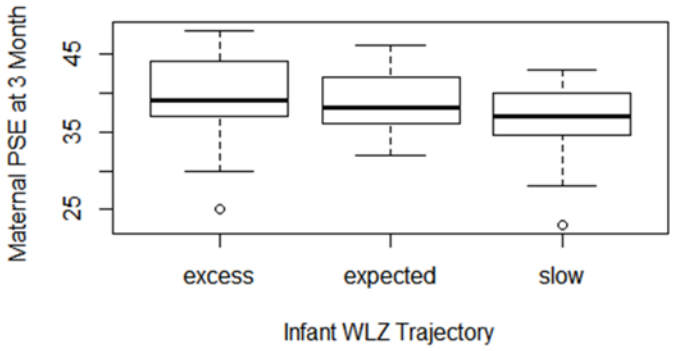

Figure 1. BoxPlot of maternal PSE at 3 months vs infant WLZ trajectories. Mean PSE of excessive trajectory and slow trajectory were significantly different (p = 0.03)

Discussion

In this sample of first time, low-income, African-American mother-infant dyads, we found a significant association between maternal sense of PSE and infant WLZ trajectories from three to 12 months. In general, mothers who reported a higher sense of PSE at infant age of three months had infants with a greater increase in WLZ score from three to 12 months. Although only significant between infants whose WLZ trajectory was classified as slow compared to those whose WLZ trajectory was classified as excessive, the mean PSE score rose across each infant WLZ trajectory (Figure 1) implying a linear association between PSE and WLZ. This group difference in PSE score remained while controlling for infant birthweight.

The current study is the first to examine the association between PSE and WLZ trajectories. Researchers in a prior cross-sectional study reported a non-significant trend for PSE to be positively associated with infant BMI z-score, but this study did not examine the prospective association of PSE with subsequent BMI change (Stifter et al., 2011). It is important to examine the change in growth prospectively because growth trajectory, rather than BMI at any single timepoint, is the most reliable predictor of obesity risk (Karaolis-Danckert et al., 2006; Ong et al., 2000). The positive association between PSE and WLZ trajectory found in this study appears counterintuitive, particularly considering that prior research has found PSE to be associated with positive infant or child outcomes (Coleman & Karraker, 1997; Salonen et al., 2009), including greater engagement in obesity prevention strategies for parents of older children (Kahlor et al., 2011; Willis et al., 2014). However, it is possible that the positive association

between PSE and an excessive infant growth trajectory is at least partially attributable to a cultural perception that a larger infant is healthier.

Prior research has shown that in the African-American culture, a heavier infant is viewed as healthy and a sign of good parenting (McGarvey et al., 2006; Radzyminski & Callister, 2016; Schafer, Williams, Digney, Hare, & Ashida, 2016; Thompson, Adair, & Bentley, 2014). A qualitative study by McGarvey and colleagues (2006) reported that low-income, African-American mothers expressed an attitude that "overweight or obesity in children are genetic and related to a 'solid' (implying healthy) physical build rather than adiposity" (McGarvey et al., 2006, p. 278). Consequently, parents with a high sense of PSE may value a heavier infant and consciously, or sub-consciously, engage in practices that promote an excessive infant growth trajectory. It is also possible that the positive association of PSE and an excessive infant WLZ trajectory is attributed to parents having an inaccurate perception of their infant's weight status.

Prior research suggests that mothers often have a skewed perception of their child's weight (Brown et al., 2016; Hager et al., 2012). In a study of predominately (70%) African-American mother-toddler dyads, 94% of mothers of overweight toddlers and 60% of mothers of normal weight toddlers evaluated their toddlers as being smaller than their WLZ percentile (Hager et al., 2012). Consistent with these prior studies, 33% of mothers in the current study had a perception of their infants' weight status that was discordant with the infant's actual WLZ percentile. Future research should consider whether PSE is associated with parental perception of their infant's weight status. Another potential contributor to the association of PSE with infant WLZ trajectory is that mothers who express confidence in their ability to parent may have less understanding of

the adverse health consequences associated with excessive infant weight gain and childhood obesity.

Results from the 2003 National Assessment of Adult Literacy (NAAL) found that 38% of adults in the U.S. have basic or below basic health literacy, and those most at risk include racial and ethnic minorities, individuals of low SES, and those who lack a high school diploma (National Center for Education Statistics, 2006). Mothers included in the current study were African-American, low-income, and 26% lacked a high school diploma indicating that they are at risk for low health literary. Therefore, it is possible that PSE may be higher among mothers who are not aware that an excessive infant growth trajectory could increase the risk of future obesity. Future research should examine whether the association of PSE with infant growth trajectory is modified by parental health literacy.

Strengths and Limitations

A strength of this study was the ability to access and use longitudinal infant weight and length data from the Infant Care dataset which provided the ability to examine WLZ trajectories rather than WLZ at a single time point. Additionally, research personnel collected data in the participants' homes and were trained in collecting infant anthropometric measurements. This is an advantage over using data self-reported by mothers. Although only a subset of the Infant Care sample was available for analysis in the current study due to the attrition rate, the number of participant data available was sufficient to yield a small to medium effect of the associations examined.

This study does have limitations. The lack of infant length at birth in the Infant Care dataset precluded an assessment of WLZ change from birth to 12 months of age. Previous studies have found that excessive growth may occur during the first few months of infancy, however, it is unknown in the current study whether this affected the WLZ change measured from three to 12 months. Similarly, a mother's sense of PSE has been shown to increase the longer she has parented. The first measurement of PSE in the Infant Care dataset is at infant age of three months. Without a measure prior to that time, it is unknown how mothers reported their sense of PSE during pregnancy, at birth, or in the postpartum period. Change may have occurred in the first three months of parenting, yet that change is not captured in the current study. Additionally, the PSOC tool measures a global sense of PSE as opposed to self-efficacy specific to infant growth. It is unknown whether such a tool would provide different results.

Conclusions

The current study is the first to examine the association between maternal sense of PSE and infant WLZ trajectories across the first year of life in a group of low-income, African-American mother-infant dyads. This is an important area for study because African-American infants are at risk for excessive weight gain in the first year of life placing these infants at risk for childhood obesity (Taveras et al., 2010). PSE is a modifiable risk factor that can be assessed by clinicians in clinical practice. However, findings in the current study suggest that mothers who reported a higher sense of PSE at infant age of three months had infants who followed an excessive WLZ trajectory. Therefore, contributors to the development of PSE in first-time mothers warrants

additional study, particularly among populations at high risk for obesity such as African-Americans and those of low-income.

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CONCLUSIONS

In the United States (U.S.), 35.1% of children are either overweight or obese (Skinner et al., 2018). Modifiable factors contributing to this high percentage have been identified during infancy including infant feeding practices and rate of infant weight gain (American Academy of Pediatrics [AAP] Committee on Nutrition, 2014; Birch & Anzman, 2010; Birch & Doub, 2014). African-American infants have been found to be at high risk for these behaviors (Taveras et al., 2010). Infant feeding practices of most African-American infants do not follow recommendations provided by organizations such as the AAP (AAP Committee on Nutrition, 2014; Taveras et al., 2010). Breastfeeding initiation in this population of mother-infant dyads is lower than in Caucasian and Hispanic populations, and those who choose to breastfeed only do so for short periods of time (Centers for Disease Control and Prevention [CDC], 2016). Also, African-American infants tend to be fed complementary foods earlier than the recommended four to six months of age, including a high rate of adding cereal to a bottle and giving juice (McGarvey et al., 2006; Taveras et al., 2010; Wasser et al., 2011). These practices have been found to be most common in African-American infants from low socioeconomic status (SES) families (Gibbs & Forste, 2014). Additionally, African-American infants are at risk for an excessive rate of weight gain through the first year of life (Taveras et al., 2010). This trajectory of weight gain may be due to infant feeding practices or other factors that have not been fully elucidated.

Understanding contributors to the infant feeding practices and weight gain trajectory seen in low-income, African-American infants is important for research in an effort to identify interventions that may prevent these infants from becoming obese later in life. Self-efficacy is one such concept that prior research has suggested may be a contributor to parental decisions during infancy including those regarding feeding (Koh et al., 2014; Redsell et al., 2016; Robinson & VandeVusse, 2011; Salonen et al., 2009). Therefore, the purpose of this dissertation was to explore the associations among parental self-efficacy (PSE), infant feeding practices, and infant weight-for-length z-score (WLZ) trajectories. This purpose was accomplished through three manuscripts: 1) an integrative review of evidence regarding self-efficacy and infant feeding practices and infant weight gain (not limited to any one racial or ethnic group); 2) a correlation study examining the association between PSE and infant feeding practices in a cohort of first-time, low-income, African-American mother-infant dyads; and 3) a correlation study examining the association between PSE and infant WLZ trajectories in a cohort of first-time, low-income, African-American mother-infant dyads. This chapter provides an overview of the manuscripts, a synthesis of findings, strengths and limitations of the dissertation, and implications for practice and research.

Overview of the Three Manuscripts

Manuscript 1: Self-efficacy, Infant Feeding Practices, and Infant Weight Gain: An Integrative Review

The integrative review conducted for this dissertation followed the method suggested by Whittemore and colleagues (2014); results included 43 articles representing research from around the world. Findings indicated a plethora of evidence regarding

breastfeeding self-efficacy and breastfeeding practices. Literature is consistent in that mothers who report a high sense of breastfeeding self-efficacy are more likely to initiate breastfeeding and breastfeed for longer durations compared to mothers who report a low sense of breastfeeding self-efficacy (Barbosa, Masho, Carlyle, & Mosavel, 2017; Furman, Banks, & North, 2013; Gercek, Sarikaya Karabudak, Ardic Celik, & Saruhan, 2017; Karall et al., 2015; Robinson & VandeVusse, 2011). In contrast, evidence regarding the association between self-efficacy and feeding practices other than breastfeeding is limited. The studies that have been conducted used a variety of tools to measure self-efficacy some specific to parenting and some specific to feeding. Although findings are consistent, mothers with an increased sense of self-efficacy are likely to provide feeding practices that align with recommendations, the variation in measurement precludes comparisons among the studies (Barrett et al., 2016; Campbell et al., 2010; Koh et al., 2014; Xu et al., 2013; Zhang, Shi, Chen, Wang, & Wang, 2009). Additionally, minority groups are underrepresented in these studies. Research regarding breastfeeding self-efficacy and breastfeeding have included African-American mother-infant dyads (McCarter-Spaulding & Gore, 2009; Robinson & VandeVusse, 2011), but self-efficacy regarding other feeding practices has primarily been conducted in Caucasian mother-infant dyads. Finally, the review only identified one study that examined the association between self-efficacy and infant weight gain highlighting the need for more research.

Manuscript 2: Associations of Parental Self-Efficacy with Infant Feeding Practices in a Group of First-Time, Low-Income, African-American Mother-Infant Dyads

The second manuscript for this dissertation examined the association among infant feeding practices (breastfeeding initiation and duration, age at complementary food introduction, and introduction of inappropriate foods during infancy) and PSE in a group of first-time, low-income African-American mother-infant dyads. This longitudinal, correlation study was a secondary analysis of the Infant Care, Feeding, and Risk of Obesity (Infant Care) dataset. These data were collected between 2003 and 2007 from Supplemental Nutrition Program for Women, Infants, and Children (WIC) centers in central North Carolina. The current study included data from four times points of the Infant Care dataset, infant age of three, six, nine, and 12 months; all participants (N = 217) were included. PSE (as opposed to general self-efficacy, breastfeeding self-efficacy, or self-efficacy to infant feeding) was chosen as the variable to measure self-efficacy because the Parenting Sense of Competence scale (PSOC) was available in the Infant Care dataset which includes as subscale to measure PSE. Contradictory to prior research, no significant associations between PSE and each of the feeding practices were identified during analyses. Reasons for this discrepancy are unclear but could be due to cultural differences of populations in each study or the variation in measurement tools used to measure self-efficacy.

This study included covariates that have previously be found to be associated with infant feeding practices and/or PSE. The covariates where used to determine whether the association between PSE and each feeding practice changed when controlling for the covariates. Covariates available in the Infant Care dataset and used for this study included maternal sociodemographic (age, marital status, education level, depression risk,

body-mass-index) and infant (birthweight and sex) variables. Additionally, the covariates were examined to determine which were most strongly associated with each feeding practice.

The association with PSE did not change when controlling for the covariates, it remained non-significant. However, significant findings were seen when examining the association between maternal sociodemographic covariates and infant feeding practices. Mothers who were married or had a college education were more likely to breastfeeding and breastfeed for longer durations. Additionally, mothers with a college education were less likely to provide inappropriate foods to their infant during the first year of life. These findings are consistent with prior research (Hendricks et al., 2006; Rossiter & Evers, 2013) suggesting the need for education and support in single mothers and those without a college education.

Manuscript 3: Associations Between Parental Self-efficacy and Weight-for-Length Z-score Trajectories in a Group of African-American Mother-Infant Dyads

The final manuscript was also a secondary analysis of the Infant Care dataset. The purpose of this correlational study was to examine the association between PSE and infant WLZ trajectories. The lack of infant birth length in the Infant Care dataset prevented examination of the trajectory from birth, therefore WLZ change from three to 12 months was examined. Infants' WLZ was classified into three trajectories: 1) slow growth (standard deviation [SD] change less than -0.67); 2) expected growth (SD change equal to or between -0.67 and 0.67); and excessive growth (SD change greater than 0.67). Bivariate analysis between infant birth weight and WLZ trajectory was significant, therefore, birth weight was controlled for in subsequent models. Due to missing data and

the attrition rate in the Infant Care study, only 127 mother-infant dyads had complete data for this study. The mothers' reported PSE at infant age of three months was analyzed for an association with the infant WLZ trajectories, controlling for infant birth weight. Results of this analysis were significant. Mothers of infants who followed an excessive WLZ trajectory reported higher PSE scores at infant age of three months than the mothers of infants who followed a slow WLZ trajectory. This excessive WLZ change of greater than 0.67 SD represents crossing a major percentile line and has previously been associated with increased risk for childhood obesity (Ong et al., 2000). To our knowledge, this is the first study to examine the association between PSE and WLZ trajectories in a group of low-income, African-American mother-infant dyads. This finding, however, requires more investigation as prior research has found PSE to be associated with positive infant or child outcomes (Coleman & Karraker, 1997; Salonen et al., 2009) as opposed to the negative infant outcome seen in the current study. Cultural beliefs regarding parenting and perception of infant weight status are important to consider as is the tool used to measure PSE.

Synthesis of the Body of Work

The purpose of this dissertation was to examine the associations among PSE, infant feeding practices, and infant WLZ trajectories. Findings from this body of work contribute to existing evidence which examines risk factors for childhood obesity during infancy. The integrative review (manuscript 1) provided an overview of what is known regarding self-efficacy, infant feeding practices, and infant weight gain as well as identified gaps in literature. Manuscript 2 examined the association between PSE and

infant feeding practices in a population at high risk for childhood obesity (low-income, African-American infants). Manuscript 3 examined the association between PSE and infant WLZ trajectories in this same high-risk sample. Along with analyses presented in each of the two manuscripts using the Infant Care dataset, the association between infant feeding practices and infant WLZ trajectories was also examined as part of this dissertation (Aim 2). No significant associations were seen between each infant feeding practice (breastfeeding initiation, breastfeeding duration, age at complementary food introduction, or inappropriate food introduction) and the WLZ trajectories. This result along with the results from manuscript 2 are contradictory to prior research. Reasons for these differences are unknown but may be contributed to the sociodemographic characteristics of the sample, cultural beliefs of the sample, and/or variation in tools used to measure self-efficacy.

Prior research examining the association with infant feeding practices (other than breastfeeding) and self-efficacy have been conducted with samples of Caucasian mother-infant dyads and with sociodemographic characteristics different than those of the Infant Care sample (Koh et al., 2014; Stifter & Moding, 2015). The majority of mothers in prior studies were married, of middle socioeconomic status (SES), and had education beyond high school (Koh et al., 2014; Stifter & Moding, 2015). These sample characteristics could account for the different findings seen in the current study compared to prior research. Cultural beliefs and traditions influence infant feeding practices (Cartagena et al., 2014; Schafer et al., 2016). In the African-American culture, formula feeding has been demonstrated to be preferred over breastfeeding and early introduction of complementary foods is common practice (McGarvey et al., 2006; Radzyminski &

Callister, 2016; Schafer et al., 2016). Even though infants from low SES families regardless of race or ethnicity exhibit these feeding practices (Gibbs & Forste, 2014), African-American mothers have low breastfeeding rates and are more likely to introduce complementary foods early regardless of SES (McKinney et al., 2016; Taveras et al., 2010). A low breastfeeding rate and early introduction of complementary foods was evident in the Infant Care sample and differed from infant feeding practices in prior research (Koh et al., 2014; Stifter & Moding, 2015). The different feeding practices exhibited by the mother-infant dyads in the current study (manuscript 2) as compared to prior research, could explain the lack of association between PSE and infant feeding practices. An understanding of whether this pattern of infant feeding practices is due to cultural beliefs or the sociodemographic characteristics of the sample is important for future study.

As with cultural beliefs regarding infant feeding practices, differences exist among cultures regarding parenting beliefs (Bornstein, 2012; Swick, 1985). Mothers in the Infant Care sample reported a high sense of PSE. The efficacy subscale of the PSOC ranges from eight to 48 and the mean for the Infant Care sample was 38.7. This finding indicates that mothers felt confident in their abilities to parent even though the infant feeding practices employed with their infant did not align with recommendations provided by organizations such as the AAP. In contrast to this, Xu and colleagues (2013) used a measure of PSE (opposed to self-efficacy for feeding) to examine associations with feeding practices in a cohort of Australian mother-toddler dyads. Compared to mothers who reported a low sense of PSE, mothers who reported a high sense of PSE in this study had toddlers with healthier dietary practices (i.e., increased consumption of

fruits and vegetables and less sugar sweetened beverages) (Xu et al., 2013). In contrast, no association was seen between PSE and infant feeding practices in the current study (manuscript 2) despite mothers reporting a high sense of PSE. This difference could be attributed to different cultural perceptions regarding parenting. Future research should consider inclusion of African-American mothers of all sociodemographic classes to help clarify the influence culture has on decisions regarding infant feeding practices as well as development of PSE.

Cultural beliefs are also important when considering the findings in the current study examining the association between PSE and WLZ trajectories (manuscript 3). Mothers with a higher sense of PSE at infant age of three months had infants who experienced excessive WLZ trajectory between three and 12 months. Since an excessive WLZ trajectory has been previously associated with childhood obesity (Ong et al., 2000), this finding suggests that a high sense of PSE is associated with a negative infant outcome in this sample of low-income, African-American mother-infant dyads. No prior study is identified which examined the association between PSE and WLZ trajectories, but findings could be attributed to cultural perceptions of infant size. In the African-American culture, a heavier infant is viewed as healthy and a sign of good parenting (McGarvey et al., 2006; Schafer et al., 2016; Thompson et al., 2014). Additionally, a study by Hager and colleagues (2012) found that African-American mothers had a skewed perception of their toddlers' weight status. In the current study (manuscript 3), maternal perception of infant weight status was not significantly associated with WLZ trajectories, however, the association between a high sense of PSE and excessive infant WLZ trajectory suggests that when mothers were confident in their ability to parent, their

infant experienced an excessive WLZ trajectory. Since this is the first study to examine this association, more research is needed, but this finding provides valuable information regarding PSE and infant WLZ trajectories in the African-American population.

Differences in findings of the current study (manuscript 2) from prior research could also be attributed to the tool used to measure self-efficacy. A measure of PSE was available in the Infant Care dataset, hence was used in the current analyses, however it is unknown whether this is the best measure of self-efficacy to use when examining infant feeding practices or infant weight gain. The integrative review (manuscript 1) found that prior research has demonstrated a consistent correlation between breastfeeding self-efficacy and breastfeeding, in racially diverse samples. No association between PSE and breastfeeding was found in the current study (manuscript 2), however, the global measure of PSE is different than a measure of self-efficacy specific to breastfeeding. This measurement difference could explain why no significant association was seen. Additionally, most of the research which has examined the association between self-efficacy and infant feeding practices other than breastfeeding, used a tool that measured self-efficacy specific to feeding (Campbell et al., 2010; Koh et al., 2014; Spence et al., 2014). As previously noted, Xu and colleagues (2013) used a tool to measure PSE; additionally, Stifter and Moding (2015) measured PSE, but looked at an association with mothers' use of food to soothe an infant which was not examined in the current studies. As highlighted in the integrative review (manuscript 1), the variation in tools used in current evidence, makes comparisons across studies difficult.

Strengths and Limitations

The strengths and limitations for this dissertation stem from using existing data. The strengths included having data that was collected at multiple time points across the infants' first year of life, which allowed longitudinal analyses. Additionally, the Infant Care dataset had extensive infant dietary data including dietary histories and 24-hour dietary recalls at four times points. This provided a thorough representation of infant feeding practices for these analyses. Finally, using existing data allowed the research to be completed in a timely manner at lost cost since no recruitment of participants was required.

Limitations of secondary data analyses also exist; primarily being limited by the data available. For this dissertation, having no infant birth length in the data precluded examining WLZ trajectories from birth to 12 months. Weight-for-length change between birth and three months could have implications for future infant growth and childhood obesity risk, therefore, a limitation to this study. There was also no measure of maternal knowledge of infant feeding recommendations. Examining the relationship between PSE, infant feeding practices, and weight gain while including maternal knowledge would have provided valuable information in which to consider the context of the findings. Finally, the tool used in the Infant Care study was a measure of PSE, and although has been deemed valid and reliable, it is a measure of global PSE rather than self-efficacy specific to breastfeeding or infant feeding.

Clinical Implications

Findings from the integrative review (manuscript 1) regarding breastfeeding self-efficacy are useful for the clinician who cares for mothers and infants. Breastfeeding self-efficacy was found to be consistently associated with increased initiation of breastfeeding and increased duration of breastfeeding in multiple racial and ethnic groups. This finding suggests that clinicians use a breastfeeding self-efficacy tool to identify mothers who may be at risk for a low sense of breastfeeding self-efficacy and, hence, not initiating breastfeeding or discontinuing breastfeeding earlier than recommended. The Breastfeeding Self-Efficacy Scale – Short Form is by far the most common tool reported in the literature (Dennis & Faux, 1999). This 14-item, self-report questionnaire can be administered pre- or post-natally to assess a mother's sense of breastfeeding self-efficacy. Early identification of mothers with low breastfeeding self-efficacy, affords clinicians the opportunity to initiate appropriate educational interventions to increase a mother's knowledge regarding breastfeeding as well as her breastfeeding self-efficacy.

Findings from the two secondary data analyses (manuscripts 2 and 3) conducted in this dissertation have limited application to the clinician setting. Clinicians should be aware of PSE as a concept yet understand that more research is needed to fully understand the impact on infant feeding practices and infant WLZ trajectories in low-income, African-American mother-infant dyads. Findings regarding marital status and education level and the association with infant feeding practices are consistent with prior literature; low-income, African-American mothers who are married and have a college education are more likely to follow recommended feeding practices (i.e., breastfeeding

and providing age appropriate foods to infants). This information is helpful to clinicians in identifying mothers who require more support or education in their decisions regarding infant feeding.

Future Directions

Findings from this body of work offer several suggestions for future research. The integrative review identified gaps in the evidence regarding the association between self-efficacy and infant feeding practices other than breastfeeding. Findings from this dissertation regarding the association between PSE and infant feeding practices (Manuscript 2) were null, suggesting the need for more research to understand factors influencing parental decisions regarding infant feeding practices. However, findings from Manuscript 2 highlight two areas in which future research is needed: 1) measurement of cultural perspectives on infant feeding; and 2) the need for a tool that measures self-efficacy specific to infant feeding. Future research should consider repeating the study in a sample of more diverse African-American mother-infant dyads (i.e., those from all SES, more married mothers, more mother-infant dyads that follow infant feeding recommendations). Assessment of cultural beliefs and traditions regarding infant feeding should be included in future research to determine how these beliefs and traditions influence decisions regarding infant feeding as well as one's sense of PSE. Additionally, a tool that measures self-efficacy specific to feeding should be considered for future development. Bartle and Harvey (2017) suggested the need for development of a formula feeding self-efficacy tool to compliment the Breastfeeding Self-Efficacy Scale – Short Form. This would be particularly valuable in African-American mothers since formula feeding rates are higher in this population compared to Caucasian or Hispanic

mothers (CDC, 2015). Finally, assessment of maternal knowledge of infant feeding recommendations is necessary to determine whether mothers with a high sense of PSE are also knowledgeable regarding recommended feeding practices.

Manuscript 3 is the first known study to examine the association between PSE and infant WLZ trajectories. The significant finding seen in this study, is important because it identified a maternal characteristic that is associated with infant WLZ trajectories. However, these findings need to be validated in future studies and with diverse samples of mother-infant dyads. Also, since prior research has found that African-American mothers have a skewed perception of infant weight status, maternal perception of infant WLZ should be considered in future research to determine how this may mediate or moderate the relationship between PSE and WLZ trajectories. Finally, future research should examine WLZ trajectories from birth as well as at different time periods during infancy to determine whether there is a particular period in which the infants are growing excessively and whether PSE is predictive of infant growth.

Conclusion

This body of work contributes to existing research that aims to find ways to halt the childhood obesity epidemic. PSE has previously been identified as an important concept in the study of parenting practices and decisions including those related to infant feeding (Redsell et al., 2016; Salonen et al., 2009). The three manuscripts presented for this dissertation identified that self-efficacy may be a concept with important implications for infant feeding and growth, however, this depends on the type of self-efficacy measured (i.e., specific to breastfeeding, infant feeding, or a global measure of PSE).

Additionally, the current studies highlighted the role that cultural beliefs and perceptions regarding parenting, infant feeding, and growth may have on practices in which mothers choose to engage with their infants. Findings regarding breastfeeding self-efficacy can be implemented into clinical practices, however, other findings require more investigation to understand the associations examined in these studies.

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APPENDIX A

DEINITION OF KEY TERMS

Body mass index – A measure of body fat based on height and weight, it applies to individuals two years and older. To calculate, an individual's weight in kilograms divided by the square of height in meters (kg/m^2) (CDC, 2014).

Childhood Overweight – A body mass index equal to or greater than the 85^{th} percentile for age and gender, but less than the 95^{th} percentile (CDC, 2014).

Childhood Obesity – A body mass index equal to or greater than the 95^{th} percentile for age and sex (CDC, 2014).

Complementary foods – Nutrient- and energy-containing foods and liquids, which introduced to an infant to provide nutrients which may be lacking from breastmilk or formula (AAP Committee on Nutrition, 2014; Arikpo et al., 2015).

Failure to thrive – An abnormal pattern of growth in which the infant does not gain adequate weight over time (Homan, 2016).

Generalized estimating equation – A statistical approach used when fitting marginal models to longitudinal data (Hothorn & Everitt, 2014).

Generalized linear mixed model – A statistical approach that is an extension to generalized linear model used when the outcome is categorical (Hothorn & Everitt, 2014).

Inappropriate feeding – Feeding or foods which are not able to be properly consumed due to the developmental level of an infant or child, do not provide essential nutrients for healthy growth, or provide an excess amount of calories, sugar, salt, or fat (AAP, 2017; AAP Committee on Nutrition, 2014; Thompson & Bentley, 2013; WHO, 2016).

Energy density – The amount of calories per gram of food. Energy dense (or high energy density foods) typically have more calories per each gram of food (AAP Committee on Nutrition, 2014).

Responsive Feeding – Behaviors by a caregiver that encourage a child to self-regulate their food intake or allowing a child to leave food unfinished (Blaine et al., 2015; DiSantis et al., 2011)

Parental feeding styles – "The attitudes that characterize parental approaches to maintaining or modifying children's eating behavior and the quality of interaction during feeding" (Thompson et al., 2013, p. 562).

Parental self-efficacy – The belief a parent has in his/her ability to accomplish the tasks of parenting (Bandura, 1997).

Weight-for-length z-score – The z-score is a standard deviation score that has the same relationship to the distribution of the mean for every age and sex which allows for comparisons among all groups of infants (WHO, 2017). Weight-for-length is a measure of growth which compares an infant's weight to his/her length.

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Institutional Review Board for Human Use

Exemption Designation
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The Assurance number is FWA00005960 and it expires on November 8, 2021. The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56.

Principal Investigator:	Bahorski, Jessica
Co-Investigator(s):	
Protocol Number:	**E170622007**
Protocol Title:	*Parental Self-Efficacy and Feeding Practices in Infancy: A Secondary Analysis*

The above project was reviewed on 6/22/17. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This project qualifies as an exemption as defined in 45CFR46.101(b), paragraph 4.

This project received EXEMPT review.

Date IRB Designation Issued: 6/22/17

Cari Oliver, CIP
Assistant Director, Office of the
Institutional Review Board for Human
Use (IRB)

Investigators please note:

Any modifications in the study methodology, protocol and/or consent form/information sheet must be submitted for review to the IRB prior to implementation.

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APPENDIX C

NOTICE OF INTENT

INFANT CARE PROJECT

NOTICE OF INTENT TO PRESENT/PUBLISH DATA

Date of NOI submission: 5-23-17

Submitted by: Jessica Bahorski

Proposed Title/Topic: Parental Self-Efficacy and Feeding Practices During Infancy: A Secondary Analysis

Lead Author: Jessica Bahorski

Contributing authors: From University of Alabama at Birmingham: Gwendolyn Childs, Lori Loan, Marti Rice, Andres Azuero, Paula Chandler-Laney. From UNC: Eric Hodges, Heather Wasser, Amanda Thompson, Margaret Bentley

For presentations:

Name of meeting: TBA

Deadline for abstract submission (if applicable): _____

Date of presentation: _____

For papers:

Intended date of submission: TBA

Journal of choice: _____

Other journals: _____

Main objectives of paper/presentation:

The main objective is to complete the dissertation for satisfaction of a PhD in Nursing. Papers and presentations will ensue after the completion of the dissertation. The purpose, aims, and research questions are as follows:

Purpose

The purpose of this secondary data analysis is to explore the relationship between parental self-efficacy (PSE), feeding practices, and infant weight-for-length z-score (WLZ) trajectories between birth and 12 months in first time, non-Hispanic Black (referred to henceforth as Black), low-income mother-infant dyads in North Carolina

using a longitudinal, correlational study design. The study aims and research questions (RQ) are presented below.

Aims and Research Questions

Aim 1: Examine whether PSE is associated with infant feeding practices in a group of first time Black mother-infant dyads throughout the infant's first year of life (data points 3, 6, 9, and 12 months).

RQ 1.1: Is PSE associated with milk feeding type?

RQ 1.2: Is PSE associated with duration of any breastfeeding?

RQ 1.3: Is PSE associated with age at complementary food introduction?

RQ 1.4: Is PSE associated with the introduction of inappropriate foods during infancy?

RQ 1.5: Considering PSE and covariates simultaneously, what are the strongest predictors of each feeding practice?

Aim 2: Examine whether infant feeding practices are associated with infant WLZ trajectories between birth and 12 months of age in a group of Black full-term infants.

RQ 2.1: Is the infant's milk feeding type (formula only, breastfed only, or mixed) associated with infant WLZ trajectory?

RQ 2.2: Is the duration of any breastfeeding associated with infant WLZ trajectory?

RQ 2.3: Is the age at which complementary foods are introduced associated with infant WLZ trajectory?

RQ 2.4: Is the introduction of foods inappropriate for an infant during the first year of life associated with infant WLZ trajectory?

RQ 2.5: Considering the feeding practices and covariates simultaneously, what are the strongest predictors of WLZ trajectory?

Aim 3: Examine whether PSE is associated with infant WLZ trajectories between birth and 12 months of age in a group of Black full-term infants.

RQ 3.1: Is a mother's self-reported PSE associated with infant WLZ trajectory?

RQ 3.2: Considering PSE and covariates simultaneously, what are the strongest predictors of WLZ trajectory?

DATA REQUEST FORM

Date of request: 5-23-17

Requested by: Jessica Bahorski

Data needed by this date: 7-31-17

Main outcome variable(s): Infant weight-for-length z-score trajectories between birth and 12 months of age

Other major variables: parental self-efficacy (efficacy subscale of the Parenting Sense of Competence Scale), infant feeding practices (breastfeeding initiation and duration, age at complementary food introduction, introduction of inappropriate foods by 12 months of age) and as covariates maternal and sociodemographic variables (maternal age, maternal BMI, maternal education level, maternal marital status, family income, maternal depression, mother's belief of infants' weigh status [question from Infant Health & Sleep Patterns questionnaire, #9 & #10]

Please check required data sources:

1. Formative data
    a. Video data _____
    b. Coded transcripts _____
2. IFSQ pretest survey data _____
3. Cohort data

File description	3M	6M	9M	12M	18M
Household-level data					

Household roster					
Household profile (income/other characteristics	X	X	X	X	
Food security					
Food shopping and eating patterns					
Neighborhood environment and facilities					
Interview notes/household maps					

Mother-specific data	**3M**	**6M**	**9M**	**12M**	**18M**
Mother's profile (demographics, health)	X	X	X	X	
Anthropometric measurements	X	X			
NDS					
IFSQ					
Body satisfaction questionnaire					
Intervention exposure and sources of infant care information	X	X	X	X	
Parent satisfaction scale	X	X	X	X	
Parental spanking attitudes					
Maternal physical activity					
Child care use					
Maternal depression	X	X	X	X	
Maternal self-esteem					
Marlowe-Crowne social desirability scale					
Infant-specific data					
Infant characteristics (birth data, anthro)	X	X	X	X	
NDS	X	X	X	X	
Breastfeeding, Infant Diet History	X	X	X	X	
Infant health and sleep patterns	X	X	X	X	
Infant activity table					

Pacifier use and crying patterns					
Infant temperament	X	X	X	X	
Bayley Motor scale development					
Individual play videotape					
Individual play video codes file					
Mother-child video data					
Feeding videotape					
Feeding video codes file					
Play videotape					
Play video codes file					
Biological father's profile					
Demographics					
Anthropometric measurements (one set only)					
Alternate caregiver's profile					
AC questionnaire					
Anthropometric measurements (one set only)					

By signing below, I, Margaret E. Bentley, grant permission to the data requestor/lead author to use the selected Infant Care data for the purpose of the publication/presentation outlined herein.

Jessica Bahorski — Signature of data requestor/lead author

Margaret E. Bentley — Signature of PI

5-26-17 — Date

5/26/2017 — Date

By signing this form, I, Jessica Bahorski, agree to only use the data for the purpose of the publication/presentation outlined herein and to securely discard any copies of the de-identified dataset upon completion of the proposed study.

Jessica Bahorski — Signature of data requestor/lead author

Margaret E. Bentley — Signature of PI

5-26-17 — Date

5/26/2017 — Date

APPENDIX D

INFANT CARE STUDY INFORMED CONSENT

The University of North Carolina

Infant Care Project

Consent Form for Mothers

WHAT IS THIS STUDY ABOUT?

Researchers at the University of North Carolina at Chapel Hill are studying the infant-care practices of African-American mothers in this part of North Carolina. We're particularly interested in learning about infant feeding, parenting styles, physical activity and growth.

We are recruiting healthy African-American women who are 18 to 35 years old and who are first-time mothers of healthy babies who are less than four months old. The mother's household should also be generally eligible for programs such as WIC, Medicaid, and Food Stamps. If you agree to participate, you will be one of about 250 mothers in the study.

The study is being conducted by Dr. Margaret Bentley, Professor, Department of Nutrition, University of North Carolina at Chapel Hill. She can be contacted at 919-843-2648. You may call collect.

WHAT WILL I BE ASKED TO DO?

If you agree to participate, a study team of 2 people will come to your home when your child is 3, 6, 9, 12, and 18 months old. At each visit they will ask you to do several things:

Interviews: You will be asked questions about your health, work, education, household characteristics, diet, food shopping, physical activity, and factors that might affect infant care such as depression, alcohol and drug use. (If your responses about depression, alcohol and drug use suggest that you are in need of professional help, we will provide you with information on how to contact a health care provider). We will also ask questions about the quality of your neighborhood's environment, and obtain other information on characteristics that may be related to where you live.

The questions about your child will be mainly about feeding, care, activity and

development. We will ask your opinions about feeding infants and toddlers in general, and about how you feed your own child.

Development tests: We would like to see how your child is developing by watching how he/she does activities typical of a child his/her age (such as sitting, crawling, or reaching and holding a toy). Children vary a lot in the age when they first learn a new skill, and this is normal. However, if your child's test results from 2 different visits suggest any developmental problems, we will tell you, and give you information about how you can get a more complete assessment of your child.

Videotapes: We would like to make a videotape of you feeding and playing with your child. We will ask you to feed your child as you normally do. For the play session, we will bring a set of toys and ask you to sit on the floor and play with your child. We will also videotape your child during the development test described above.

Measurements: We would like to measure your child's weight, height, head size, and skin folds on his/her arm, back and near the belly button. We would also like to measure your weight and height, waist and hips, and arm and back skin folds. Skin folds are measured by pinching a fold of skin with a caliper [to be shown to you].

We estimate that each visit will take from 2-5 hours.

Follow-up phone call: After each of these visits, we will make at least two separate phone calls to you. We will ask about all of the foods your child ate on the previous day during both calls. During only one of the calls we will ask about your child's behavior, and what you ate the previous day. These phone calls should take about 20-30 minutes each. If the interview was not completed during the home visit, we may continue the interview during one of these calls or give you a separate call to finish the interview.

WHO ELSE WILL BE INTERVIEWED?

If someone else (such as the child's father, grandparent, or child care provider) feeds and cares for your child for about 50% or more of the time, we would like your permission to interview them about infant care and feeding, and your child's diet and activities. We would also like to measure or ask about this person's weight and height because we are interested to know if these have any effect on infant care. This person will be interviewed when your child is 3, 6, 9, 12, and 18 months old for as long as he or she is identified as the caregiver. If the child's father is not considered a caregiver and if he is available, we would also like to ask your permission to contact him to measure his weight and height. We will give you two separate sheets describing the study for you to give to the caregiver and to the child's father. Each sheet will describe what each of them will be asked to do.

If your child goes to a child care center or child care home, we would like your permission to observe your child at feeding and play times at this facility, and to interview your child care providers about your child's activities while in their care. If the child is fed at the child care center/home for about 50% or more of the time, we will ask the person who feeds your child to fill out a 5-day food record form. This form records

the amount and kind of food your child consumes for 5 consecutive days that he/she is in the facility's care. We will then ask you to sign a letter to the child care center or home that you have given us permission to observe your child and inform the facility about the study.

If, for any reason, someone else other than you becomes mainly in charge of feeding and caring for your child while the child is in our study, we would like to ask your permission to continue visiting the child and interview the new caregiver.

WHAT ARE THE RISKS AND BENEFITS OF MY PARTICIPATION?

We believe that there are minimal risks to you and your child for participating in this study.

The measurements are similar to what is done when your child visits the doctor. The skin fold measurement is not painful and our study team members are highly trained in how to take these measurements. All of the equipment and toys that we bring will be thoroughly cleaned before we bring them to your home.

Some of the questions may cause discomfort or embarrassment, but you may stop the interview at any time or to tell us that you do not wish to answer a question. We will respect your wishes. If you heard about this study through the health clinic, your services at the clinic will not be affected by any of your decisions about being in the study.

There are no direct benefits to you. However, we believe that what we learn in this study will have important benefits to the community and for public health programs relating to maternal and infant health issues.

ARE THERE ANY COSTS?

There will be no costs for participating, aside from your time.

WILL I BE PAID?

In appreciation of your time, we will pay you $60 at the completion of all your interviews (both done at home and through the phone) that are scheduled for each visit. You will also receive a photo of your child from each visit, and a copy of the videotape of your child at the completion of the study.

WHAT IF I WANT TO STOP PARTICIPATING IN THE STUDY?

You can withdraw from this study at any time, without penalty. The researchers also have the right to stop your participation at any time. This could be because you have failed to complete the study requirements, you no longer meet the qualifications needed to be part of the study, or because the entire study has stopped.

WHAT ARE MY RIGHTS AND HOW WILL YOU KEEP THE INFORMATION I GIVE PRIVATE?

If you agree to be in this study, please understand that your participation is voluntary

(you do not have to do it). You have the right to withdraw your consent or stop being in the study at any time without penalty. You have the right to refuse to answer particular questions or say no to any part of the study. You have the right to refuse to be videotaped at all or you may ask that the video recording be stopped at any time.

As soon as we are done studying the videotape, we will send you a copy. Our copy of the video will be destroyed at the end of the study. All of your answers, and all of the information we collect about your child, including the videotape, will be kept with only an ID number, not your name. Information and tapes will be stored in a locked file cabinet in the study office. Only the study researchers will have access to it. We will keep your name and address in a separate locked file. You will not be identified in any report or publication of this study or its results. Please understand, however, that researchers are required by North Carolina law to report to authorities if they observe any evidence that your child is in danger of serious harm.

To further protect your privacy, we have obtained a Certificate of Confidentiality from the Department of Health and Human Services. With this certificate, the researchers cannot be forced (for example, by court order) to give research information that may identify you or your family in any legal proceeding. However, you and your family would not be prevented from releasing information about yourself or your involvement in this study.

This study has been reviewed and approved by the Public Health Institutional Review Board. This is a group that makes sure that study participants are treated fairly and protected from harm. If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact -- without giving your name, if you wish -- the Public Health Institutional Review Board, University of North Carolina at Chapel Hill, CB # 7400, Chapel Hill, NC 27599-7400, or by phone 919-966-3012. You may call collect.

The extra copy of this consent form is for you to keep.

AGREEMENT STATEMENTS:

I have read and understand the information presented here, and I freely give my consent to participate in this research.

Signature: _____ Date: _____

IRB Approval Date: _____ Expiration Date: _____

APPENDIX E

PARENTING SENSE OF COMPETENCE SCALE

Parenting Sense of Competence Scale
(Gibaud-Wallston & Wandersman, 1978)

1. The problems of taking care of a baby are easy to solve once you know how your actions affect your baby, an understanding I have acquired.

1	2	3	4	5	6
strongly agree					strongly disagree

2. Even though being a parent could be rewarding, I am frustrated now while my child is only an infant.

1	2	3	4	5	6
strongly agree					strongly disagree

3. I go to bed the same way I wake up in the morning – feeling I have not accomplished a whole lot.

1	2	3	4	5	6
strongly agree					strongly disagree

4. I do not know why it is, but sometimes when I'm supposed to be in control, I feel more like the one being manipulated.

1	2	3	4	5	6
strongly agree					strongly disagree

5. My mother was better prepared to be a good mother than I am.

1	2	3	4	5	6
strongly agree					strongly disagree

6. I would make a fine model for a new mother to follow in order to learn how to become a good parent.

1	2	3	4	5	6
strongly agree					strongly disagree

7. Being a parent is manageable, and any problems are easily solved.

1	2	3	4	5	6

strongly agree — strongly disagree

8. A difficult problem in being a parent is not knowing whether you're doing a good job or a bad one.

1	2	3	4	5	6
strongly agree					strongly disagree

9. Sometimes I feel like I'm not getting anything done.

1	2	3	4	5	6
strongly agree					strongly disagree

10. I meet my own personal expectations for expertise in caring for my baby.

1	2	3	4	5	6
strongly agree					strongly disagree

11. If anyone can find the answer to what is troubling my baby, I am the one.

1	2	3	4	5	6
strongly agree					strongly disagree

12. My talents and interests are in other areas, not in being a parent.

1	2	3	4	5	6
strongly agree					strongly disagree

13. Considering how long I've been a mother, I feel thoroughly familiar with this role.

1	2	3	4	5	6
strongly agree					strongly disagree

14. If being a mother of an infant were only more interesting, I would be motivated to do a better job as a parent.

1	2	3	4	5	6
strongly agree					strongly disagree

15. I honestly believe I have all the skills necessary to be a good mother to my baby.

1	2	3	4	5	6
strongly agree					strongly disagree

16. Being a parent makes me tense and anxious.

1	2	3	4	5	6
strongly agree					strongly disagree

17. Being a good mother is a reward in itself.

1	2	3	4	5	6
strongly agree					strongly disagree