EXAMINING RELATIONSHIPS BETWEEN FAMILY MEALTIME ROUTINES AND FEEDING OUTCOMES IN YOUNG CHILDREN WITH SENSORY FOOD AVERSIONS

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Picky eating is a common behavior of early childhood. Young children with Sensory Food Aversions (SFA) are at increased risk for picky eating behaviors that persist throughout childhood and into adulthood. Interventions that support increased dietary variety in the home are needed to prevent nutritional deficiency and related health issues later in life. The focus of this dissertation was to develop and test the feasibility and preliminary effects of an intervention, embedded within daily family meals, to improve feeding outcomes in young children with SFA. First, we conducted a hierarchical logistic regression to determine if frequency of family meals predicted low fruit and vegetable consumption in a large sample of preschool-age children. Next, we evaluated the feasibility and preliminary effects of the Mealtime PREP intervention for eleven children with SFA and their parents.

Our findings support that the established protective benefits of family meals for school-age children and adolescents generalize to *young* children as well. We learned that low frequency of family meals is predictive of low fruit and vegetable intake among preschoolers. Additionally, we determined that the Mealtime PREP intervention package is feasible to deliver in the home and acceptable to parents of children with SFA. Preliminary analyses of effects suggest that statistically significant changes in food acceptance and clinically relevant shifts in mealtime

behavior and risk of nutritional deficiency were observed in 9 of 11 child participants after parents were trained to deliver intervention strategies during scheduled, daily family meals.

Valuable insights gained from this project will be incorporated into future studies examining the effects of the Mealtime PREP intervention. Future studies should focus on the development of an effective, yet parsimonious, protocol to promote healthy dietary variety in young children. Larger scale studies are required to make inferences about the effects of this type of intervention in the population of young children who are picky eaters. Future work is also needed to parse out the effects of parent-mediated interventions using a behavioral activation approach to parent-training. This method shows promise to bridge the gap of intervention delivery between the clinic and the home environment.

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PREFACE

I would like to acknowledge those individuals who have contributed to this dissertation. There are not enough words to thank my mentors Elizabeth Skidmore, PhD, OTR/L and Roxanna Bendixen, PhD, OTR/L for their expertise, unwavering support, and guidance throughout this process. I am also grateful to Lauren Terhorst, PhD and Cynthia Danford, PhD, RN, PNP-BC, CPNP-PC for their time, effort, and expertise that they generously contributed to this work.

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1.0 INTRODUCTION

1.1 BACKGROUND AND SIGNIFICANCE

It is estimated that nearly half of all children are picky eaters at some point during early childhood (i. e., ages 1.5 - 5; Cano et al., 2015; Carruth et al., 2004). Because the prevalence of picky-eating drops to 7-27% during later childhood (i. e., ages 6 – 18; Marchi & Cohen, 1990; Mascola, Bryson, & Agras, 2010; Micali et al., 2011), picky eating has long been dismissed as a transient behavior (Cano et al., 2015). Yet recent evidence suggests that even moderate levels of picky eating during the early formative years are associated with wide range of behavioral problems both concurrently and later in life (Bryant-Waugh, Markham, Kreipe & Walsh, 2010; Equit et al., 2013; Mascola et al., 2010), as well as anxiety, depression, attention-deficit/hyperactivity disorder, and caregiver stress later in childhood (Goh & Jacob, 2012; Zucker et al., 2015). While most toddlers and preschoolers will outgrow this behavior, it is estimated that 20-50% of all children considered picky eaters will demonstrate persistence in this pattern and will continue to restrict their diet throughout childhood (Cano et al., 2015; Toyama & Agras, 2016).

Picky eating is also associated with low intake of fruits and vegetables (Horodynski, Stommel, Brophy-Herb, Xie & Weatherspoon, 2010; Wardle, Carnell, & Cooke, 2005). This is concerning, as low intake of fruits and vegetables has been associated with increased risk for

obesity (Cooke et al., 2003). Prevention of childhood obesity is crucial, as children who are obese are at increased risk for developing diabetes and cardiovascular disease at a younger age (World Health Organization, 2015). Interventions that promote healthy dietary variety in young children are recommended as a first line of defense against this global public health crisis (Karnik & Kanekar, 2012). These interventions should be prioritized early in life, as children are more receptive to trying new foods prior to the age of 5 (Skinner, Carruth, Bounds, & Ziegler, 2002). Increasing preferences for healthy foods when children are young is optimal, because food preferences established at this time are likely to carry forward into adulthood (Mascola et al., 2010; Lien, Lytle, & Klepp, 2001; Lytle et al., 2000).

Children with Sensory Food Aversions (SFA) are at increased risk of becoming persistent picky eaters because they refuse novel foods and have strong likes and dislikes based on the sensory characteristics of the food (Mascola et al., 2010; Toyama & Agras, 2016). Frequently, children with Sensory Food Aversions begin to demonstrate food refusal between six and ten months, when they are offered a variety of table foods for the first time. Refusal behaviors are initially overlooked, but become increasingly concerning to parents as they persist over time (Chatoor, 2009). Persistent food refusal leads to oral-motor delays and/or risk of nutritional deficiency in children with SFA (Zero to Three, 2005). When dietary variety is limited and mealtimes become a daily struggle, many children are referred to feeding specialists and early intervention services (Jacobi, Agras, Bryson, & Hammer, 2003). Consistent with other children who are picky eaters, children with SFA often refuse fruits and vegetables (Chatoor, 2009). Therapist-led interventions, using behavioral modification strategies and repeated exposure, have improved acceptance of and preferences for specific foods targeted during treatment. However,

these interventions have not effectively increased dietary variety (Marshall, Ware, Ziviani, Hill & Dodrill, 2015).

In addition to limited dietary variety, children with Sensory Food Aversions often engage in inappropriate mealtime behaviors (i.e. crying or throwing food; Chatoor, 2009) to avoid non-preferred foods. Social influences play a significant role in the development of adaptive mealtime behaviors in young children (Addessi, Galloway, Visalberghi, & Birch, 2005), yet opportunities for social learning during mealtimes are limited, as family meals are increasingly rare (Neumark-Sztainer, Wall, Fulkerson, & Larson, 2013; Gillman et al., 2000). Family meals are predictive of dietary variety in school-age children and adolescents (Robinson-O'Brian, Neuman-Sztainer, Hannan, Burgess-Champoux, & Haines, 2009; Cho, Kim, & Cho, 2014). Therefore, the enhancement of family mealtime routines (using evidence-based strategies) is theoretically promising to improve dietary variety in young children. If successful in children with Sensory Food Aversions, this type of intervention could be used to promote nutritious food acceptance and dietary variety for all young children to help establish the foundation of a healthy lifestyle.

The purpose of this dissertation is to gain a better understanding of how feeding outcomes in young children are related to family mealtime and to examine feasibility and effects of an intervention designed to improve family mealtime routines for young children with SFA. Each aim of this project will contribute to the modification and refinement of this intervention package for future, large-scale trials. We will examine the relationship between family meal frequency and low fruit and vegetable intake using secondary data analyses to inform intervention optimization for each participant. We will also test the feasibility and acceptability of the Mealtime PREP (Promoting Routines of Exploration and Play) intervention approach,

using a novel approach to training parents to deliver evidence-based feeding techniques in the home environment. Single-case experimental design (SCED) provides a rigorous method to closely monitor the effects of embedding the Mealtime PREP intervention within daily family meals for each participant. Through multiple replications of this design, we plan to examine variations in individual treatment effects (food acceptance, mealtime behaviors and dietary variety) in response to the Mealtime PREP intervention.

1.2 INNOVATION

This dissertation study incorporates many elements designed to inform an intervention approach rooted in pragmatism. A secondary data analysis will deliver evidence to support or refute the link between frequency of family meals and fruit and vegetable intake in young children. While this relationship has been observed in school-age children and adolescents, evidence to support this association in younger children is lacking. The Mealtime PREP intervention is innovative in that it embeds evidence-based strategies into routine family meals to maximize functional outcomes within the home environment. This two-pronged intervention encompasses two distinct foci; the first to change the behavior of the parent participant, and the second to change the behavior of the child participant. Each treatment recipient (parent and child) will be provided with a separate set of active ingredients to completely modify daily mealtimes. The principles of behavioral activation guided the development of our parent-training element. The child-focused element consists of a parent-led mealtime routine that is customized to minimize barriers of treatment delivery while promoting a positive mealtime experience for all.

The success of this intervention relies on parental participation and influence over family routines. The ability of each family to change routines is a critical component to effectively embedding these techniques into daily meals. Parent-led interventions have been effective in promoting behavior change in children (Bearss et al., 2015; Skotarczak & Lee, 2015; Mueller et al., 2003). Nevertheless, a frequent barrier to implementing these interventions is finding ways to alter and implement new routines in the home (Golley, Hendrie, Slater, & Corsini, 2011). Behavioral activation is a treatment approach that is effective at helping individuals establish new, healthy routines (Cuijpers, van Straten, & Warmerdam, 2007). Principles of behavioral activation (goal setting, activity scheduling and monitoring, and skill development) provide a replicable infrastructure to train parents on multiple intervention components, one at a time (Kanter et al., 2010). This unique approach to parent-training systematically integrates the active ingredients for improved child feeding outcomes into scheduled mealtimes, when it matters most. Parents are given the opportunity to practice skills and receive feedback from a therapist trained on the intervention protocol before being trained to deliver the next active ingredient. This approach to parent-training has never been applied to this population, and, if successful at influencing routines, could easily be adapted to future parent-led interventions for young children.

The parent-led, child-focused element of the Mealtime PREP intervention employs the active ingredients of social modeling, positive reinforcement and repeated exposure to promote improved feeding outcomes. Delivering these ingredients in the context of a structured family meal is innovative in that we are inherently removing barriers to fidelity through embedding treatment strategies into daily routines (McConnell, Parakkal, Savage, & Rempel, 2014). While many forms of positive reinforcement are commonly used by feeding professionals, we have

woven these, traditionally overt, strategies into a naturally occurring routine of scheduled family meals. Parents are trained to provide verbal praise, acknowledgement, and eye contact when a child is interacting with all food options to create a positive environment. These strategies are well-suited for integration into daily family meals on a long-term basis to maximize the benefits of continued social learning.

1.3 ANTICIPATED OUTCOMES

The overall goal of this dissertation study is to examine the relationships between family mealtime and feeding outcomes (e.g., dietary variety, fruit and vegetable intake) among young children. We seek to add to the body of evidence that supports a link between frequency of family meals and fruit and vegetable intake in children, by examining this relationship among preschoolers. We predict that we will identify possible confounding variables to this relationship that can be further investigated in future studies. We will also examine the feasibility, and variations in individual treatment effects, of a novel treatment approach, the Mealtime PREP intervention, for young children with Sensory Food Aversions. Observed effects were explored within individual participants and across all participants to elucidate improvements made by each child and identify overall trends.

Results from this project will directly influence specification, refinement and dosing of the Mealtime PREP intervention for future large-scale trials. We predict that several other studies may emerge as products of this dissertation project. We will investigate the feasibility of the Mealtime PREP intervention to change behaviors of both child and parent participants. Based on

the parent participants' responses to a behavioral activation approach to parent-training, future studies might examine the applicability of a behavioral activation approach to training parents to deliver other interventions in natural contexts. We believe that behavioral activation principles provide a systematic method for intervention development and that delivery could be generalized to other populations as well.

If future, large-scale trials find the Mealtime PREP intervention successful in changing feeding behavior of children with SFA, this intervention could be modified for application to other populations, such as children at risk for obesity or children with autism spectrum disorder. Insights gleaned as a result of this project may also help clinicians understand what is happening in the home environment and provide an idea of anticipated gains in food acceptance, dietary variety and mealtime behaviors after implementing the Mealtime PREP intervention. Finally, it is our hope that dissemination of the results of this project increases awareness of the significance of family meals for young children, and helps to facilitate increased participation in this meaningful occupation.

1.4 SPECIFIC AIMS

The specific aims of this dissertation are:

Specific Aim 1: To examine the associations between family meal frequency and low fruit and vegetable intake in preschool children and identify probable confounding factors using data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B).

Hypothesis: We anticipated that frequency of family meals would be associated with fruit and vegetable intake, and that the number of individuals living in the home, disability status, and cultural factors might be associated with both frequency of family meals and fruit and vegetable intake.

Specific Aim 2: To examine the feasibility and acceptability of the Mealtime PREP intervention; a behavioral activation approach to training parents to deliver evidence-based techniques during family meals.

Specific Aim 3: To estimate the effects of the Mealtime PREP intervention on food acceptance, mealtime behavior, and dietary variety for young children with SFA.

At the end of this dissertation, we expect to have a better understanding of the relationship between family meals and fruit and vegetable consumption among preschoolers, determine if the Mealtime PREP intervention is feasible, and estimate the effects of this intervention package to inform future trial design.

2.0 DOES FAMILY MEAL FREQUENCY PREDICT FRUIT AND VEGETABLE INTAKE AMONG PRESCHOOLERS? A LOGISTIC REGRESSION ANALYSIS

2.1 INTRODUCTION

It is well documented that daily fruit and vegetable consumption has protective benefits against obesity, diabetes and cardiovascular disease across the lifespan (McCrory et al., 1999; Joshipura et al., 2001; Ford & Mokdad, 2000; Whincup et al., 2002; Klesges, Klesges, Eck, & Shelton, 1995; Moller, Taubert, Allen, Clark, & Lauer, 1994). However, the majority of children and adults are not meeting the daily dietary recommendations for intake of these nutrient-dense foods (Kirkpatrick, Dodd, Reedy, & Krebs-Smith, 2012). Unhealthy eating patterns are a substantial contributor to the obesity epidemic in the United States (WHO, 2015). Early intervention to promote healthy dietary variety in young children has been recommended as a first line of defense against this global public health crisis (WHO, 2015; Karnik & Kanekar, 2012). Increasing fruit and vegetable intake during the preschool years is particularly important, as children are more receptive to trying new foods prior to the age of five (Skinner et al., 2002), and early food preferences in young children are likely to carry forward into adulthood (Mascola et al., 2010; Lien et al., 2001; Lytle et al., 2000). Practical interventions to improve healthy eating patterns are needed, as nearly half of all preschool children consume fewer than two fruits and

vegetables per day (Dennison, Rockwell, & Baker, 1998), while the daily recommendation is more than two times that amount (U.S. Department of Health and Human Services, 2015).

Although awareness of this problem is growing among health professionals and parents, the most effective methods of promoting healthier diets for young children remain unclear (Flynn et al., 2006; Bluford, Sherry, & Scanlon, 2007). In order to develop robust interventions that improve fruit and vegetable intake, we must gain a better understanding of family-based factors contributing to both healthy and unhealthy eating patterns, during this critical period of development. Across the lifespan, frequently sharing a meal as a family has been shown to correlate with healthy eating patterns, whereas less frequent shared meals has been shown to correlate with unhealthy eating patterns (Fulkerson, Larson, Horning, & Neumark-Sztainer, 2014; Hammons & Fiese, 2011). This is true for both school-age children and adolescents, but the relationship is less clear for preschool-age children. While, consistent mealtime routines are associated with greater exposure to fruits and vegetables and lower obesity prevalence in preschoolers (Anderson & Whitaker, 2015; FitzPatrick, Edmunds, & Dennison, 2009), evidence to support the link between family meals and actual consumption of fruit and vegetables during early childhood is limited.

Due to a proposed critical period for the development of taste preferences, it is essential that we clarify the relationship between eating patterns and family meals for young children. Because food preferences early in life have been linked to food preferences into adolescence and adulthood, the benefits of improving healthy dietary variety during the preschool years could persist throughout the lifespan. Based on data from older children, we predicted that frequency of family meals might also predict unhealthy dietary patterns, such as low fruit and vegetable

intake, in young children. Should our prediction be supported, family mealtimes may provide an optimal platform for interventions that promote healthy eating patterns early in life.

The purpose of this study is to examine the associations between fruit and vegetable intake and frequency of family meals in preschool children and identify probable confounding factors using data from the Early Childhood Longitudinal Study-Birth Cohort (National Center for Education Statistics, 2009). Specifically, we will answer the following research questions: 1) Does the frequency of family meals predict low fruit and vegetable intake in preschool children? 2) What are the other possible covariates associated with low fruit and vegetable intake in preschool children?

2.2 METHODS

2.2.1 Settings and Design

We conducted a secondary analysis using data from the Department of Education's Institute for Education Services' Early Childhood Longitudinal Study – Birth Cohort (ECLS-B). The ECLS-B contains data from child assessments and parent interviews for a cohort of children born in 2001. Data gathered included information on child health, development, and learning experiences during this time (NCES, 2009). For this cross-sectional study, we were specifically interested in data obtained during the preschool wave of data collection (during the academic year 2005-2006), immediately preceding this group's anticipated kindergarten-entry. Participants included in this wave of data collection had not been adopted and were born to mothers who

were at least 15 years old (NCES, 2009). Parent respondents provided written consent for themselves and their child to participate in the ECLS-B Study (NCES, 2009). This study was approved by the University's Institutional Review Board.

2.2.2 Measures

We examined parent-reported consumption of fruits and vegetables and weekly frequency of shared evening meals to determine if family meals were predictive of low fruit and vegetable intake in preschool-age children.

Low Fruit and Vegetable Intake: Qualitative responses on frequency of fruit and vegetable intake were transformed into continuous values that reflect an average daily intake following the method adapted from Sturm and Datar's (2011) technique. For example, if a parent reported a child consumed vegetables "4-6 times during the past seven days," we transformed this qualitative response to 5 times per week and then divided by 7 to calculate an average daily intake (NCES, 2009). Based on nutritional guidelines and an accepted categorization scheme (Hammons & Fiese, 2011; U.S. Department of Health and Human Services, 2015), children in our sample were classified as demonstrating "low fruit and vegetable intake" if, on average, they consumed fruits and vegetables, as a combined category, less than two times per day per parent report. Children consuming, on average, greater than or equal to two fruits and vegetables daily served as our reference group. Fruit juice, French fries and other fried potatoes were not considered a fruit or vegetable.

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Family Meal Frequency: We categorized family meal frequency based on parent report during the interview as they answered the question, "In a typical week, please tell me the number of days your family eats the evening meal together?" (NCES, 2009). In order to compare low fruit and vegetable intake across categories, we collapsed family meal frequency scores into three categories, based on Larson et al.'s (2007) categorization scheme. Our three categories were 1) families that ate the evening meal together zero to two times per week, 2) those that ate the evening meal together three to six times per week, and 3) families that ate the evening meal together seven times per week. We created dummy variables to represent each of our indicator variables: sharing a family meal zero to two evenings per week and sharing a family meal three to six evenings per week (each coded as '1' in separate dummy variables). Sharing a family meal seven evenings per week served as our reference group for both of these variables.

Covariates: We controlled for the covariates of parental education status, household income level, resident mother's age, child race, and child body mass index (BMI). These factors have established relationships with child eating patterns and/or family meal frequency (Friend et al., 2015; Berge et al., 2015; Masters, Krogstrand, Eskridge, & Albrecht, 2014; Neumark-Sztainer et al., 2013).

Exploratory Predictors: We examined additional exploratory predictors to determine if they played a significant role in the development of low fruit and vegetable intake among preschoolers: number of individuals residing in the home (dichotomous variable representing households with < 5 residents and those with ≥ 5 residents), resident parental employment status (one parent employed, both employed, or neither employed) and child disability status (presence/absence). We were interested in the relationship between number of individuals residing in the home and fruit and vegetable intake based on the significant role that social

influences play in the development of eating behaviors in young children (Addessi et al., 2005; Birch, 1999). Parental employment status was also included in our modeling, as we postulated it might be related to frequency of family meals. Finally, we explored associations with disability status, as feeding difficulties are highly prevalent among children with disabilities (Linscheid, Budd & Rasnake, 2003; Gisel, Birnbaum, & Schwartz, 1998).

2.2.3 Statistical Analysis

To examine the relationship between low fruit and vegetable intake and frequency of family meals among preschoolers, we used Spearman rank correlations and chi-square analyses, as appropriate. We examined the magnitude of the predictor correlations to screen for multicollinearity.

Next, we developed a hierarchical logistic regression analysis to determine the best model to describe the relationships between low fruit and vegetable intake and frequency of family meals among preschoolers. We forced the established covariates of parental education status, household income level, resident mother's age, child race, and child BMI into the initial block to control for known relationships between these variables and our variables of interest. Next, we forced the dummy variables created to represent the three levels of our predictor of interest, frequency of family meals, into the second block of the analysis in order to evaluate if this predictor enhanced the model as compared to the control variables alone. Finally, we entered a group of experimental predictors (number of individuals residing in the home, parental employment status, and child disability status) into the third block of our analyses using

conditional backwards elimination. Those not significantly related to low fruit and vegetable intake (p >.05) were dropped from the final model in a stepwise manner (Field, 2013).

We used the -2 Log likelihood (-2LL), Hosmer and Lemeshow (H-L) test, and c-statistic to assess model fit. We examined and interpreted odds ratios (OR) with 95% Wald confidence intervals for each predictor included in our final model. This process allowed us to build the best model for predicting low fruit and vegetable intake in preschoolers using our predictor of interest, experimental predictors, and covariates. All statistical procedures were completed using IBM SPSS Statistics Version 23 (IBM Corp, 2014).

2.3 RESULTS

2.3.1 Sample

During the preschool wave of the ECLS-B, data were collected on approximately 8950 children between the ages of 44 and 65 months, with a mean age of 53 months (four years, five months). As shown in Table 1, the sample included an approximately equal distribution of males and females (50.8% male). For the entire sample, 44% of the children were white, 20% were Hispanic, 15% were black, and 21% were Asian or of other race-ethnicity. Over half of the sample reported eating the evening meal as a family seven days per week (53.4%), and nearly half of the preschoolers ate less than two fruits and vegetables per day (47.1%).

Table 1. Sociodemographic Characteristics among Preschool-Age Children in ECLS-B

Characteristic	n[a]	Prevalence, %
Child Gender		
Male	4550	50.8
Female	4400	49.2
Child Race/Ethnic group		
Non-Hispanic white	3900	43.5
Non-Hispanic black	1350	15.1
Hispanic	1750	19.8
Other	1900	21.5
Child Disability Status		
Present	850	9.3
Absent	8100	90.7
Household Income ($)		
0-25,000	2650	29.5
25,001-50,000	2400	26.6
50,001-75,000	1400	15.8
75,001-100,000	2500	28.1
Number of Individuals Residing in the Home	5300	59.0
≤ 4		
≥ 5	3650	41.0
Highest Parent Education		
$\leq$ High school diploma	3200	35.6
Some College	2600	29.3
Bachelor's degree	1600	18.0
Graduate degree	1550	17.1
Parent Employment Status		
Father employed	2600	30.0
Mother employed	1450	16.8
Both employed	3750	42.9
Neither employed	900	10.3

[a] Sample sizes are unweighted, and each cell has been rounded to the nearest 50 to conform to NCES guidelines.

ECLS-B: Early Childhood Longitudinal Study-Birth Cohort

2.3.2 Missing Data

Due to the low levels of missing data (<5% per variable), we excluded missing cases in any variable from this analysis (n = 670). Chi square and Mann Whitney U tests were run, as appropriate, to test for differences between those cases included in the analysis and those excluded due to missing data. Chi square tests were run on nominal variables to determine if the distribution of observed frequencies differed between missing and included cases. Mann Whitney U is a non-parametric alternative to the unpaired t-test (Portney & Watkins, 2009) that was used to determine if there were differences between missing and included cases for ratio variables. We used non-parametric tests because the assumption of normality was not met. No significant differences were found between those included and those excluded with respect to child BMI, child gender, age of resident mother, size of household, frequency of family meals or presence of unhealthy eating patterns. There were significant differences detected between those included and those excluded in terms of child race, child disability status, household income, parent education level, and parent employment status. Because the covariate of child BMI had the highest percentage of missing data (4.5%), a post-hoc hierarchical logistical regression was run omitting this variable as a sensitivity analysis, and similar results (with the same significant predictors: both of interest and exploratory) were found. Additionally, we ran a second post-hoc sensitivity analysis excluding those variables in which inequities were observed between missing and included cases; again, the overall results of the analysis (in terms of significant targeted and exploratory predictors) were unchanged.

2.3.3 Logistic Regression

Using the stepwise method described above, we entered established covariates, predictors of interest, and exploratory predictors into our hierarchical logistic regression model. During the conditional backwards elimination, the two exploratory predictors of disability status (β=.123, p=.12) and parental employment status (β=-.034, p=.70) were removed, and one, number of individuals residing in the home (β=.125, p=.007) remained in the model. We observed a significant improvement in model fit with the addition of frequency of family meals (χ^2 = 36.98, p <.001), and again with the addition of number of individuals residing in the home (χ^2 = 7.34, p =.007). The H-L goodness of fit test was not significant (χ^2 = 11.64, p =.17), which indicates that based on our model, there is a good match between our predicted and observed low fruit and vegetable intake. The chi-square value and -2LL for our overall model was significant (χ^2 = 68.08, p <.001), supporting the validity of this model providing a better prediction of low fruit and vegetable intake in preschoolers than the null model.

After controlling for the known covariates of child BMI, child race, mother's age, parent education and household income, frequency of family meals was found to predict low fruit and vegetable intake among preschoolers (See Table 2, Model 1). The odds of a preschooler demonstrating low fruit and vegetable intake were greater (OR=1.5, β=.376, p <.001) if his/her family typically shared less than three evening meals together or if his/her family shared three to six evening meals per week (OR=1.3, β=.232, p <.001), than a preschooler from a family that shared the evening meal together every night. After adding our exploratory variables to the model, frequency of family mealtime was still associated with low fruit and vegetable intake. Additionally, children residing in a home with four or fewer individuals were also found to have

greater odds of demonstrating low fruit and vegetable intake than those residing in a home with five or more individuals (See Table 2, Model 2). In both models, children from lower income families (<$25,000 annually) had greater odds of demonstrating low fruit and vegetable intake than children from families with higher income (>$75,000 annually).

2.4 DISCUSSION

The established nutrition benefits of frequent family meals across the lifespan (Fulkerson et al., 2014; Hammons & Fiese, 2011) are further supported in this study. This analysis demonstrated that observed relationships between frequency of family meals and fruit and vegetable intake in school-age children and adolescents are present in preschool age children in addition to older children (Hammons & Fiese, 2011). These new findings are important because they suggest that the frequency of shared family meals early in a child's life may help facilitate a foundation of healthy eating patterns, such as adequate fruit and vegetable intake. When children observe models (e.g. parents, peers) eating fruits and vegetables on a consistent basis, they are more likely to accept these foods (Horne et al., 2004). Furthermore, the presence of at least one parent during the evening meal is associated with decreased odds of low consumption of fruits and vegetables (Videon & Manning, 2003). Social modeling has been distinguished as a primary determinant of food intake and acceptance (Cruwys, Bevelander & Hermans, 2015); therefore, family meals may provide an ideal setting for the promotion of healthy food consumption.

Table 2: Logistic regression analysis to determine predictors of low fruit and vegetable intake

		Model 1			***Model 2***	
Variable	**OR**	**95% CI**	***p***	**OR**	**95% CI**	***p***
0-2 evening family meals/week (reference: 7 evening family meals/week)	1.46	1.24-1.71	**<.001**	1.46	1.24-1.70	**<.001**
3-6 evening family meals/week (reference: 7 evening family meals/week)	1.26	1.15-1.39	**<.001**	1.26	1.15-1.38	**<.001**
Households with 4 or fewer residents (reference: households with 5 or more residents)				1.13	1.03-1.24	**.008**
Covariates						
Child BMI	1.00	.98-1.01	.67	1.00	.98-1.01	.65
Age of resident mother	1.00	1.00-1.01	.25	1.01	1.00-1.01	.16
Highest parent education level						
≤ High school diploma (reference: ≥ college graduate)	1.08	.94-1.24	.27	1.11	.97-1.27	.14
Some college (reference: ≥ college graduate)	1.08	.96-1.23	.19	1.10	.97-1.25	.12
Household income						
≤ $25,000 (reference: > 75,000)	1.18	1.02-1.37	**.03**	1.17	1.01-1.36	**.04**
$25,001-75,000 (reference: > 75,000)	.92	.82-1.04	.19	.92	.82-1.03	.13
Child race						
Black (Non-Hispanic) (reference: White)	.99	.86-1.14	.91	.99	.87-1.14	.93
Hispanic, Asian, Other (reference: White)	1.06	.96-1.17	.24	1.06	.97-1.17	.21

Likelihood ratio test: χ^2 =68.08, p<.001; Hosmer-Lemeshow test: χ^2=11.64, p=.168; c=54.4%
OR: Odds Ratio; CI: Confidence Interval

Family meals may also be protective against feeding disorders, as they provide parents with the opportunity to notice differences in a child's eating patterns as they emerge, and address these issues before they become problematic (Neumark-Sztainer, Wall, Haines, Story, Sherwood & van den Berg, 2007). Children with low fruit and vegetable intake, at less than half of the daily recommended amount, are creating a pattern of nutritional deficiency that is likely to persist over time (Mascola et al., 2010; Lien et al., 2001; Lytle et al., 2000). Frequent family meals during the preschool years may improve early identification of these patterns, as it provides parents with the chance to notice which commonly offered foods their child is consistently refusing. While most research highlighting the benefits of family meals has focused on adolescents, there is evidence to suggest that the protective qualities of family meals observed in adolescents generalize to younger children (Campbell, Crawford & Ball, 2006; Hammons & Fiese, 2011). For these reasons, the psychosocial and health benefits of family meals for adolescents have been promoted within the media (Jayson, 2013; Neumark-Sztainer, Larson, Fulkerson, Eisenberg, & Story, 2010; Videon & Manning, 2003; Utter, Scragg, Schaaf, & Mhurchu, 2008), and the campaign to increase family-style meals for young children is also growing (Lifsey, 2015).

More research is needed to gain a better understanding of the specific benefits of family meals for preschoolers, and whether or not all "family meals" are created equal. For instance, in our model the covariate of household income was a significant predictor of low fruit and vegetable intake. This could signify that these families have limited time to prepare healthy meals or limited access to a variety of healthy (and typically more expensive) food options. These factors likely play a significant role in the likelihood that a preschooler demonstrates low fruit and vegetable intake. This finding is not surprising, as prior studies have demonstrated a link between accessibility to healthy or unhealthy foods and nutrition in adolescents (Boutelle,

Fulkerson, Neumark-Sztainer, Story & French, 2007; Laska, Hearst, Forsyth, Pasch, & Lytle, 2010; Powell, Chaloupka, O'Malley, & Johnston, 2007). Future studies might further explore what options are being served at meals and how food exposure or accessibility affects fruit and vegetable intake among preschoolers.

A limitation of this study, as well as many others on this topic (Fulkerson et al., 2014; Hammons & Fiese, 2011; Anderson & Whitaker, 2010), has been a lack of clarity regarding what exactly constitutes a "family meal." In this study, parents were simply asked how many nights per week their family "eats the evening meal together." We have no information on whether or not these families are sharing the same food, the context in which the meal is occurring, or what behaviors are being modeled during mealtime. Despite this lack of consistency, it is promising that family meals still appear to have a protective benefit against unhealthy eating patterns in preschoolers. While we found a significant association between low fruit and vegetable intake and less frequent family meals, the odds ratios were not large (1.3 and 1.5 respectively). Although these results are comparable or larger than the protective benefits of family meals found in prior research (Anderson & Whitaker, 2010; FitzPatrick et al., 2007), improved descriptors of family mealtime could provide guidance for developing and optimizing family-based interventions for improving nutrition among preschoolers. Moving forward, studies should strive to achieve a more specific definition of "family meals," as well as parse out which aspects of the family meal are most beneficial for the development of healthy eating patterns among young children.

An exploratory variable that was shown to predict low fruit and vegetable intake in this study was the number of individuals residing within a child's home, with fewer than five residents being associated with increased odds of low fruit and vegetable intake. We included

this exploratory variable because we proposed the presence of more individuals in the home may lead to increased opportunities to observe modeling of fruit and vegetable consumption. The theory of social facilitation during mealtimes may also provide insight into these results. When eating in a larger group, preschoolers have been found to eat 30% more than when eating in a smaller group (Lumeng & Hillman, 2007). It has been proposed that larger group settings stimulate arousal and activation of children; therefore, they eat larger quantities at a faster rate (DeCastro, 1990). Perhaps if children are eating more in general, they are more likely to consume fruits and vegetables. Although, our database does not provide sufficient data to specifically investigate whether eating in a larger group leads to greater intake of fruits and vegetables, social facilitation theory allows us to postulate why a higher number of individuals residing in the home appear to be protective against low fruit and vegetable intake. Future research is needed to clarify the relationship between number of individuals present during meals and fruit and vegetable consumption in young children.

Optimizing opportunities to enhance shared family meals for young children is a promising method to promote healthy eating patterns that warrants further investigation. Children who eat a variety of fruits and vegetables during early childhood are likely to continue choosing these foods throughout adolescence and into adulthood (Mascola et al., 2010; Lien et al., 2001; Lytle et al., 2000). Given that a child's willingness to try new foods declines after the age of five, which encompasses a theorized critical period of development for taste preferences, it is crucial that the acceptance of a wide variety of healthy foods is prioritized early in life (WHO, 2015; Karnik & Kanekar, 2012; Skinner et al., 2002). Effective interventions that promote child fruit and vegetable intake prior to the age of five are needed to support the movement to prevent obesity and related chronic conditions (such as cardiovascular disease and

diabetes) in later childhood. In order to build robust interventions, future research is needed gain a better understanding of the therapeutic benefits of family meals and social interaction as well as the role that exposure to healthy foods plays in the development of eating patterns among preschoolers.

3.0 FEASIBILITY AND ACCEPTABILITY OF THE MEALTIME PREP INTERVENTION

3.1 INTRODUCTION

Limited dietary variety is a common concern expressed by the parents of young children that often leads to physician visits and conflict within the family unit (Jacobi et al., 2003; Zucker et al., 2015). Most often, a child's diet is restricted by picky-eating behaviors, which peak during the toddler years. Per caregiver report, prevalence of picky eating at the age of two has been estimated to be as high as fifty percent of children (Carruth et al., 2004). Moderate levels of selective, or picky, eating have been linked to depressive symptoms, anxiety, and hypersensitivity to external stimuli among preschoolers (Zucker et al., 2015). These findings suggest that parental concerns of mealtime dysfunction and picky eating in early childhood are justified and that these children should be referred for appropriate treatment. While some children will outgrow these problematic feeding behaviors, children who demonstrate strong likes and dislikes and are unwilling to try new food are more likely to demonstrate persistent picky eating habits (Mascola et al., 2010). Because children are more likely to try new foods prior to the age of 5 (Skinner et al., 2002), it is essential that these children receive early intervention to maximize potential benefits in food acceptance. Food preferences developed

during this critical stage of development are likely to carry forward into adulthood (Mascola et al., 2010; Lien et al., 2001; Lytle et al., 2000).

Children with Sensory Food Aversions (SFA) may be at even greater risk for health issues than other "picky-eaters" because they refuse specific foods based on sensory characteristics of the food and demonstrate oral-motor delays and/or nutritional deficiencies (Zero to Three, 2005). These children are less likely to outgrow picky eating habits because, to meet the diagnostic criteria for SFA, they must demonstrate strong likes and dislikes (based on sensory characteristics) and likely refuse novel foods (Mascola et al., 2010; Zero to Three, 2005). Commonly, children with SFA refuse fruits and vegetables (Chatoor, 2009), which could increase their risk for obesity, cardiovascular disease and diabetes later in life (Cooke et al., 2003). Furthermore, children with SFA often eat alone (Chatoor, 2009) and, consequentially, have limited access to positive social influences that could significantly influence their mealtime behaviors (Addessi et al., 2005; Cruwys et al., 2015). Current therapist-led interventions have improved acceptance of and preferences for specific foods targeted during treatment, but have failed to increase overall dietary variety (Marshall et al., 2015).

Interventions based on the Person-Environment-Occupation (PEO) Model may facilitate improved dietary variety on a daily basis. PEO is a theoretical framework that is used to carefully examine the transactional components of a person, their environment and the occupation, or task, in which he/she is engaged (Law et al., 1996). Application of this framework allows clinicians to assess and treat feeding dysfunction by evaluating and optimizing the fit between the child (and family), the occupation of eating, and the environment. Any, or all, of these components may require changes or adaptations to facilitate optimal performance and participation in daily meals. This model is particularly helpful to enhance engagement within the

natural environment and facilitate alliances between the client and clinician (Strong et al, 1999). Therefore, it is well-suited to guide the development of interventions that are family-based and delivered within the context of the child's typical routines. The PEO model allows the clinician to embed recognized intervention techniques into already established routines. Enhancing daily routines will, theoretically, support the generalization of targeted food acceptance to a variety of foods more consistently. Through the lens of PEO, it becomes apparent that it is impossible to alter mealtimes for young children without close collaboration with parents. Parents coordinate the occupation of eating and organize the environment in which child meals take place. Therefore, parental participation is crucial to the success of this type of intervention, as parents will be responsible for intervention delivery, altering mealtimes and providing a supportive environment every day.

Successful parent-training strategies include direct instruction, home practice, discussion, role-play, and feedback (Bearss et al., 2015; Perrin, Sheldrick, McMenamy, Henson, & Carter, 2014). These strategies have yielded parent-led interventions that effectively improve behaviors and language skills in toddlers, preschoolers and school-age children (Bearss et al., 2015; Skotarczak & Lee, 2015; Perrin et al., 2014; Beaudoin et al., 2014; Weinberg, 1999). While positive outcomes have been observed, evaluation of parental treatment fidelity is often limited to self-report. Furthermore, parents frequently report difficulty finding ways to alter and/or build new routines when implementing these interventions (Golley et al., 2011).

Behavioral activation is a treatment approach that is effective at helping individuals establish new, healthy routines (Cuijpers et al., 2007). Behavioral activation is based on the premise that meeting small, attainable goals motivates individuals to meet the next goal when working to perform a more complex set of tasks (Wallbridge, Furer, & Lionberg, 2008). While

this method has been acknowledged as a robust mechanism of change in rehabilitative interventions, it has not yet been applied to parent-training in this population. There are four main principles associated with BA; they include goal-setting, skill training, activity scheduling and activity monitoring (Kanter et al., 2010). We predicted that application of this novel approach to parent-training would create opportunities to incorporate treatment strategies on a daily basis, when it matters most, during mealtimes. By incrementally introducing one intervention component at a time, we anticipated that parents would build confidence in their ability to provide a complex intervention while gradually increasing their skills.

The purpose of this study was to determine the feasibility and acceptability of a behavioral activation approach to training parents to deliver techniques of a complex feeding intervention for children with Sensory Food Aversions. Specifically, this study aimed to describe parental adherence to and acceptance of the Mealtime PREP (Promoting Routines of Exploration and Play) feeding intervention as well as inform intervention optimization and specification for the development of future studies.

3.2 METHODS

We recruited participants through flyers given to families by county-wide early intervention providers and primary care physicians, as well as from social media advertisements over a seven-month time frame. We obtained informed consent from at least one parent for participation (self and child) in the study using approved institutional review board procedures. Children were screened for the following inclusion criteria: (1) meeting all four criteria of Sensory Food

Aversions (see Table 3), as described in DC:0-3R (Zero to Three, 2005) and determined by an occupational therapist; (2) having at least one parent fluent in English and able to read at the 6th grade level to follow written and verbal protocol instructions. Children currently receiving occupational therapy services for feeding issues were excluded from participating in this study. We used a single-case experimental design (SCED) with multiple replications to collect rich data to inform modification of this novel intervention approach (Horner et al., 2005). This design was replicated over multiple participants to allow us to explore the effects of this intervention across participants. Because carry-over of intervention effects was not only expected, but desired, this study followed an ABB^1 (see Table 4) SCED, with each phase anticipated to include 10 video-recorded meals.

Table 3. Criteria for Diagnosis of Sensory Food Aversions

1. Consistently refuses to eat specific foods with specific tastes/textures and/or smells.
2. Onset of food refusal occurs during the introduction of a novel type of food.
3. The child eats without difficulty when offered preferred foods.
4. The food refusal causes specific nutritional deficiencies or delay of oral motor development.

Table 4. Phases of the SCED

A- Baseline	Parents are instructed to record typical child mealtimes, in the context that they normally occur (usually the home). Parents aim to video-record ten child meals over a 10-14 day timeframe.
B- Parent-Training	Parents are trained to deliver child-focused active ingredients, one at a time, using a behavioral activation approach. Occupational Therapist holds four parent-training sessions, using the active ingredients of behavioral activation to facilitate parent behavior change and implementation of new routines. As parents are being trained, they practice delivering the active ingredients during daily meals and video-recording these parent-led family meals. Parents aim to video-record ten child meals over a 10-14 day timeframe.

Table 4. (continued.)

B[1]-Family Autonomy	Therapist support and parent-training are withdrawn. Family independently delivers the child-focused active ingredients in the home. Parent(s) aim to video-record ten child meals in which they implement the child-based portion of the Mealtime PREP intervention over a 10-14 day timeframe.

3.2.1 Intervention

All intervention sessions were delivered in the home of the participant, within the families' natural mealtime environment. All parent-training sessions were led by the same licensed occupational therapist (also the principal investigator of this study) with over eight years of clinical experience in pediatrics. At the onset of the intervention phase, the family collaborated with the treating therapist to categorize foods commonly offered at mealtimes as "preferred" or "targeted." Preferred foods are those the child accepts most of the time, whereas targeted foods are those the parent would like the child to eat, but are not currently accepted, or refused after the first bite. Parents were instructed to offer at least one preferred and one targeted food per meal, and to refrain from offering food and beverages, except water, in the hour directly before the video-recorded mealtime. Parents were also instructed to refrain from having the television on and using cell phones during meals.

The Mealtime PREP (Promoting Routines of Exploration and Play) intervention is a two-pronged intervention that was developed to promote behavior change in the parent participant(s) and the child participant. The PEO framework (Law, 1996) provides the overarching framework that guides this intervention approach with a dyadic focus on both the parent(s) and the child. Because parents play a primary role in determining a young child's food choices and establishing a mealtime environment, changing the way they organize a child's mealtime experience is vital

to achieving successful child feeding outcomes. Therefore, the Mealtime PREP intervention has been designed to train parents to embed techniques to improve child food acceptance into scheduled family meals.

3.2.1.1 Mealtime PREP - Parent Experience: Parents were trained to implement new mealtime routines designed to facilitate improved feeding outcomes for their children. Parent-training took place during four therapist-led sessions that occurred during the parent-training (B) phase of the study. Each session included the following behavioral activation principles, delivered to the parent as active ingredients to promote follow-through and alter daily mealtime routines:

1. Goal-Setting: At the onset of parent-training, the parent(s) and occupational therapist collaborated to set an overarching functional goal for treatment. During each parent-training session, the parent(s) and therapist collaborated to make a "plan" for practice. This plan was essentially a goal to practice incorporating skills into each meal (See Appendix A.1).
2. Skill Training: Each of the first three sessions, a new active ingredient of the child-focused treatment was introduced (*Family Meals, Positive Reinforcement, Food Exploration and Play*). After written and verbal education was provided, the family was given the opportunity to practice these skills during a meal with the occupational therapist. If this was not possible, role-play and discussion about the technique occurred between the therapist and parent(s). Feedback was provided by the therapist as appropriate.

3. Activity Scheduling: The parent(s) and occupational therapist scheduled meals over the next 3-4 days to practice (and video-record) meals.
4. Activity Monitoring: Parents kept a daily log of foods offered during each meal and noted if the child or family experienced anything unusual that day. They video-recorded each meal that Mealtime PREP intervention strategies were implemented.

Consistent with the behavioral activation approach, parents were trained to deliver each child-focused, treatment component one at a time, to provide opportunities for successful performance before adding complexity to the routine (see Figure 1).

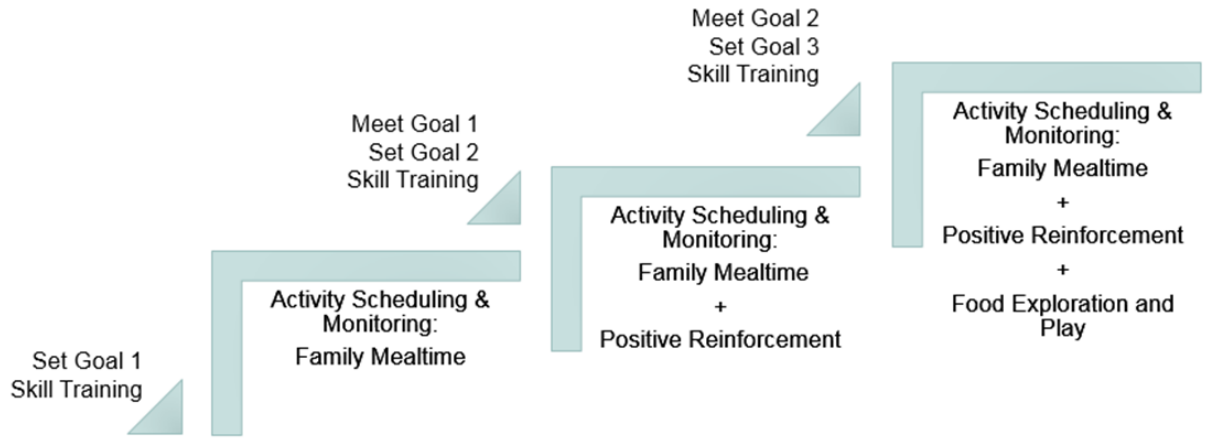


Figure 1: Behavioral Activation Approach: Parent-Training in Mealtime PREP Intervention

During each parent-training session, the occupational therapist worked with each family to create achievable goals. While it was anticipated that each family would achieve their goal and create another at the next parent-training session, the flexibility of SCED allowed each family to progress through goals at their own pace. Parent-training was completed using a combination of direct instruction, discussion, written education materials, demonstration, and

home practice during mealtimes with immediate and delayed verbal feedback. For some families, home practice in the presence of the therapist was not possible; in these instances, role modeling and feedback was provided based on parental report of experiences (both positive and negative) during mealtimes. The fourth session served as a wrap-up session where all of the active ingredients to improve child feeding outcomes were reviewed, questions were answered, and discussion focused on how to overcome barriers and continue with the new family meal routine. This session also served as a chance to introduce one more child-focused active ingredient (in case a family had not progressed through all of the training) and receive final feedback. In order to facilitate therapist intervention adherence during parent-training sessions, the same occupational therapist led all sessions and used work-book style written education with prompt boxes (see Appendix A.1), and a checklist incorporated into a daily note (see Appendix A.2), to guide intervention through a similar progression with each family. Each parent-training module was planned to be completed within a one-hour intervention session.

3.2.1.2 Mealtime PREP - Child Experience: Children participated in family meals enriched with the active ingredients of social modeling (*Family Meals*), operant conditioning (*Positive Reinforcement*), and repeated exposure (*Food Exploration and Play*) during daily family meals. Parent(s) embedded these intervention components into routine family meals one at a time, as they were being trained to deliver them. In other words, initially, social modeling during a new *Family Mealtime* routine was the only intervention component incorporated into child meals. If the parent was able to successfully meet their goal of delivering this component, they were trained to integrate *Positive Reinforcement* into this newly established *Family Mealtime* routine. *Food Exploration and Play* was the last active ingredient to be incorporated into daily routines.

The PEO model served as a framework when developing this child-focused prong of intervention, with an evidence-based active ingredient addressing each of the three concepts (person, environment and occupation) of this model in an effort to achieve optimal performance in food acceptance, mealtime behavior, and dietary variety (See Figure 2).

A structured *Family Mealtime* was developed to promote interaction with food in a predictable environment. The occupational therapist and parent(s) collaborated to create a routine customized to the environment and unique needs of each family. Every routine included a predictable schedule of events for the meal, "family-style" serving where food is passed around the table and placed within sight throughout the meal, active child participation in either mealtime preparation or clean-up, and specified activities that signified the beginning and end of each meal. The learning plate (Toomey, 2013) was introduced, and parents were encouraged to describe sensory features of food placed onto this community plate. This plate was only used for children who could not tolerate specific foods being served directly onto their own plates. They were given the option to serve a portion onto a community plate placed in the middle of the table and learn about the size, shape, color and taste of through discussion.

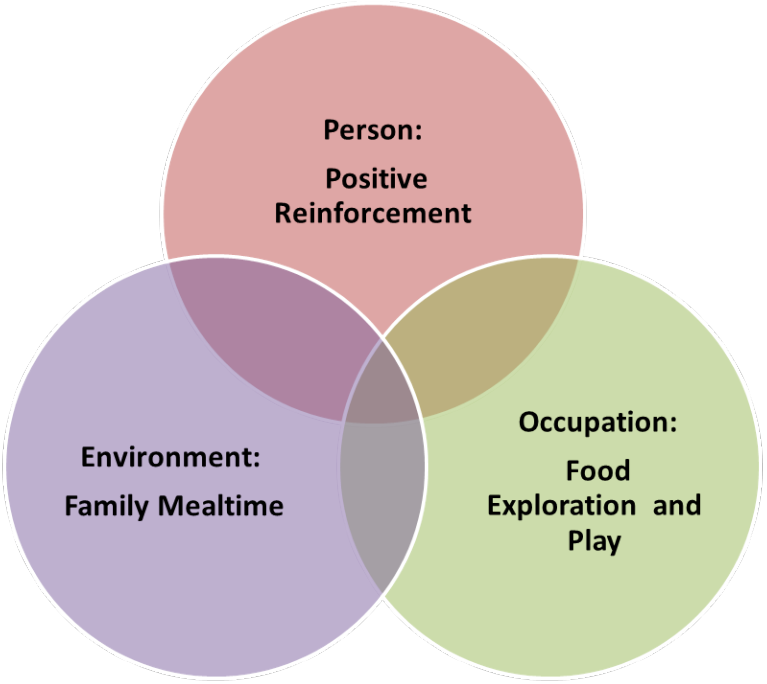


Figure 2. Active Ingredients of Mealtime PREP Intervention Mapped onto the PEO Model

Mealtime behaviors were managed using the principles of operant conditioning, and the theory that behavior is controlled by its consequences (Skinner, 1938). Specifically, our intervention emphasized the use of *Positive Reinforcement,* the concept that behavior is reinforced by consequences that are rewarding (Skinner, 1938). *Positive Reinforcement* is effective at improving acceptance of targeted foods and mealtime behaviors in children (Gentry & Luiselli, 2008; Horne, Lowe, Fleming, & Dowey, 1995). However, offering obvious rewards (such as stickers, tokens, and bubbles) to eat a specific food may actually devalue the food, leading to increased acceptance, but decreased preference for that food (Wardle, Herrera, Cooke, & Gibson, 2003a). Consequently, parents were trained to positively reinforce food acceptance and appropriate mealtime behavior with verbal praise, smiling and eye contact. Using reinforcers (e.g. praise, clapping) that fit more naturally into a typical mealtime experience, and rewarding exploration of both targeted and preferred foods, was encouraged to improve food acceptance

without the risk of devaluing targeted foods. Parents were also trained to redirect inappropriate behaviors to acceptable alternatives, and reinforce this alternate behavior. For example, if a child frequently threw food during the meal, he/she was redirected to push the food away from them or put it in a scrap bowl instead of throwing it. If he/she chose to complete this alternate behavior, *Positive Reinforcement* was provided. Negative language, punishment and/or threats were discouraged.

Repeated exposure alone is effective at improving preferences for and acceptance of targeted food in children (Cooke, 2007). This strategy was incorporated into our intervention through *Food Exploration and Play*. In typical children, availability and exposure to a wide variety of foods is important for building healthy eating patterns (Couch, Glanz, Zhou, Sallis, & Saelens, 2014). Children with Sensory Food Aversions may respond better to a modified exposure plan that gradually increases the intensity of experiences with new or frequently refused foods. Graded exposure to targeted foods is a common tool used by occupational therapists to systematically increase a child's ability to interact with a specific food (i.e. exposure across the table → exposure passing serving dish → exposure on plate; Toomey, 2010). Parents were educated on the importance of grading exposure for children with Sensory Food Aversions. They were trained to gradually increase interaction with food through *Exploration* of sensory characteristics and *Play* to facilitate positive, child-initiated, food acceptance. Parents were provided with a list of different ways to interact with food and the relative intensity of each type of exposure (Toomey, 2010).

3.2.2 Measures

3.2.2.1 Mealtime PREP – Parent Experience: Therapist-led intervention feasibility was assessed as the number of parent-training sessions held, intervention adherence of the therapist, ability to observe family meals and provide direct feedback in the home environment, and duration of each parent-training session. Therapist intervention adherence was assessed by reviewing checklists that were completed at each visit by the treating occupational therapist (who is also the P.I of this study). Daily documentation also included data regarding whether the therapist was able to participate in a family meal, or if practice was completed using role-play (See Appendix A.2).

3.2.2.2 Mealtime PREP – Child Experience: Parent-led intervention feasibility was assessed by number of parent-led meals recorded, adherence to intervention protocol, and treatment acceptance. Parents were instructed to video-record one child meal per day during each phase. We decided a priori that we would aim for each family to record and participate in ≥ 8 intervention sessions during the B and B^1 phases.

Intervention *adherence* was determined using intervention fidelity checklists developed to reflect the main concepts of each active ingredient parents were trained to deliver (see Appendix B.1). Fidelity checklists were completed by the treating occupational therapist (also the principal investigator: 64%), a trained master of occupational therapy graduate student (26%), or both raters (10%) through video review of parent-led meals during all three phases. This checklist was refined for reliability after both the occupational therapist and graduate student rated the fidelity of five meals and compared results. Changes were made to improve

clarity and eliminate repetition of overlapping treatment concepts. After revisions were made, the two-raters were able to come to consensus for all items on the updated fidelity checklist for each of these initial five videos examined. One video per phase was randomly selected (using a random number generator) to be assessed by both raters to determine inter-rater reliability. The feasibility benchmark of achieving 75% parental adherence to intervention techniques during the family-autonomy (B^1) phase was set prior to study initiation.

Treatment acceptance was assessed through parental completion of the Treatment Acceptability Questionnaire (TAQ) after the parent-training (B) and family autonomy (B^1) phases. The TAQ is and adapted version of the Abbreviated Acceptability Rating Profile (AARP), but has been slightly modified for improved applicability to parents (as opposed to educators). The TAQ has been found to have good internal ($\alpha = .97$) and construct validity (Krain, Kendall, & Power, 2005). Higher scores on the TAQ signify better acceptance of a given intervention. Based on developed standards, we designated a score of >28/48 to signify that this intervention was an acceptable treatment option for parents (Tarnowski & Simonian, 1992).

Ability to collect essential outcome measures in the home was calculated as percentage of measures collected out of those that were planned. Essential outcome measures included those of treatment acceptability, video-recorded meals, and child feeding outcomes. The benchmark of collecting >90% of essential outcome measures was set a priori to meet our anticipated level of feasibility. Feasibility data were also collected to describe recruitment and duration of parent-led intervention sessions. No benchmarks were set regarding these exploratory measures. They were assessed to inform the development of future studies and gain a better understanding of the length of child meals with and without the Mealtime PREP intervention.

3.2.3 Data Analysis

We employed descriptive statistics, including raw scores, percentages and frequencies, to assess therapist intervention adherence, parental intervention adherence, number of sessions held (both therapist-led and parent-led) and treatment acceptance. We also used these same descriptive statistics to analyze our ability to collect essential outcome measures in the home and describe recruitment and intervention delivery characteristics. The Intra-class Correlation Coefficient was calculated to determine the intervention fidelity checklist inter-rater reliability for the randomly selected meals from each phase that both raters reviewed. This measure of reliability is appropriate for ratio data with two or more raters, and takes into consideration the magnitude of disagreement (Hallgren, 2012).

3.3 RESULTS

Thirteen families were successfully recruited through referral from primary care pediatricians and early intervention professionals, social media advertisements and flyers posted in local daycare facilities over a six-month period. One family was screened for eligibility and did not meet inclusion criteria (did not demonstrate an oral motor delay or risk of nutritional deficiency), and one family decided not to participate after eligibility was confirmed. Therefore, eleven children, ranging in age from 19 to 35 months, and their parents initiated study participation and all eleven dyads completed the study. The children in our sample were white (100%), resided with both parents (100%), and were nearly equally distributed between genders (64% male).

About half of our child participants had one sibling (55%), about half demonstrated an oral motor delay (55%), and a majority of child participants were at risk for nutritional deficiency (73%). The parents in our sample were highly educated, with 95% having a bachelor's degree or higher, and household income ranged from middle to high (55% earning >$100,000 annually; See Table 5).

3.3.1 Mealtime PREP – Parent Experience

Each parent participant participated in four parent-training sessions with the occupational therapist. Using a checklist to guide treatment, the therapist demonstrated excellent adherence to the parent-training intervention (100% of planned behavioral activation principles employed). All eleven parent participants progressed through the training and were able to be trained on all three components of the parent-led intervention (Family Meals, Positive Reinforcement, and Food Exploration and Play). Five out of the eleven families were able to practice treatment delivery during family meals while the therapist was present. On average, each parent-training session lasted 63 minutes (range = 40 – 80 minutes). The first session, introducing *Family Meals* and creating a routine, tended to be the longest (mean = 71 minutes), while the second session (a behavior management) was, on average, the shortest (mean = 52 minutes).

Table 5. Participant Demographics

	N	Percent
Age (months)		
18-23	5	45
24-29	2	18
30-35	4	36
Gender		
Male	7	64
Race/Ethnicity		
White (Non-Hispanic)	11	100
Number of Siblings		
0	5	45
1	6	55
Household Income ($)		
50,001 – 100,000	5	45
> 100,000	6	55
Parental Marital Status		
Married	22	100
Mother Age		
25-29	2	18
30-34	7	64
35-39	2	18
Mother Education		
Associates/Bachelors	7	64
Masters	2	18
Doctoral	2	18
Mother Employment		
Part-time	2	18
Full-time	8	73
Father Age		
25-34	4	45
$\geq$ 35	5	55
Father Education		
Bachelors	4	45
Masters	3	33
Medical	2	22
Father Employment		
Full-time	11	100
Oral Motor Delay	6	55
Risk of Nutritional Deficiency	8	73

3.3.2 Mealtime PREP – Child Experience

On average, parents led approximately ten mealtime intervention sessions during the parent-training (B) and family autonomy (B^1) phases (See Table 6). This met our target of at least eight intervention sessions for each of these phases. Every family that participated in the study was able to meet this benchmark of eight intervention sessions per phase. In terms of intervention adherence, parents employed approximately 64% of learned intervention techniques during the family autonomy phase. Although this did not meet our a priori benchmark of 75%, it was an increase of 36 percentage points from baseline, when adherence to the Mealtime PREP intervention components was only 28%. Adherence to the intervention components during the family autonomy phase ranged from 44% to 84%, with three families meeting the target of 75% adherence. Interestingly, our greatest level of parent intervention adherence was observed during the parent training stage (68%) even though parents were trained on one intervention component at a time. Nearly half of our sample (five families) averaged 75% adherence to the intervention during the parent-training phase. Inter-rater reliability of adherence (for the 33 meals rated by both raters) was determined to be excellent according to established standards (Hallgren, 2012), with an ICC of .791 (95% CI= .575-.897).

Following the family autonomy phase, average treatment acceptance was rated at 43 out of a possible 48 points. Overall, treatment acceptance remained steady following the parent-training and family autonomy phases, with the average in both of these phases at 43/48. This well surpassed our treatment acceptability benchmark of 28/48. Directly following parent-training (B), treatment acceptance ranged from 32/48 to 48/48, signifying that each individual family met our benchmark for treatment acceptance during this phase. At study completion

(following the family autonomy phase – B^1), treatment acceptance ranged from 26/48 to 48/48, with all but one family meeting our benchmark of acceptability set at 28/48.

Table 6. Descriptive Statistics of Intervention Feasibility

	Mean	SD	Benchmark	Achieved
Number of Sessions Completed				
Baseline	**10.18**	0.87	**≥8**	**YES**
Parent Training	**10.27**	1.90	**≥8**	**YES**
Family Autonomy	**9.55**	1.37	**≥8**	**YES**
Overall	30.00	4.14		
Parental Adherence				
Baseline	28.00%	8.24		
Parent-Training	67.93%	12.13		
Family Autonomy	**63.93%**	11.98	**≥75%**	**NO**
Overall	53.24%	7.82		
Treatment Acceptance (TAQ raw)				
Post Parent-Training	**43.36**	4.39	**≥28**	**YES**
Post Family Autonomy	**42.82**	7.05	**≥28**	**YES**
Overall	42.60	5.53		
Mealtime Length (minutes)				
Baseline	16.29	4.29		
Parent-Training	18.30	5.17		
Family Autonomy	18.23	5.20		
Overall	17.20	4.16		

We were able to collect and analyze data on 100% of essential outcome measures for all participants that initiated study participation. This exceeded our expected benchmark of collecting 90% of these outcomes. All families that participated in the study protocol completed all three phases and the outcome measures for all three time points.

Average mealtime length during intervention sessions was similar for both parent-training and family autonomy phases, averaging approximately 18 minutes per meal for each of

these phases. This was, on average, two minutes longer than each meal lasted during the baseline phase (See Table 6). During the baseline phase, mealtime duration ranged from 2 minutes and 30 seconds to 34 minutes and 43 seconds; alternately, duration ranged from 2 minutes 31 seconds to 52 minutes 12 seconds during the intervention phases.

3.4 DISCUSSION

Our data suggest that it is feasible to recruit parents and children with Sensory Food Aversions and deliver the Mealtime PREP feeding intervention in the home. Furthermore, it is feasible to collect data on child feeding outcomes within the natural context of the child's daily meals. Each family met our feasibility benchmark of participating in and video-recording at least 8/10 planned parent-led meal sessions in each of the intervention phases. The occupational therapist was able to complete all parent-training within the home environment, and was able to provide feedback on child-focused intervention delivery to the parent participants of five families during actual family meals. Providing intervention and feedback in the natural context, during regularly scheduled meals, allows the therapist to observe real-world barriers to intervention delivery, and work with the family to find solutions. Parents were open to this approach and deemed the Mealtime PREP intervention package to be an acceptable treatment for their children.

While we did not meet the benchmark of 75% parental adherence to intervention techniques during the family autonomy (B^1) phase, data suggest that changes were made to mealtime routines during the parent-training phase, and that most of these changes were maintained during the family autonomy phase. Each family demonstrated increased adherence to

the child-focused Mealtime PREP intervention techniques after parent-training was initiated. This signifies that the behavioral activation approach was successful at helping parents implement new routines and shift mealtime practices in the home. These fidelity data lead to a number of hypotheses and research questions for future research to address. Decreased parental adherence during the family autonomy phase suggests that frequent contact with a therapist may be an important component to maintaining newly established routines. Future research should examine whether continuing parent-training until specific competency criteria are achieved would enhance parental adherence during the family-autonomy follow-up period. Other options, such as a "booster session" scheduled midway through the family autonomy phase, also require further investigation to optimize fidelity to the Mealtime PREP intervention during the period immediately following parent-training.

Moreover, decreased parental adherence to the intervention protocol after therapist support is withdrawn may foreshadow limited carry-over of techniques over time. In addition to examining the dose of the therapist-led, parent-training, prong of the Mealtime PREP intervention package, longitudinal surveillance (at 3, 6 and 12 months post-training) is needed to determine which components of the intervention assimilate into daily routines on a long-term basis, and which ones fade over time.

Based on subjective feedback from participants, we suggest that the slight decline in parental adherence during the family autonomy phase may also be related to improved parental confidence to manage child behavior and mealtimes. Repeatedly, families expressed feelings of better control over mealtimes and the ability to employ strategies that they deemed appropriate for their child or lifestyle. This subjective feedback suggests that there may be an opportunity for further intervention customization during the parent-training phase. After completing training

and practice of each intervention component, an additional parent-training session could support intervention optimization through collaboration between the therapist and family to address barriers. By allowing parents another opportunity to participate in intervention refinement (through omission or adaptation of intervention techniques), we anticipate better congruence between the person (family), environment and occupation and improved parent intervention adherence.

We intentionally decided not to structure the length of mealtimes during this study in an effort to gain a better understanding of how the Mealtime PREP intervention meshed into different family routines. We learned that there is great variability in the length of mealtimes both within and between families. Typical mealtimes of toddlers are, on average, 20 minutes long (Reau et al., 1996), and while our average mealtime during intervention was just under this time (18 minutes), we observed child meals that ranged in length from 2-52 minutes. Future research is necessary to determine what, if any, outcomes are associated with mealtime duration. This could guide intervention optimization through the determination of mealtime duration that best supports improved child feeding outcomes.

We only screened one child for participation in this study who did not qualify. The reason he did not qualify was lack of an oral motor delay or risk of nutritional deficiency; thus, he did not meet the criteria of Sensory Food Aversions. Since beginning this study, a new test has emerged to determine which children are at highest risk to become persistent picky eaters. This simple test is based on how caregivers answer three questions: 1) Is your child a picky eater? 2) Does he/she have strong likes and dislikes? 3) Is he/she willing to try new foods? The answers, 1) “yes”; 2) “yes”; and 3) “no” indicate a child that is unlikely to “outgrow” picky eating behaviors. This test has demonstrated adequate sensitivity and specificity, and may be a more

efficient and less restrictive way to screen children for participation in future studies (Toyama & Agras, 2016). We feel this pragmatic intervention approach could benefit children who do not meet the criteria for SFA, therefore less conservative inclusion criteria may be reasonable.

In conclusion, the results of this feasibility study suggest that the Mealtime PREP feeding intervention is feasible and acceptable to parents of children with Sensory Food Aversions. This study was innovative in that we used a novel approach to parent-training and collected data on parental delivery of intervention techniques in the home, without the presence of research personnel. This work can be used to inform future studies on parent-training to better understand the feasibility and effects of parent-mediated intervention employed within the natural environment. Furthermore, future, large-scale, trials are warranted to determine the effectiveness of the Mealtime PREP feeding intervention for young children with restricted diets. If successful in children with SFA, this intervention could potentially promote improved nutrition and minimize risks associated with poor dietary variety among children in general.

4.0 PRELIMINARY EFFECTS OF THE MEALTIME PREP FEEDING INTERVENTION

4.1 INTRODUCTION

Approximately 50% of all children are considered picky eaters at some point during early childhood (Carruth et al., 2004; Cano et al., 2015). While many of these children will outgrow this behavior pattern without intervention, children with Sensory Food Aversions (SFA) are less likely to progress without treatment due to their inability to try new foods and strong taste preferences (Mascola et al., 2010; Toyama & Agras, 2016). Children with SFA often avoid entire food groups, commonly fruits and vegetables (Chatoor, 2009). Due to the global obesity epidemic, the World Health Organization (2015) has recommended interventions that promote healthy dietary variety and physical activities early in life. While established interventions have been successful at improving acceptance of specific foods targeted during treatment (Gentry & Luiselli, 2008; Wardle et al, 2003a), evidence to support interventions that improve dietary variety overall is lacking (Marshall et al., 2015). Embedding evidence-based intervention strategies into a child's natural daily routines has the potential to promote improved food acceptance, mealtime behaviors, and dietary variety in young children with SFA.

Recognized techniques that have been shown to improve food acceptance and mealtime behaviors in children include positive reinforcement, repeated exposure, and using social

modeling (Gentry & Luiselli, 2008; Wardle et al., 2003a; Cruwys et al., 2015). Positive reinforcement is a behavioral modification principle based on the theory of operant learning, which states that behavior is controlled by its consequences (Skinner, 1938). Specifically, positive reinforcement is a strategy used to increase desired behaviors, such as trying novel foods, by ensuring these behaviors are followed by positive consequences. Positive reinforcement has been effective at increasing acceptance of non-preferred or targeted foods in children who are selective eaters (Gentry & Luiselli, 2008; Horne et al., 1995). Using natural reinforcers (verbal praise, clapping, or high fives) for exploration and trying food options (both preferred and targeted) supports sustainable behavior change and contributes to a positive mealtime experience for all.

The next recognized technique, repeated exposure to a specific, or targeted, food has been shown to improve intake and preferences for that specific food (Wardle et al., 2003a, Wardle, Cooke, Gibson, Sapochnik, Sheiham & Lawson, 2003b). This technique is based on the theory of "learned safety," wherein a child becomes more and more comfortable accepting a food that they have tried in the past without ill effects (Kalat & Rozin, 1973). Similarly, sensory education programming to increase comfort with foods has been shown to improve long-term preference of specific foods (Reverdy, Shilich, Koster, Ginon & Lange, 2010). In summary, repeated exposure and sensory education about targeted foods has been shown to be effective at increasing food acceptance and preferences for those specific, targeted foods.

Social modeling is a third recognized technique to improve food acceptance, it has been established that social influences play a significant role in the development of mealtime behaviors for young children (Addessi et al., 2005; Cambell et al., 2006; Cruwys et al., 2015). Opportunities to observe social influences are limited when children eat alone. While the family

meal is an ideal venue for children to be exposed to positive mealtime influences (Hammons & Fiese, 2011), many families find it easier to cook separate meals for their young child with SFA (Chatoor, 2009). In addition to providing a foundation for social learning, we have shown that low frequency of family meals is associated with low fruit and vegetable intake in young children (see Table 2). The potential benefits of family meals may extend beyond healthy eating, as they have been linked to decreased odds of obesity in children (Hammons et al., 2011) and increased family connectedness (Resnick et al., 1997). Therefore, we predict that embedding positive reinforcement and repeated exposure to food within a consistent family meal routine will lead to improved food acceptance, dietary variety and/or mealtime behaviors for young children with SFA.

The purpose of this study is to estimate the feeding outcomes (food acceptance, dietary variety, mealtime behavior, and nutrition) of the Mealtime PREP intervention for children with Sensory Food Aversions. Specifically, we aim to gain a better understanding of what benefits we might expect to observe in children with SFA through implementation of the Mealtime PREP intervention package. Because our intervention is embedded within structured family meals, we also anticipate increased frequency of family meals.

4.2 METHODS

This study followed a single-case experimental design (SCED) with multiple replications. We used an A-B-B^1 design to collect data during baseline (A), as parents were being trained (B), and when each family was independently delivering the Mealtime PREP intervention on a daily basis

(B^1). In addition to repeated observations within each SCED, outcomes were also collected at baseline and after each intervention phase. Eleven families, recruited through local early intervention agencies, primary care physician referral, and advertisements within the community and on social media, completed the study. To be included in the study, child participants had to be between the ages of 18 and 36 months, meet all four diagnostic criteria of Sensory Food Aversions (see Table 3), and have at least one parent who could speak and read English at a 6th grade level. Children currently receiving occupational therapy services for feeding issues were excluded from participation. All procedures were IRB approved and at least one parent provided consent for participation (self and child).

4.2.1 Primary Outcome Measures

Food acceptance was assessed through observation of video-recorded meals as percentage of bites of targeted food consumed, in relation to total number of bites (preferred + targeted) consumed. "Bite" was operationalized to include any single event when the child accepted food into his/her mouth, and it did not come back out of the oral cavity. "Preferred foods" were identified prior to intervention by caregivers as those the child will eat 90% of the time. "Targeted foods" were also identified prior to treatment as those frequently offered during meals, but that the child refuses to try or refuses after one bite. Video-recorded meals were rated for bites by the treating occupational therapist (also P.I. of this study: 64%) and a trained graduate student enrolled in a master of occupational therapy program (26%). Both raters completed ratings of ten percent (33) of the video recorded child meals to determine inter-rater reliability.

Child mealtime behaviors, parental perception of problems, and parental feelings related to child mealtime behaviors were collected via parent-report using the Behavioral Pediatrics Feeding Assessment (BPFAS; Crist & Napier-Phillips, 2001) at baseline, after parent-training, and at study completion. This 35-item scale is a valid measure of child feeding issues from a caregiver perspective (Crist & Napier-Phillips, 2001). The BPFAS has adequate sensitivity and specificity to discriminate between children with and without clinical feeding disorders based on raw score and number of mealtime problems identified by parents (Dovey, Aldridge, & Martin, 2013).

Dietary variety was assessed through parental completion of a 3-day food diary spanning at least one weekday and one weekend day and collected during the first 3 days of the A phase and during or immediately following the last 3 days of the B^1 phase (in order to include a weekend day). The 3-day food diary (see Appendix B.2) combines the strengths of two valid nutrition assessments for children, the 24-hour Multiple Pass Recall and Weighed Food Records (Burrows, Martin, & Collins, 2010) and provides the specificity to answer our research question, without placing undue burden on caregivers. A child food inventory (see Appendix B.3), a checklist including 54 foods organized by type (protein, dairy, carbohydrates, etc.) was also used to collect data on the number of foods the child would eat on a regular basis per parent report. This checklist was completed at baseline and after the family autonomy (B^1) phase.

4.2.2 Secondary Outcome Measures

Risk of nutritional deficiency was measured through parent completion of the Nutrition Screening Tool for Every Preschooler (NutriSTEP) - Toddler version at baseline and after the

family autonomy (B^1) phase. The NutriSTEP Toddler is a reliable and valid screen of nutrition risk in preschoolers and toddlers (Simpson, Keller, Rysdale, & Beyers, 2008). Cutoffs scores have been established to determine risk of nutritional deficiency (low < 20, moderate ≤ 25, and high >25).

Frequency of family meals was estimated by parents to signify the number of times per week that the child participates in family meals at baseline, post parent-training and after the family autonomy phase. For the purposes of this study, a family meal was defined as any event when multiple family members (at least the child and one adult) sit down at a table together and share the same food options.

Demographic information (parental age, parental education, parental employment status, parental marital status, socioeconomic status, race, ethnicity, child age, child gender, and number of siblings) was also collected at baseline per parent report.

4.2.3 Intervention

The Mealtime PREP is a two-pronged intervention with a dyadic focus on both the parent(s) and child. When viewing child meals through the lens of the Person-Environment-Occupation (PEO) framework, it becomes evident that child-focused treatment in isolation is not enough to change daily routines. Because caregivers are responsible for providing food options, organizing the environment, and scheduling child meals, they are a critical contributor to every child mealtime experience. Therefore, we developed an intervention in which an occupational therapist trains parent participants to deliver evidence-based treatment techniques to improve child food acceptance during daily family meals.

4.2.3.1 Mealtime PREP – Parent Experience: Parents are trained to deliver each of these components during mealtimes using a step-wise, behavioral activation approach. Behavioral activation is an effective method of promoting behavior change and establishing new routines or enhancing current routines (Cuijpers et al., 2007). The parent-training prong of the Mealtime PREP intervention incorporated four active ingredients of behavioral activation (1. skills training; 2. goal-setting; 3. activity scheduling; and 4. activity monitoring) to help parents establish a family meal routine that is enriched with techniques that promote child food acceptance (See Table 7).

Table 7. Behavioral Activation Approach to Parent-Training

Active Ingredient	Exemplar of 2nd Therapist-Led Session
Skills Training	After reviewing the "plan" (a goal to implement *Family Meals*) from prior session, parent-participant(s) are trained in a new skill, *Positive Reinforcement*. As the parent(s) practice this skill during a family meal, child behaviors that arise are redirected to acceptable alternatives, with the assistance of the occupational therapist.
Goal Setting	A new "plan" is developed. Goals now address implementation of *Family Meals*, and rewarding appropriate behaviors/redirecting inappropriate behaviors using *Positive Reinforcement.*
Activity Scheduling	Meals are scheduled during the next 3-4 days for the parent(s) to practice these skills.
Activity Monitoring	Each of these meals is logged and video-recorded.

An occupational therapist, with eight years of clinical experience in pediatrics (also the P.I. of this study), led four parent-training sessions in the home. During each session a new

technique to promote child feeding outcomes was introduced and parents were provided with the opportunity to practice during a meal, role play, and troubleshoot potential issues. Therapist feedback included knowledge of performance and/or knowledge of results. Parents continued to practice skills by delivering intervention components in the home over the next 3-4 days.

4.2.3.2 Mealtime PREP – Child Experience: Using the *Person-Environment-Occupation* model as an organizing framework, the child-focused prong of the Mealtime PREP intervention embeds positive reinforcement of appropriate child behaviors (*Person*) and repeated exposure to targeted foods (*Occupation*) into a consistent family meal routine (*Environment*) to facilitate food acceptance during meals. Parents incorporated the three active-ingredients of *Family Meals*, *Positive Reinforcement* and *Food Exploration and Play* into the child's meal routine sequentially, as they were trained to deliver them. By the time parent participants entered the Family Autonomy (B^1) phase, they were ready to embed all three of these active ingredients into each family meal. In essence, the parent provided a predictable family meal routine, encouraged active child participation, rewarded appropriate child behaviors and redirected inappropriate behaviors to acceptable alternatives. Parents also modeled interaction with food and encouraged their child to interact using exploration and play. The intervention was customized to accommodate a variety of mealtime environments, address unique child behaviors and incorporate play that was meaningful to each child (See Table 8). For more detailed information on the development of the Mealtime PREP intervention, please refer to Chapter 3, Section 3.2.1: Intervention.

Table 8. Exemplar of Mealtime PREP Intervention during Family Autonomy (B^1) Phase

Active Ingredient	Exemplar
Family Meals	Violet is given a warning, "We are going to get ready for dinner in two minutes." After two minutes, Violet pushes a stool to the sink to wash her hands, and climbs into her highchair. She helps serve macaroni and cheese (preferred) and chicken (targeted) onto her plate. Violet serves green beans (targeted) onto a learning plate to discuss during the meal. Her mother and father also serve a portion of each food onto their plates. When Violet is finished eating and playing, she says, "all-done," and uses her hand to clear food from her plate and into a scrap bowl.
Positive Reinforcement	During the meal, Violet screams when the sauce from the macaroni and cheese touches her elbow. Her mother redirects her to use a napkin to wipe the sauce away. She wipes the sauce from her arm and her mother praises her. Violet also decides to try a bite of chicken, and receives a high five from her father.
Food Exploration and Play	Throughout the meal, Violet's mother and father model interacting with food in different ways (making a smiley face with green beans, pretending bites of chicken are "swimming" in the macaroni), and praise each other for trying and interacting with all foods. Violet is invited to join in, and "fishes" some chicken out of her macaroni and cheese using her fork. She then decides to try a bite! She also describes the green beans on the learning plate, "They are green and look like sticks." Her mother acknowledges Violet's description and explains what a green been tastes and feels like as she bites into one, "This green bean is soft, warm, and tastes salty."

4.2.4 Data Analysis

Food acceptance: Percentage of targeted food consumed was initially assessed for each participant using visual analysis of linear graphs to detect notable differences between phases. Ten percent of the video-recorded meals (33) were rated by both raters and inter-rater reliability

was assessed using the Intra-class Correlation Coefficient (ICC). Serial dependency in the data was assessed using the auto-correlation coefficient and Bartlett's test to determine significance (Ottenbacher, 1986). Three distinct methods (celeration line, c-statistic, and standard mean difference) were used to examine the effects of the Mealtime PREP intervention on targeted food acceptance. The celeration line method and the c-statistic calculations were completed to determine if the Mealtime PREP intervention led to a significantly improved outcome. Both of these methods account for trends that may be present at baseline (Ottenbacher, 1986).

A priori, we decided to classify participants into the categories of "responder" and "non-responder" based on whether they achieved significant improvement using the celeration line methodology. The celeration line allowed for prediction of a participant's score during the intervention phase based on trends present at baseline. This line, which visually represents the baseline trend, was extended through the remaining phases of the study, and performance was assessed based on where data points, or observations, fall in relation to this line. We used Ottenbacher's (1986) probability table, that he adapted from Bloom's (1975) work to determine the number of observations needed to fall above the celeration line to demonstrate a statistically significant effect.

The c-statistic was used to identify statistically significant trends in repeated measures, or time-series, data. First, the c-statistic was calculated to determine if a statistically significant trend was present at baseline. If so, a comparison data set was constructed for the following phases, which accounted for the trend present at baseline. If not, raw data can be evaluated and observations from subsequent phases are combined with the baseline data to determine if a statistically significant trend was present after intervention was initiated. If a significant trend is identified after intervention was initiated that was not present at baseline, this change was

attributed to the intervention. The c-statistic was then converted to a Z-score to determine the reliability (*p*-value) associated with this change (Ottenbacher, 1986).

In addition, the standard mean difference (SMD), with confidence intervals, was calculated to provide a meaningful effect size (Cohen's *d*) for the Mealtime PREP intervention during the parent-training and family autonomy phases for each participant (Busk & Serlin, 1992). Individual effect sizes (SMD) were then combined to describe overall effects observed across all participants in this study, and a standard effect size (SES) was calculated by determining a weighted average of individual effects. A weight was assigned to each individual SCED study based on the inverse variance of difference scores between baseline and intervention data points (Borenstein, Hedges, Higgins, & Rothstein, 2009). Results of individual SCEDs are presented in visual graphs, and combined effects are presented in forest plots to examine variability in responses and observe the overall effect.

Child mealtime behavior, dietary variety, risk of nutritional deficiency, and frequency of family meals: Descriptive statistics were used to describe changes in child mealtime behaviors, dietary variety, nutrition risk, and frequency of family meals. Raw scores (BPFAS, number of feeding "problems," number of foods eaten over three days, Toddler NutriSTEP, number of family meals) are presented in addition to change scores.

4.3 RESULTS

4.3.1 Participants

This study was conducted using the same sample described in Chapter 3.0, Feasibility and Acceptability of the Mealtime PREP Intervention. Eleven families, recruited from primary care physicians, early interventionists and community and social media advertisements, completed the study. Child participants ranged in age from 19 to 35 months and our sample was fairly equally distributed in terms of gender (64% male). All participants were white, and most parent participants were highly educated (95% had earned a bachelor's degree or higher). Many of the child participants were at risk for nutritional deficiency (73%), and about half (55%) demonstrated an oral motor delay (Table 5).

4.3.2 Primary Outcomes

4.3.2.1 Food Acceptance: Reliability between coders was found to be excellent (ICC = .948; 95% CI = .894-.974) for percentage of targeted foods consumed during meals. As shown in Tables 9 and 10, five out of eleven children responded to treatment during the parent-training phase, and six out of eleven responded during the family autonomy phase according to the celeration line method. None of our participants demonstrated serial dependency during baseline, as determined by non-significant autocorrelation coefficients. Based on c-statistic calculations, designed to identify significant trends, only participant 001 (during both intervention phases) and

participant 006 (during the family autonomy phase) demonstrated significant changes after treatment was initiated.

Table 9. Targeted Food Acceptance during B (Parent-Training) Phase

Participant	celeration line (significant change)	Z-scores based on c-statistic	SMD (95% CI)	Response to Intervention
001	**X**	**Z = 2.07***	0.56 (0.27-0.85)	**Responder**
003		Z = 1.17	-0.38 (-1.58-0.82)	
004		Z = 0.50	0.60 (0.32-0.88)	
005		Z = 1.11	0.80 (0.63-0.97)	
006	**X**	Z = 0.58	1.06 (0.91-1.21)	**Responder**
007	**X**	Z = 0.58	1.14 (0.88- 1.40)	**Responder**
008	**X**	Z = 1.23	0.76 (0.58–0.94)	**Responder**
009		Z = 0.27	0.47 (0-0.94)	
011		Z = 0.00	0 (0-0)	
012		Z = 1.07	0.35 (-0.23-0.93)	
013	**X**	Z = 0.11	0.56 (0.27-0.85)	**Responder**

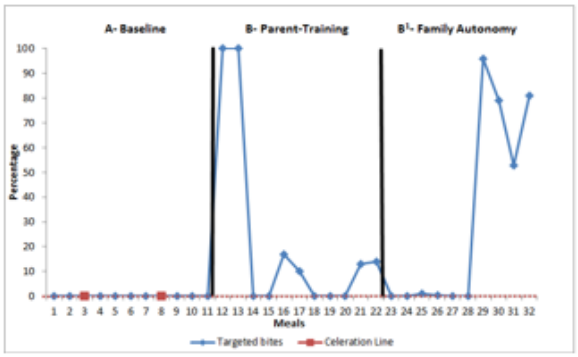
Note: A Z-score $\geq$1.64 is statistically significant at the p<.05 level: SMD calculated as Cohen's d effect sizes.
*p< .05

Table 10. Targeted Food Acceptance during B-prime (Family Autonomy) Phase

Participant	celeration line (significant change)	c-statistic	SMD (95% CI)	Response to Intervention
001	**X**	**Z = 2.00***	0.70 (0.53-0.87)	**Responder**
003		Z = 0.61	-0.46 (-1.76-0.83)	
004		Z = 0.26	0.42 (-0.05-0.89)	
005		Z = 0.41	0.35 (-0.18-0.88)	
006	**X**	**Z = 3.77****	1.00 (0.95-1.05)	**Responder**
007	**X**	Z = 0.51	0.99 (0.94-1.04)	**Responder**
008	**X**	Z = 0.23	1.12 (0.95-1.29)	**Responder**
009		Z = 0.00	0 (0-0)	
011		Z = 0.00	0 (0-0)	
012	**X**	Z = 0.61	0.41 (-0.11-0.93)	**Responder**
013	**X**	Z = 0.03	0.70 (0.53-0.87)	**Responder**

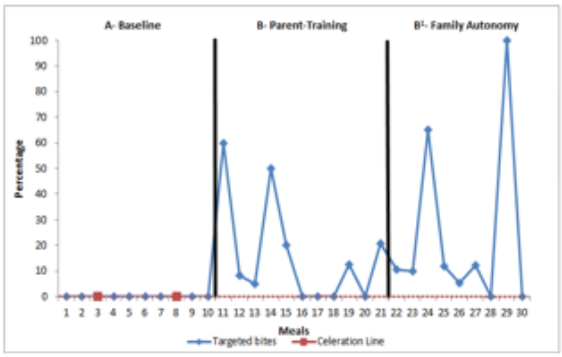
Note: A Z-score ≥1.64 is statistically significant at the p<.05 level; SMD calculated as Cohen's d effect sizes.
**p*< .05; ***p*< .01

Responders



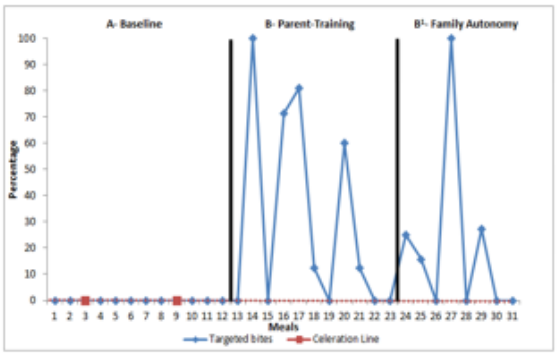
Participant 001

δ^2: A = 0; B = 1,488.1; B^1 = 1,835.6



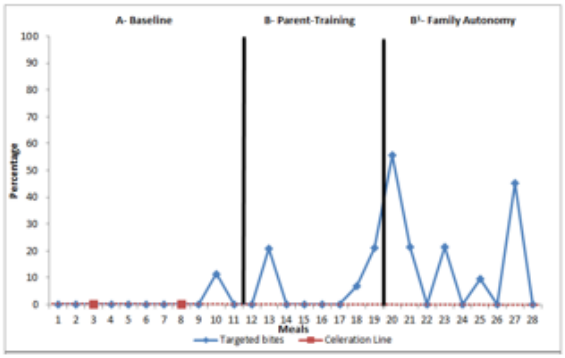
Participant 006

δ^2: A = 0; B = 434.7; B^1 = 1,203.5



Participant 007

δ^2: A = 11.9; B = 1,521.0; B^1 = 1,155.4



Participant 008

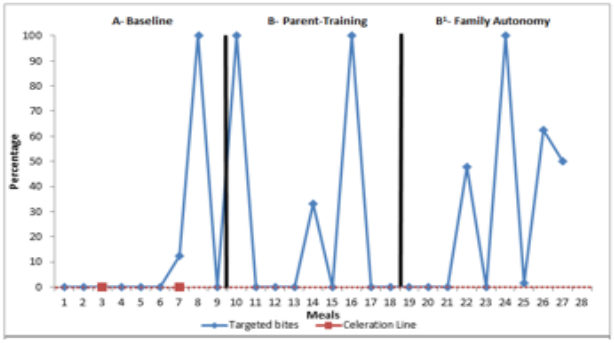
δ^2: A = 11.9; B = 89.0; B^1 = 441.1

Participant 013

δ^2: A = 0; B = 80.5; B^1 = 92.4

Figure 3. Responders to Intervention

Delayed Responder

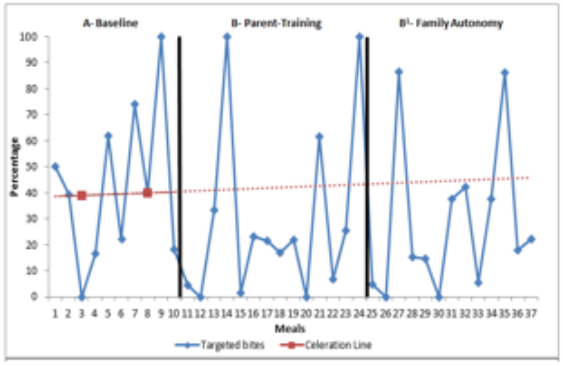


Participant 012

δ^2: A = 1,093.8; B = 1,882.7; B^1 = 1,383.5

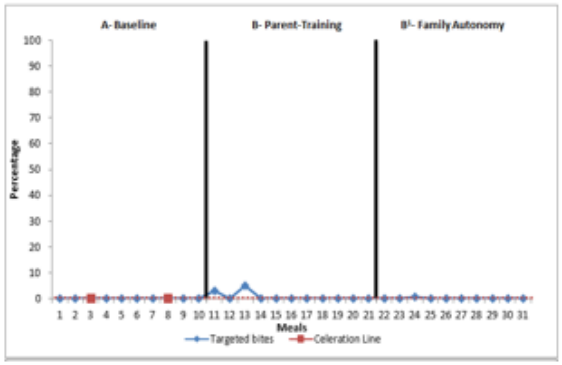
Figure 4. Responder to Intervention (Only during Family Autonomy)

Non-Responders



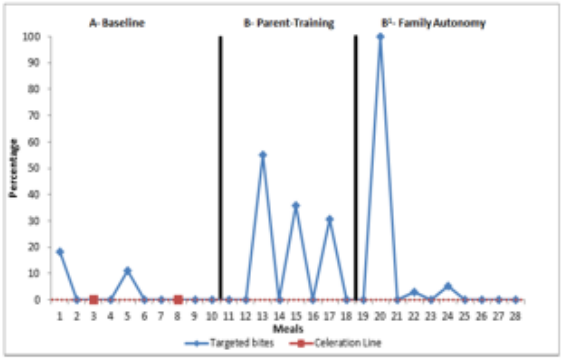
Participant 003

δ^2: A = 914.2; B = 1,150.2; B^1 = 858.8



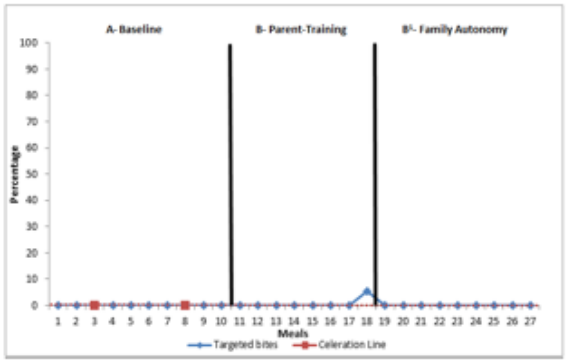
Participant 004

δ^2: A = 0; B = 2.90; B^1 = 0.1



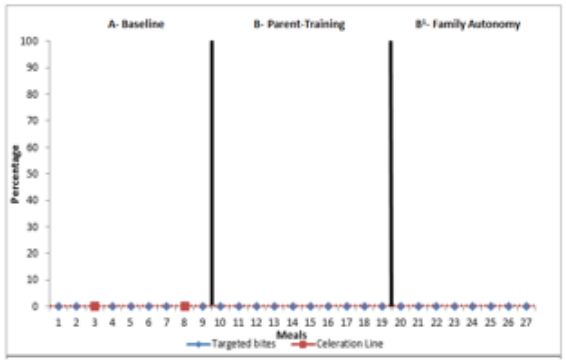
Participant 005

δ^2: A = 40.9; B = 486.1; B^1 = 984.7



Participant 009

δ^2: A = 0; B = 3.9; B^1 = 0



Participant 011

δ^2: A = 0; B = 0; B^1 = 0

Figure 5. Non-Responders to Intervention

Visual analysis of the data suggests that although changes in food acceptance were apparent in all of our responders, there was great variability in this construct both between and within participants. Among non-responders, great variability and instability of food acceptance was observed across all phases for two participants (003 & 005) and very little (if any) change was observed in the remaining three participants (004, 009 & 011).

Combined Effects

As depicted in the forest plot (see Figure 6), effect sizes ranged from moderate and favoring no treatment (-0.46) to large and favoring the Mealtime PREP intervention *(*Cohen's *d* = 1.14) during the parent-training (B) phase. Notably, the one effect size favoring no treatment demonstrated extreme variability in responses, leading to an unstable effect. In contrast, all five responders and two non-responders (004 & 005) to the Mealtime PREP intervention demonstrated moderate to large, stable effects during the parent-training (B) phase. The overall standard effect size (SES) during this phase was unstable and of moderate size (Cohen's *d* = 0.55; 95% CI= -1.97 - 3.06). The SES was unstable due to the extreme variability observed in targeted food acceptance after baseline.

Similarly, during the family autonomy (B^1) phase, effect sizes ranged from moderate and favoring no treatment (Cohen's *d*=-0.46) to large and favoring the intervention *(*Cohen's *d*=1.12). Stability of these effects was compromised during this phase, as increased variability in responses was observed (See Figure 7). Nonetheless, five out of our six responders demonstrated large stable effects of the Mealtime PREP intervention on acceptance of targeted food. The overall standard effect size (SES) during the family autonomy (B^1) phase was unstable and of

moderate size (Cohen's *d* = 0.42; 95% CI= -0.10 – 0.94). Again, the SES was unstable due to the extreme variability observed in targeted food acceptance after baseline.

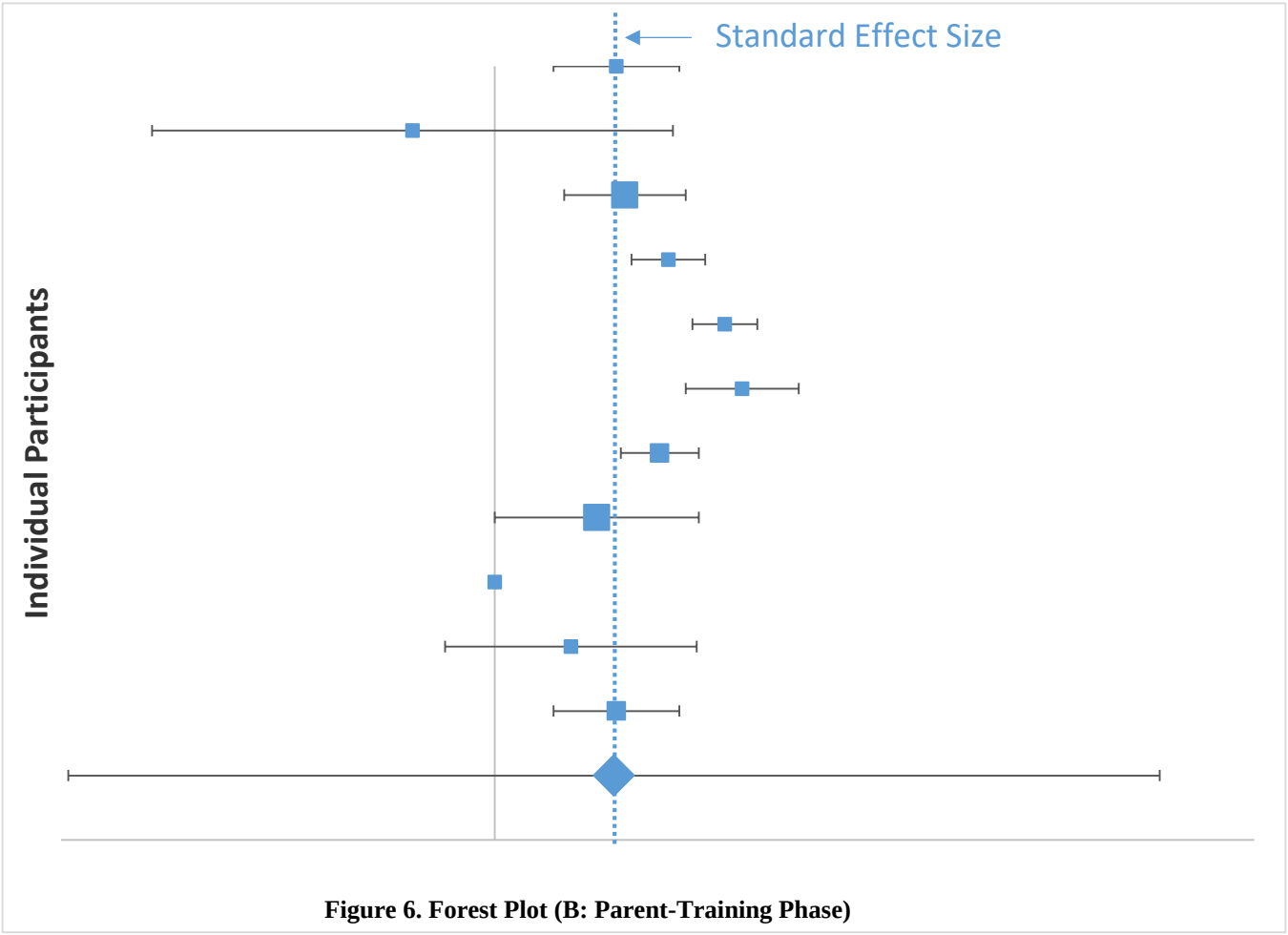


Figure 6. Forest Plot (B: Parent-Training Phase)

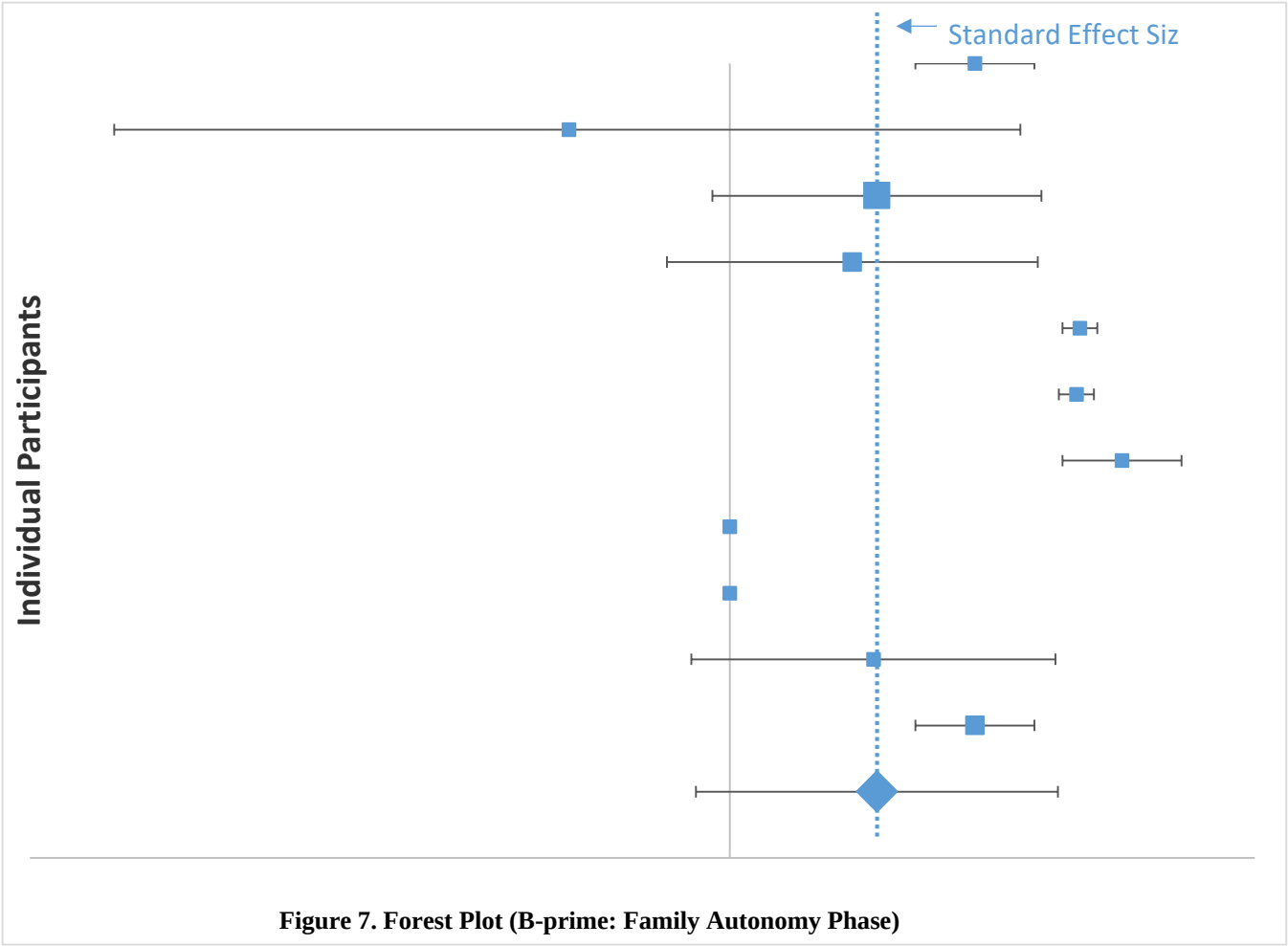


Figure 7. Forest Plot (B-prime: Family Autonomy Phase)

Visual analysis of the forest plots (See Figures 6 & 7) comparing observed effects in child food acceptance during the parent-training and family autonomy phase revealed notable similarities and differences. While the standard effect size was slightly greater during the parent-training phase (Cohen's *d* = .55), it was comparable to the family autonomy phase (Cohen's *d* = .42). Interestingly, while the effects of our five responders (for both stages) don't change much in magnitude, confidence intervals become narrower, which suggests that the effects observed during the family autonomy phase are a more reliable estimate of behavior change for targeted

food acceptance. This is in contrast to the non-responders, where we observed some confidence intervals became wider, while others became narrower.

Demographic characteristics and treatment differentiation between responders and non-responders to intervention were examined to identify possible differences. We found that 5 out of 6 responders participated in training with the occupational therapist during family meals, while none of the non-responders participated in family meals with the therapist present. Instead, they received feedback about how to troubleshoot problems based on role play or discussion. Furthermore, all 6 responders also multiple caregivers actively involved in parent-training and intervention delivery, while the mother, alone, delivered intervention techniques to all five non-responders. One outlier case, in which the child responded to treatment despite a lack of feedback from the therapist during family meals, was identified. This family demonstrated high levels of adherence when delivering intervention techniques during both phases (75% during parent-training and 81% during family autonomy).

4.3.2.2 Child Mealtime Behavior: A large effect (Cohen's *d*=-1.09; 95% CI= -2.35-0.18) was observed for improved mealtime behaviors after initiation of the Mealtime PREP intervention. Average child behavior score decreased from an average baseline score of 82 to an average score of 71 at the end of the study. Perhaps even more meaningful are those children who began the study with scores above the clinical cut-off for having a feeding disorder, and completed the study with scores below this cut-off (See Figure 8). Child participants 003, 004, 005 and 006 all demonstrated sufficient improvements in behavior after the Mealtime PREP intervention, per caregiver report, to score <61, indicating that they were no longer categorized as having a clinical feeding disorder. In addition, parent-reported mealtime problems decreased

from an average of 6.27 at baseline to 2.55 after the family autonomy (B^1) phase (Cohen's *d* = -1.24; 95% CI= -2.53-0.05). All participants that exceeded the clinical cut-off for a feeding disorder based on the number of parent-identified problems (001, 004, 005, 007, 008 and 012) demonstrated a shift below the established cut off of 6 mealtime behavioral problems after participation in the Mealtime PREP intervention (See Figure 9). Raw and change scores on the BPFAS scores can be located in Table 9.

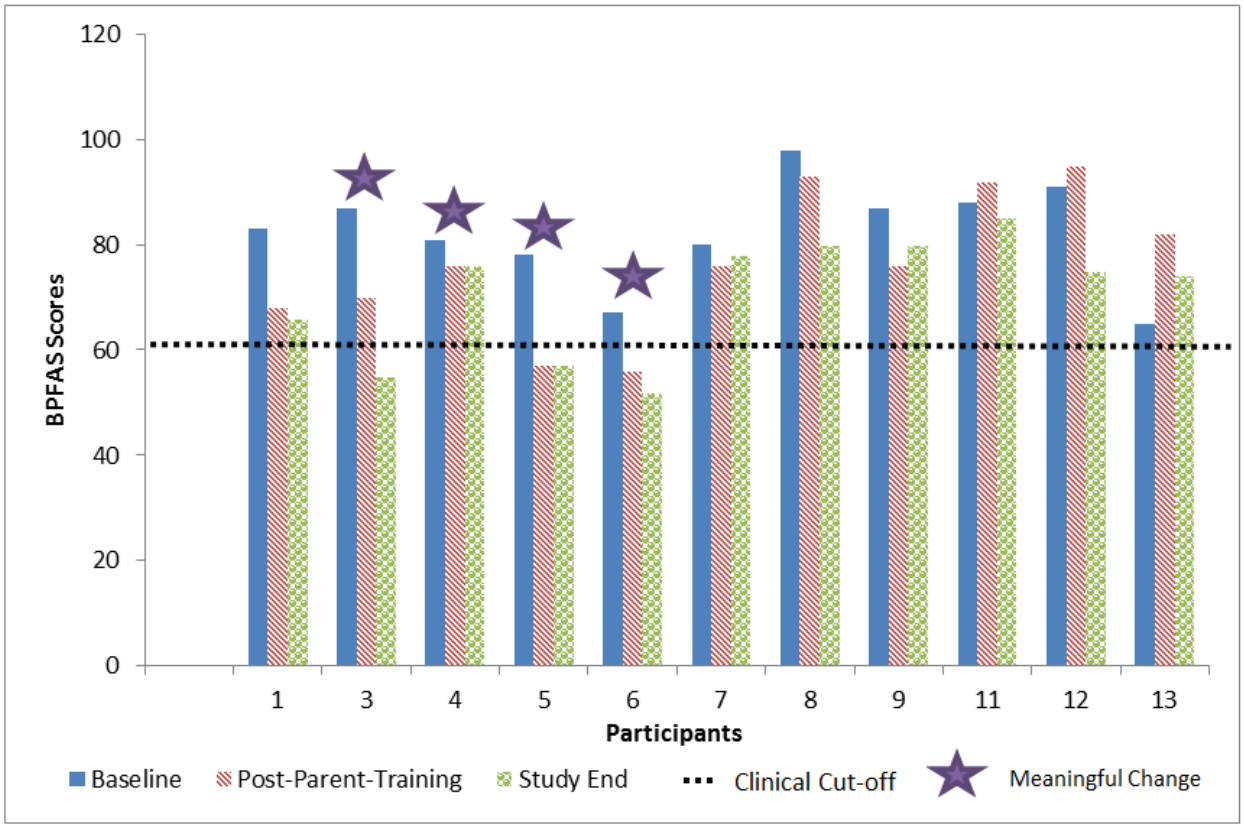


Figure 8. Total BPFAS Score Compared to Clinical Cut-off for a Feeding Disorder

Note: Scores ≥61 signify a clinical feeding disorder according to established norms. Those participants that scored ≥ 61 at baseline and < 61 at study end were designated with a star to symbolize a meaningful shift in behavior.

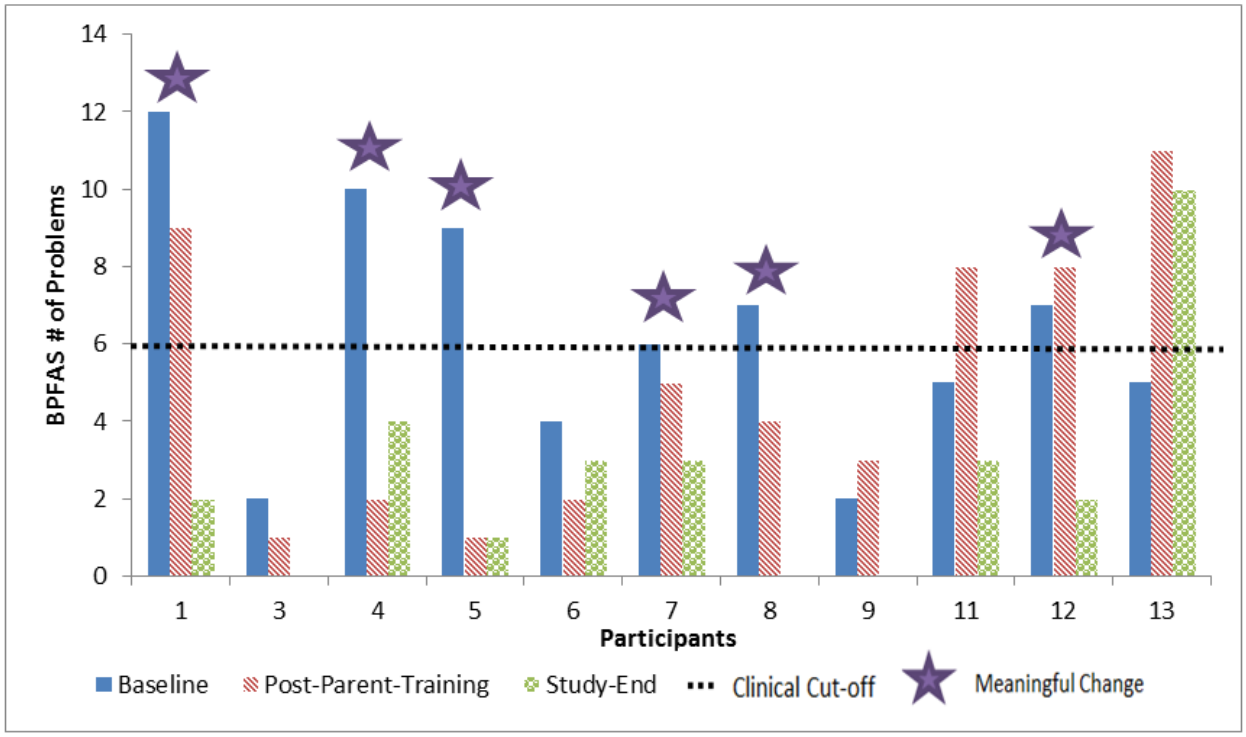


Figure 9. Total Problems Identified as Compared to Clinical Cut-off for a Feeding Disorder

Note: ≥6 parent-identified problems signify a clinical feeding disorder according to established norms. Those participants that scored ≥6 at baseline and <6 at study end were designated with a star to symbolize a meaningful shift in behavior.

4.3.2.3 Dietary Variety: Based on the 3-day Food Diary, a small effect (Cohen's *d* = 0.12; 95% CI= -1.07-1.30) was observed for overall dietary variety, with the children eating an average of 17 different foods over a three-day period at baseline and an average of 18 different foods over this same time-frame during the family autonomy (B^1) phase. Moreover, a large effect was observed in fruit and vegetable variety; which improved from 2.5 different fruits and vegetables consumed over a three-day span, on average, at baseline, to 4.5, on average, during the family autonomy (B^1) phase (Cohen's *d* = 0.89; 95% CI=-0.35-2.12). On the child food inventory, a small to moderate effect was observed in the number of foods the child was willing

to accept with an improvement of accepting, on average, 34.2 different foods after the family autonomy (B^1) phase as compared to 29.8 different foods at baseline (Cohen's *d*=0.39; 95% CI =-0.80-1.59). Total and change scores on for these measures can be reviewed in Table 11.

4.3.3 Secondary Outcomes

4.3.3.1 Risk of Nutritional Deficiency: As an exploratory analysis, we examined the effects of the Mealtime PREP feeding intervention on risk of nutritional deficiency, as measured by the NutriSTEP Toddler. A large effect was observed (Cohen's *d* =-0.83; 95% CI=-2.06-0.40) signifying lower risk of nutritional deficiency after the family autonomy (B^1) phase (mean = 18) as compared to baseline (mean = 20.9). The cut-off score of 21 is meaningful – as this score represents a moderate risk of nutritional deficiency. Three participants in our study crossed this threshold (003, 005, 006), suggesting that they entered the study at moderate risk for nutritional deficiency and exited with low risk (See Figure 10). Raw and change scores on the NutriSTEP Toddler can be found in Table 12.

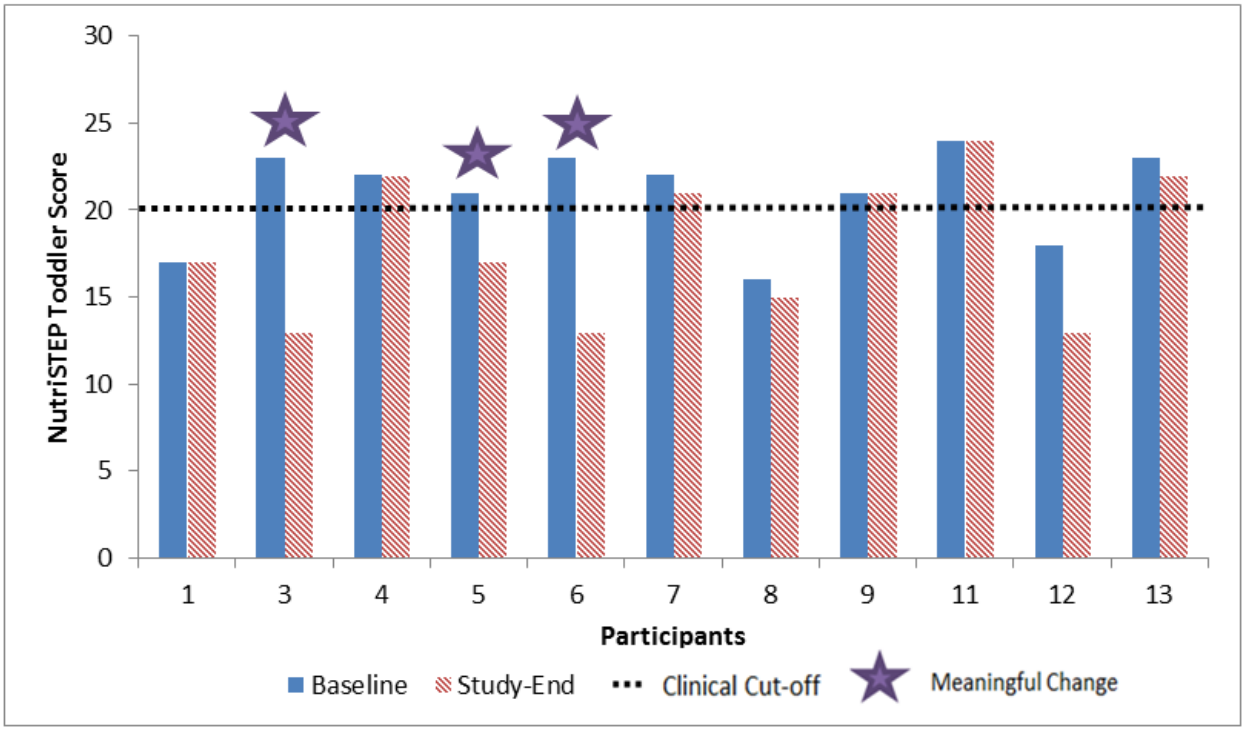


Figure 10. NutriSTEP Toddler Scores

Note: Scores ≥ 20 signify a moderate risk of nutritional deficiency. Those participants that scored ≥ 20 at baseline and < 20 at study end were designated with a star to symbolize a meaningful shift in risk.

4.3.3.2 Frequency of Family Meals: Across participants, frequency of family meals increased from an average of 5.3 per week at baseline to an average of 8.5 per week after the family autonomy (B^1) phase (*d* = 0.82; 95% CI -0.412 - 2.049). At baseline, frequency of family meals per week ranged from 1-14, whereas after the family autonomy phase (B^1), frequency ranged from 5-14. Interestingly, the least amount of variation was observed directly following parent-training, when frequency of family meals ranged from 6-10 per week (See Figure 11). Total and change scores for frequency of family meals can be reviewed in Table 12.

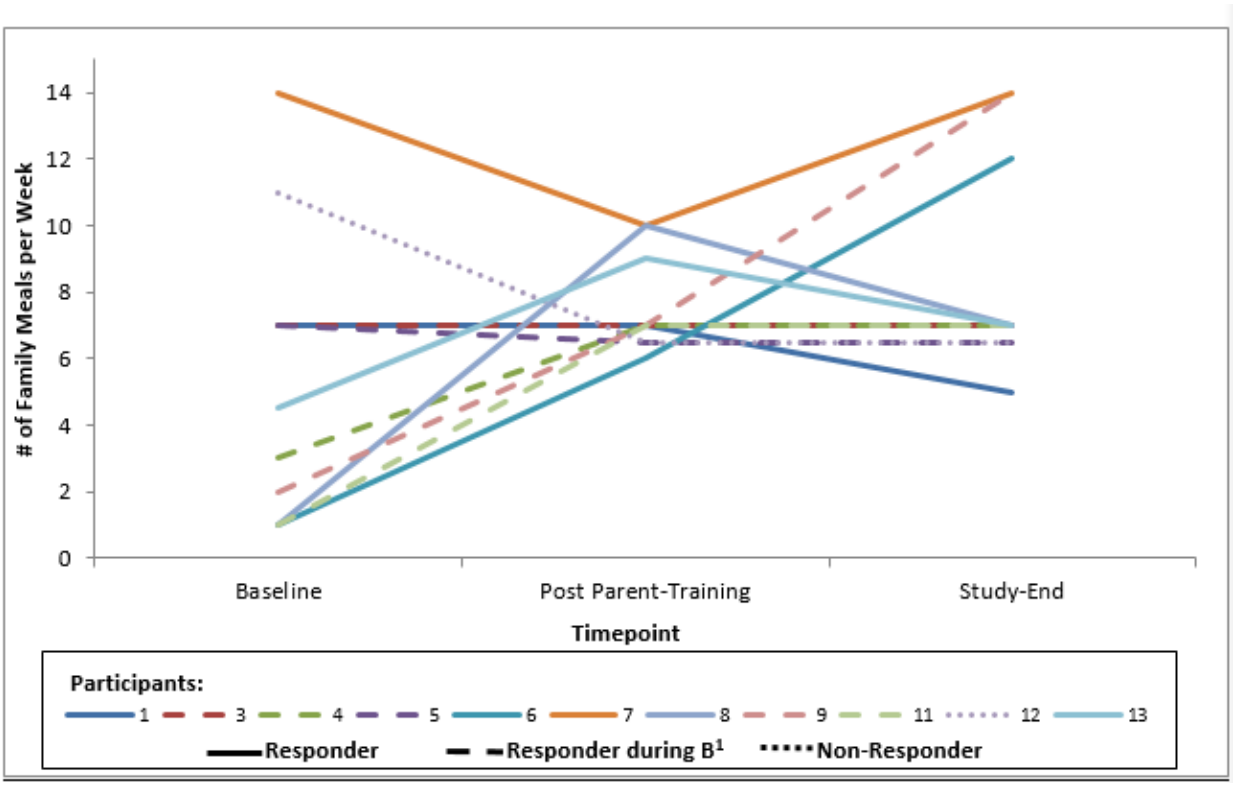


Figure 11. Frequency of Family Meals per Week by Response in Targeted Food Acceptance

Note: Solid lines correspond to "responders" to intervention for food acceptance, whereas dashed lines correspond to "non-responders." The dotted line indicates the participant who responded during B^1 (family autonomy) phase but not during the B (parent-training) phase.

Table 11. Raw and Change Scores (Primary Outcomes)

	BPFAS Baseline Raw Score (# of problems)	***BPFAS Final Raw Score (# of problems)***	***BPFAS Raw Score (# of problems) Change***	***3-day Food Diary Total (F/V) Baseline***	***3-day Food Diary Total (F/V) Final***	***3-day Food Diary Total (F/V) Change***	***Child Food Inventory Total Baseline***	***Child Food Inventory Total Final***	***Child Food Inventory Change***
001	83 (12)	66 (2)	**-17 (-10)**	11 (0)	16 (4)	**+5 (+4)**	18	28	**+10**
003	87 (2)	55 (0)	**-32 (-2)**	19 (5)	18 (5)	**-1 (+4)**	44	51	**+7**
004	81 (10)	76 (4)	**-5 (-6)**	20 (5)	25 (9)	**+5 (0)**	25	32	**+7**
005	78 (9)	57 (1)	**-21 (-8)**	29 (5)	26 (3)	**-3 (-2)**	41	50	**+9**
006	67 (4)	52 (3)	**-15 (-1)**	16 (2)	15 (5)	**-1 (+3)**	32	38	**+6**
007	80 (6)	78 (3)	**-2 (-3)**	20 (2)	25 (8)	**+5 (+6)**	43	52	**+9**
008	98 (7)	80 (0)	**-18 (-7)**	15 (3)	20 (6)	**+5 (+3)**	27	31	**+4**
009	87 (2)	80 (0)	**-7 (-2)**	9 (0)	11 (0)	**+2 (0)**	27	30	**+3**
011	88 (5)	85 (3)	**-3 (-2)**	15 (1)	7 (1)	**-8 (0)**	20	16	**-4**
012	91 (7)	75 (2)	**-16 (-5)**	24 (1)	25 (6)	**+1 (+5)**	31	31	**0**
013	65 (5)	74 (10)	**+9 (+5)**	14 (3)	12 (3)	**-2 (0)**	20	17	**-3**

Table 12. Raw and Change Scores (Secondary Outcomes)

	NutriSTEP Toddler Raw Score Baseline	*NutriSTEP Toddler Raw Score Final*	*NutriSTEP Toddler Change*	*Frequency of Family Meals Baseline*	*Frequency of Family Meals Final*	*Frequency of Family Meals Change*
001	17	17	**0**	7	5	**-2**
003	23	13	**-10**	7	7	**+0**
004	22	22	**0**	3	7	**+4**
005	21	17	**-4**	7	6.5	**-0.5**
006	23	13	**-10**	1	12	**+11**
007	22	21	**-1**	14	14	**0**
008	16	15	**-1**	1	7	**+6**
009	21	21	**0**	2	14	**+12**
011	24	24	**0**	1	7	**+6**
012	18	13	**-5**	11	6.5	**-4.5**
013	23	22	**-1**	4.5	7	**+2.5**

4.4 DISCUSSION

The Mealtime PREP intervention yielded benefits in targeted food acceptance and/or mealtime behaviors for nine out of the eleven participants in this study. Six participants demonstrated significant improvement in the acceptance of targeted foods during the family autonomy phase, when parents were delivering the intervention without face-to-face therapist interaction. Three more participants experienced improvements in mealtime behaviors that led to the meaningful shift from a score within the range that specifies a childhood feeding disorder at baseline according to a validated assessment, to a score that signifies typical mealtime behaviors after the family autonomy (B^1) phase. Of these nine participants, one demonstrated significantly improved targeted food acceptance **and** a meaningful improvement in mealtime behaviors. These gains provide a promising signal that the Mealtime PREP intervention merits further investigation as a treatment for children with Sensory Food Aversions.

When effects of targeted food acceptance were combined, a moderate, but unstable, standard effect size was observed during both intervention phases. We also observed narrower confidence intervals during the family autonomy phase for children who responded to the Mealtime PREP intervention. This is interesting, because even though the magnitude of targeted food acceptance varied greatly after baseline, even among responders, improved reliability of our estimates during the second intervention phase suggest that with time, variability in responses may be lessening. While visual analysis supports the conclusion that each “responder” (based on the celeration line method) did experience an evident shift in behavior from baseline, more stable

responses are needed to detect significant change using more conservative methods, such as the c-statistic. Our data suggest that observing meals in intervals over a longer period of time may support more stable responses to treatment.

Regarding the primary outcome of acceptance of targeted food, we have developed a few hypotheses related to the success of responders to the Mealtime PREP intervention. Five out of six responders invited the therapist to sit in on actual family meals during the parent-training phase. Furthermore, all six responders had multiple caregivers (e.g. mother, father, grandparent, nanny) engaged in parent-training sessions and delivery of intervention strategies during mealtimes. This is particularly interesting, because the five families who did not demonstrate improved child food acceptance did not have access to an occupational therapist during scheduled family meals and only had one caregiver trained to change mealtime routines. These results suggest that the presence of an occupational therapist during family meals and participation/commitment from more than one caregiver may be critical to the success of the Mealtime PREP intervention. Those components should be examined as possible active ingredients for future studies estimating the effects of this intervention package.

Another interesting finding was that all six child participants who met the clinical cut-off for having a feeding disorder, based on parent-identified mealtime behavior problems, did not meet this cut-off at after the family autonomy (B^1) phase. While causal inferences are not supported by this study design, we postulate that this finding is related to our approach to parent-mediated intervention. It is possible that as parents are trained to manage behaviors and stressors, they feel more competent in their ability to lead family meals, and better equipped to handle issues that arise during meals; therefore, behaviors that do occur are seen as less problematic.

Future studies should investigate this phenomenon more carefully through the addition of an assessment of parental self-efficacy and/or parental stress related to mealtimes.

It is difficult to make conclusions related to the effects of the Mealtime PREP intervention for overall dietary variety, as effect sizes ranged from small to moderate and were not stable. Seven of the eleven participants ate a greater variety of foods over a three-day span during the family autonomy (B^1) phase than they did during baseline. Perhaps even more noteworthy, was the large effect observed in variety of fruits and vegetables consumed over a three-day period during the family autonomy (B^1) phase as compared to baseline. Six participants consumed a greater variety of fruits and vegetables over a three-day span during the family autonomy (B^1) phase, four remained the same, and only one participant consumed less variety in fruits and vegetables than he did at baseline. While these results are promising, dietary variety may be influenced by the number of different foods children are offered. Review of the written 3-day Food Diaries revealed that some foods were offered to children every day, or even several times a day. As we continue to develop this intervention package, basic education on offering a wide variety of healthy food options (including ideas of foods to offer) may yield greater benefits in dietary variety overall.

There were two participants in our study who did not demonstrate statistically significant gains in targeted food acceptance or clinically relevant shifts in mealtime behaviors or dietary variety despite implementation of the Mealtime PREP intervention package. These participants were unique, and while direct conclusions regarding lack of response are not supported, these participants deserve closer examination.

Participant 009 (2 ½ years old) demonstrated concurrent medical issues including severe food allergies and a history of vomiting after eating certain foods. His diet was inherently limited

due to these food restrictions, but he was only eating chicken and sweet and crunchy snacks at baseline. Although he did not respond to intervention, his mother reported that he enjoyed the Mealtime PREP intervention, and she felt mealtimes were easier when they followed the routine. After completing the study, participant 009 was re-diagnosed with gastro-esophageal reflux. After just a few days on medication, his mother reported that he is eating a much wider variety of foods. It is difficult to predict how he would have responded, or if he would have even qualified to participate, had his reflux been diagnosed prior to entering our study.

Participant 011 (1 ½ years old) was one of our youngest participants, and demonstrated the most noteworthy oral motor delays (i.e. decreased lip closure, increased drooling, and lack of diagonal jaw movements during chewing) of all participants in the study. While participating in our study, he received an early intervention evaluation, and qualified for occupational therapy services to address feeding difficulties. While his mother initially reported excitement and acceptance of the Mealtime PREP intervention, after completing the study she reported that she did not think the approach was intense enough to yield changes for her son. Because our intervention did not directly address improved oral motor control, children with marked oral motor delays may benefit from targeted intervention to improve oral motor skills prior to starting the Mealtime PREP intervention. Alternately, the Mealtime PREP intervention could be adapted to incorporate techniques to improve oral motor skills for children who need this treatment. Future studies are required to parse out the optimal dose and timing of the Mealtime PREP intervention for children of varying oral motor abilities and concurrent medical conditions.

A limitation of this study includes the small sample, which prohibits inferences about the effects of the Mealtime PREP intervention to the general population. While benefits were observed for nine out of the eleven participants in this study, more work is needed to estimate the

effects of the Mealtime PREP intervention for young children with SFA. Additionally, daily response to intervention recorded using the SCED approach revealed instability of targeted food acceptance during the parent-training and family autonomy phases. This instability, or lack of trend, likely influenced the results of our study as calculated by the c-statistic. Insight into the variability of child responses is valuable for developing and modifying the intervention package. This rich data highlights extreme variability in the responses of both parents (in terms of intervention fidelity) and children (in terms of targeted food acceptance). These data inform researchers and clinicians about patterns of behavior as they occur in the natural environment. While a certain amount of variability is expected, methods to optimize the Mealtime PREP intervention for more consistent delivery and response should be explored in future studies.

In summary, the Mealtime PREP intervention package is a promising treatment approach for improved acceptance of targeted foods and mealtime behaviors in children with Sensory Food Aversions. Future work should focus on intervention optimization through increased presence of the occupational therapist during family meals and encouraging all caregivers who lead mealtime to participate in parent-training and intervention delivery. While many of the children recruited demonstrated benefits to this treatment approach, more work is needed to specify optimal dosing and timing of intervention delivery, and whether adaptation of the intervention is required for children with concurrent medical conditions or developmental delays. Additionally, future studies should aim to refine this intervention and weigh the relative effects of the active ingredients within a larger cohort of children demonstrating limited dietary variety.

5.0 CONCLUSION

Young children with SFA often avoid entire food groups based on sensory characteristics (commonly fruits and vegetables) and have increased risk for a wide range of behavioral, psychological and health-related issues. This purpose of this research was to examine the relationships between family meals and feeding outcomes in young children. The feasibility and preliminary effects of the Mealtime PREP intervention for children with SFA was explored. This project includes a secondary data analysis and a single-case experimental design study with multiple replications.

5.1 AIMS

This dissertation had the following aims:

1) To examine the associations between family meal frequency and fruit and vegetable intake in preschool children and identify probable confounding factors using the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B).

   Hypothesis: We anticipated that frequency of family meals would be associated with fruit and vegetable intake, and that number of individuals residing in the home, disability status and cultural factors might be associated with fruit and vegetable intake.

2) To examine the feasibility and acceptability of a behavioral activation approach to training parents to deliver the Mealtime PREP intervention during family meals.
3) To estimate the effects of the Mealtime PREP intervention on food acceptance, mealtime behavior, and dietary variety in young children with SFA.

5.2 SUMMARY OF FINDINGS

Current evidence highlights a positive relationship between frequency of family meals and healthy dietary variety in school-age children and adolescents (Hammons & Fiese, 2011). However, this relationship has not been observed in younger children (Sweetman, McGowan, Croker, & Cooke, 2011). Young children's food preferences are greatly affected by social influences (Addessi et al., 2005), therefore, we hypothesized that lower frequency of family meals may predict low fruit and vegetable intake in preschool-age children. We examined this relationship in a large cohort of preschool children and found that the odds of a preschooler demonstrating low fruit and vegetable intake were 1.5 times greater if his/her family typically shared less than three evening meals together than a preschooler whose family shared the evening meal together every night. Number of individuals residing in the home and household income were also associated with low fruit and vegetable intake. These findings suggest that family meals may provide a favorable venue for interventions that promote healthy dietary variety in young children. Furthermore, they provide insight into demographic factors (number of individuals residing with a child and income) that likely affect the availability and consumption of healthy foods among young children.

These results supported the development of a customizable, family-centered intervention that is embedded within daily family meals. Parents were trained to enhance family meals with evidence-based techniques to promote food acceptance. They received training on one component at a time, using a behavioral activation approach, to facilitate changes in routines. All of the intervention was conducted in the home, to support customization of techniques and promote changes within the child's natural environment. We recruited and trialed the Mealtime PREP intervention with eleven child and parent dyads using a single-case experimental design. We found that the parents were able to incorporate strategies to improve food acceptance into child meals on a daily basis and rated the intervention positively. While we did not meet our benchmark of 75% parental adherence to intervention strategies, parent participants did demonstrate >60% adherence to the intervention protocol. We collected rich data through video-recorded meals that will inform future modification of parent-training to maximize adherence moving forward.

Repeated observations of targeted food acceptance allowed us to identify responders to treatment. Mealtime behaviors and dietary variety were assessed using pre-post measures. We found that families who received immediate feedback from the treating therapist during family meals were more likely to respond to the Mealtime PREP intervention than those who received delayed feedback based on parental report. Also, children with more than one caregiver involved in parent-training responded better than those with only one caregiver trained. Eight out of eleven child-participants demonstrated meaningful shifts in mealtime behavior after delivery of the Mealtime PREP intervention. These are promising results that support continued research to optimize and refine this intervention package.

5.3 LIMITATIONS

While the results of this project suggest that the Mealtime PREP intervention is a promising method to improve feeding outcomes for children with SFA, there are a number of limitations. Due to our small sample size, inferences regarding benefits of this intervention to all young children with SFA are not supported. In addition, a lack of heterogeneity in our sample (in terms of race, income, parent education) limits our ability to develop hypotheses regarding how cultural factors may affect intervention delivery. SCED allowed us to closely monitor the effects of our intervention over time and make determinations regarding significant improvements within each participant. The data collected as part of this study are invaluable for intervention optimization, but more data are needed to support generalization to a larger population. Future work is needed to determine the effectiveness of the Mealtime PREP intervention.

Additionally, hypotheses regarding responders and non-responders to our intervention are useful for adapting the intervention to maximize potential benefits, but these predictions require further examination in future studies for confirmation. Although parents were able to employ many techniques of the Mealtime PREP intervention during daily meals, adherence to the intervention was not as high as we had anticipated. Moreover, parents reported high acceptability of the intervention package, but certain strategies, such as incorporating play into meals, were met with more hesitation from parents than others, such as building a mealtime routine. Future work should strive to elucidate which active ingredients are crucial to improved outcomes.

Although inconsistency in food acceptance is commonly observed among typically developing toddlers and preschoolers, our results related to food acceptance were highly variable. Because of this variability, more conservative statistical approaches, such as the c-

statistic, were unable to detect a significant change for most participants. This finding indicates that repeated measures are necessary to elucidate the stability or instability of changes in food acceptance observed in young children. Measuring this construct for a longer period of time, or limiting the number of targeted foods for each participant family, are methods that might increase the stability of these measures in future trials.

Finally, because our cross-sectional study confirmed an association between fruit and vegetable intake and frequency of family meals among preschoolers, we have postulated that family meals may be supportive of healthy dietary variety in young children. However, more research is needed to determine if the observed predictive power of frequency of family meals for low fruit and vegetable intake is actually due to a protective benefit of frequent family meals or a due to a spurious association. Prospective, longitudinal studies could provide stronger evidence to support the potential protective benefits of frequent shared family meals.

5.4 FUTURE DIRECTIONS

Occupational therapy offers a distinct value to enhancing child development through the promotion of change at the level of the child, the caregiver and the environment. It is only through close collaboration with parents that we can expect to observe changes in a child's everyday routine. Behavioral activation provides a systematic framework to train and empower caregivers to enrich their child's environment and facilitate skill development. We chose to focus on child mealtimes first because they are inherently part of daily family routines, and are a common cause of frustration and stress for young children and caregivers alike. Plans for long-

term future endeavors include training parents to enhance other daily child routines, such as morning self-care, transitions, bedtime, and structured opportunities for play. We believe that this type of intervention has the potential to influence child outcomes (feeding, sleep, independence) and parent outcomes (e.g. parental self-efficacy, parental stress) alike. In the short-term, continued pilot work is needed to refine and optimize the Mealtime PREP intervention. There are a number of valuable lessons learned through the completion of this dissertation that will be incorporated into future studies.

A major finding of our study was that families who participated in meals with the treating occupational therapist and had multiple caregivers involved in parent-training appeared to respond better to the Mealtime PREP intervention. Moving forward, therapist presence during family meals will be considered an essential active ingredient of this treatment package. Observation of parent-participants delivering the intervention provides the therapist with a great opportunity to identify barriers and help parents overcome issues that might interfere with treatment delivery in the future. We recognize that in terms of clinical applicability, therapist presence during family meals may be difficult to coordinate. However, this practice does occur in early intervention, and simulation or tele-rehabilitation methods may be useful for integration into the clinical realm.

Involving multiple caregivers (as available) in the parent-training sessions will also be encouraged in future studies. In our secondary data analysis, we found that having more individuals living in the home is protective against low fruit and vegetable intake. Consequently, we predict that the availability of multiple trained role models could facilitate greater improvements in child outcomes. It is also important to consider that it may not have been the presence of additional caregivers during mealtimes that was important, but the consistency of the

routine being implemented. Therefore, children who only have one primary caregiver who leads mealtime may not be at a disadvantage. Instead, multiple caregivers leading mealtime could lead to inconsistent approaches, so training additional caregivers may be required to improve the potency of this approach. In other words, caregivers who are role models, but not following the treatment protocol may water-down the potential effects of intervention. We will continue to examine this phenomenon in future studies.

In an effort to develop the most advantageous and parsimonious treatment package for children and families, future work using the multiphase optimization strategy, or MOST approach (Collins, Dziak, Kugler, & Trail, 2014) would provide a better understanding of the unique contributions of active ingredients embedded within this complex intervention. Review of the current body of evidence and application of theoretical models has facilitated specification of potential active ingredients of the Mealtime PREP intervention. This foundational work allows us to progress to the next phase of the MOST approach, measuring the relative effects of each of these components. This will be accomplished by offering different combinations of our child-focused active ingredients (e.g. family meals, positive reinforcement, exploration and play). Based on these effects, decision rules for treatment implementation will be derived, and finally, these rules will be implemented to estimate the benefits of the adapted intervention (Collins, Murphy & Bierman, 2004). This type of approach could also be used to examine if each behavioral activation principle is needed to effectively train parents. If simplification of this intervention, without sacrificing benefits, is possible, it would likely improve parental intervention adherence after therapist support is withdrawn.

Future studies should aim to recruit participants from diverse backgrounds to gain a better understanding of how cultural factors and disabilities might affect response to the

Mealtime PREP intervention. We did not have any children in our sample with a developmental disability, even though up to 80% of children with disabilities demonstrate a feeding disorder sometime during life (Linscheid et al., 2003). Furthermore, to inform future implementation of this intervention into the community, we need to gain a better understanding of the role that cultural factors (such as household composition or income) play in treatment delivery and response to the Mealtime PREP intervention. This is particularly important, as the findings of our secondary data analysis highlight that income and the number of individuals residing in a home are related to fruit and vegetable consumption among preschoolers. Consistent with prior research, we might anticipate less availability of healthy food options in homes with lower socio-economic status (Laska et al., 2010; Boutelle et al., 2007; Powell et al., 2007). If this is the case, additional training or support may be required to optimize our intervention to meet the needs of these families.

Lessons learned from this project will support future studies on the effects of the Mealtime PREP intervention. We plan to continue to collect pilot data on an optimized intervention directly influenced by this project. We will do this using a repeated measures cohort study to collect data on parent-mediated intervention and child outcomes pre and post-intervention, as well as at follow-up time points: 1 month, 3 months and 6 months after parent-training. It will be important to recruit individuals from diverse backgrounds for this slightly larger pilot study of approximately 20 parent-child dyads. This study will allow us to predict how demographic characteristics might influence intervention delivery, feasibility and child outcomes.

Our next trial will use the Multiphase Optimization Strategy Trial (MOST) design and directly evaluate the relative effects of each specified active ingredient (Collins et al., 2014). The

purpose of the MOST trial will be to refine and optimize the Mealtime PREP intervention to be potent, yet practical. This refined intervention package could be implemented in early intervention programs, starting with a local, county-wide initiative. This would allow us to examine the effects of the Mealtime PREP intervention in the real world using a pragmatic trial design. A pragmatic trial would yield insight into the clinical applications of this approach to scale the intervention in preparation for supporting larger (state and national) parent-training initiatives in early intervention services.

Training parents and caregivers to alter routines using a behavioral activation approach has the potential to empower parents to be agents of change and enrich the everyday environment in which young children learn and grow. Behavioral activation provides a systematic framework that can be used to organize complex interventions into smaller units that are delivered step-by-step, making them more manageable for parents, other healthcare professionals, and educators. We believe the clinical utility of this approach stretches beyond early intervention and could help to re-shape occupational therapy service delivery in hospitals, clinics and schools. Furthermore, it has the potential to facilitate the integration of OT interventions and OT practitioners into primary care settings. In summary, there are many factors that contribute to the learning, growth and development of young children. This dissertation is only the first step to building robust programs that empower caregivers, educators, and clinicians to enhance child development in the community, every day.

APPENDIX A

A.1 PARENT-EDUCATION WORKBOOK

Creating Routines for Family Meals

Did you know?

- Watching others eat greatly influences mealtime behaviors and food acceptance in young children [1].
- Children who are not participating in family meals have fewer opportunities to learn from others. [2-3].
- On average, children who participate in more frequent family meals consume a wider variety of foods. [4-5].

Toddlers thrive on predictable routines…

- All children benefit from routines; a predictable mealtime routine will help your child prepare [6].
- Each meal should begin and end in a predictable way.
- Participation in meal preparation and/or clean-up is a great way to get your child involved!

This is a team effort!

- All family members should follow the routine and share the **same** food options.
- You can offer as many choices as you like, but each meal should include at least **1** of your child's *preferred* foods, and **1** of your child's *targeted* foods.
- All family members should self-serve all foods offered to his/her plate **OR** to the **learning plate.**
- The learning plate provides a safe zone to learn about foods.

- The learning plate should be placed in the middle of the table, so everyone is able to "learn."
- Describe food in terms of sensory and physical characteristics, but avoid positive or negative connotations (i.e. the taste is "sweet" or "tart," rather than "good" or "bad.")
- Have fun! Build a positive environment of exploration without pressure.

The Learning Plate

Let's Get Started!

- ❖ Practice following a predictable mealtime routine over the next 3-4 days.
- ❖ Every recorded meal should be served "family style," and include at least one adult and your child.
- ❖ No electronics, toys, or phones at the table. Focus on each other and food exploration.

Preferred vs. Targeted Foods

- ***Preferred*** foods are foods that your child will *accept* (food is accepted into mouth, chewed and swallowed) *most of the time* (>90%) when he/she is offered.
- ***Targeted*** foods are foods that you would like your child to eat, but he/she will *refuse completely*, or *refuse after one bite* when these foods are offered.

Food List

Preferred	Targeted
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____
6. _____	6. _____
7. _____	7. _____
8. _____	8. _____
9. _____	9. _____
10. _____	10. _____
11. _____	11. _____
12. _____	12. _____
13. _____	13. _____
14. _____	14. _____
15. _____	15. _____
16. _____	16. _____
17. _____	17. _____
18. _____	18. _____

Goal-Setting

Family Intervention Goal:

Let's create a routine that works for your family!

Steps	Customization
Warning	
Hand-washing	
Transition	
Serving Food	
Meal Clean-up	

Parent-led Intervention Plan

1. I, _____, will incorporate ___ out of the ___ steps to our Family Meal Routine during each of our scheduled daily video-recorded meals.

Scheduled Daily Family Meals

Date	Time, Place, Who will participate
1.	
2.	
3.	
4.	

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Behavior Management

Did you know?

- Mealtime behaviors and feeding can be supported with natural "rewards" (praise, clapping, etc.) [1-2].

Positive Reinforcement

- Behavior that is "rewarded" is more likely to be repeated [3].
- Reinforce your child's food acceptance, exploration of new foods and appropriate mealtime behaviors with verbal praise, recognizing his/her effort, giving eye contact and celebrating small changes.
- It is important to positively reinforce acceptance of all foods offered, so each food is valued equally [4].
- Use this strategy with all family members, to maximize opportunities to learn from others.

Redirecting Inappropriate Behaviors

- It is important to avoid "rewarding" inappropriate behavior with attention.
- If your child demonstrates an inappropriate behavior, redirect them to use an acceptable alternative (i.e. redirect throwing food on floor to placing food into another bowl or dish).
- If your child follows through, praise or recognize the alternative behavior.

Family Intervention Goal:
Progress:

Parent-led Intervention Plan

1. I, _____, will incorporate ___ out of the ___ steps to our Family Meal Routine during each of our scheduled daily video-recorded meals.
2. I, _____, will positively reinforce at least ____ appropriate, explorative or redirected behaviors during each of our daily video-recorded meals.
3. I, _____, will _____

   _____

Scheduled Daily Family Meals

Date	Time, Place, Who will participate
1.	
2.	
3.	
4.	

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Food Exploration and Play

Did you know?

- Exposure to a wide variety of foods is important for building healthy eating patterns. [1].
- Simply repeating exposure to a food improves preference for and acceptance of that food in children [2].

Systematic Desensitization

- Some children may respond negatively to exposure if they are not prepared.
- Increasing the intensity of exposure gradually allows your child to interact within his/her comfort zone.
- Use the "Steps-To-Eating" to increase exposure to and promote exploration of targeted foods in a systematic way.
- Exploration activities should be based in play. Playing with food and getting messy are encouraged!

Family Intervention Goal:
Progress:

Parent-led Intervention Plan

1. I, _____, will incorporate ___ out of the ___ steps to our Family Meal Routine during each of our scheduled daily video-recorded meals.
2. I, _____, will positively reinforce at least ____ appropriate, explorative or redirected behaviors during each of our daily video-recorded meals.
3. I, _____, will demonstrate at least ____ different ways to explore and interact with foods during each of our daily video-recorded meals.
4. I, _____, will

   _____

Scheduled Daily Family Meals

Date	Time, Place, Who will participate
1.	
2.	
3.	
4.	

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A.2 THERAPIST DOCUMENTATION AND ADHERENCE CHECKLIST

Family Meals Component

☐	Educate family on the importance and benefits of family meals and routines for toddlers.
☐	Develop a family meal routine with the family. Make sure each routine includes: 1. An activity that each meal begins with (e.g. hand-washing). 2. Child participation during serving of food. 3. An activity that signifies the end of each meal (e.g. cleaning-up). Encourage parents to allow the child to use his/her hands while cleaning up.
☐	Specify "preferred" and "targeted" foods.
☐	Work with the family to set a meaningful goal for intervention.
☐	Introduce the rules of "family meals" 1. Everyone participates and shares the same food options. Each meal should include at least one caregiver and your child. 2. Offer as many food options as you like, but be sure to include at least 1 of your child's "preferred" foods, and one of your child's "targeted" foods. 3. All family members present should self-serve all foods to his/her plate OR the learning plate. 4. Foods on the learning plate should be discussed, with sensory characteristics described, during mealtime. 5. No electronics, phones or toys at the table (unless the toy is serving as a model to try and/or describe foods).
☐	Introduce the learning plate
☐	Provide feedback based on mealtime intervention delivery or potential issues.

Family Intervention Goal:

Plan for Practice:

1. I, _____, will incorporate ___ out of the ___ steps to our Family Meal Routine during each of our scheduled daily video-recorded meals.

Teaching Methods	
☐	Verbal Education
☐	Written Education
☐	Demonstration
☐	Mealtime Practice OR Role-Playing

Family ID:_____ Date: _____.

Positive Reinforcement Component

Family Intervention Goal:

Progress:

Were you able to complete planned practice in home? □ Yes

□ No

□	Educate family on the importance and benefits of positive reinforcement or rewards.
□	Encourage parent/caregiver to naturally reward (e.g. praise, clapping) acceptance and exploration of all food. All family members should be rewarded for this appropriate mealtime behavior.
□	Explain how to avoid "rewarding" inappropriate behavior with attention.
□	Teach parent/caregiver how to redirect inappropriate behaviors to acceptable alternatives, and then reinforce choosing to complete this alternate.
□	Problem solve through behavior issues specific to the child.
□	Provide feedback based on mealtime intervention delivery or reported outcomes.

New Plan for Practice:

1. I, _____, will incorporate ___ out of the ___ steps to our Family Meal Routine during each of our scheduled daily video-recorded meals.
2. I, _____, will positively reinforce at least ____ appropriate, explorative or redirected behaviors during each of our daily video-recorded meals.
3. I, _____, will

_____

Teaching Methods	
□	Verbal Education
□	Written Education
□	Demonstration
□	Mealtime Practice OR Role-Playing

Food Exploration and Play Component

Family Intervention Goal:

Progress:

Were you able to complete planned practice in home? □ Yes

□ No

□	Educate family on the importance and benefits of repeated exposure.
□	Explain why some children need graded exposure to new or previously refused foods.
□	Introduce the Steps To Eating, and explain how to use this tool to encourage various types of engagement with food.
□	Explain why play during meals is not only permitted, but encouraged. The messier, the better.
□	Brainstorm ways to play with food that are acceptable to the family, and supported by the environment.
□	Provide feedback based on mealtime intervention delivery or reported outcomes.

New Plan for Practice:

1. I, _____, will incorporate ___ out of the ___ steps to our Family Meal Routine during each of our scheduled daily video-recorded meals.

2. I, _____, will positively reinforce at least ____ appropriate, explorative or redirected behaviors during each of our daily video-recorded meals.

3. I, _____, will demonstrate at least ____ different ways to explore and interact with foods during each of our daily video-recorded meals.

Teaching Methods	
□	Verbal Education
□	Written Education
□	Demonstration
□	Mealtime Practice OR Role-Playing

Family ID:_____ Date: _____.

Wrap-Up

Family Intervention Goal: Progress:

☐	Review the basics of Family Meals, Positive Reinforcement and Food Exploration and Play. 1. Family Style Serving 2. Child participation in meal prep or clean-up 3. At least one adult shares meal with child 4. Rewarding appropriate behaviors 5. Redirecting inappropriate behaviors 6. Avoiding negatives during mealtime 7. Demonstrate and encourage different levels of food exploration 8. Allows child to guide their own exploration 9. Incorporating play into meals
☐	Discuss potential barriers to continued intervention implementation.
☐	Brainstorm solutions to barriers (such as scheduling daily meals, behavioral redirection, etc.).
☐	Provide feedback based on mealtime intervention delivery or reported outcomes.

Teaching Methods	
☐	Verbal Education
☐	Written Education
☐	Demonstration
☐	Mealtime Practice OR Role-Playing

Family ID:_____ Date: _____.

APPENDIX B

Parent Intervention Fidelity				
Phase: _____ *Baseline* _____ *Parent-Training* _____ *Family Autonomy* ***Meal (1-10):*** _____				
Family Meals				
	Yes	**No**	**Trained**	**N/A**
"Family-Style" serving with food on table within sight				
Child participates in serving food and/or meal clean-up				
At least one adult shares meal (same food options) with child				
Positive Reinforcement				
Reinforces appropriate/acceptable behaviors using praise				
Redirects inappropriate behavior to an acceptable alternative				
Avoids negatives (language, threats, punishment) during mealtime				
Food Exploration and Play				
Demonstrates & encourages different levels of food exploration				
Allows the child to guide their own exploration (i.e. backing down when the child refuses or demonstrates anxiety)				
Incorporates play into meals				

Figure 12. Fidelity Checklist

3-Day Food Diary

Day 1:	Day 2:	Day 3:
Breakfast	Breakfast	Breakfast
Between Meals (Snack)	Between Meals (Snack)	Between Meals (Snack)
Lunch	Lunch	Lunch
Between Meals (Snack)	Between Meals (Snack)	Between Meals (Snack)
Dinner	Dinner	Dinner
After Dinner	After Dinner	After Dinner

In order to help us better understand what your child eats on a regular basis, please do the following:

1. Record all the foods and drinks that your child has during a 24 hour period.
2. Record the amount of food or drink that is consumed. You can use measuring cups or common items to describe the size.
   Example: 1 apple, ½ cup Cheerios, chicken breast the size of a computer mouse, ketchup portion the size of a quarter
3. Record as many details as possible about the food and how it was prepared.
   Example: 8 ounces of whole milk, 1 fried chicken thigh, ¼ cup mashed potatoes with gravy
4. Be sure to include at least one weekend day (Saturday or Sunday) during your 3-day food diary.

Figure 13. 3-Day Food Diary

CHILD FOOD INVENTORY

Indicate using the symbol **X** whether your child eats or drinks, does not eat or drink, or has not been offered each food listed below.

	Eats or drinks	Does not eat or drink	Has not been offered
Beverages			
Milk			
Hot chocolate			
Orange juice			
Other juice			
Fruit drinks (ex. Lemonade, sports drinks)			
Coffee			
Tea			
Soda			
Sugar-free soda			
Dairy			
Cheese			
Yogurt			
Ice cream			
Pudding			
Carbohydrates			
Bread			
Rice			
Pasta			
Pizza			
Tortillas			
Cereal			
Muffins			
Pancakes or waffles			
Snacks			
Chips			
Popcorn			
Pretzels			
Nuts			
Crackers			
Cookies			
Brownies			
Cake or pie			
Chocolate or candy bars			
Other candy			
Jello or pudding			

	Eats or drinks	Does not eat or drink	Has not been offered
Protein			
Beans			
Hot dogs			
Hamburger			
Fish			
Beef or steak			
Chicken			
Pork			
Ham			
Liver or organ meats			
Peanut butter			
Eggs			
Vegetables			
Corn			
Peas			
Tomatoes			
Peppers			
Carrots			
Broccoli			
Green beans			
Spinach			
Squash or zucchini			
Potatoes			
Lettuce			
Mixed vegetables			
Fruits			
Banana			
Peaches			
Oranges			
Apples			
Grapes			
Strawberries			
Pineapple			
Mixed fruit			
Condiments			
Salad dressing			
Mayonnaise			
Ketchup			
Mustard			
Butter			
Margarine			

Figure 14. Child Food Inventory

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