

ASSESSING PHOTO-TEXTING METHODS IN A HOME-BASED PARENT  
NUTRITION INTERVENTION

by

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## **DEDICATION**

This thesis project is dedicated to my committed and supportive family. My husband, B.J. Lines, sacrificed countless hours working overtime to pay for my degree, and listened to many more hours of nutrition research. My son, Zeke Donald Lines, you are a sweet, goofy and curious little boy. I love you beyond words and worlds. My Father and my Big Bit, James Donald Ladner, has encouraged me with laughs and financially supported me without hesitation. My Mother, Sara Beth Cain, has motivated and inspired me to work hard, be strong and not take myself too seriously. Last but not least, my sister, Colette has been by my side, simply allowing me to be me. I love you all very much.



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## **I. BACKGROUND**

Obesity prevalence has reached epidemic rates in the United States for both adults and children with an estimated 34.9% of adults and 16.9% of children (ages 2-19) categorized as obese.<sup>1</sup> Research predicts detrimental consequences of obesity in both childhood and adulthood, which has fueled the need for assessing and intervening on contributing factors to obesity.<sup>2</sup> Previous obesity interventions have focused on individual change, environmental assessments, as well as family support.<sup>3,4</sup> Modifiable contributors, such as physical settings, social networks, and personal factors, are a common focus for interventions.<sup>5</sup> Despite strong efforts from local, community, and national programs to improve the diet and physical activity of US citizens, obesity remains a public health concern.<sup>6</sup> Following a literature review of child obesity prevention and treatment interventions, a need for parent-focused interventions within the home food environment (HFE) has been identified. The following thesis reviews the current literature surrounding parenting practices that contribute to child obesity and details a piloted nutrition intervention for parents of pre-school aged children based on the needs identified through previous studies.

### **Tracking of Child Obesity**

Data from the National Health and Nutrition Examination Survey (NHANES) allows tracking of obesity trends throughout the United States.<sup>7</sup> The survey measures obesity risk factors of Americans through physical assessments and interviews among various population subgroups. NHANES conducts 24-hour recalls and food frequency questionnaires to determine dietary intake among participants. Resulting dietary and

nutrition analysis link dietary trends to body composition.<sup>7</sup> Specifically, poor nutrition intake and behaviors are often correlated with increased body mass index (BMI) and weight status. Diagnostic terms defined by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) are used to categorize obesity for adults and children.<sup>8</sup> BMI cut-off values of children between the ages of 2-19 years are determined using CDC sex-specific growth charts ( $\geq 95^{\text{th}}$  percentile is obese). However, adults' weights for those aged 20 years and older are characterized using BMI measurements; a BMI  $\geq 30$  is considered obese.

NHANES also identifies common weight-related co-morbidities including, but not limited to, heart disease, stroke, type 2 diabetes, and cancer.<sup>9</sup> In fact, obesity reduces quantity of life through increased risk of comorbidities and lowered life expectancy.<sup>10,11</sup> In 2004, the practicing Surgeon General Richard Carmona predicted that current generations of young citizens might be the first in history to have a lower life expectancy than their parents due to the prevalence of chronic diseases, namely obesity.<sup>12</sup> Developing obesity during childhood poses risk for additional systemic health ailments (Figure 1).<sup>2,13</sup> Health risks of obese children persist to adulthood, therefore interventions designed to reduce obesity among young children are needed.<sup>13-15</sup>



Figure 1. Depiction of consequences resulting from child obesity. Adapted from Lakshman et al., 2012.<sup>13</sup>

### **Disparities in Obesity Trends**

A recent report shows that obesity rates among children aged 2-5 declined by 43% since 2004.<sup>1</sup> Despite this improvement, obesity rates among adults and children remain high in the US, and rates have not declined evenly across the country.<sup>1,16</sup>

Geographic location and population demographics contribute to obesity rate disparities in the US.<sup>17</sup> For example, current obesity rates are higher among individuals in the Midwest

and South regions of the US compared to those in the Northeast and West regions 29.5%, 29.4% and 25.3%, 25.1% respectively.<sup>14</sup> Texas shows higher disparities in obesity rates among adults and children compared to other areas of the nation. Alarming, the CDC reported that 65.9% of Texas adults had a BMI  $\geq 25$  and thus categorized as overweight, one of the highest percentages among all 50 states.<sup>17</sup> Furthermore, high school students in Texas had higher rates of obesity compared to high school students across the US.<sup>18</sup> For example, the Robert Wood Johnson Foundation reported that 15.7% of Texas high school students are obese compared to 19.1% of youth between the ages of 10 and 17 years nationally.<sup>16,18</sup>

Demographic characteristics provide additional measures that contribute to obesity risk.<sup>1,19,20</sup> According to the National Institute for Children's Healthcare Quality, Texas children who live below the federal poverty level have 2.7 times the risk of becoming obese compared to children living above the poverty level.<sup>18</sup> Higher rates of obesity among low-income households have been attributed to food insecurity, lack of health resources, and lower education levels.<sup>21</sup> In 2012, the National Center for Chronic Disease Prevention and Health Promotion reported that 32% of low income children ages two and five are either overweight or obese in the state of Texas.<sup>22</sup> Additionally, a study among low-income children shows that obesity prevalence further differs among ethnic groups.<sup>23</sup> Although current data is unavailable, this finding is supported by previous obesity rates historically being highest among Hispanic child and adult populations throughout the United States.<sup>17,18,22</sup>

Within the state of Texas there are further disparities in child obesity rates. Children in Hays County, Texas have higher rates of overweight and obesity compared to



surrounding districts.<sup>22</sup> This may be attributed to a high distribution of Hispanic and Latino citizens (38.4%) as well as citizens living below the federal poverty level (16.8%).<sup>24</sup> Obesity intervention programs aimed at assisting these populations should identify modifiable factors within their environment which are contributing to increased risk.<sup>3,20</sup>

### **Contributors to Obesity**

A variety of factors are linked to obesity risk and development such as environment, genetics, demographic characteristics, and gut microbiota.<sup>25,26</sup> Dietary intake and physical activity are two main contributors to obesity in the US.<sup>27</sup> Unfortunately, many American children are not meeting recommended dietary intakes.<sup>7,22,28</sup> Nutrient dense foods such as fruits, vegetables, and whole grains are consumed in limited quantities, while foods high in saturated fat, sodium, and calories are consumed in excess.<sup>29</sup> One explanation relates to the consistent demand for foods prepared outside of the home, such as from restaurants and fast foods.<sup>30</sup> The Economic Research Service (ERS) reported that Americans spend more money each year on food purchases; expenditures on foods away from home have nearly doubled since 1960.<sup>30</sup> Compared to meals cooked at home, meals purchased outside of the home are consistently higher in fat, sodium and calories, in addition to having larger portion sizes.<sup>31</sup> Furthermore, consuming nutrient poor foods promote a preference for these foods in children.<sup>32,33</sup> Research suggests an increased need for modification of obesogenic environments to create settings that promote healthy relationships with food, and endorse food preferences for nutrient dense foods, such as fruits, vegetables, whole grains and low-fat dairy.<sup>32,34</sup> Food preferences are developed through our environments, and the social models within these environments, beginning at

a young age.<sup>5,33</sup> For instance, a child's taste preferences begin much before solid foods are consumed; a parent's decision to breast or formula feed strongly encourages an infant's taste preferences, which continue into young childhood.

### **Contributing Environments**

Preventing obesity prior to the age of 5 years exhibits promising protective results from weight-related disorders.<sup>31,33</sup> Furthermore, early intervention allows the shaping of healthy eating behaviors which carry into adolescence and adulthood.<sup>35,36</sup> Eating behaviors are learned through a child's environment such as the home, school and community.<sup>5</sup> The model shown in Figure 2 summarizes a conceptual framework of obesity contributors within the mentioned environments. The four constructs of the model represent settings that influence a child's eating behavior: (1) individual factors, (2) social networks, (3) physical environments, and (4) sectors of society. Together, these settings interact to influence health behaviors, which can increase or decrease one's risk of obesity. Macro-level environments produce political, economic, and industrial influences on lower-level physical environments within a society. Physical environments include settings within the community, such as work, school and home, as well as the social interactions within these environments. Children's food preferences are learned through the exposure of eating behaviors modeled by family, friends and guardians within these environments.<sup>5,37</sup> Therefore, a majority of child obesity interventions focus on the home and school setting.<sup>13</sup> As mentioned, a child's food habits and behaviors are most significantly influenced during the first years of life.<sup>33,38,39</sup> Since the parent (or legal guardian) is the primary caretaker during early life, parents strongly influence on a child's taste preferences and food behaviors that contribute to obesity risk.

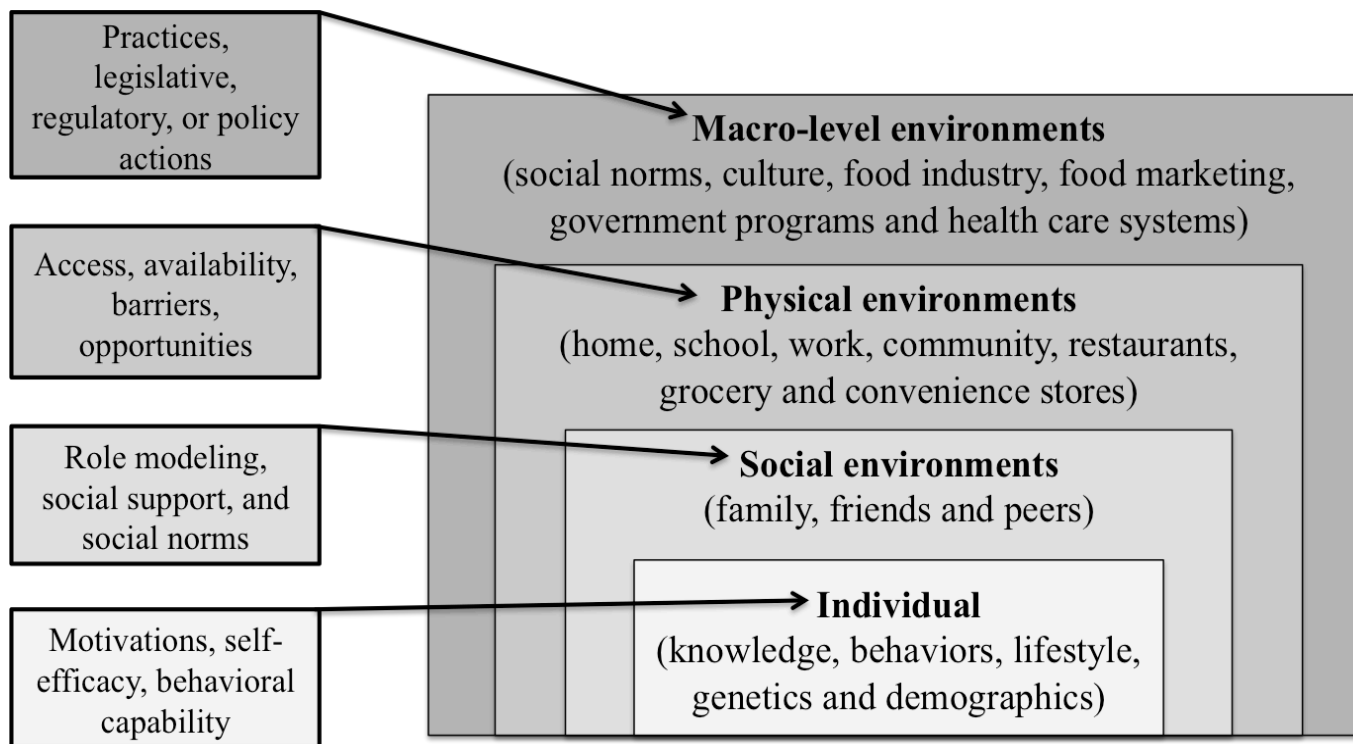


Figure 2. Behavioral settings that influence what children eat. Environments house both social and individual influences on food behaviors. For young children, the parent within the home setting is a major contributor to learned behaviors. Adapted from the ecological model created by Story et al.<sup>5</sup>

### Obesity-related Parenting Practices

Parents influence their child's eating behaviors through food purchases, modeling of personal eating behaviors, and encouragement of food preferences for healthful or unhealthful foods.<sup>37,40</sup> Davison et al. developed the family ecological model (FEM) which focuses on four areas of parenting that are associated with a child's risk of obesity.<sup>41</sup> The model explores the interlinking components of parenting that influence child obesity. The center of the model suggests that parenting practices influence

nutrition and physical activity behaviors and patterns of a child. Parenting practices are affected by additional factors, such as demographics of the family and child, characteristics of environmental settings, and government influence on policies affecting child nutrition.<sup>41,42</sup> Parent's knowledge and beliefs regarding healthy behaviors often guide their own parenting behaviors.<sup>42</sup> Parenting choices reflect onto the child through the parent's modeling of healthy or unhealthy behaviors, and encouragement of these behaviors through availability and access to health-promoting resources such as foods or physical activity.<sup>43-45</sup> Therefore, addressing parenting practices as an early age intervention for obesity prevention assists in changing both the parent and the child's eating behaviors in order to create sustainable, healthy eating behaviors.<sup>32,46</sup>

Both nutrition and physical activity are addressed in the FEM. Research findings suggest that learned dietary behaviors are the most significant predictor of obesity risk of young children.<sup>2,37,47</sup> Illustrating these relationships, Figure 3 displays an adaptation of the FEM, the Parent Nutrition Practices (PNP) model, which places additional emphasis on parenting behaviors related to nutrition in the home, and removes outside influences in order to focus on parenting inside the home and family environment. The PNP model was created to inform development of a parent nutrition intervention study.

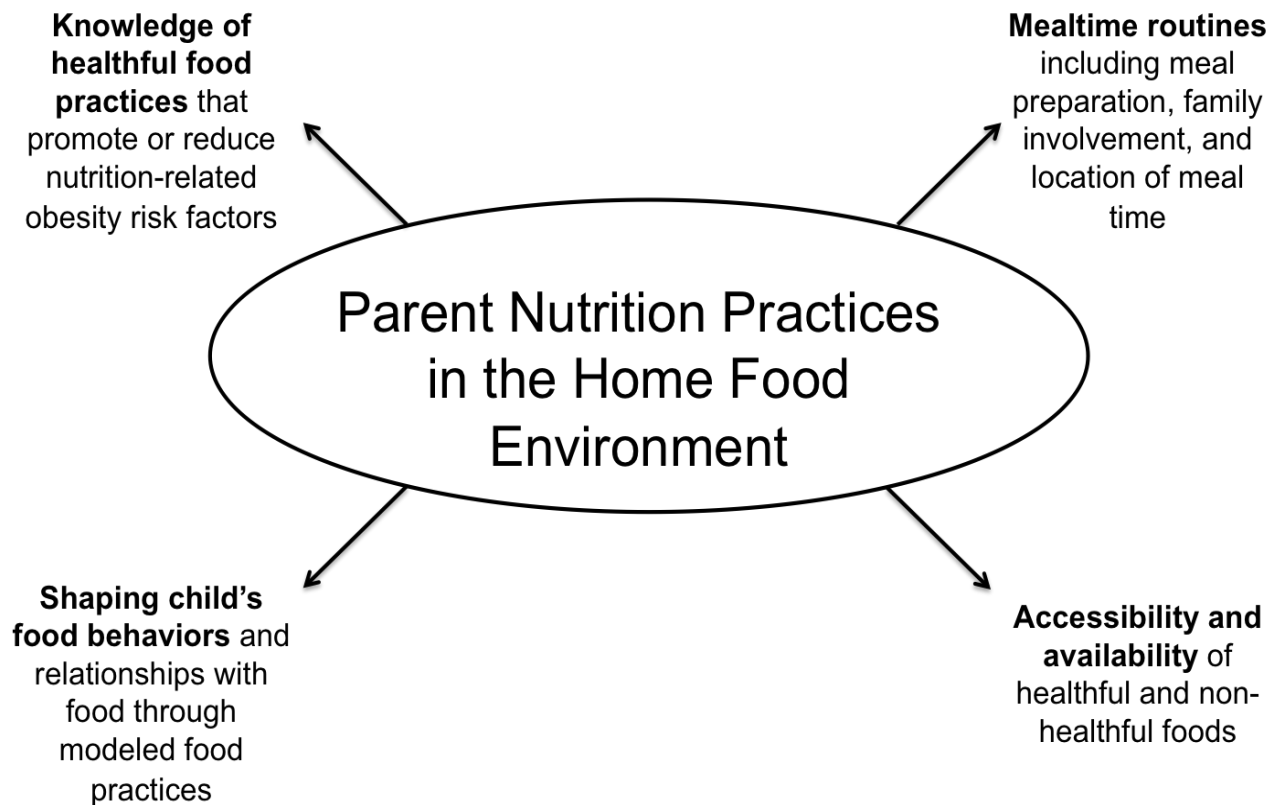


Figure 3. The parent nutrition practices model places emphasis on how parenting factors contribute to child nutrition practices in the home food environment. Model is adapted from the family ecological model by Davison et al.<sup>41</sup>

Measures within the PNP model focus on how parents influence a child's food preferences, which may promote or prevent child obesity. The measures include 1) knowledge of healthful food practices, 2) mealtime routines, 3) shaping of food behaviors, and 4) access and availability of foods. Focusing on these four areas of parenting can assist in categorizing the needs of parents to modify their child's dietary intake in the home. The model measures have been studied in previous interventions targeting child obesity in the HFE.<sup>32,48,49</sup> The measures have been identified as predictors

of child weight status and eating behaviors; eating behaviors differ among normal and overweight children, and are influenced by the eating behaviors of their parents.<sup>31,32,50</sup> Parent's eating behaviors serve as a guide for children's behaviors because children may model the behaviors they observe. Parent's eating behaviors may be modeled through food preferences. For example, a parent's preference for fast foods is modeled to their child, and may encourage the child's preference for fast foods. In contrast, parent's consumption of fruits and vegetables is consistently associated with their child's consumption of the same foods.<sup>46,51,52</sup> Each parent nutrition practice listed within the PNP model (Figure 3) interacts with individual factors of other family members and the home food environment that creates food behaviors of the young child.

### **Shaping Child's Food Behaviors**

Parents shape their child's relationship with food through encouragement of healthy or non-healthy foods.<sup>53,54</sup> Parents may use food as a reward or punishment, thereby shaping how children feel about foods.<sup>55,56</sup> Consistency of mealtime practices determined by the parent also shape how children feel while eating, such as consuming meals with family members versus consuming meals alone or in front of the television.<sup>57,58</sup> Children who consistently consume meals with their family have reduced obesity risk.<sup>58</sup> Additional benefits of shared family meals include increased consumption of balanced diets, improved emotional well-being and family bonding.<sup>31,59,60</sup> Measuring the barriers and facilitators that parents face when encouraging family meals at home can assist these parents in creating environments which promote shared family meals and emotional benefits to the child.<sup>58,61</sup>

## **Parent's Nutrition Knowledge**

Research suggests an association between parent's nutrition knowledge and beliefs and child weight status.<sup>62</sup> Home-based interventions should measure parents' nutrition knowledge and beliefs to assist in creating environments for children that promote healthy eating behaviors.<sup>63</sup> Parenting knowledge and beliefs include a parent's perception regarding their ability to influence a child's food preferences, the impact of outside influencers such as peers and media, and the importance of nutrition.<sup>64,65</sup> Parental knowledge and beliefs also guide dietary choices in the home setting.<sup>66,67</sup> For example, parents likely decide food purchases and meal content, and parents determine whether foods is within reach or visible to a child.<sup>68,69</sup> Food accessibility has been shown to influence what foods are consumed, e.g. when fruits and vegetables are visible to children, consumption of these foods is increased.<sup>70,71</sup>

The knowledge and beliefs reflected in the parent's eating behaviors are correlated to multiple demographic characteristics.<sup>20</sup> Therefore, it is important to assess demographic characteristics of a population in order to understand possible cultural, socioeconomic and education barriers and facilitators affecting dietary choices. For example, disparities in frequency of shared family meals, and availability of fresh fruits and vegetables in the home vary among low-income, minority populations; low-income households are associated with fewer shared family meals and availability of fresh fruits and vegetables.<sup>72,73</sup> Also, low-income families may lack nutrition education, access to healthy foods or proper cooking equipment which can adversely affect healthy food choices.<sup>74</sup> If demographics affect the decisions of a population's dietary choices then identifying these disparities is necessary to assist participants in overcoming these barriers.

## **Child Obesity Intervention Review**

A literature review focused on influential physical environments contributing to child obesity interventions identified a pressing need for further assessments within the HFE, particularly related to parent-feeding practices within the HFE. Most studies that have examined the influence of the physical environment on child obesity have focused on school and clinical interventions. Such studies aimed to modify or measure child food preferences, and focused namely on increasing caregiver nutrition knowledge and modeling eating behaviors by peers and caregivers.<sup>75-77</sup> The school-based interventions acknowledge that parents should be involved in the intervention in order to assist the child's acceptance and adherence to the behavior change.<sup>78</sup> An unpublished study conducted through Best Food For Infants and Toddlers (Best Food FITS or BFF) that assessed the food environments of childcare centers, improved facility menus and surveyed facility directors, also highlighted a need for parent-focused interventions within the home. Facility directors acknowledge that they require the help of parents to encourage healthy nutrition practices for children at school. However, directors reported that reaching parents was difficult due to family schedules.

Home based interventions commonly focus on parent feeding practices, such as knowledge and/or beliefs about nutrition, personal food preferences, and parent's modeling of eating behaviors.<sup>36</sup> Common findings include a strong association between parent's eating behaviors and child eating behaviors.<sup>32</sup> Ultimately, findings among HFE studies conclude that changes in the HFE promote positive dietary changes in young children.<sup>79,80</sup> Improving food practices of the entire family, or social environment, within the home, increases a child's likelihood to adopt these healthy behaviors.



The inclusion of family members, specifically parents, enhances intervention outcomes by focusing on feasible changes parents can make within the HFE.<sup>79,81</sup> Successful interventions include altering the availability and accessibility of foods and planning mealtimes to include all family members.<sup>82</sup> In fact, parent-only interventions show increased child weight loss or maintenance when compared to child-only obesity interventions.<sup>81</sup> Development of intervention programs, which meet the unique needs of a parent population, may help facilitate participant's understanding and commitment to the intervention.<sup>75,82</sup> Suggestions for future interventions highlight a need for parent interventions to focus on behavior change.<sup>40,45,50</sup> Behavior change techniques encourage self-awareness of current barriers, and promote self-empowerment to improve personal barriers for change.<sup>35,83</sup>

Based on the literature, there is a compelling need for parent focused nutrition interventions in households with preschool aged children. Parents have been identified as the largest influence on their young child's eating behaviors because parents likely determine when, and what a child eats.<sup>15</sup> Improving nutrition within the home can reduce the risk of child obesity and associated co- morbidities.<sup>84</sup> Increasing the parent's awareness of food behaviors can assist in improving their accountability for current eating behaviors, and can help improve such behaviors in the home.<sup>5,68,85</sup> Parent empowerment and awareness regarding obesity risk factors should be addressed in a way that engages parents.<sup>82</sup> Employing interventions that assist parents to modify their knowledge, beliefs, and behaviors around food in turn assist them in creating healthy food environments for their children.

## **Photography-based Intervention Methods**

Community-based participatory research techniques recently began utilizing imagery focused methods for story telling and reflection processes.<sup>86-88</sup> For example, photo voice has been used as documentary processes of data collection. Photo voice was originally developed as a method to garner dialogue from participants, both through photographs and participants voiced reflection of the photograph's meaning.<sup>89-91</sup> Photo voice has been adapted to elicit dialogue from various populations and conducted within numerous settings. Photographs are then used to encourage individual, community, or political change through personal reflection. Photo voice methods assist researchers in identifying descriptive themes within a data set that otherwise may be missed with traditional collection methods, such as surveys and interviews.<sup>92,93</sup> Photo-reflections provide researchers with an understanding of the data measurements from the participant's viewpoint to initiate changes to specific environments.<sup>94</sup> Researchers using photo methods have the ability to collect detailed, insightful, qualitative data from a range of population sizes.<sup>95</sup> The photo documenting process has been described as both enjoyable and helpful; participants report increased awareness of their environment, and increased confidence in implementing healthful changes on the individual and community level.<sup>96,97</sup> Furthermore, participants benefit from critical thinking and active engagement in the data collection process, which facilitates individual empowerment.<sup>98</sup>

Strengths of photo-based research include decreased project cost and the ability for communication between researcher and participant to be relatively quick. Notable limitations have been reported with photo voice projects and should be considered when developing future methods. First, distribution of disposable or digital cameras to

participants has resulted in loss of photographs due to camera misplacement or participants being unfamiliar with the use of the camera.<sup>97</sup> Second, age of participants was reported to be a determinant of photo-quality and understanding of the project's purpose; researchers suggest using adult populations, or developing a youth photo voice curriculum that allows more time for project explanation and data collection among young age groups.<sup>99</sup> Third, studies report a lack of diversity among participant populations; many studies had primarily female populations, or struggled to gather varying ethnicities within a sample.<sup>94,100</sup> Lastly, stress is placed upon following ethical standards when handling private data such as photographs. Data dissemination must consider outcomes and implications so as not to misrepresent a photograph's meaning.<sup>101</sup> Any study using photo-based methods should address the mentioned limitations in order to facilitate increased participation and data quality.

Photo methods have been used in various fields of study including health promotion, community action, and environment analysis.<sup>91,97,98</sup> For example, obesity prevention has been studied using photo voice methods with adolescents in community settings and has been used to track food intake and nutrition practices.<sup>94, 102,103</sup> Photo methods are a promising for nutrition interventions within the home as they allow participants to increase awareness of their current environmental settings, and facilitate individual change based on photo-reflection.<sup>101</sup>

### **Text-messaging as a Data Collection Tool**

The use of electronic technology has emerged as an efficient tool for collecting data among parent populations.<sup>104,105</sup> Parent populations benefit from web and text-based

education programs by saving time and money required for involvement.<sup>83</sup> The increase in available technology has triggered the use of mobile devices as a data collection tool. Cell phone ownership has increased in the past decade, in fact, 85% of adults in the United States own a cell phone, and a higher percentage have access to a cell phone in their household.<sup>106</sup> Text messaging has emerged as a highly acceptable form of communication among adults aged 18-68 years.<sup>107</sup> Among cell phone owners, text messaging and photography remain the highest reported use of cell phone functions.<sup>108</sup> In fact, participants report text messaging to be a more acceptable form of communication compared to cell phone calls.<sup>83</sup> Furthermore, parent populations acknowledge the benefits of using text messaging to improve their child's health status, monitor and modify child health behaviors.<sup>104</sup>

As cell phone technology expands, a need for innovative and validated data collection tools should be explored. Text messaging allows for a convenient, private, and direct communication with researchers. Woolford et al., 2012 tested the use of text messaging among an adolescent population to gather photos on struggles associated with obesity.<sup>102</sup> Participants in this study reported a high acceptance of the convenience and ease of sending photographs via text message, as well as increasing their awareness of what motivates and inhibits behavior change. Mareno 2014 focused on mothers' perception of physical activity and healthy practices.<sup>94</sup> These same methods should be explored in a parent population to assess food practices within the HFE that contribute to child's dietary preferences and food behaviors. Photos and reflections from this parent population may provide valuable insights to conducting child obesity interventions in the

HFE. To our knowledge, the combination of text messaging and photo voice has been combined as a data collection previously.<sup>94,102</sup>

### **Research Questions**

The purpose of this qualitative study was to develop a photo-texting method for nutrition interventions among a population of parents having a pre-school aged child in Hays County, Texas. The focus of this study involves addressing parenting factors, such as shaping the child's food behaviors, knowledge of healthful food practices, mealtime routines, and food accessibility. Previous research has revealed that increasing parent's nutrition knowledge and nutrition behaviors has been limited by time constraints, response rates/participation, and a need for population-specific content which contributes to positive child nutrition practices within the HFE.<sup>80</sup> This study aimed to explore an efficient method for intervening on a parent population with the main objective of increasing parent nutrition knowledge, and modifying nutrition behaviors within the home.

Central research questions: 1) Can a photo-texting method effectively assess parents' facilitators and barriers to a healthy HFE? 2) Is this method, using personal mobile devices, acceptable to parents, to use for both nutrition assessment and goal setting?

### **Aims and Objectives**

The specific aims of the study are: (1) develop a photo-texting technique tool to evaluate the nutrition behaviors of parents with preschool aged children; (2) assess participant's nutrition knowledge, nutrition practices, and self-awareness relating to their HFE for

participants to identify target areas for individual behavior change needs; (3) analyze the effectiveness of using text messaging as a medium for photo assessment methods among a parent population.

**Specific Aim (1)** Develop a photo-texting technique to as a tool to evaluate the nutrition behaviors of parents with preschool aged children.

*Objective 1.* The first objective is to design a self-assessment tool that correlates to the constructs of the Parent Nutrition Practices model (Figure 3). For this objective two photo assignments are designed per the model focus area: 1) shaping child's food behaviors, 2) knowledge of healthful food practices, 3) mealtime routines, and 4) accessibility and availability of foods. A total of eight photo assignments are created to measure the participant's nutrition practices in their home.

*Objective 2.* For the second objective, themes are created from the project model using QSR International's NVivo 10 software. A coding structure identifies reoccurring themes from the data and themes are categorized into facilitators and barriers of the HFE.

**Specific Aim (2)** Assess participant's nutrition knowledge, nutrition practices, and self-awareness relating to their HFE to identify target areas for individual behavior change needs.

*Objective 1.* The first objective identifies parent's nutrition practices as either a facilitator or a barrier to the HFE. Practices are categorized into emerging themes within photographs and text reflections.

*Objective 2.* The second objective measures participant's responses from a follow-up survey focusing on their perceived level of awareness of their HFE following the photo-texting pilot intervention.

**Specific Aim (3)** Assess the effectiveness of using text messaging as a medium for photo-texting methods among a parent population.

*Objective 1.* The first objective calculated text message response rates for each photo assignment as well as the average time to respond to each photo assignment.

*Objective 2.* The second objective measures responses from an online survey for participant's perceived time, effort, and acceptance of using text messaging to conduct a photo-texting activity.

## **II. METHODS**

### **Project Design: Best Food FITS**

The Best Food FITS intervention project has worked within Hays County, Texas to reduce young children's obesity risk. Previously, Best Food FITS collaborated with local restaurants and childcare centers. The research team assisted restaurants to develop children's menus free from sugar-sweetened beverages (SSB), and to increase fruit and vegetable options.<sup>109</sup> From 2012-2013, Best Food FITS researchers studied the nutrition and physical activity environments of childcare centers, and provided each facility with tools to improve their individual food environmental needs. Interviews with childcare center directors identified barriers to serving children nutritious meals and snacks in school settings. Common barriers included state mandated menu requirements, cost of food, child food preferences and resistance to food policies and service by parents. Best Food FITS assisted childcare centers in addressing the identified barriers through providing example policy changes, low-cost recipes, and environmental modifiers to promote nutrition and physical activity. To address the impact of the HFE on child food preferences, Best Food FITS initiated the Parent's study to focus on parents of pre-school aged children, and how to identify their barriers and facilitators in regards to promoting healthy eating environments to their families.

The Best Food FITS Parent's study consisted of three phases. The first phase included a comprehensive survey and collection of dietary intake. During the second phase researchers distributed printouts of educational information on healthy nutrition practices through the childcare centers. The packet included an optional access to a private



Facebook page ran by Best Food FITS to provide additional nutrition education, and an invitation to the photo-texting project. The third phase included a post-intervention comprehensive survey and two 24-hour recalls. The collected data has been analyzed to explore the ability of modifying parent-feeding practices within the HFE.

The comprehensive survey was designed to collect both parent and child anthropometric and demographic data, in addition to questions assessing the HFE. Specifically, questions asked about parent nutrition knowledge, parent feeding practices, parent-self efficacy, and mealtime management. Parents also completed a series of 24hr-recalls to provide researchers with information on their child's dietary intake.

Information packets containing printed educational materials to improve the HFE were given to all parents who completed the survey. Printed materials included meal planning assistance, healthy recipes, how to serve healthy meals on a budget, managing mealtimes and parent feeding practice tips. Parents were also sent a flier and email invitation to take part in a photo-texting project using their mobile phones, referred to as a home photo activity. A total of 43 parents enrolled in the photo-texting activity, with 41 participants completing the project.

### **Recruitment and Sample**

Parent study participants were recruited from 11 childcare centers in Hays County, Texas. Childcare center directors provided permission for researchers to recruit parents of their students during hours of child drop-off and pick-up. Directors were notified of the study's objectives, timeline and incentive for participating. Childcare centers did not receive an incentive for participation in the recruitment process, however, directors were aware that

participating parents would be incentivized with grocery store gift cards for each phase of the study. Both English and Spanish speaking parents were recruited.

Parents with a child 2-5 years old at the time of recruitment were asked to complete the comprehensive survey either in person, or online. One survey per household was allowed; parents with more than one child between the ages of 2-5 were asked to choose one child on who to base answers. Researchers confirmed that surveys were complete, included an appropriate age child, and that one answer per question was given. A total of 161 parents completed the survey and were included the intervention phases of the project.

From the initial 161 participants, all were invited to enroll in the photo-texting portion of the study through e-mail and fliers distributed through the childcare center. Through self-selection, 43 participants enrolled in the photo-texting project; one participant dropped out prior to data collection. To enroll, parents were instructed to text message the word “yes” to the research mobile phone. Researchers replied via text message with information about the photo-texting project including the start date, expectations, and how to discontinue participation at any time.

Participant demographics were obtained via a self-administered survey; a summary of the photo-texting participant demographics may be viewed in Table 1. The majority of participants from the photo-texting project resided in San Marcos (57.14%), followed by Kyle (19.05%), Buda (16.67%), and less than 8% from the surrounding cities of Manchaca, Cedar Creek, and, Austin.

Table 1. Photo-texting participant demographics (n=42).

<b>Measure</b>	<b>Sample (n)</b>	<b>%</b>
<b>Household role</b>		
Mother	40	95.24
Father	2	4.76
<b>Age (years)</b>		
20-29	13	30.95
30-39	27	64.29
40-49	1	2.38
>50	1	2.38
<b>Ethnicity</b>		
Non-Hispanic White	24	57.14
Hispanic	15	35.72
Black	2	4.76
Asian	1	2.38
<b>Annual household income</b>		
<10,000	3	7.14
10,000-20,000	7	16.67
20,001-40,000	5	11.9
40,001-75,000	13	30.95
>75,001	14	33.33
<b>Employment status</b>		
Unemployed	8	19.05
Work <40 hrs. wk.	8	19.05
Work >40 hrs. wk.	26	61.9
<b>Children in home (#)</b>		
1	19	45.24
2	15	35.71
3	6	14.29
4-6	2	4.76

## **Photo-texting Methodology**

Drawing from the project aims and objectives, a photo-texting method was developed. Design processes sought to assess the HFE through text messaging using mobile devices owned by participants. All materials and methods were compliant with the Texas State University Institutional Review Board guidelines (IRB); all aspects of this project were approved (2013Q9495).

The following seven steps are an excerpt from a manuscript prepared for and submitted to the Centers for Disease Control and Prevention's academic journal, *Prevention Chronic Disease*. The full manuscript was submitted as of March 2016. This section provides a stepwise guide of the implemented photo-texting methodology.

### **Excerpt Step 1. Development of Photo Assignments**

The purpose of this step is to create photo assignments in which the participant is instructed to take a photo and reflect on a certain activity or area of the participant's HFE. The appropriate length of photo assignments is approximately 20-25 words, which are clearly stated to explain the photo topic and provide a submission deadline. Additionally, a directive may be provided to participants instructing that they not alter their environment prior to taking photographs (i.e. no cleaning, organization or rearrangement of the environment). Participants should also be informed that photos might be disseminated or shared.

The next priority is to identify target assessment areas within the HFE; these areas of the home inform the context of each photo assignment. A systematic literature review of

modifiers to healthy behaviors within the HFE will help to identify themes that will assist with the development of photo assignments, which promote critical reflection about each topic. In general, assessment areas may be selected to reflect factors representing multi-level concepts of the social ecological model or other desired project outcomes. Photo assignment areas related to household food practices can include mealtime routines, parent nutrition knowledge, and access to foods. The number of photo assignments needed depends on the project time frame; one photo assignment per weekday, and no more than 4-5 per week may be feasible to allow participant to have time for daily reflection. The incorporation of participant “free days” allows the participants an opportunity to submit tardy assessments and enables the cohort to complete the assessments at the same rate. Flexibility within the assessment schedule can assist in participant retention. Within a pilot-study of this method, four household food areas were assessed with eight different photo assignments (two photo assignments per area). Table 2 describes the assessment areas and corresponding photo assignment. Each participant received a daily text message prompt, over a 2-week period, excluding weekends. During a third week, project members helped participants set goals based on their self-assessments of previous photo assignments.

Table 2. Photo-texting assignments and their associated measure within the parent nutrition practices model.

<b>Assessed Topic within the Home Food Environment</b>	<b>Photo-texting Assignment(s)</b>
Shaping Food Behaviors	Your child's favorite fruit or vegetable in the home
	Something that gets in the way of your family eating healthy
Food Accessibility/Availability	Open refrigerator
	Open dry food storage area
Family Mealtime Routines	Tonight's family dinner preparation
	Tonight's family dinner
Goal Setting	Nutrition goal that you can achieve over the weekend
	Nutrition goal that you can achieve over the next month

## **Excerpt Step 2. Conducting Pilot Testing**

An optional, though recommended, developmental step of photo-texting is to conduct a procedural pilot. Once photo assignments have been developed, a pilot is helpful to assist with adjustments to communication and technique with the target population.

Adjustments then can be made, prior to data collection and management. Through pilot studies, unforeseen data management needs were identified. Team members were inundated with incoming data and had to develop practical time and data management techniques. (Suggested methods to manage incoming data are discussed in Step 6.)

Additionally, based on feedback from pilot groups, text message language was modified to reduce the word count and clarify instructions and timeframe adjustments (i.e. participants were asked to respond within 24 hours).

## **Excerpt Step 3. Recruiting Participants**

Once the photo assignment protocols are refined, participant recruitment can begin.

Recruitment materials should invite participants to join a photo activity and capture food behaviors in their home. Recruitment fliers explain enrollment procedures, the project's timeline, list of expectations (including required personal mobile device equipped with a camera and text message capabilities), and provide the project's contact cell phone number. If applicable, participants are informed of potential costs associated with texting.

To confirm interest in enrollment, participants can send a text message to the project's contact phone number. Then, the contact can direct the participant to the project timeline and information about procedures by responding to the text message. A day prior to the

project start date, a text message can be used to remind participants about the project launch. Participants may opt out by texting “stop” to the contact phone number.

Pre-assessment questionnaires can be used to collect desired demographic and baseline data prior to beginning the study. Consider implementing a screening tool regarding feeding practices, food frequency questionnaire, or a HFE survey.

#### **Excerpt Step 4. Collecting Photographs and Self-assessment Responses**

To begin the process of photo collection, a text message containing one photo assignment should be sent to participants. Texts sent early in the day allow most participants to plan for the daily assessment. Each participant submission should include the photo that represents the self-assessment assignment and a corresponding text message to describe the photo. Participants should be encouraged to provide both facilitators and barriers within the photo assignment theme. Multiple photos and corresponding texts may be submitted per daily assignment. Submission deadlines for photo assignments allow for the progression of the assessment with a large group, however photos may be accepted until the project’s end date. Likewise, break days for participant to “catch up” with the assignment schedule provides flexibility and encourages participant retention.

After the schedule of photo assignments, ask participants to reflect upon the submitted self-assessments. At this point, each participant can develop a short-term (i.e. over the weekend) and long-term (i.e. over the next month) goal to improve upon their family’s current dietary or other health practices. The project leaders can then text with the participant to make specific, measurable, attainable, realistic and timely (SMART) goals. In addition, the leader can choose to continue counseling with participants via text



message or e-mail. Moreover, the leader can provide nutrition education through targeted education materials, web sites, community resources, and future activities after the photo text assessment.

### **Excerpt Step 5. Responding to Participants**

Timely responses require the contact person to operate the phone during day hours and respond to evening submissions the following morning. A verification response should follow each text message submission. Responses can also include helpful, supportive, and encouraging comments for effective behavior change. For example, responses can acknowledge a photo submission (i.e. “thank you for your submission”,) reassure that they followed directions (i.e. “great work!”,) and/or answer questions. Additionally, reminder prompts can encourage participants to submit photo assignments on time; reminder prompts are more effective if sent to participants in the evening. Commentary from pilot testing feedback showed that reminders helped participants stay on schedule, especially those sent between 8:00pm and 10:00pm.

### **Step 6. Photo-text Management, Classification, and Analysis**

When a photo assignment is received, the photograph can be downloaded from the phone and uploaded to a password protected storage system, or an external hard-drive; spreadsheets can facilitate the storage of written text assessments. Data are reserved outside of the phone’s storage card to allow access, organization, analysis and safety insurance of data.

Next, to commence with analysis of the photographs and self-assessments, the identified themes from the literature can be used to categorize photo assignments and create a code structure. Coding of text and photo submissions should be done through multiple passes to identify emergent and reoccurring themes. For the analysis of a large data set, qualitative organization software, such as QSR International's NVivo 10, may be used with one or more coders.

Analysis was completed using QSR International's NVivo 10 Software. Codes were assigned per photo and multiple coders followed a standardized coding method. Multiple coders allowed for agreement on emergent themes before applying them to the code structure and calculation of inter-coder reliability. This final code structure revealed the most prevalent facilitators and barriers within and across the photo-texting assignments.

### **Excerpt Step 7. Collecting Participant Feedback**

In the final week of the project, an evaluation survey can be conducted through a phone call, text messages, or e-mail link to a secure email account. A follow-up online survey can be provided to assess the efficacy of the project. Feedback surveys can include questions to assess participant feedback regarding the project, as well as assessment of knowledge and behavior change.

Pilot project participants were texted a link to engage in an online survey, post completion of photo-texting assignments and goal setting. Survey findings yielded positive feedback regarding the methods. Participants felt the photo-texting project was convenient and worthwhile, with a majority of participants who responded to the survey indicated interest in participation in future photo-texting projects.

## **Data Analysis**

The mixed methods approach of the proposed study utilized both quantitative and qualitative analysis to draw conclusions from the collected data. Results from both methods strengthen the validity, and assist in filling any gaps occurring in using only one method of data collection.<sup>110</sup> Qualitative analysis provides reasoning and understanding of quantitative data. Quantitative data alone does not provide participant motivation, or voice, when measuring parental feeding behaviors and perceptions.<sup>111</sup> However, the quantitative measurements obtained from the self-administered surveys provide numerical values to augment the participant's behaviors collected through photographs over a two-week period.

### **Quantitative Analysis**

Participant responses from the questionnaire following the photo-texting project were analyzed using Excel for Microsoft 2011, version 14.6.1. A total of 28 participants completed the questionnaire which measured the following participant perceptions; 1) desire to participate in a future photo-texting project, 2) acceptance of texting methods to communicate with researchers, and 3) ability for photo-texting to increase the health of their HFE.

Response rate(s) for the collective and individual photo assignments were calculated to provide an average response rate. Response rate were determined by subtracting the time a photo was received from the time a photo assignment was sent, divided by the total number of responses. Response rate assists in identifying which photo assignments

generated the highest level of participation. This information may further assist future interventions in estimating timeline needs among the sample population.

### **Qualitative Analysis**

Photos were assigned numerical identification as they were received, and were uploaded to a private, online database. At the end of the study, photos and photo-reflection dialogue were uploaded into QSR International's NVivo 10 software for qualitative data analysis.<sup>112</sup> Previous photo voice studies have used similar coding methods to analyze photographs, and to develop themes via cluster analysis.<sup>100,113,114</sup> Data analysis was conducted using a three-coder system; one lead coder and two secondary coders analyzed reoccurring themes using a developed coding structure (Figure 4). The coding structure was developed from the PNP model (Figure 3); the five dimensions correlate with major themes identified in the model. Under each major theme are minor themes that assisted in creating a hierarchal structure to the PNP model. For each minor theme a facilitator or barrier category helped to identify whether the selected data helps or hurts the major theme of parenting practice. As data coding progressed, researchers populated the coding structure with additional minor themes as needed to create a code-list specific to that of the participant's responses. Identifiable information, such as names and faces, were not coded in order to maintain participant confidentiality.

Once all photos and texts were coded by all three coders, inter-coder reliability reports were generated to assess reliability among the themes identified; inter-coder reliability gives a percentage of agreement between the three coders using the equation: # of code agreements/# of code decisions made. Additionally, to control for the chance of

agreement among coders, kappa scores, using kappa statistic guidelines, were generated to determine the strength of coding reliability.<sup>114</sup> Kappa statistic guidelines are as follows: 0.75-1.00 = excellent; 0.60-0.74 = good; 0.40-0.59 = fair; and <0.40 poor. The lead coder determined whether coding disagreements were made due to error, or due to difference of opinion and/or interpretation. In the event of a coding error, the lead coder recoded the data to allow for agreement. However, in the event of a disagreement the code was left unchanged.

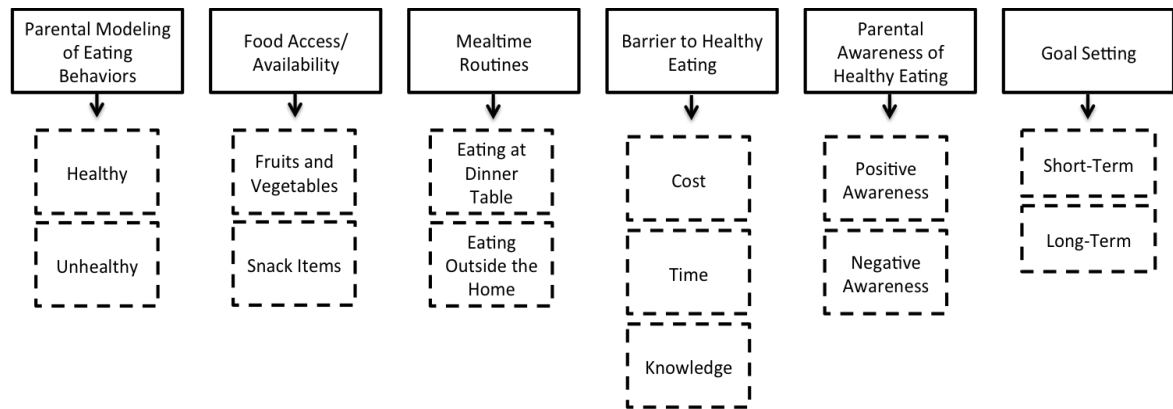


Figure 4. Coding structure developed from project model constructs and reoccurring themes from data sources. Coding structure is analyzed using QSR International NVivo 10 software.

### **III. MANUSCRIPT**

#### **Title**

Technique for Assessing the Home Food Environment of Families with Preschool Aged Children: Results of a Pilot-Study.

#### **Abstract**

Background: The home food environment is an established contributor to the development of learned nutrition behaviors in young children that increase obesity risk. Within the home, parent nutrition practices promote behaviors in children through modeling of personal food behaviors and providing access to foods. Objective: This project aimed to evaluate the feasibility of photo-texting to identify home food environment facilitators and barriers within households with preschool aged children. The project also sought to facilitate behavior change through self-assessment and goal setting. Participants/setting: A sample of 42 parents participated in a home-based texting project, using their personal mobile device and text-messaging plan. Method: Participants were provided with photo assignments over a two-week assessment period. A total of eight photo assignments were designed to capture facilitators and barriers to healthy nutrition practices within the home. Photo assignments instructed participants to take an image within their home, and to reflect upon the image through a text message. Researchers then assisted in goal setting on identified barriers. Photos and reflections were uploaded to coding software for qualitative data analysis and theme identification. Results: Photo-texting elicited a high participation rate throughout the project. Participants were open to sharing images and personal insight about their home food

practices. Major themes are listed as facilitators and barriers to the home food environment, and future uses for this method are discussed. Conclusions: It is crucial to intervene on the family and household level in order to create nutrition behavior changes within the home environment. Parents are eager for time-sensitive and convenient methods to communicate with nutrition professionals and improve the nutrition of their family.

## **Introduction**

Substantial research shows that poor nutrition practices, such as excessive intake of nutrient-poor foods and frequent meals consumed outside the home, contribute to the current obesity epidemic.<sup>2,16</sup> The HFE is a source of multi-dimensional influences of nutrition practices developed within early childhood that endure into adulthood.<sup>13,115</sup> Ongoing public health efforts aim to reduce the incidence of child obesity, however, most interventions are limited in their ability to address the myriad of possible contributing factors.<sup>28,116</sup> Sustainable techniques are needed that focus on the modifiable risk factors of child obesity, namely the environmental setting.<sup>4,82</sup> The personal nature of the HFE may serve as a platform to engage household-level establishment of healthy food practices, and promote healthy body weight of parents and children.<sup>117</sup>

The HFE includes influential routines and social models which contribute to the development of a child's eating behaviors.<sup>5,118</sup> Within the HFE, parents and adult caregivers have the ability to control dietary practices, such as modeling personal food behaviors, choosing available foods, enforcing mealtime etiquette, and displaying personal nutrition knowledge or beliefs.<sup>32,34,115</sup> Interventions which have focused on

parents with young children have demonstrated the benefit of modeling healthy dietary behaviors to children at the ages when eating behaviors are developed.<sup>38,45,119,120</sup>

Furthermore, helping parents assess HFE barriers and best practices may provide health professionals an opportunity to intervene in this sensitive HFE, to prevent the development of obesogenic behaviors.<sup>79</sup>

Self-assessments are an effective approach to engage participants in the identification of inter- and intrapersonal barriers surrounding their food choices, with potential benefit to assess the HFE.<sup>79</sup> Self-assessments are designed to encourage increased self-awareness through critical evaluation, which can lead to behavior change through reflection and goal setting.<sup>121,122</sup> Self-awareness has been shown to promote behavior change when the process is supported with the help of nutrition and health experts.<sup>123</sup> Diverse methods, such as photo voice and photo elicitation, have been used to conduct self-assessments of sensitive topics and settings.<sup>91</sup> Photo reflection methods stimulate community and individual change through the reflection and analysis of photographs taken by participants.<sup>90,124,125</sup> This mechanistic approach is accessible to those of varied education levels and demographics, facilitating its use among diverse populations.<sup>99,98</sup> Such methods provide professionals proximity to clients without the need of being inside the home, providing the ability to assess the HFE and eliminating the time requirements of other methods aimed at early childhood parent populations.<sup>79</sup> Other methods such as the use of text messaging and other smartphones applications in data collection has become a growing practice with the potential to reduce communication barriers, decrease time demands, and increase participation rates.<sup>93,126</sup>



Drawing from photo elicitation and photo voice techniques, the purpose of this study was to develop and implement a self-assessment of the HFE, developed and tailored to accommodate the scheduling demands of a preschool parent population. By focusing on the parent, through photography driven self-assessment, modifications of the HFE may ultimately improve healthy eating patterns for children.<sup>41</sup> This article describes the identified themes that emerged from HFE photo assignments and reflections provided through participant's photo-texts. The study objectives are to 1) identify primary nutrition practice observations within a series of HFE themes, 2) guide participants to identifying barriers of nutrition and to set goals to improve their personal barriers, and 3) determine parent acceptability of photo-texting method for nutrition assessment and goal setting.

## **Methods**

This study is a component of a mixed method, multi-phase project conducted through Best Food for Infants and Children (Best Food FITS or BFF), an ongoing community nutrition initiative designed by nutrition faculty at Texas State University to reduce childhood obesity.<sup>109</sup> The Texas State University Institutional Review Board approved this project as a part of the Best Food FITS Parent's Study, a project focused on the parent's role in early child nutrition. A convenience sample from this project included 42 eligible parents (Figure 5) who self-enrolled by text messaging "yes" to the provided research phone number as instructed on flier and email recruitment materials distributed through area preschools. All participants had previously provided consent to participate in the study and those who enrolled in this photo-texting project provided an additional statement of consent through text message.

The study spanned six-weeks, and included 1) photo assignments, 2) goal setting and technical assistance, and 3) a post-assessment evaluation survey. Participants who completed the project's third week received supporting resource documents for goal setting and a \$25 grocery store gift card in return for their participation in the photo-texting project.

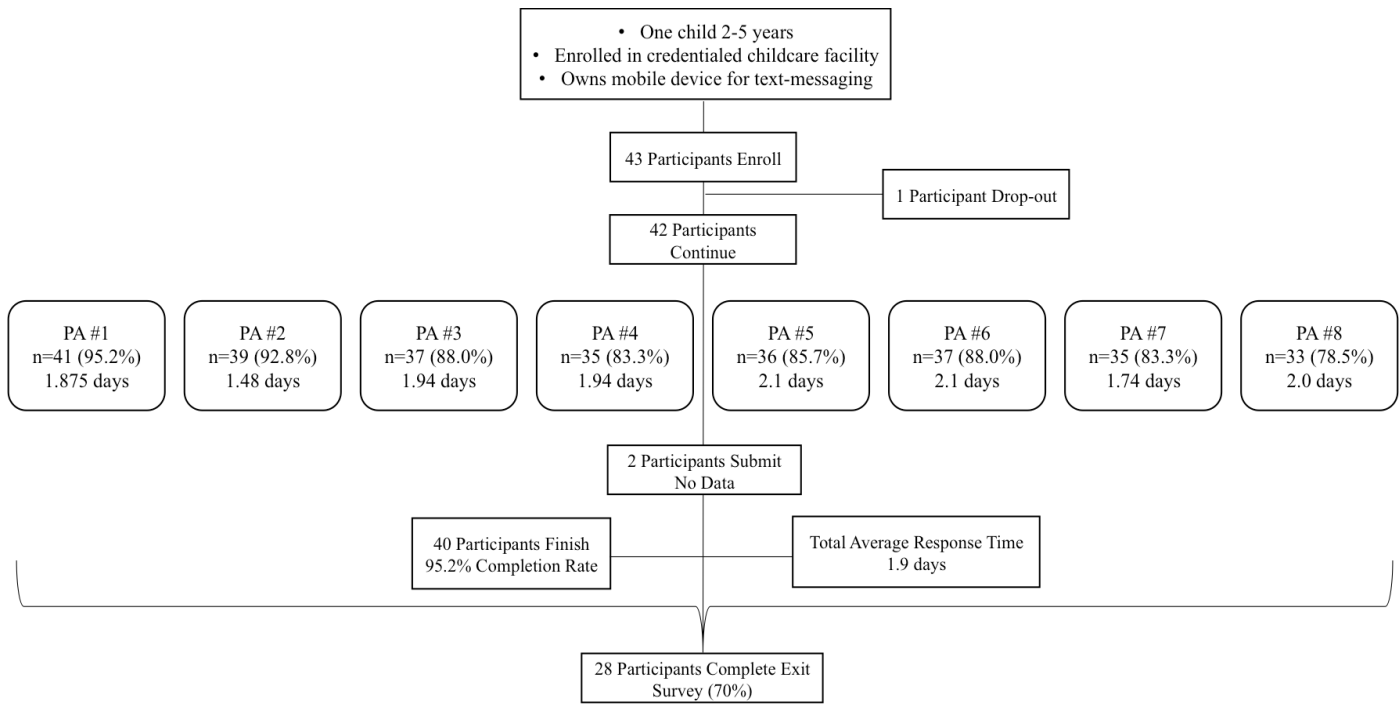


Figure 5. Flow chart of photo-texting project, starting from enrollment through the commencement of data collection. Details provided include eligibility requirements, participation within each photo assignment (PA), percentage of participation, and average time to respond.

## **Photo Assignment Development**

The study was developed as a tool for home self-assessments in order for participants to increase awareness of the HFE.<sup>90,124,125</sup> Text messaging was the primary medium of communication with participants to allow for optimal flexibility and autonomy. The HFE themes were determined through a systematic review of literature of parent feeding practices, environmental contributions to child obesity, and young children's food preferences. Themes assessed within the home included 1) shaping food behaviors of children in the home, 2) food accessibility and availability, 3) family mealtime routines, and 4) goal setting (Table 2). Themes were developed into photo assignments formatted for text messaging to participant's mobile devices. After the photo assignment was texted to participants, they were asked to text back photographs and to submit written reflections about their photos.

## **Data Collection**

Over a two-week period all photo assignments were collected; four photo assignments were given per week. Monday through Thursday, participants received a single photo assignment through private text message to be completed and submitted to researchers within 24 hours. Weekends were allotted for submission of incomplete photo assignments. Researchers utilized text messaging to send photo assignments, reminder messages for incomplete submissions, as well as to answer questions posed by participants.

Upon completion of the eight photo assignment topics, goal setting was incorporated into texting assignments (Table 2), followed by collaboration with researchers to refine the

goals to be specific and measureable. Subsequently, participants received mobile friendly resources to assist participants to achieve their individual goals. Concluding data collection, participants were sent an online invitation to complete an exit survey. The exit survey was designed to provide process feedback and included Likert scale items and open-ended responses. All forms of collected data were uploaded onto a secure server for storage and data evaluation.

### **Data Analysis**

Content analysis of photographs and text reflections were accomplished using descriptive qualitative coding techniques.<sup>127</sup> Following photo-texting data collection, photos and corresponding text reflections were upload into NVivo 10 Software by QSR International. The lead researchers examined all photographs and written text reflections to identify reoccurring themes of facilitators and barriers within the HFE. Coupled with the HFE themes (Table 2), a thematic coding structure was developed illustrating major themes, and supporting minor themes. Additional themes were created as needed to reflect nuances in the data.

A three-coder system was utilized; coders were trained in research ethics and qualitative coding processes.<sup>127</sup> The first two coders independently analyzed each photo and written text reflection, and the third coder (lead coder) reconciled coding discrepancies, followed by calculating inter-coder reliability scores of each theme.

Key findings from the home food environment were organized into facilitators and barriers to providing a healthy HFE within each major theme. The final coding structure included 5 major themes, and 32 minor themes (Table 3). Major theme reliability scores

ranged between 82.1% and 95.3%. Collective coding reliability scores of major and minor themes averaged 91.2%. The lead coder also selected representative text reflection statements for each theme for data dissemination.

For the theme regarding food access and availability, data from photos and reflections were coded as healthy (fruit, vegetables, whole grains, fat-free or low-fat dairy) and unhealthy (snack foods, sweets, sugar sweetened beverage, fruit juice blends) food items as defined by the WHO.<sup>28</sup> Statements of knowledge or belief about nutrition practices, coded from written text reflections, were categorized as either helpful or hurtful to a healthy HFE. Mealtime routines were derived solely from the photo assignment prompting participant's mealtime evaluation, whereas food practices and food availability were identified and coded using photos and text reflections. Content and quantity of barriers reported by participants were compared to barriers observed by researchers using both photos and written text reflections throughout the project. Finally, goal setting analysis was categorized into short and long-term goals, then further organized into leading goal themes. On multiple instances, participants expressed more than one goal within the goal-setting photo assignment; in such cases goals were coded separately.

Additional analyses included response time and return rate of photo assignments. Figure 5 illustrates individual and collective response times for each photo assignment. Finally, frequency of responses from the exit survey and demographics were calculated using Microsoft Excel 2011 version 14.6.2.

## Results

A total of 42 parents completed the photo-texting project; participants were 40 mothers and 2 fathers, between the ages of 22 and 50 years. A greater number of participants were white non-Hispanic (n=24) followed by Hispanic (n=15). The majority (36%) reported earning less than \$40,000 annually per household, followed by greater than \$75,001(33%), and between \$40,001-\$75,000 (31%) annually.

A total of 362 photographs and 257 text reflections were submitted from the 8 photo assignments. The following major themes were identified: 1) knowledge of healthy foods and practices, 2) mealtime routines, 3) food practices, and 4) access and availability of foods. Table 3 provides theme reference results that represent the number of times photos and/or text reflections fit within topic themes.

### Knowledge of Healthy Foods and Practices

The first emerging theme was parents' statements of knowledge or lack of knowledge regarding healthful foods and food behaviors. The knowledge factor most often associated with facilitating the HFE mentioned organizing and planning meals to be nutritionally balanced. One participant wrote, "*we do our best to eat a balanced diet.*"

The second most mentioned factor included statements indicating perceived benefits of healthful eating. For example, one parent stated, "*we are cooking onion, it is healthy for [our] heart.*" Furthermore, one participant wrote "*we grow our own food because it is healthier*" which was reflected within knowledge barriers such as "*it's more expensive to eat fruits, veggies, and meat unless you grow it yourself.*" Additional barrier statements included "*not knowing how to correctly read food labels*" and "*I don't know how to*

*grocery shop for healthy food on a budget.*” Slightly fewer knowledge barriers (n=29) were identified than facilitators (n=30).

### **Mealtime Routines**

Facilitators (n=123) outweighed barriers (n=20) within the family mealtime theme. The three most common facilitators were 1) cooking meals at home (n=59), 2) eating together as a family (n=36), and 3) eating meals at dinner table (n=28). One participant stated, *“no matter how busy we get, my children and I have supper together every night of the week!”* Common reported HFE barriers identified scheduling and time demands getting in the way of family meals. As one participant reported, *“tonight is gymnastics night so we eat at Chick-fil-a first.”* Another participant stated, *“it’s always a struggle in evenings during the week to have time to come up with healthy meals unless I preplan on the weekend.”* Written reflections revealed that eating meals as a family was a priority for many parents, yet time demands often prevent home-cooked meals or eating at home together.

### **Food Practices**

The highest observed facilitating food practice within the HFE was serving fresh fruits and/or vegetables to children (n=56), most often as a snack. Many facilitating reflection statements surrounded their child’s favorite foods in the home, *“this is [my daughter] enjoying her after school snack of carrots, cucumbers and celery,”* and *“[his] favorite vegetable is a raw carrot, because that is what bunnies eat!”* Creativity with fruits and vegetables was often stated in reflection statements (n=42); for example, a submitted photograph illustrated a happy face made from fresh carrots and blueberries (Appendix Section A). The most common food practice barrier was resorting to unhealthful foods

due to time demands (n=13), for instance, *“shopping healthy and eating healthy can be time consuming”* or *“the convenience of fast food is tempting and I wish we planned better in order to not feel we need this outlet.”* An additional barrier was offering non-nutrient dense foods outside of mealtimes, such as candy, crackers or fast foods (n=7).

### **Access/Availability of Foods**

Within the major theme of food accessibility, more healthy food items compared to unhealthy food items were found in the refrigerator. However, unhealthy food items (n=138) exceeded healthy food items within dry food storage (n=39). In general, healthy foods were found about equally with unhealthy foods (Table 3). Many participants described encouraging access to healthy foods in the home, *“my kiddos favorite veggie is broccoli, he has loved [broccoli] since he was an infant & we always keep it in the house.”* Participants also acknowledged unhealthy food items. For example, one participant wrote: *“not really sure which items I need to have in my pantry, but essentials are cereal and bread!”* Reflecting on a photo of their pantry, another participant reflected with, *“Ugh, lots of junk!”*

Overall, data analysis revealed that participants reported fewer barriers to a healthy HFE compared to researcher-observed barriers. Reported barriers included access to unhealthful foods, cost of healthful foods, and family time demands. One participant reflected *“being on the go makes it easy to grab unhealthy snacks or fast food.”* Barriers observed by the researchers consisted of lack of meal planning, limited availability of healthful foods in the home, and knowledge deficits.



## Goal Setting

The majority of participant's goals lacked specificity; 47 of 68 submitted goals were not specific or measureable. For example, one participant responded, *"our goal is to make healthy treat choices instead of bad ones over the next week."* The research team formatted twenty-seven of the thirty-five short-term goals, and twenty of the thirty-three long-term goals to be specific and measureable. Leading goal categories were to consume more healthful foods such as fruit, vegetables and whole grains, followed by adopting a new nutrition practice, such as meal planning, cooking new recipes, and drinking more water. Often, participants set a goal that corresponded with identified barriers in previous photo assignments. The most commonly identified goals were reflected within the themes of knowledge and food practice barriers, such as, *"my nutrition goal is to plan my family's meals for this week"* and *"we plan to eat these [photographed fruits, vegetables and almonds] in place of usual unhealthy treats this weekend."*

## Response Rates and Exit Survey

Response rate percentages and participation within individual photo assignments as well as collectively are displayed in Figure 5. Twenty-eight (66%) participants submitted a five-question exit survey completed online via SurveyMonkey Inc. In addition to multiple-choice responses, participants were provided with space to write commentary on each response. The first question asked if text messaging was convenient to communicate with researchers. All survey participants responded "yes," concluding that texting was a convenient method for this project. Provided commentary from this question included *"It made what could have been an intrusive research study seem accessible and*

*manageable*” and *“It didn't take much time, but it did focus attention on the topic.”* One participant reported that she *“looked forward to the questions each day.”* Other responses stated that texting was great for being busy and for working around schedules with small children. The second question asked participants if they felt this project increased their awareness of their HFE. Twenty-three (82%) respondents responded “yes” and wrote, *“it helped me reflect on my home environment (areas to improve, how much time I spend on preparation of meals, etc.)”* as well as *“it allowed me to view what unhealthy items I have in my pantry and refrigerator.”* No commentary was received from participants who answered “no” to this question. The third question asked if they had arranged anything within their home prior to taking photographs; 89% responded “no.” Participant who responded “yes” to this question explained their responses: “I moved some items so the picture could show more of what my fridge & pantry had since my kitchen is so small” as well as “I straightened the pantry a little, everything else was right from the heart.” In response to the forth and fifth questions, perceived effort and time put into the photo-texting project respectively, the majority reported a moderate to high effort (57% and 25%, respectively) into completing the assignments each day. Further, in response to perceived time-commitment per day, most exit survey respondents reported that photo-texting took less than 15 minutes of their time each day. No commentary was received from the effort and time perception responses. Appendix B provides a table view of the exit survey responses.

Table 3. Results of the photo-texting project categorized by facilitators and barriers within major and minor themes.

<b>Major Theme</b>	<b>Coding references</b>	<b>Facilitator (+)</b>	<b>Barrier (-)</b>
<b>Leading minor themes</b>			
<b>Knowledge of Healthful Food Practices</b>			
Stay organized/meal plan	12	+	
Benefits of healthful foods	9	+	
Lack cooking skills/creativity	8		-
Unorganized/no meal planning	8		-
How to purchase healthful foods on a budget	6		-
Potential harms of unhealthy foods	5	+	
Desert choices/preferences	4		-
Benefits of a home garden	4	+	
Reading nutrition fact label	2		-
Portion sizes/food ingredients	1		-
<b>Total references:</b>	<b>59</b>	<b>30</b>	<b>29</b>
<b>Mealtime Routines</b>			
Cook food at home	59	+	
Eat with family	36	+	
Eat at dining table	28	+	
Technology at mealtime	8		-
Family eats at separate times	6		-
Eat outside of the home	6		-
<b>Total references:</b>	<b>143</b>	<b>123</b>	<b>20</b>
<b>Food Practices</b>			
Serve fresh fruits/vegetables to child	56	+	
Encourage healthful foods	42	+	
Plan meals/shopping list	18	+	
Encourage unhealthy foods	13		-
Include child in meal preparation	11	+	
Unhealthy food in home/family food preferences	10		-
Consume fast foods regularly	7		-
Healthful foods at child's eye level	4	+	
Home garden/chickens	4	+	
No technology at mealtimes	3	+	
Pack meals for school and work	2	+	
<b>Total references:</b>	<b>170</b>	<b>140</b>	<b>30</b>
<b>Food Availability/Access</b>			
Healthful foods	191	+	
Unhealthful foods	185		-
<b>Total references:</b>	<b>376</b>	<b>191</b>	<b>185</b>

## **Discussion**

Overall, this project was successful in testing the feasibility of photo-texting to help understand the salient needs of parents with preschool aged children within the HFE. Findings suggest that parents are responsive to new methods of engaging with health professionals on nutrition practices, and that photo-texting is a feasible self-assessment tool to collect multiple measures of home behaviors within a short amount of time.

The diverse demographic characteristics of our study participants indicate an interest for photo-texting among varied populations. In fact, our demographics are reflective of the Hays County, Texas population, exemplifying a fair sub-sample of this region.<sup>128</sup>

Although a majority of participants were mothers, this finding is consistent with literature on preschool aged children and home environment studies.<sup>117</sup> Overall, the diverse characteristics of our sample exemplifies that a large-scale photo-texting project may be useful in highlighting and addressing nutrition barriers among various demographic populations.

The leading barriers identified by our participants (i.e. knowledge deficits, lack of meal planning, mealtime disruptions, family food preferences) to having a healthy HFE were consistent with those cited in previous literature among a population of parents with preschoolers.<sup>48</sup> In order to achieve behavior change within this population, parents need individualized attention to address their household barriers. For instance, in our study, parents expressed either having established nutrition knowledge or knowledge deficits, reflecting their varied education experiences. Likewise, self-efficacy of nutrition knowledge and skills are often reported as nutrition barriers for parents.<sup>45</sup> Addressing the

needs of individual parents versus cohort interventions can save time and protect the interest of participants by supplying personalized information. The researcher-observed barriers exceeded participants reported barriers in all major themes. This finding suggests that through photo evaluation, researchers are an integral means to identify participant's unfavorable food practices within the HFE, while participants may be more inclined to report positive practices. Comparatively, responses to identify specific HFE barriers displayed that parents are willing to discuss their shortfalls when prompted. Parents were willing to discuss positive and negative routines in order to garner confidence in nutrition knowledge and skills.

Goal setting with parents of preschool children is a necessary component of guided self-assessments.<sup>31,68,129</sup> In this study, the majority of goals set by participants were not specific or measureable. Participants had to partner with researchers to refine their goals to increase achievability. The goal editing process is time consuming for the professional, and it may be helpful to define specific goal-setting characteristics within photo assignment submissions. Recent technology-based interventions found it effective to focus on setting SMART goals for dietary behavior changes.<sup>122</sup> Although behavior change was not followed past goal setting in this study, participants often set a goal that corresponded with identified barriers in previous photo assignments. This finding suggests that parents became self-aware of their HFE, and were interested in the behavior change processes.

Participant-driven data collection allows participant's autonomy, critical thinking, and self-assessment, which are theorized to increase participation.<sup>124,130</sup> Photo-texting achieved a high participation rate among all photo assignments, and participant

recruitment, which is also consistent with a recent photo voice study that found youth are active in behavior change when they engage in self or community assessment.<sup>130</sup>

Together with the perceived limited time commitment reported in the exit survey, parent's willingness for photo-texting creates a practicable method for HFE self-assessment and behavior change. Furthermore, these findings are consistent with recent intervention outcomes reporting parents are highly engaged in texting methods for child obesity treatment programs.<sup>126</sup>

Study limitations should be considered upon interpretation of the key findings of this study. For example, although it was not an objective of this study, long-term behavior change could not be assessed due to the timeline of this feasibility study. An extended study timeline may allow for longitudinal participant assessment and support and may be beneficial for behavior change analysis. Furthermore, although recruitment materials were distributed in both Spanish and English, no Spanish speaking families enrolled in the project. This may be of importance considering the needs and disparities among a population historically at greater risk for obesity.<sup>1</sup> Furthermore, food inventory photo analysis is limited as many food items are not visible. Future interventions may consider including other methods of food inventory, such as food inventory checklists.

Photo-texting has the potential to reach priority populations with its application within clinical, community and private dietetic practices. In addition to our project aims of developing a photo-texting methods and assessing parent's HFE facilitators and barriers, addition assessment options could include collection of dietary recalls, home food inventory, and goal setting support. Photo-texting may extend to private practices where research is not an objective. Data analysis is not required to benefit from the images

captured through photo-texting. For example, this technique may be used for individual or group counseling techniques, dietary recalls and individual goal setting.

## **Conclusions**

The BFF child obesity prevention program remains active in the Hays County, Texas community; ongoing measures and community events exemplify the program's mission to end childhood obesity in central Texas. Recent focus on parents as an agent for change in child nutrition practices described herein touch on parent's contributions to environmental causes of obesity. Furthermore, this project details how the landscape of the HFE allows for in-depth assessments, which produce data on individual family needs to reduce obesity risk factors. These results highlight key areas of the HFE in which dietitians and other health professionals may address nutrition practice behavior change in families with young children. Photo-texting has profound implications for future dietetic and health-related interventions to provide insight on social and environmental causes of obesity within the home. The potential for photo-texting to motivate, support, and encourage participants has not yet been reached; however the findings of photo-texting may direct the future uses of HFE interventions. Furthermore, photo-texting may be used to identify HFE barriers prior to the actualization of nutrition and weight-related problems in adults and in young children. Unique themes identified from both the participants and findings noted by the researchers may be used to direct specific programs, educational tools and communication methods of future interventions.

## APPENDIX SECTION

### APPENDIX A

Home food environment barrier photo examples:



“Not knowing how to correctly read food labels often gets in the way as I am not sure of exactly to look for.”



“Chores seem endless and get in the way of meal planning and prep sometimes”



“Money! It is more expensive to eat fruits, veggies, and meat protein unless you grow it yourself.”



“Crazy, hectic schedules are what keeps us out of the kitchen... :(“



Home food environment facilitator photo examples:



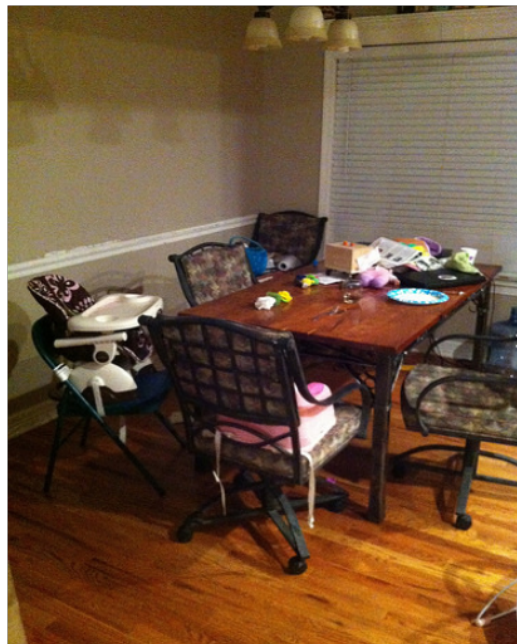
“blueberries and carrots are [my daughter’s] favorite fruits and veggies.”

---



“working in our garden to eat the produce from it!”

---



“We try for [the kids] to have what we have. On good days [they] eat everything!”

---



“continue feeding our family a balanced diet.”

---

Goal setting photo examples:



“Clean out the pantry. Healthier options to replace Cheetos, Oreos, girl scout cookies, etc.”



“Use a calendar to plan meals ahead of time and to follow menu plan for this weekends dinners”



“Monthly goal: eating out less, especially chic fill a, it's my weakness”



“Eat more food from our garden”



Home food inventory photo examples:



“We eat lots of fresh fruits and veggies, some dairy and lunch meats. Not much meat at dinner, though. My kiddo won't eat meat unless its salami or old Wisconsin turkey sticks, and I'm not fond of cooking it.”



“Ugh. Lots O Junk!”



“Candies and fruit gummies are located on the top shelf and out of sight and out of reach.”



“Never really sure which items I need to make sure to have in my pantry, but essentials are cereal and bread! :)”

## APPENDIX B

Exit survey responses, n = 28

Question	Response options	Responses	Provided commentary
How much effort did you put into taking and sending photos to us?	Very little effort	5 (17.86%)	—
	Moderate effort	16 (57.14%)	
	A lot of effort	7 (25.0%)	
How much time per day did you spend taking and sending photos to us?	< 5 minutes	12 (42.8%)	—
	5-10 minutes	12 (42.8%)	
	10-15 minutes	4 (14.2%)	
	>20 minutes	0	
Did sharing your photos increase your awareness of your home environment?	Yes	23 (82.14%)	"It helped me reflect on my home environment"; "it didn't bother me what we were eating until I had to send photos so others could see..."
	No	5 (17.86%)	—
Did you change anything in your home prior to taking photographs?	Yes	3 (10.71%)	"I moved some items so the picture could show more of what my fridge & pantry had since my kitchen is so small."
	No	25 (89.29%)	"I wanted the photos to be as accurate as possible in order to get the best/accurate feedback."
Was text messaging a convenient way to communicate with us?	Yes	28 (100%)	"if I was busy, I could respond when convenient"; "It made what could have been an intrusive research study seem accessible and manageable."
	No	0	

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