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Improving Diet & Physical Activity Behaviors Through Tailored mHealth Messages: Application to Childhood Obesity Prevention in a Pediatric Emergency Department

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Improving Diet & Physical Activity Behaviors Through Tailored mHealth Messages: Application to Childhood Obesity Prevention in a Pediatric Emergency Department

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Approval Page

Masters of Science Thesis

Improving Diet & Physical Activity Behaviors Through Tailored mHealth Messages: Application to Childhood Obesity Prevention in a Pediatric Emergency Department

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CHAPTER ONE

INTRODUCTION

1.1 The Childhood Obesity Epidemic

Current obesity rates are elevated to such an extent that obesity is now considered to be an epidemic by many professionals in the health care field including epidemiologists, researchers, and practitioners\(^1\). Since 1980, childhood obesity rates have tripled to 17% of the population, where now one in three American children are either considered to be overweight or obese based on age and sex-adjusted body mass index (BMI) percentiles. BMI percentiles are a more accurate assessment of child weight status compared to a simple BMI classification as the percentile accounts for the growth curve of the child as they age. The CDC defines overweight as at or above the 85\(^{th}\) percentile and obese as at or above the 95\(^{th}\) percentile\(^2\). Adolescents have seen a quadrupling rise in obesity since 1980, increasing from 5% to a staggering 20.5% of their population, according to the 2011-2014 National Health and Nutrition Examination Survey (NHANES) data\(^3\). A 2009 study cited a 300% increase in extreme obesity since 1976 for individuals of all ages, and a rise of over 70% in extreme obesity for children ages 2-19 years old since 1994\(^4\) where extreme obesity is defined as a BMI percentile >120% of the 95\(^{th}\) percentile\(^4,5\).

In the long term, these children are more likely to be overweight or obese as adults compared to their normal weight counterparts. A study conducted by the CDC concluded that 70% of overweight or obese 5-17 year-olds had at least one cardiovascular disease risk factor such as high blood pressure, high triglycerides or high cholesterol. This can lead to increased risk for developing obesity-induced chronic diseases or conditions such as metabolic syndrome, heart disease, stroke and diabetes even in childhood\(^6,7\). These diseases - once thought to arise most commonly in adulthood - are now emerging in children as young as ten years old, to the extent
that pediatricians currently screen for indicators that may put children at risk for developing these chronic illnesses, as well as conditions such as bone and joint problems and sleep apnea. In addition to physical consequences of childhood obesity, there are clear negative effects to the child’s mental state including low self-esteem, depression, anxiety, and behavioral issues, which may be instigated by bullying from peers due to their extreme weight status. These vulnerable emotional and mental states may fuel the cycle of poor health behaviors that drive obesity at its roots.

1.2 The Etiology of Childhood Obesity

The etiology of excess adiposity in children between ages 2-19 years old is extremely intricate. Interplay between genetics, media influences, environment, lack of adequate health care, poor food choices, lack of physical activity, increased sedentary behaviors and a myriad of factors beyond current understanding, may contribute to this epidemic.

Diet Quality & Portion Sizes Diet is typically cited as a root cause of excess weight gain for people of all ages. Poor food options in terms of nutrients and portion sizes have reached harmful levels in our society today. Many Americans now consume 20-25% more calories than had been consumed just fifty years ago in 1970. This may be attributed to higher availability of processed foods containing excess amounts of fat and sugar. These unhealthy food items are often sold in drastically large portions for what the body needs. Even at home, it is possible to eat in excess as can be demonstrated through the expansion of the “typical” dinner plate size from nine inches in the 1960s to the usual twelve-inch diameter plates that are seen in homes and restaurants today – an increase in 36% surface area to put more food compared to six decades ago.

Food Environment & Availability The environment plays an influential role in the health of the pediatric population. Most children are dependent on others to provide their meals, up until...
a certain age. Therefore, if the only foods available to the child are non-nutrient dense/high calorie/high sugar convenience foods, then these unhealthy items will most likely make up the majority of the child’s diet and can contribute to excess weight. Targeting the parent or guardian for healthy nutrition education is an important component of effective treatments for childhood obesity, especially for children who lack the autonomy and responsibility to make healthy food choices.

One major factor increasing the risk of childhood obesity is the lack of availability of supermarkets in “food desert” and “food swamp” areas. A food desert can be defined as an area that is lacking in fresh vegetables, fresh fruit, and other healthy and whole foods\textsuperscript{19}. According to the USDA, in order for a community to qualify as a food desert, at least 33% of the population must live more than one mile from a supermarket or large grocery store\textsuperscript{19}. The USDA estimates that 23.5 million people in the U.S., including 6.5 million children, live in areas that are more than one mile from a supermarket\textsuperscript{20}. These food deserts can be found in impoverished areas and have a direct effect on the health of its residents. An area considered to be a food swamp will have a higher abundance of unhealthy fast food restaurants and corner convenience stores than fresh produce opportunities, making healthy food choices even more difficult and challenging for children to consume a balanced diet\textsuperscript{36}.

**Physical Activity** The etiology of pediatric obesity becomes even more intricate with the rates of regular childhood physical activity not meeting recommended requirements for children of all ages. According to the Office of Disease Prevention and Health Promotion (ODPHP), only 21% of American children meet the physical activity recommendations of 60 minutes per day, as of 2016. Furthermore, the ODPHP revealed that 50% of high school students attend a maximum of 1 weekly physical education (PE) class and only 29.8% of high school students participated in
daily PE classes - which is a 4% decrease in participation just from 2009\textsuperscript{21,22}. Moreover, many elementary and middle schools in the nation have cut down recess time or eliminated it altogether to make more time for the classroom\textsuperscript{23}. Without the commitment from schools, it is hard for some children to meet the exercise requirements at home, especially if they live in an unsafe area or have a lack of resources that are not conducive to physical activity.

\textbf{Media, Technology & Sedentary Behaviors} The media and technology both play a substantial role in pediatric obesity. The rise of technology has led to an overall increase in sedentary behaviors. Multiple studies have shown a direct relationship between high TV viewing time and an increased risk of excess adiposity in children and teens\textsuperscript{24}. Specifically, a large study (n=46,707) concluded that children and adolescents who spent 3+ hours per day watching TV, had a 65% higher risk of being obese, compared to their counterparts who only watched TV for one hour per day\textsuperscript{25}.

Time spent being sedentary is fueled by the daily bombardment of new video games, novel ways to watch movies and television, or fun new devices available to children today at the touch of a button. The American Academy of Pediatrics (AAP) no longer recommends a specific limit (e.g. 2 hours) on screen time for children. Rather, they advocate for a balance between media use and physical activity advising children ages 6 years and older to “make sure media does not take the place of adequate sleep, physical activity and other behaviors essential to health”\textsuperscript{37}. On average, children between the ages of 8-18 years old spend 8 hours in front of a screen across all devices – a rise from five hours in 1999\textsuperscript{26}. Reports have shown that for people of all ages, an increase in screen time may be coupled with mindless eating and snacking. For children, it was found that for every one-hour increase per day watching television, 50 extra calories are consumed consisting mainly of non-nutrient dense foods and sugar sweetened beverages\textsuperscript{27}.
Excessive TV and screen time also make children more susceptible to targeted unhealthy food advertising through commercials or internet ads. Studies have been able to directly link the concept of targeted food marketing to childhood obesity\textsuperscript{27}. Even one single exposure to an unhealthy food item through advertising directly affects product preference in children, especially those under 8 years-old who do not fully grasp the concept of persuasive marketing\textsuperscript{27}. According to the American Psychological Association (APA), every three out of four foods advertised to children is of the unhealthy variety, with little to no effort put forth by the networks to increase frequency of healthy food ads showing fruits, vegetables, whole grains, or low-fat dairy products\textsuperscript{27}. Funding is lacking in the healthy advertising area, however measures could be taken in the home to decrease overall screen time and TV viewing and therefore limit exposure to these unhealthy ad campaigns.

This epidemic does not come cheap – each year in the United States, roughly $14 billion in medical costs is spent to cover treatments relating to childhood obesity\textsuperscript{28}. Moreover, about 20% of all medical expenses in this country are related to obesity treatment for people of all ages. Overweight and obese children are likely to carry these issues into adulthood; determined efforts will be necessary to combat this destructive trend in our youngest generation’s health. Elevated rates of childhood obesity call for a multi-tiered systems approach in the clinical setting for influential obesity risk screening and subsequent education to take place\textsuperscript{33}. Low-income children and adolescents who utilize the Pediatric Emergency Department (PED) for routine non-urgent issues have been shown to display unhealthy dietary behaviors\textsuperscript{34}. Furthermore, this population may not seek primary medical care on a regular basis, making it less likely they will be screened for obesity or risky health behaviors, indicating a need to target obesity preventative measures in the PED setting\textsuperscript{34}. 
1.3 The Pediatric Emergency Department (PED) as a Reliable Setting for Obesity Risk Screening and Nutrition Education

Even though many practitioners are aware of this rising epidemic in our society and the detrimental effects it may have on the future medical and financial health of our country, the treatment is not easy, nor is it clear-cut. Weight status is a sensitive topic for both children and parents, and some practitioners feel uncomfortable starting the discussion, as they don’t want to embarrass the patient or family. Alternatively, health care professionals may not approach the topic in conversation due to the short time period patients are given for well-check visits – on average 10-15 minutes per patient. Prior to chronic disease assessment as part of a comprehensive pediatrician’s visit, a simple effort could be made to increase initial screening for overweight and obesity. Although height and weight are usually measured, BMI or BMI percentile is not always calculated, nor is it reported to the parent and explained. It is important this information is relayed to the parent if the child measures as overweight or obese, as it is the prime age for nutrition education to take place to begin to create healthier attitudes and behavior change in the home.

Early nutrition education has the potential to occur in various settings including in the home, at school, primary care office, urgent care clinics, dental clinics or even the hospital emergency department. Primary care physicians and pediatricians play an important role in health maintenance and disease prevention. The use of obesity preventative measures in the primary care and other healthcare settings is currently lacking. Pediatricians often fail to “diagnose childhood obesity and only inconsistently use BMI and/or provide nutrition and physical activity counseling”. Due to consistent annual follow-up with the patient, the primary care office visit is a vital time to incorporate nutrition interventions.

However, many children and families, especially in low-income areas, do not have access to a regular pediatrician whether it is due to lack of adequate health insurance or they have not located a
pediatrician for their child. Because of this, many families use the pediatric emergency department as their sole source of care, even in non-emergent situations. Therefore, emergency department pediatricians must also be aware of this ever-growing epidemic and know how to adequately assess and treat obesity and its related risk factors. The pediatric emergency department (PED) is a prime setting to initiate a talk with parents of overweight or obese children about adequate nutrition and physical activity in order to prevent the child from becoming overweight as an adult.

Integrating mHealth in either the PED or primary care center is a very promising intervention to begin to treat childhood obesity as it occurs. Previous research recruited 100 parent/child dyads, who were receiving care in the PED, to watch an audio-visual presentation regarding nutrition and healthy behaviors while they were waiting to be treated. The participants were then surveyed regarding their overall impressions of the education. The results demonstrated that 99% of participants felt the PED should provide nutrition education if time allows, 90% reported they learned something new, and 90% reported that they planned on making changes simply based on the one-time educational presentation they saw. This is overwhelming support that nutrition education in the PED is feasible as well as accepted by patients, especially when combined with an interactive entertainment-education component.

Furthermore, the survey tool used in this research, the Pediatric Adapted Liking Survey (PALS), has shown good to excellent test-retest reliability (Pearson’s correlation = 0.68; ICC = 0.81) when assessing its accuracy in the home environment versus the pediatric emergency department, revealing that survey responses are not affected in an atypical manner while in the PED. Additionally, previous PALS research revealed the PED had an overall higher level of pediatric obesity compared the national average (37.4% PED vs. 36.6% US overweight; 21.2% PED vs. 19.6% US obese), indicating the population that visits the PED for care may be at a higher risk for practicing unhealthy behaviors. These results further support the PED as an appropriate setting for implementing nutrition education and screening for obesity using the proposed platform.
1.4 Purpose of Research

The purpose of this research is to investigate whether two modes of intervention in a clinical setting are feasible and once combined, have the possibility to improve attitudes and behaviors towards healthy eating and activities of young children and their parents. The modes of assessment and intervention include 1) surveying child food preferences through an online platform and 2) subsequently offering tailored health messages to the child and parent based on previous food preference survey responses. The results of these investigations will allow for further development of simple but effective nutrition education and pediatric obesity preventative tools.

1.5 Research Goals

Chapter Two: Testing the Usability & Feasibility of an Online Obesity Risk Screening Tool for Diet and Physical Activity Behaviors of Children and Parents in a Clinical Setting

1. To determine the usability and feasibility of an online (Qualtrics-based platform) obesity risk screening tool for diet and physical activity (PA) preferences of children and parents in a clinical setting (the PALS)

2. To evaluate the difference in reporting between paper/pencil and tablet-based survey responses

3. To assess whether the PALS parent report can be used as a proxy for child preferences and therefore child diet quality

Chapter Three: mHealth Tailored Messaging & Follow-Up Program Development

4. To formulate the framework for a tailored messaging program for children and their parents based on PALS responses

5. To assess the short-term outcomes of online tailored health messages through reported acceptability, relevance and usefulness

6. To develop a follow-up protocol to assess the utility of the tailored messages in the home
on intent to change behaviors as well as making concrete behavior changes in child/parent dyads in order to create a successful and easy tool to increase obesity risk screening and nutrition education in the pediatric health care system

1.6 Significance

With childhood obesity reaching an epidemic state, effective step-by-step interventions are required. Although this is a large task, creating simple tools to screen for obesity risk behaviors may be the first step in this process. This research aims to determine the potential of implementing an online tailored health message program into routine child health care. Due to the fact that many fields of healthcare are transitioning to an electronically-based medical record system, it is a viable option to create an mHealth tool for childhood obesity prevention that fits within these parameters.

The mHealth nature of this program may allow for seamless integration into the electronic medical record (EMR) and will provide all medical professionals a cohesive continuity of care when it comes to obesity risk screening and subsequent tailored nutrition education for their patients. The long-term goal of this project is to have the program be an integral part of all healthcare visits for the child in order to make obesity prevention an easier topic to discuss in a more effective and personalized way for both the practitioner and the families. In the future, it is possible that this tool may be adapted to be a part of normal school health screenings for young children in order to ensure that all children are reached, regardless of insurance type or the presence of a primary care physician.

1.7 References


CHAPTER TWO

Testing the Usability & Feasibility of an Online Obesity Risk Screening Tool for Diet and Physical Activity Behaviors of Children and Parents in a Clinical Setting

2.1 BACKGROUND

Childhood obesity is considered to be a worldwide health crisis. In the United States, over one third of American children are considered to be overweight or obese\(^1\). Pediatric obesity rates have seen a large jump of 12% over the last forty years, with 1 in 5 children being obese\(^1-3\). Overweight or obese children are more likely to carry their weight status into adolescence and adulthood, increasing the risk of obesity-induced chronic diseases as well as the accompanying medical costs. Children with high adiposity levels average an excess annual cost of $1,000 in health care bills compared to their healthy weight counterparts\(^5\). Overall medical spending in the US is estimated at 21% of its yearly expenses to obesity-related illnesses – equivalent to $190.2 billion, with $14 billion coming directly from childhood obesity expenditures\(^5\).

High body mass index percentiles (BMIP) in children and teens may be met with conditions that were once thought only to occur in adulthood such as elevated serum cholesterol and triglycerides, type II diabetes, sleep apnea, as well as bone and joint issues\(^2,3,5\). Obesity in childhood also can induce a wide array of negative mental health consequences such as poor educational and cognitive performance, depression, anxiety, and low self-esteem, which may only work to emphasize the poor diet and lifestyle choices of an overweight or obese individual\(^3\).

The American Academy of Pediatrics (AAP) Expert Committee outlines a five-step approach for treating child and adolescent overweight and obesity, with the initial step being early identification of overweight status and subsequent tailored treatment\(^5,6\). Simple and effective screening tools are necessary to address weight status at many if not all points of child health care.
Notifying a parent that their child is at risk for being obese may be awkward to deliver as a practitioner and hard to receive as a parent. If the child or family is unaware of the risk, they may fail to address the unhealthy behaviors that can lead to excess adiposity. Even though clinicians typically measure height and weight, researchers estimated that BMI percentile is calculated in about 50% of obese patients, and even at a lower rate for overweight individuals (38.9%). Furthermore, even when BMI category is assessed, it is not always reported to the patient or family.6

Along with screening for obesity risk comes education regarding diet and physical activity (PA) recommendations to prevent excess weight gain during youth. Physicians may have low self-efficacy when it comes to obesity counseling due to the sensitivity of the topic cultural barriers present with many patients (e.g., differing perceptions of an unhealthy weight)53,54. Time restraints during healthcare visits (10-15 minutes) are not conducive to nutrition counseling and, furthermore, practitioners may not have the most effective tools or materials to address the topics, such as increasing fruit and vegetable intake, decreasing sugar consumption, increasing physical activity or simply preparing and eating meals as a family.7 Unfortunately, research has revealed that only 38% of physicians believe their nutrition and PA counseling is effective and 72% cited they would greatly benefit from having recommendations provided for them, prior to entering the appointment8,55.

Implementing a protocol that screens for childhood obesity risk based on BMI percentile and for diet and lifestyle behaviors is part of multi-tiered efforts to begin the conversation regarding obesity preventative measures. Previous studies have been conducted regarding the development of a simple screener for diet behaviors by asking what foods are liked and disliked9-16. Assessing likes and dislikes in children is a simple method to measure typical behaviors as research has indicated people typically consume what they like and avoid what they don’t9. Furthermore,
child food preference is an important determinant of actual food choice\textsuperscript{44}. Many studies have correlated the liking survey assessment tool used in this research with multiple dietary markers (including CVD risk factors, adiposity, and skin carotenoid status) in various populations including bariatric surgery patients, college students, adults, preschoolers, twins, children and adolescents\textsuperscript{10-16}. These findings support that the liking survey measures food intake.

The master’s thesis research work conducted by the preceding UConn graduate assistant at Connecticut Children’s Medical Center (CCMC), Kayla Vosburgh, analyzed results from 925 child/parent dyads who completed the Pediatric-Adapted Liking Survey (PALS) by hand (paper and pencil)\textsuperscript{17}. The results showed both criterion and construct validity as well as statistical reliability of a Healthy Behavior Index (HBI) generated from the participants’ scores. This study also found some correlation between lower overall HBI scores (indicating poorer dietary quality) and higher adiposity. Additionally, it is much less difficult for an individual to report which foods they like and dislike, compared to reporting how much they eat of a certain food and how often, especially for children\textsuperscript{18}. Nutrition screening tools, such as the 24-hour recall, may not be valid in some clinical settings as the past 24 hours may not reflect usual eating behaviors prior to the clinical visit. Therefore, the PALS, utilized in this current research, has been determined to be an appropriate measure of typical behaviors in order to screen for dietary quality in the pediatric emergency department (PED).

There have been a limited number of validated tools in the literature to accurately assess dietary quality and intake of the pediatric population, most of which are time consuming and/or expensive\textsuperscript{49,50}. There has been conflicting research as to whether or not the parental report of their child’s food intake can be used as the “gold standard” and a more accurate indicator of diet quality than the child’s report. Previous dietary assessment studies have found children (between 8-11 years old) to be more accurate than their parents, and fathers more accurate than mothers when food-frequency questionnaires were compared to actual food records and doubly labeled water measures (DLW)\textsuperscript{50}. Other studies have found
parents of older, black, or white children to be more accurate when it comes to assessing intake measures such as school meal participation. This research aims to assess the correspondence between parent-reporting of their child likes and dislikes on the PALS and child-reporting on the PALS.

The final important aspect to consider regarding effective childhood obesity prevention tools is the mode of intervention. Researchers have hypothesized that combining children’s love for technology with health promotion and communication of healthy behaviors would be effective to prevent childhood obesity. The World Health Organization defines “mHealth” or “mobile health” as “the use of mobile and wireless technologies to support the achievement of health objectives”. mHealth, and the use of other types of technologies to promote health, have the potential to be very successful platforms for reducing health risks among many different populations, including overweight or obese children and adolescents. Previous research combining mHealth and childhood obesity prevention tools has shown a high acceptability rate of the electronic platform, as well as significant improvements in child and parental knowledge regarding nutrition and physical activity. Additionally, many participants in past studies have opted to increase the level and frequency of prompts/messages from these online health information modalities.

The present study involves administering the PALS on an online survey platform, Qualtrics, to assess diet and physical activity preferences in children and adolescents. The target population of this research is children and their parent/caregivers who have received non-urgent care in the PED. The specific aims of this phase are 1) to determine the usability and feasibility of an online (Qualtrics-based platform) obesity risk screening tool for diet and physical activity (PA) preferences of children and parents in a clinical setting (the PALS); 2) to evaluate the difference in reporting between paper/pencil and tablet-based survey responses, and 3) to assess whether the PALS parent report can be used as a proxy for child preferences and therefore child diet quality.
Outcomes from the online survey will be compared to previous results of paper and pencil PALS conducted in the same setting (n=925)\textsuperscript{17}. Current findings will be compared to the previous dataset to determine whether the parent-reported child preferences are a more accurate predictor of child adiposity than child-reported preferences. Outcomes will also shed light on differences in reporting between technology-based tools as a mode of dietary quality assessment in the pediatric population compared to previous paper and pencil versions\textsuperscript{17}. Results from this study will support the idea of using an mHealth-based intervention tool in the non-urgent care setting in order to screen and predict for high adiposity risk in today’s youth based on BMIP and child food preferences.

2.2 METHODS

This observational study conveniently sampled child/parent dyads who were receiving non-urgent care in the PED of Connecticut Children’s Medical Center (CCMC), located in Hartford, CT. Data collection occurred between August 2016 and April 2018 by trained research assistants (RAs) taking part in the Undergraduate Research Assistant Program (URAP) at the University of Connecticut (UConn). Children were eligible to participate if they were between the ages of 5-17 years old (up until their 18th birthday) and if they had a parent/guardian present to take the survey with them. They were excluded if they had previously participated in the study, had history of a psychiatric/behavioral health issue (other than ADHD), had a diagnosed eating disorder, if they or their parent/guardian were non-English speaking, or if they were too sick to participate as deemed by their attending physician. This study was approved by both the UConn and CCMC Institutional Review Boards (IRB). Prior to participating, parents/guardians signed informed consent and children older than 7 years of age signed an assent form.

2.2.1 Procedure

The trained RAs first consulted the electronic medical record (EMR) to determine if the individual admitted to the PED was of a low enough risk to be considered for the study (Appendix
A depicts the RA training procedure). Patients were only approached to participate if they had a “low” risk level as deemed by their attending physician. RAs were also able to obtain age, height and weight from the EMR for the majority of patients, unless it had yet to be measured or recorded by the healthcare team. RAs subsequently located the attending physician or nurse of the patient in question to verify the inclusion/exclusion criteria and to ask permission if the patient and parent/guardian could be approached to participate. After required forms had been signed, RAs initiated data collection via online tablets to assess variables including: parent/guardian name and address, child’s age, sex, race/ethnicity, type of insurance, history of chronic medical condition (e.g., asthma, diabetes), and questions about the child’s dental health and home internet access. Additional variables including anthropometric measures, responses to the PALS survey, and online tablet usability/feasibility will be discussed in detail in the coming sections. Following data collection, parents received multiple colored print handouts including “Understanding Your Child’s Size” depicting their child’s weight status and a second handout with tips and resources for reducing sugary beverage intake (“Water 1st For Your Thirst”). Total data collection time averaged 25 minutes. Please refer to Appendix B: Documents A-H for all nutrition handouts.

2.2.2 Adiposity Measures

Research assistants were able to obtain height and weight from the EMR for the majority of the enrolled participants (>90%). For children who had to have their height or weight measured, RAs led them to the triage area in the PED where there is a standard height meter (cm) and weight scale (kg). RAs obtained permission from CCMC PED medical staff prior to using these instruments. Age-and-sex specific BMI and BMIP were then calculated utilizing the online CDC BMI percentile calculator by entering the child’s birth date, visit date, gender, height (cm) and weight (kg). Children were assigned to one of four BMIP categories: underweight <5th, healthy
weight 5\textsuperscript{th} – <85\textsuperscript{th}, overweight 85\textsuperscript{th} – <95\textsuperscript{th}, obese \geq 95\textsuperscript{th} percentile, or extremely obese \geq 120\% of the 95\textsuperscript{th} percentile\textsuperscript{22,23}.

Waist circumference (WC) was measured (cm) using a flexible measuring tape. RAs asked the child to stand up and point to their belly button. The RA would place three finger widths above the belly button and measure around the child’s waist. WC percentiles (WCP) were calculated using estimations of every 5\textsuperscript{th} percentile from gender, age and race-specific tables, based on the National Health and Nutrition Examination Survey (NHANES) data\textsuperscript{52}.

2.2.3 Pediatric-Adapted Liking Survey (PALS)

The Pediatric-Adapted Liking Survey (PALS) was completed online by both children and parents. Children were asked to report on their own likes/dislikes, and parents were asked to report on what they believed their child’s likes/dislikes were, rather than their own. The survey consisted of 27 food items and 7 non-food items, depicted through both pictures and words with a seven-face hedonic scale labeled as love it, really like it, like it, it’s okay, dislike it, really dislike it, and hate it by (Figure 1). Average completion time for this portion of the survey was 5 minutes. The PALS included 3-4 items in order to fit in each of the major food/activity groups (high fiber foods, fruits, vegetables, protein, dairy, sweets, sugary beverages, salty foods, physical activities and technology/sedentary behaviors). As in the initial PALS survey\textsuperscript{17}, children also were asked to report the liking/disliking of brushing their teeth.

Child/parent dyads were given the opportunity to practice using the tablet and the PALS scale with an example question prior to beginning the real questions. To ensure accurate responses, RAs were able to help any participants having trouble to verify the tablet and scale were being used correctly. The 34 survey items were presented randomly, which is different from the paper/pencil administration that lists the survey items in the same order for all participants.
Assessment of French fries was included twice throughout the survey to account for internal consistency within the survey responses. As can be viewed in Figure 1, participants drag or tap a movable circle on the scale line to indicate the level of liking/disliking. Qualtrics automatically measures the numerical value assigned to the dot placement, which is gauged from the center of the scale (0; he/she thinks it’s okay) to the participant’s marking, with a maximum of +100 (he/she loves it) and a minimum of -100 (he/she hates it). Children/parents also had the option to select “never tried or done” for all items listed, but could not skip any questions as the tablet would not move forward unless all items were rated.

![Figure 1. Example of an online-formatted PALS question with the sliding Likert scale](image)

2.2.4 Online Tablet Usability & Feasibility

The usability, acceptability and feasibility of the new online version of the PALS was determined through a series of ten questions on a similar hedonic scale as the food and activity preference questions (Table 1). Participants could respond to the questions by dragging and dropping or tapping the circle on the scale under their desired response or smiley face. Options included strongly agree, agree, somewhat agree, neither agree nor disagree, somewhat disagree,
disagree and strongly disagree. Both children and parents completed this phase of the survey immediately after the PALS in <5 minutes.

Table 1. Tablet Usability/Feasibility Questions rated on a 5-point Likert scale

<table>
<thead>
<tr>
<th>Question</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like using a computer, tablet, or smartphone.</td>
<td>The survey is user-friendly.</td>
</tr>
<tr>
<td>This survey was easy to complete.</td>
<td>It was easy to understand the pictures.</td>
</tr>
<tr>
<td>I could complete the survey without help.</td>
<td>The questions made me think about what I eat and do.</td>
</tr>
<tr>
<td>I could fix my mistakes easily and quickly.</td>
<td>The pictures were of what I/my child eat[s] and do[es].</td>
</tr>
<tr>
<td>I could answer the questions quickly.</td>
<td>The survey was fun to use.</td>
</tr>
</tbody>
</table>

2.2.5 Data Analysis

All data were analyzed using Microsoft Excel (version 15.13.1) and SPSS statistical software (version 25.0.0) with a significance level set at p<0.05 for all analyses. First, descriptive statistics (frequencies, percentages, means) were used to describe basic demographic and anthropometric data as well as to compare the adiposity distribution in the PED to national samples and to the previous CCMC PED PALS dataset17.

Internal reliability and consistency of the PALS food/activity groups was evaluated using Cronbach’s alpha where an $\alpha > 0.7$ was considered acceptable. An exploratory principal component analysis (PCA) was conducted to the number of constructs measured by PALS (i.e., construct validity). Intra-class correlation coefficient (ICC) values were used to test intra-rater reliability of repeated survey measures and inter-rater reliability between child and parent responses. The Kolmogorov-Smirnov test (KS-test) was used to test for differences in central tendency and distribution between the online PALS dataset versus the paper/pencil dataset. PALS criterion validity was assessed using bivariate correlation analysis and Spearman’s rho of survey groups against various measures including child age, health insurance status or adiposity level (BMIP or WCP) to determine any significant or trending associations. Finally, Spearman’s rho
was also utilized to determine any possible effects of child’s age on the online tablet usability, acceptability and feasibility.

2.3 RESULTS

The initial study sample consisted of 634 participants, with 99 ineligible enrollments. Ineligibility occurred due to incomplete forms or missing signatures (20%), behavioral or psychological illnesses (8%), tablet or internet malfunctions (7%), missing survey responses (6%), patients becoming too sick to continue (3%), eating disorders (1%), previous participation (1%), or various other reasons such as loss of interest in the survey, falling asleep, or interruption due to medical care (5%). The final study sample consisted of 535 child/parent dyads diverse in age, gender, race/ethnicity, insurance type, and adiposity status (Table 2).

<table>
<thead>
<tr>
<th>Table 2. Characteristics of CCMC PED patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=535</td>
</tr>
<tr>
<td>Age [Avg. 10.9 y]</td>
</tr>
<tr>
<td>5 - &lt;9 y</td>
</tr>
<tr>
<td>9 - &lt;13 y</td>
</tr>
<tr>
<td>13 – 17 y</td>
</tr>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
</tr>
<tr>
<td>Caucasian</td>
</tr>
<tr>
<td>Black</td>
</tr>
<tr>
<td>Hispanic</td>
</tr>
<tr>
<td>Mixed Race</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Insurance</td>
</tr>
<tr>
<td>Private</td>
</tr>
<tr>
<td>Public</td>
</tr>
<tr>
<td>Self Pay</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>BMIP</td>
</tr>
<tr>
<td>Underweight</td>
</tr>
<tr>
<td>Normal Weight</td>
</tr>
<tr>
<td>Overweight</td>
</tr>
<tr>
<td>Obese</td>
</tr>
<tr>
<td>Extremely Obese</td>
</tr>
</tbody>
</table>

WCP
<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>30</td>
<td>5.6</td>
</tr>
<tr>
<td>Normal Weight</td>
<td>370</td>
<td>69</td>
</tr>
<tr>
<td>Overweight</td>
<td>73</td>
<td>13.6</td>
</tr>
<tr>
<td>Obese</td>
<td>63</td>
<td>11.8</td>
</tr>
</tbody>
</table>

*Percentages ≠ 100 due to missing data*

2.3.1 Child Adiposity

Overall, 16.4% of children in the PED sample were categorized as overweight based on BMIP (based on age and gender) whereas 17.2% were classified as obese, with 4.1% of that percentage fitting into the extreme obesity category (>120% of the 95th percentile\(^{23}\)). Compared to BMIP, 13.6% of children in the sample fit into the overweight category based on WCP (based on age, gender and race) and 11.8% were classified as obese (Table 2). Previous research has shown that BMIP may overestimate adiposity compared to WCP as it does not take race into account\(^{24}\). BMIP and WCP were highly correlated based on Spearman’s rho correlation coefficient (0.564, \(p=0.000\)). When evaluating PED adiposity levels against the national average, our sample had a slightly lower percentage of overweight (33.6%) and obese (17.2%) compared to the national averages of 36.6% and 19.6%, respectively (Table 3). These results are also lower than the previous set of data collected in the same urban PED between 2013-2016, which revealed a higher level of overweight (37.4%) and obesity (21.2%) compared to the national averages\(^{17}\).

In our population, females had a higher rate of overweight (8.8%) and obesity (7.2%) compared to males (5.9% and 7.2%, respectively); however, males slightly outweighed females in terms of extreme obesity (2.4% vs. 1.7%). In terms of age, children between ages 9-13 years old had the highest levels of being overweight (20%), obese (15.1%), and extremely obese (5.4%) when evaluated against their younger (5-<9 years old) and older (13-<18 years old) counterparts (Table 4).
Table 3. Body Mass Index (BMI) percentiles of children (5 to <18 years) who were patients at a pediatric emergency department (PED) compared to 2013-2014 U.S. averages

<table>
<thead>
<tr>
<th>≥85&lt;sup&gt;th&lt;/sup&gt; percentile</th>
<th>U.S. (%)</th>
<th>PED (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>36.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>33.6</td>
</tr>
<tr>
<td>Female</td>
<td>37.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>32.6&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>≥95&lt;sup&gt;th&lt;/sup&gt; percentile</td>
<td>19.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>17.2</td>
</tr>
<tr>
<td>Male</td>
<td>19.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.9&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>Female</td>
<td>20.3&lt;sup&gt;b&lt;/sup&gt;</td>
<td>16.3&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

*U.S. prevalence based on 2013-2014 NHANES data<sup>38</sup>
† Percent of sample size of respective gender (male n=246; female n=288)
a Percent of total sample size, N= 2550
b Percent of sample size of respective gender (male n=1314; female n=1236)

Table 4. Body Mass Index (BMI) percentiles by age and gender of children who were patients at a pediatric emergency department (PED)

<table>
<thead>
<tr>
<th>5-&lt;18 years</th>
<th>5 - &lt;9 years</th>
<th>9 - &lt;13 years</th>
<th>13 - &lt;18 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>%*</td>
<td>Count</td>
<td>%*</td>
</tr>
<tr>
<td>&lt;5&lt;sup&gt;th&lt;/sup&gt; percentile (Underweight)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>3.2</td>
<td>10</td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>2.0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>28</td>
<td>5.2</td>
<td>12</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; – &lt;85&lt;sup&gt;th&lt;/sup&gt; percentile (Normal Weight)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>143</td>
<td>26.7</td>
<td>49</td>
</tr>
<tr>
<td>Female</td>
<td>183</td>
<td>34.1</td>
<td>57</td>
</tr>
<tr>
<td>Total</td>
<td>328</td>
<td>61</td>
<td>106</td>
</tr>
<tr>
<td>85&lt;sup&gt;th&lt;/sup&gt; – &lt;95&lt;sup&gt;th&lt;/sup&gt; percentile (Overweight)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>41</td>
<td>7.6</td>
<td>10</td>
</tr>
<tr>
<td>Female</td>
<td>47</td>
<td>8.8</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>16.4</td>
<td>24</td>
</tr>
<tr>
<td>≥95&lt;sup&gt;th&lt;/sup&gt; percentile (Obese)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>31</td>
<td>5.9</td>
<td>7</td>
</tr>
<tr>
<td>Female</td>
<td>38</td>
<td>7.2</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>13.1</td>
<td>17</td>
</tr>
<tr>
<td>≥120% of the 95&lt;sup&gt;th&lt;/sup&gt; percentile (Extreme Obese)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>13</td>
<td>2.4</td>
<td>2</td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>1.7</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>4.1</td>
<td>7</td>
</tr>
<tr>
<td>Total per age group</td>
<td>535</td>
<td>166</td>
<td>185</td>
</tr>
</tbody>
</table>

*Percent of total age group sample (by column); Percentages ≠ 100 due to missing data
2.3.2 PALS Reliability

Test-retest reliability The assessment of liking for French fries was the one repeated measure for both children and parents to account for response consistency and intra-rater reliability. Based on the intraclass correlation coefficient (average measures) (ICC), children displayed an ICC of 0.751 and parents an ICC of 0.739, indicating that both of the responses to liking French fries were similar and displayed good reliability among each individual rater (a good ICC $\geq 0.750$). Furthermore, confidence intervals reveal that 95% of the child’s sample fit within an ICC of 0.703-0.781 and 95% of the parent’s sample fit within an ICC value of 0.608-0.781, indicating the majority of the sample demonstrates high agreement between both French fry responses and therefore verifying reliability and accuracy of the food preference measures.

PALS Group Internal Reliability Cronbach’s alpha was used in order to determine the internal consistency of all PALS food groups for both child and parent responses. As depicted in Table 5, the PALS items that produced the highest reliability were the salty and sweet groups. Due to the low results (alpha < 0.750), the groups were not used to construct an index of dietary quality.

<table>
<thead>
<tr>
<th>Table 5. Internal reliability of PALS groups (Cronbach’s alpha)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cronbach’s alpha</strong></td>
</tr>
<tr>
<td><strong>Fruit Group</strong>: Apple, Banana, Orange</td>
</tr>
<tr>
<td><strong>Vegetable Group</strong>: Carrots, Corn, Tomatoes, Green beans</td>
</tr>
<tr>
<td><strong>Fiber Group</strong>: Cheerios/Kix, Whole wheat bread, Beans/Lentils</td>
</tr>
<tr>
<td><strong>Protein Group</strong>: Tuna, Eggs, Chicken nuggets, Burger</td>
</tr>
<tr>
<td><strong>Salty Group</strong>: French fries, Salty snacks, Adding salt to foods</td>
</tr>
<tr>
<td><strong>Sweets Group</strong>: Cookies/cake, Candy, Sweet Cereal</td>
</tr>
<tr>
<td><strong>SSB Group</strong>: Soda, Fruit punch, Juice</td>
</tr>
<tr>
<td><strong>Dairy Group</strong>: Yogurt, Milk, Chocolate milk</td>
</tr>
</tbody>
</table>
PALS Construct Validity  Exploratory principal component analysis (PCA) revealed that two factors explained nearly 50% of the variability across the group for both child (Figure 2) and parent (Figure 3). The factors and extraction were nearly identical. In both cases, factor one was comprised of the salty group, sugar-sweetened beverage group, sweet group and sedentary group. The second factor was the fiber group, vegetable group and fruit group. In both child and parent, the dairy group and protein group loaded both on factor 1 and factor 2.

Table 6. Exploratory PCA component results for both child and parent responses

<table>
<thead>
<tr>
<th>Component</th>
<th>% of variance (child responses)</th>
<th>% of variance (parent responses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - salty group, sugar-sweetened beverage group, sweet group and sedentary group</td>
<td>30.62</td>
<td>30.02</td>
</tr>
<tr>
<td>2 - fiber group, vegetable group and fruit group</td>
<td>16.82</td>
<td>17.82</td>
</tr>
</tbody>
</table>

Figures 2 & 3. Principal component analysis depicting two major factors of variance for child (left) and parent (right)

<table>
<thead>
<tr>
<th>Structure Matrix</th>
<th>Structure Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
<td>Component</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C_FbrGrp</td>
<td>.004</td>
</tr>
<tr>
<td>C_VegGrp</td>
<td>.097</td>
</tr>
<tr>
<td>C_FrtGrp</td>
<td>.200</td>
</tr>
<tr>
<td>C_DairyGrp</td>
<td>.458</td>
</tr>
<tr>
<td>C_AcitGrp</td>
<td>.507</td>
</tr>
<tr>
<td>C_StGrp</td>
<td>.730</td>
</tr>
<tr>
<td>C_SSBGrp</td>
<td>.755</td>
</tr>
<tr>
<td>C_ProGrp</td>
<td>.512</td>
</tr>
<tr>
<td>C_SwtGrp</td>
<td>.759</td>
</tr>
<tr>
<td>C_SedGrp</td>
<td>.672</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
PALS criterion validity - Based on group mean scores, older children (>11 years old) have healthier preferences than their younger counterparts (≤11 years old) as depicted by both child and parent reports. Furthermore, females, white children, and those with private insurance tend to have healthier liking compared to males, children of minorities, or those with public insurance.

Bivariate correlation analysis did not reveal any significant relationships between child/parent food group preferences or adiposity measures for the total study population. However, various significant trends became apparent when selecting specific subgroups of the study sample.

When the analysis was restricted to participants with BMIP and/or WCP between 10th - 100th percentile, associations appeared as the cases of underweight and extremely obese individuals were excluded. The two dimensions (healthy and unhealthy) significantly correlated with adiposity levels in multiple population subgroups. Based on child-reported liking, higher preferences for unhealthy foods correlated with lower BMIP for all children on public health insurance (p=0.019). Parent-reported preferences revealed that females, especially older females, who reported a high affinity for healthy foods associated with higher BMIP (p=0.011), however the opposite was true for males where higher liking was correlated with lower BMIP.

When looking at waist circumference percentile, different relationships arose. Just as with BMIP, females with a high liking for healthy foods also significantly correlated with higher WCP, however this was only true for girls on public health insurance and when preferences were reported by the child (p=0.042). High parent-reported liking for healthy foods trended with elevated WCP for all children on public health insurance, more so in females over males (p = 0.008; p = 0.014, respectively).

Restricting to just overweight or obese children with a BMIP or WCP between the 85th and 100th percentile revealed opposite trends with healthy foods, where higher liking correlated with a
lower BMIP for older females (p = 0.04, child-reported) and males on private insurance (0.026, parent-reported). Contrary to what would be expected, a higher child-reported preference for unhealthy foods actually associated with lower BMIP for overweight/obese females, especially when on public health insurance and those older on public health insurance (p = 0.034, p = 0.005, and 0.02, respectively). As expected, overweight or obese children who reported a high liking for PA/music had lower BMIP, more so for girls on public insurance (p = 0.038).

Again, WCP differed in significant relationships, however there were none based on child-reported preferences. Parent-reported liking showed a lower WCP when higher liking of healthy foods existed for publicly-insured females (p = 0.018). High liking for unhealthy foods was significant with a lower WCP for females on public insurance (p = 0.036) but with a higher WCP for females on private insurance (p = 0.02).

2.3.3 PALS Accuracy – Consistency between child and parent ratings

The present study asks parents to disclose what they believe their child’s preferences are, as compared to the previous dataset where parents were asked to report their own preferences, which were then compared to the child’s likes\(^ {17} \). The purpose was to assess whether parental report could be used as a proxy for child dietary quality. As presented by Table 7, it is clear there was little to no discrepancy between the child and parent reports based on the ICC, assuring that the parent can be used as an accurate predictor and a proxy for the child’s preferences. Tables 8 & 9 further breakdown this relationship by the child’s age. Both age groups (younger or older than 11 years old) continued to have a large ICC, indicating there were no significant differences in parental reporting accuracy by age. In terms of the child or parent being a better predictor of child adiposity levels, there were no more significant relationships between the parent-reported preferences and BMIP/WCP, than occurred with the child’s preferences.
Variance in liking was greatest between children and parents for vegetables and high fiber foods, whereas the lowest variance occurred amongst salty foods and fruits for children, and physical activities and protein foods for parents (Table 7). It appears for children, the most variance occurred among the least liked items, however this cannot be said for the parent-reported child preferences. Although there were slight differences in overall group rankings between children and parents, the ICC value for reliability measures was ≥ 0.857 for all groups, indicating excellent response consistency and accuracy between child and parent reports.

Table 7. Variance and estimated effect sizes of parent-child survey-reported preferences of groups (n=423)

<table>
<thead>
<tr>
<th></th>
<th>Child</th>
<th></th>
<th>Parent</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Variance</td>
<td>Mean</td>
<td>SD</td>
<td>Variance</td>
<td>ICC</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>19.55</td>
<td>41.09</td>
<td>1688.19</td>
<td>18.01</td>
<td>39.65</td>
<td>1572.50</td>
<td>0.946</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>51.70</td>
<td>35.40</td>
<td>1253.11</td>
<td>47.91</td>
<td>34.88</td>
<td>1216.82</td>
<td>0.883</td>
<td></td>
</tr>
<tr>
<td>Salty</td>
<td>45.23</td>
<td>34.30</td>
<td>1176.65</td>
<td>46.84</td>
<td>33.14</td>
<td>1098.04</td>
<td>0.923</td>
<td></td>
</tr>
<tr>
<td>Sweets</td>
<td>49.62</td>
<td>38.77</td>
<td>1503.00</td>
<td>49.34</td>
<td>34.99</td>
<td>1224.59</td>
<td>0.902</td>
<td></td>
</tr>
<tr>
<td>Sugary Drinks</td>
<td>48.59</td>
<td>35.77</td>
<td>1279.40</td>
<td>47.12</td>
<td>34.94</td>
<td>1220.53</td>
<td>0.921</td>
<td></td>
</tr>
<tr>
<td>Physical Activity</td>
<td>49.10</td>
<td>36.33</td>
<td>1319.83</td>
<td>49.08</td>
<td>32.57</td>
<td>1061.09</td>
<td>0.857</td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>41.42</td>
<td>38.56</td>
<td>1487.21</td>
<td>40.15</td>
<td>37.01</td>
<td>1369.90</td>
<td>0.927</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>36.13</td>
<td>34.98</td>
<td>1223.88</td>
<td>36.84</td>
<td>33.12</td>
<td>1096.74</td>
<td>0.908</td>
<td></td>
</tr>
<tr>
<td>Fiber</td>
<td>21.48</td>
<td>40.53</td>
<td>1642.56</td>
<td>21.48</td>
<td>37.78</td>
<td>1427.26</td>
<td>0.894</td>
<td></td>
</tr>
<tr>
<td>Physical Activity + Music</td>
<td>55.23</td>
<td>30.56</td>
<td>934.19</td>
<td>55.19</td>
<td>28.44</td>
<td>808.66</td>
<td>0.871</td>
<td></td>
</tr>
<tr>
<td>Healthy</td>
<td>34.04</td>
<td>23.34</td>
<td>544.78</td>
<td>32.86</td>
<td>22.30</td>
<td>497.20</td>
<td>0.910</td>
<td></td>
</tr>
<tr>
<td>Unhealthy</td>
<td>47.81</td>
<td>29.29</td>
<td>858.10</td>
<td>46.83</td>
<td>27.60</td>
<td>761.57</td>
<td>0.927</td>
<td></td>
</tr>
</tbody>
</table>

Table 8. Variance BY AGE and estimated effect sizes of parent and child survey-reported preferences of selected food/activity groups (n=247)

<table>
<thead>
<tr>
<th></th>
<th>Young Children (&lt;=11 y/o)</th>
<th>Parent</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Variance</td>
<td>Mean</td>
<td>SD</td>
<td>Variance</td>
<td>ICC</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>19.68</td>
<td>44.63</td>
<td>1992.13</td>
<td>17.49</td>
<td>42.69</td>
<td>1822.24</td>
<td>0.953</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>53.77</td>
<td>35.92</td>
<td>1290.14</td>
<td>52.24</td>
<td>34.49</td>
<td>1189.30</td>
<td>0.879</td>
<td></td>
</tr>
<tr>
<td>Salty</td>
<td>51.97</td>
<td>32.13</td>
<td>1032.02</td>
<td>49.54</td>
<td>30.67</td>
<td>940.76</td>
<td>0.903</td>
<td></td>
</tr>
<tr>
<td>PA + Music</td>
<td>55.73</td>
<td>30.98</td>
<td>959.91</td>
<td>55.16</td>
<td>27.69</td>
<td>766.63</td>
<td>0.841</td>
<td></td>
</tr>
<tr>
<td>Healthy</td>
<td>36.68</td>
<td>24.36</td>
<td>593.58</td>
<td>35.76</td>
<td>23.20</td>
<td>538.38</td>
<td>0.915</td>
<td></td>
</tr>
<tr>
<td>Unhealthy</td>
<td>55.12</td>
<td>28.29</td>
<td>800.03</td>
<td>53.35</td>
<td>26.34</td>
<td>693.57</td>
<td>0.916</td>
<td></td>
</tr>
</tbody>
</table>
Table 9. Variance BY AGE and estimated effect sizes of parent and child survey-reported preferences of selected food/activity groups (n=177)

<table>
<thead>
<tr>
<th></th>
<th>Older Children (&gt;11 y/o)</th>
<th>Parent</th>
<th></th>
<th></th>
<th></th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Variance</td>
<td>Mean</td>
<td>SD</td>
<td>Variance</td>
</tr>
<tr>
<td>Vegetables</td>
<td>19.38</td>
<td>35.70</td>
<td>1274.63</td>
<td>18.75</td>
<td>35.06</td>
<td>1229.49</td>
</tr>
<tr>
<td>Fruits</td>
<td>48.82</td>
<td>34.56</td>
<td>1194.31</td>
<td>41.82</td>
<td>34.62</td>
<td>1198.59</td>
</tr>
<tr>
<td>Salty</td>
<td>35.87</td>
<td>35.12</td>
<td>1233.13</td>
<td>35.95</td>
<td>33.81</td>
<td>1143.08</td>
</tr>
<tr>
<td>PA + Music</td>
<td>54.53</td>
<td>30.05</td>
<td>902.98</td>
<td>55.23</td>
<td>29.53</td>
<td>872.12</td>
</tr>
<tr>
<td>Healthy</td>
<td>30.37</td>
<td>21.37</td>
<td>456.63</td>
<td>28.81</td>
<td>20.34</td>
<td>413.76</td>
</tr>
<tr>
<td>Unhealthy</td>
<td>37.66</td>
<td>27.68</td>
<td>765.48</td>
<td>37.68</td>
<td>26.78</td>
<td>717.27</td>
</tr>
</tbody>
</table>

Relative liking differences between child and parent-reported food and activity preferences can be seen in Table 10 by rank and in Figures 4 & 5. Both groups rated technology (watching TV, playing video games, listening to music) with the highest liking. However, parents reported their children had a slightly higher affinity for physical activities (playing outside, playing sports, dancing) and sweet foods (candy, cookies/cake, sweet cereal) and a lower affinity for fruits (banana, apple, orange) than the child actually reported, when compared to the remaining ranking of group preferences. Children and parents both ranked sugary drinks (soda, juice, fruit punch), salty foods (salty snacks, French fries, adding salt to foods), dairy foods (milk, chocolate milk, yogurt), protein foods (tuna, eggs, burger, chicken nuggets), high fiber foods (whole wheat bread, beans/lentils, high fiber cereals), and vegetables (green beans, carrots, corn, tomatoes) as the remaining least liked groups. On average, parents reported lower preferences for their children for most groups except for protein, high fiber, and vegetables, where they believed their child had higher preferences for these healthier foods than the child actually reported based on group means.

Group ranking different very slightly when looking at variances between BMIP categories. All children and parents ranked sedentary behaviors/technology as their most liked group for all BMIPs except overweight individuals where children and parents ranked physical activities as most liked, and parents of obese children ranked fruits as most liked (Tables 11 & 12). Both
children and their parents for all BMIP categories ranked protein, fiber and vegetables in the bottom three groups, revealing the healthier items are not as well liked as the unhealthier items.

Table 10. Ranking of groups from highest liking to lowest liking for children and parent reports. (n=423)

<table>
<thead>
<tr>
<th>Child</th>
<th>Avg. Rank*</th>
<th>Parent</th>
<th>Avg. Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>4.13</td>
<td>Technology</td>
<td>3.99</td>
</tr>
<tr>
<td>Fruits</td>
<td>4.74</td>
<td>Sweets</td>
<td>4.75</td>
</tr>
<tr>
<td>Sweets</td>
<td>4.84</td>
<td>Physical Activity</td>
<td>4.92</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>4.96</td>
<td>Fruits</td>
<td>4.93</td>
</tr>
<tr>
<td>Sugary Drinks</td>
<td>5.06</td>
<td>Sugary Drinks</td>
<td>5.07</td>
</tr>
<tr>
<td>Salty</td>
<td>5.41</td>
<td>Salty</td>
<td>5.35</td>
</tr>
<tr>
<td>Dairy</td>
<td>5.50</td>
<td>Dairy</td>
<td>5.64</td>
</tr>
<tr>
<td>Protein</td>
<td>6.15</td>
<td>Protein</td>
<td>5.89</td>
</tr>
<tr>
<td>Fiber</td>
<td>7.07</td>
<td>Fiber</td>
<td>7.13</td>
</tr>
<tr>
<td>Vegetables</td>
<td>7.15</td>
<td>Vegetables</td>
<td>7.32</td>
</tr>
</tbody>
</table>

*1=Highest rank, 10=lowest rank

Table 11. Ranking of groups from highest liking to lowest liking for children vs. BMIP categories. (n=423)

<table>
<thead>
<tr>
<th>Average Ranking of Groups (Child Report) by BMIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Technology</td>
</tr>
<tr>
<td>Sweets</td>
</tr>
<tr>
<td>Fruits</td>
</tr>
<tr>
<td>Dairy</td>
</tr>
<tr>
<td>Salty</td>
</tr>
<tr>
<td>Sugary Drinks</td>
</tr>
<tr>
<td>Physical Activity</td>
</tr>
<tr>
<td>Fiber</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Vegetables</td>
</tr>
</tbody>
</table>

Table 12. Ranking of groups from highest liking to lowest liking based on parent report vs. child BMIP categories (n=423)

<table>
<thead>
<tr>
<th>Average Ranking of Groups (Parent Report) by BMIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>Technology</td>
</tr>
<tr>
<td>Sweets</td>
</tr>
<tr>
<td>Sugary Drinks</td>
</tr>
<tr>
<td>Fruits</td>
</tr>
<tr>
<td>Salty</td>
</tr>
<tr>
<td>Physical Activity</td>
</tr>
<tr>
<td>Dairy</td>
</tr>
<tr>
<td>Fiber</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Vegetables</td>
</tr>
</tbody>
</table>
Figure 4. Child-reported Group Liking by % of sample, from most to least liked

![Child-reported Group Liking](image)

Figure 5. Parent-reported Child Liking by % of sample, from most to least liked

![Parent-reported Child Liking](image)
2.3.4 Paper and Pencil vs. Online Tablet Format Reporting

The previous dataset gathered for this study was collected on paper and pencil prior to transitioning to the online format for the present phase. Demographic variables for dataset #1, n = 925\(^7\), versus this dataset (#2), n = 534, were extremely similar with the same mean age of 10.9 years old and similar distribution of gender, insurance status and BMIP (59.6% normal weight vs. 61%, respectively). The main difference between the two datasets occurred in the distribution of race (38.6% Caucasian in dataset #1 vs. 56.2% in dataset #2). Due to the similarity of the populations’ baseline characteristics, we were able to directly compare differences between the PALS paper reports and tablet reports.

Only the child’s responses could be compared due to the fact that parents were evaluating their own likes and dislikes in dataset #1 rather than their child’s. Overall, children rated their liking for the majority of foods lower on the tablet than when paper and pencil was provided to take the survey. The only food groups that did not agree with this trend were vegetables, which garnered the same mean for both datasets (~19), and the salty group, which resulted in a higher average liking when reported on the tablets when compared to paper and pencil (48 vs. 44, respectively). The first dataset revealed similar dimensions as the current datasets with main groups consisting of healthy and unhealthy foods.

Bar charts of each individual food group and results from the Kolmogorov-Smirnov test (KS-test) were used to test if the two datasets differed significantly as it does not make any assumptions about data distribution\(^8\). Please refer to Appendix C: Figures 1-10 to compare the distribution of food group scores between the datasets. KS-test results revealed a significant difference occurred in responses between the fruit, activity, sugary drinks, protein, sweets and sedentary behaviors/technology groups (Table 13). Both datasets contained the same items per
group. These significant differences between modes of assessment indicate that there is less of a ceiling effect when participants are using the online tablet survey format and they are better utilizing the entire liking scale than on paper.

<table>
<thead>
<tr>
<th>Table 13. Differences in groups between CCMC datasets 1 &amp; 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kolmogorov-Smirnov Test (KS-test) Results Between Datasets</strong></td>
</tr>
<tr>
<td><strong>Group</strong></td>
</tr>
<tr>
<td>Fiber</td>
</tr>
<tr>
<td>Vegetables</td>
</tr>
<tr>
<td>Fruits</td>
</tr>
<tr>
<td>Dairy</td>
</tr>
<tr>
<td>Physical Activity</td>
</tr>
<tr>
<td>Salty</td>
</tr>
<tr>
<td>Sugary Drinks</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Sweets</td>
</tr>
<tr>
<td>Sedentary behaviors/technology</td>
</tr>
</tbody>
</table>

*p≤0.05 is considered significant

The D statistic in the KS-test is “the maximum vertical deviation between the two curves” of data⁴⁸

2.3.5 Online Tablet Usability & Feasibility

The online tablet version of the current survey took between 20-25 minutes to complete, including the collection and measurement of all demographic and anthropometric variables, the PALS survey, and the tablet usability questions for both the child and the parent. Out of the 99 ineligible enrollments, only 7 were due to a tablet or internet malfunction (7%). Online tablet usability and feasibility were measured through ten questions on a hedonic scale from strongly agree to strongly disagree (Table 1 & Figure 6).

For both children and parents, ≥82% reported the survey was easy to complete; it could be completed without help; they were able to fix their mistakes quickly and easily; questions could be answered quickly; the questions were relevant; and the survey was fun. More than 92% of children and parents reported it was easy to understand the pictures. The majority of children (78%) and parents (81%) agreed that the questions made them think about their or their child’s behaviors.
User-friendliness of the online survey platform was agreed with by 87% of parents and 92% of children. Please refer to Appendix D: Figures 11-20 for bar charts depicting differences in tablet usability responses between the child and parent. Overall, children reported higher agreement than their parents for likeness of using technology (82% versus 67%), survey ease of use, user-friendliness, picture relevance and the survey being fun. Parents disclosed higher agreement with ease of fixing mistakes and being able to answer the questions quickly. Children and their parents both agreed equally that the survey could be completed without help, the pictures were easy to understand, and the survey items induced contemplation regarding their or their child’s current eating or activity behaviors.

Age differences showed that older children (>11 years old) needed less help completing the survey and it was slightly easier for them to understand the pictures than younger children. Interestingly, younger children thought more about their behaviors while answering the questions, reported a stronger relevance of the survey items, and believed the survey was more fun than their older counterparts. Parents of young children had a more significant positive response to all tablet usability and feasibility parameters compared to parents of adolescents or teenagers.

*Figure 6. Example of an online-formatted tablet usability/feasibility question with the sliding Likert scale*
2.4 DISCUSSION

Elevated rates of childhood obesity in America call for multi-tiered approaches to obesity prevention, including efforts in non-urgent care and clinical settings\textsuperscript{25}. The present study conducted in the Pediatric Emergency Department (PED) aimed to assess the usability and feasibility of the online tablet-based Pediatric Adapted Liking Survey (PALS) to screen for high adiposity risk levels and assess for obesity risk through evaluating childhood nutrition and activity behaviors. The PED has been shown to be a reliable setting for nutrition assessment and treatment\textsuperscript{26,27}. Many high-risk and low-income minority populations present to the PED for care, many of whom do not regularly obtain medical care and have been shown to have unhealthy dietary behaviors\textsuperscript{28,29}. Introducing a simple and feasible tool, such as the online-based PALS, to both screen for obesity risk and assess dietary behaviors would be invaluable in the childhood medical setting, especially the PED where previous nutrition interventions have shown promise\textsuperscript{26}.

Overall, there are many factors that can either facilitate or hinder obesity risk screening and nutrition education in pediatric health care. Whether due to a lack of resources (materials or personnel), time constraints, or practitioners’ low self-efficacy related to nutrition counseling, pediatricians likely feel overwhelmed with the task of treating the childhood obesity epidemic\textsuperscript{6,7,53,55}. Due to this new and tremendous responsibility the pediatric physicians now have, they may avoid BMI screening as a way to sidestep taking on the challenge of treating their patients for excess adiposity. These weight-related conversations are commonly a sensitive topic, and pediatricians should feel educated and prepared before they take on the task. Without the confidence or adequate knowledge regarding childhood obesity or nutrition, pediatricians run the risk of either embarrassing or offending their patients or parents, and possibly even providing inaccurate nutrition information.
Based on the tablet usability and feasibility results, it is clear that the online PALS tool presented in this research demonstrates ease of use for both the patient (child or parent) and practitioner. Furthermore, trained personnel other than the physician could easily take on the task of administering the online PALS prior to the physician addressing the patient. This would not only save time for the pediatrician, but it would give the practitioner additional baseline information about the patient’s preferences and resources to convey guidance on the serious topic of excess adiposity risk. Integrating this tool into pediatric care introduces the opportunity to normalize the obesity risk conversation for both children and their parents.

Although the food preference results from PALS failed to significantly predict adiposity in the overall study sample, it was able to detect variances in dietary quality between subgroups. Consistent with previous PALS data, the present study demonstrated preference differences for multiple variables including gender, age, and insurance status, where females, older children, and those with private insurance reported healthier preferences than males, younger children or those on public insurance. These results agree with previous data where girls tend to have healthier food choices than boys 30,31, however contradicts past studies which suggest younger children typically have better dietary quality as they have less autonomy and control over their food choices compared to adolescents or teens 30,32-34. There appeared to be a common pattern among older children and an affinity for a “meat and potatoes” type category, which included vegetables, proteins and high fiber foods. All children presented a great likeness towards foods with high sugar content such as sweets and sugary drinks. This may be due to the fact that they are drawn towards the high-calorie content of these foods while they grow and develop 35. Encouragement should be provided to satisfy these cravings with more low-calorie, high nutrient-dense natural sources of sweetness such as fruits.
Significance was detected in multiple instances for both child and parent-reported likes when associating with adiposity level, however there were few consistent trends in the data. Public insurance appeared to play a large role when predicting weight status, as many subgroups with public insurance (i.e. [younger] males, females) and a high liking for unhealthy foods correlated with both lower BMIP and WCP for either child and parent-reported likes. This is contrary to what would be expected, where a liking for high fat/sweet/salty foods may correlate more naturally with a higher weight status. This inverted relationship may be due to the fact that low-income families often live in food deserts, where there is a lack of grocery stores, farmer’s markets, fresh produce and other healthy options at an affordable cost\textsuperscript{36}. Low-income children on public insurance may face food insecurity and therefore have a high preference for unhealthy foods because the majority of their diet consists of these high fat/sugar/calorie foods, which are less expensive and can keep them satiated for a longer period of time. However, this data does not support the typical trend seen in income-disadvantaged populations, where the lack of healthy food resources, abundance of fast and processed foods and lack of opportunities for physical activity make it more difficult to engage in healthy behaviors and thus, increase obesity risk.

Overweight and obese children showed a substantial high preference for all foods, rather than just unhealthy foods as might be predicted. This may be due to the fact that children with excess adiposity simply enjoy all foods presented to them. Another explanation may be a typical high rate of misreporting by overweight or obese individuals in light of social pressures. These children may feel the need to report they like healthier options in equal amounts to their unhealthy counterparts because they know they should consume more of the nutrient-dense foods. Misreporting may also occur because they may feel under pressure as they are completing the survey in a clinical setting\textsuperscript{37,38}. However, the parental report of the overweight and obese children’s
preferences was extremely consistent with the child’s responses, so this conclusion may not be true in this specific population. Many of the significant relationships found within this subset of children showed an inverse relationship between food preference and weight status (i.e. higher liking for any type of food → lower BMIP or WCP), which is again, contrary to what one may assume for this overweight and obese population. Children in this weight category may have already been screened for excess weight and therefore have higher awareness of healthy nutrition and behaviors. This is a promising trend as it may suggest that these children are receiving the appropriate messages and beginning to adopt healthier behaviors.

Children and parents both reported on the child’s preferences in the present study, whereas in previous PALS research, the parent reported their own likes and dislikes. This was done in order to assess whether or not the parent’s evaluation of their children’s likes are, 1) consistent with the child’s preference report and 2) a more accurate predictor of the child’s weight status. Previous research has supported the idea of using parental report as a proxy for child’s food preference. However, this relationship may vary depending on the child’s age or even the parent’s education level. It was found that mothers with a lower education level (i.e. high school or below) had a larger discordance and a lower agreement with their child’s food preference responses than mothers with a bachelor’s or master’s degree.

Based on the data analysis, the parent’s perceptions of their child’s food and activity preferences were extremely accurate with the child’s responses (ICC≥0.857 for all groups indicating good/excellent agreement). Therefore, it cannot be claimed that the parent’s answers are necessarily more accurate or a better predictor for any variable in question, but this data has verified that parental responses can successfully be used as a proxy for the child’s answers. Parents of younger children were slightly more consistent in responses than those of older children, which
parallels the concept that younger children have less responsibility when it comes to making meals and choosing foods, so the parents are paying much closer attention to what their child will and will not eat. Alternatively, older children are away from the home more often and typically encounter more opportunities to choose their own meals and snacks\textsuperscript{40}.

The ability to convert the PALS to an online format is invaluable as the medical system is transitioning into a heavily technology-based system. Many health care providers have moved on to EMRs, which allows a strong continuity of care for every patient between appointments and even different providers. In the future, the online-formatted PALS may have the capacity to integrate into the EMR database and therefore all providers will be aware of the patient’s BMI status and measures of dietary quality. Additionally, these mHealth modes of intervention are beneficial because they do not need to be delivered by a highly-skilled professional (such as for face-to-face interviewing) and they do not require manual data entry as the data is recorded and saved immediately upon survey initiation. This will ultimately reduce data entry and measurement errors\textsuperscript{46}. Converting to a technology-based survey platform versus paper and pencil or face to face interviewing has revealed that many individuals, especially children, report more accurately than any other mode of assessment\textsuperscript{46,47}. This may be due to the fact that they feel less pressure to answer in a socially acceptable manner as their answers and results are hidden as questions are completed. Previous research has revealed that adolescents feel like technology-based surveys allow them to express their answers freely and easily while maintaining their confidentiality, thus increasing trust in the data collector or health practitioner\textsuperscript{47}. Although much of this previous research has been conducted regarding teenage sexual behaviors\textsuperscript{46,47}, which is a sensitive and possibly embarrassing topic, this idea does have the ability to be generalized to the overweight or obese population as they may be ashamed of their dietary behaviors and preferences.
2.4.1 Strengths & Limitations

There are many strengths to this study. First, the food preference survey has been validated as a reliable tool for dietary assessment. This is an optimal tool to use when addressing the pediatric population, as it is much easier for children to report how much they like or dislike certain foods compared to reporting what they had to eat the day before (e.g. 24-hour recall) or how often they eat certain types of foods (e.g. food-frequency questionnaire). The survey is very kid-friendly with pictures of the items as well as a hedonic scale with both words and corresponding smiley-face images. PALS is further strengthened through the report of both child and parent. Results have shown that the parent is a very accurate reporter of their child’s preferences, therefore their answers may be used as a proxy for their child’s if their child is unable to complete the survey.\textsuperscript{45} Another strength of this study is that more than one measure of adiposity was utilized in the analysis – BMI percentile and WC percentile. Studies have found WC percentile to be a better indicator of weight status, particularly cardiovascular disease risk, therefore it is beneficial to incorporate both measures of body weight status\textsuperscript{41-43}.

A significant strength of this research deals with the current online nature of the PALS. This new version of the tool was greatly accepted by the majority of participants, with ≥82% of both children and parents reporting ease of use and enjoyment. Furthermore, only 1.1% of all enrollments encountered a technology-based malfunction. Since the health care system has already demonstrated a trend toward technology-based electronic charting, it is sensible and perhaps cost efficient to adapt interviewing and assessment tools in this way.

There were multiple limitations to this study, many to do with data collection. A large number of different research assistants (RAs) collected data and took anthropometric measurements, therefore there is much room for inter-rater reliability issues as well as individual
measurement errors with height, weight and waist circumference. Limitations also arise with the risk of misreporting, especially in the overweight or obese population. Additionally, due to the study’s setting of the PED, the results may not necessarily be generalizable to all health care settings or other populations, even though the current sample had BMIP comparable to national data.

2.4.2 Future Research

This online phase of the PALS opens many doors for opportunities to utilize this survey to quickly assess obesity risk and dietary quality. Although this dataset did not successfully explain childhood adiposity, additional research should be done regarding the ability of preference surveys to do so. This could possibly be achieved by better assessing typical food intake of more specific age and/or cultural groups and adapting the survey to contain foods the children may have the opportunity to consume on a regular basis.

Utilizing the validated online format of the PALS gives rise for tailored education opportunities based on the survey responses. Automated and personalized feedback could be presented to the child and parent through positive reinforcement and/or suggestions for dietary improvement based on reported preferences. These tailored messages may have the ability to fuel positive behavior changes in both the child and their families, which even if simple or basic, could potentially begin to improve the child’s health and well-being and possibly decrease their risk for obesity in the future.

2.5 CONCLUSION

A simple obesity risk screening and dietary assessment tool, such as the online PALS, holds much promise in creating a seamless system to begin the healthy nutrition conversation in a pediatric healthcare setting, such as the PED. Although more work should be done in order to
better connect food preference directly with child adiposity measures, the idea still holds true that we eat what we like and avoid what we do not like. Therefore, integrating food preference into nutrition education for children will make for a tailored experience and subsequently create a more effective nutrition and health resource to convey positive messages that may increase knowledge and instill potential healthy behavior changes in our nation’s at-risk youth.
2.6 APPENDIX

2.6.1 Appendix A: URAP RA Student Training Procedure

1. Initial training by senior URAP student
2. Presenting of updates/protocol process via PowerPoint to class – done by principal investigator(s) and/or study staff
3. Practice enrollments with senior URAP student
4. Sign off by PI/Study Staff/Senior URAP student verifying the new URAP student is competent enrolling participants in the study
5. Sign off that they are aware of the duties they are required to perform

2.6.2 Appendix B: Colored Nutrition Handouts – offered to participants after survey completion

Document A – Understanding Your Child's Size

UNDERSTANDING YOUR CHILD’S SIZE

Body Mass Index, or BMI, is a tool doctors and dietitians use to measure the health of your child with their height and weight.

BMI is classified into four different categories: underweight, healthy weight, overweight, and obese.

Another way to understand these categories is with "My Weight Ruler"

Underweight Healthy Weight Slightly Overweight Unhealthy Weight

Too Little Just Right Big Too Big

How can I keep my child “just right” at a healthy weight?

Here are four simple changes to help keep your child at a healthy weight:

1. Try drinking fruit infused water or low fat milk instead of beverages like soda, sweet tea, and sports drinks.
   - Drinking water from the tap is good for your smile!
   - Add sliced lemon or berries to your water to create tasty new flavors!
2. Increase the amount of fruits and vegetables your child is eating.
   - MyPlate recommends that half their plate be fruits and vegetables!
3. Participate in the National School Lunch and Breakfast Programs.
   - These menus have been designed with your child's health in mind.
4. Be active for 60 minutes a day. Physical activity of any type is beneficial to your child's health.
   - Try not to sit for more than 1 hour at a time – Get up and play!

Visit www.eatright.org/childrenshealth or www.choosemyplate.gov for more information!
WATER 1ST FOR YOUR THIRST

Tips for choosing water instead of sugary drinks to keep your body hydrated and healthy all day long!

1. Try drinking fruit infused water or low fat milk instead of beverages like soda, sweet tea, and sports drinks.
   - Drinking water from the tap is good for your smile!
   - Adding sliced lemon or berries to your water bottle creates tasty new flavors!
2. If you do drink juice once in a while, make it 100% fruit juice!
   - Try watering down the juice to drink more water and less sugar.
   - Mixing a little fruit juice with unsweetened seltzer water to make a bubbly, refreshing drink!
3. Drink your water on-the-go!
   - Buy a fun reusable water bottle to carry with you all day long!
   - Don’t forget to bring your water bottle to sports practices and dance rehearsals to stay hydrated.

Did you know?

People who drink sugary drinks regularly like soda and sports drinks (1 to 2 cans or bottles per day or more) have a 26% greater risk of developing type 2 diabetes than people who rarely have these drinks.

A typical 20-ounce soda contains 15 to 18 teaspoons of sugar and upwards of 240 calories!

Rising intake of sugary drinks has been a major contributor to the obesity epidemic.
MORE MATTERS: FRUITS AND VEGGIES

Fruits and vegetables provide nutrients that are important for the health and maintenance of your body.

People who eat more fruits and vegetables, as part of an overall healthy diet, are likely to have a reduced risk of some chronic diseases.

Here are some $mart$ and $savvy$ tips for adding more fruits and veggies into your meals and snacks!

1. Buy your fresh fruits and vegetables in season
   - They will cost less and are likely to be at their peak flavor!
2. Stock up on frozen fruits and vegetables
   - This makes for quick and easy steaming in the microwave or sautéing on the stovetop.
   - Frozen produce tends to be cheaper than fresh, with all of the same beneficial nutrients!
3. Try them with a dip or dressing!
   - Try a low-fat salad dressing with fresh broccoli, bell peppers, celery or cauliflower for a tasty crunch
   - Dip your apples, banana, or strawberry slices in a creamy low-fat greek yogurt for a scrumptious snack or treat
4. Allow your child to pick a new fruit or vegetable to try while grocery shopping at the store
   - Letting your child participate in selecting their own food choices increases their willingness to try what they picked out at meal or snack time!
   - Varying your fruit and veggie choices keeps meals interesting and delicious!

Visit www.eatright.org/childrenshealth or www.choosemyplate.gov for more information!
SKIP THE SWEETS

Limit the amount of foods and beverages with added sugars your kids eat and drink.

Sweet treats and sugary drinks such as cakes, cookies, candy, sodas and energy drinks can have a lot of calories and fat with very few helpful nutrients.

Tips on skipping the sweets to keep your body happy and healthy all day long!

1. Sip smarter!
   - Skip the sugary drinks! Offer water when kids are thirsty to keep them hydrated and healthy.

2. Choose not to offer sweets as rewards
   - By offering food as a reward for good behavior, children learn to think that some foods are better than other foods.
   - Try rewarding your child with kind words, hugs or non-food items like stickers or pencils to make them feel special.

3. Make fruit the everyday dessert
   - Try serving baked apples or pears sprinkled with cinnamon or a fresh fruit salad as a delicious dessert to replace cakes, cookies and ice cream after dinner.
   - Dip your apples, banana, or strawberry slices in a creamy low-fat greek yogurt for a scrumptious treat!

4. Play detective in the cereal aisle
   - Look at the nutrition labels on different cereal boxes in the grocery store with your kids. Compare them to find the one with the least amount of sugar!

Visit [www.eatright.org/childrenshealth](http://www.eatright.org/childrenshealth) or [www.choosemyplate.gov](http://www.choosemyplate.gov) for more information!
GET UP AND GO!

Getting up and moving our bodies can have long term health benefits. People of all ages, shapes, sizes and abilities can benefit from being more physically active!

**Being physically active can help you sleep better, live longer and stay at or get to a healthy weight.**

Here are some easy tips to incorporate more physical activity into your day!

1. Choose enjoyable activities every day
   - Whether it’s playing sports, dancing or going for a walk, when we get our bodies moving, we are strengthening our muscles and heart!

2. Be more active in-doors
   - Try watching and mimicking YouTube videos of different stretches and short exercise routines to do inside your home.

3. Get the whole family involved!
   - Enjoy an afternoon bike ride or walk with family and friends.
   - It can be great time to catch up and talk with loved ones.

4. Try and limit the amount of time you spend playing computer or video games and watching TV.
   - Even though those activities are fun sometimes, make sure to get up and move for 60 minutes every day!

**Did you know?**

Physical activity and eating healthy foods work together for better health:

The more physical activity you do, the greater the health benefits.

When you’re not physically active, you are more likely to get heart disease, type 2 diabetes, and high blood pressure.

Visit [www.eatright.org/childrenshealth](http://www.eatright.org/childrenshealth) or [www.choosemyplate.gov](http://www.choosemyplate.gov) for more information!
GET YOUR DAILY DOSE OF DAIRY

Consuming dairy products provides many health benefits – especially better bone health!

Foods in the Dairy Group provide nutrients that are important for the health of your body such as: calcium, potassium, vitamin D, and protein.

Here are some easy tips to incorporate more dairy into your day!

1. Try making yogurt-based fruit smoothies at home
   - Purchase bagged frozen fruit and low fat greek or regular yogurt at the grocery store. Blend up with a frozen banana and wah-lah! You have a sweet and creamy smoothie for breakfast or a snack!

2. Add low-fat cheese to your favorite dishes and snacks!
   - Adding shredded low-fat cheese such as cheddar or mozzarella to your eggs or grabbing a low-fat cheese stick with a piece of fruit as a snack are great ways of getting more daily dairy!

3. Make a yogurt dip for your fruits and vegetables
   - Use plain greek or regular yogurt mixed with flavorful seasonings such as basil or fresh chives as a dip for your fresh broccoli, bell peppers, celery or cauliflower to get a creamy and crunchy bite!
   - Dip your apples, banana, or strawberry slices in a creamy low-fat greek yogurt for a scrumptious snack or treat

4. Include low-fat milk or calcium fortified soymilk (soy beverage) at your meals.
   - The USDA MyPlate Campaign recommends 3 servings of dairy every day to maintain healthy bones and muscles. Try serving dairy at every meal to meet their recommendation!

Visit [www.eatright.org/childrenshealth](http://www.eatright.org/childrenshealth) or [www.choosemyplate.gov](http://www.choosemyplate.gov) for more information!
H ave Fun with Fiber

Fiber provides vitamins that are important for the health and maintenance of your body.

People who eat more fiber with every meal or snack keep their digestive systems regular and reduce the risk for chronic diseases later in life!

Here are some tips for adding more fiber into your meals and snacks!

1. Begin your day with a fiber boost!
   - Choose breakfast cereals with at least 3 grams of fiber per serving, choose whole grain toast, or add fiber-rich berries to your morning.
2. Bake your own high-fiber snacks
   - Try switching to whole wheat flour in place of all-purpose white flour when making baked goods.
   - You can also add oatmeal or berries to homemade goodies such as muffins for even more fiber!
3. Add fresh fruit to every meal
   - Fruit is a great source of fiber, and can be enjoyed during meals, snacks, or for dessert. Make sure to keep the skin on!
   - Fruits highest in fiber are apples, berries, oranges, and pears.
4. Load up on legumes
   - High-fiber legumes like peas, beans, and lentils are among the best sources of fiber. Try adding them to soups, salads, or dips!
5. Choose high fiber snacks when the midday munchies hit!
   - Have your child make their own fiber rich trail mix, popcorn, or fruit salad!

Visit www.eamail.uconn.edu or www.eatright.org/childrenshealth or www.choosemyplate.gov for more tips and recipes!
Visit www.snap4CT.org for food resource benefit information
SMART SNACKING

Get the most out of your snacks by choosing at least two food groups from MyPlate!

Just like adults, kids can develop a preference for snack foods high in salt. Over time and into adulthood, this can lead to chronic health problems such as high blood pressure and heart disease.

Here are some tips for choosing lower-sodium snacks to keep those bodies healthy and happy!

1. Save time with sliced veggies!
   - Pre-slice vegetables like carrots, celery and peppers to serve with hummus or low-fat dressing. Try to choose more than one food group!
   - Try topping half a whole wheat english muffin with tomato sauce, sliced veggies and low-fat cheese; melt in the microwave for a quick healthy snack.
2. Grab a glass of milk!
   - Try a glass low-fat or fat free milk as an easy way to drink a healthy snack! Pair with a sliced banana and nut butter.
3. Fruits are quick and easy
   - Fruit is a great source of fiber which will help keep you full between meals! Try apples and nut butter or berries and low-fat yogurt.
   - Fruits highest in fiber are apples, berries, oranges, and pears.
4. Consider convenience
   - Single serving containers of low-fat yogurt, low-fat string cheese, or a whole piece of fruit can be a great on-the-go snack!
5. Go for the whole grains
   - Have your child make their own trail mix with popcorn, whole grain cereal, dried fruit, and nuts for a fun and easy snack!

Visit [www.eamail.uconn.edu](http://www.eamail.uconn.edu) or [www.eatright.org/childrenshealth](http://www.eatright.org/childrenshealth) or [www.choosemyplate.gov](http://www.choosemyplate.gov) for more tips and recipes!

Visit [www.snap4CT.org](http://www.snap4CT.org) for food resource benefit information
2.6.3 Appendix C: Figures 1-10. Bar charts to depict differences in group distributions between CCMC datasets (current tablet dataset on the left vs. previous paper/pencil dataset on the right)

Figure 1 – Fiber Group

Figure 2 – Vegetable Group

Figure 3 – Fruit Group
Figure 4 – Dairy/Milk Group

![Dairy/Milk Group Current Dataset](image)

![Dairy/Milk Group Previous Dataset](image)

Figure 5 – Physical Activity Group

![Physical Activity Group Current Dataset](image)

![Physical Activity Group Previous Dataset](image)

Figure 6 – Salty Group

![Salty Group Current Dataset](image)

![Salty Group Previous Dataset](image)
Figure 7 – Sugary Drink Group

Figure 8 – Protein Group

Figure 9 – Sweet Group
2.6.4 Appendix D: Figures 11-20. Tablet usability evaluation questions, child vs. parent response bar charts.

Figure 11

"I like using a computer, tablet or smartphone"

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree nor Disagree
- Somewhat Agree
- Agree
- Strongly Agree

Count
Figure 12

"This survey was easy to complete"

Figure 13

"I could complete this survey without help"
2.7 REFERENCES


35. Mennella JA BN. The sweetness and bitterness of childhood: Insights from basic research on taste preferences. Physiol Behav. 2015;152 part B:502.


CHAPTER THREE

mHealth Tailored Messaging & Follow-Up Program Development

3.1 INTRODUCTION

3.1.1 Childhood Technology Use & mHealth

Along with the increase in childhood overweight and obesity rates, the use of technology among adolescents has increased significantly over recent years. Research by the Pew Research Center shows that children between the ages of 8-11 may use up to three different technologic devices each day (devices such as iPods, iPads, smartphones, and mobile video game devices), not including a laptop or computer. The average age of owning one’s own smartphone has decreased: in 2014, 11% of 8-9 and 67% of 12-13 year olds had their own mobile device. The most recent 2018 Pew Research Center report revealed that 95% of all teenagers have access to a smartphone, with almost half (45%) reporting they are in use “almost constantly,” an aspect of teen technology habits that has almost doubled since 2014-2015 where only 24% reported they were constantly online. Children and adolescents use these devices to connect with their peers through social media, play a wide array of games, and also have access to a wealth of knowledge via Internet browsers. Although technology use has been associated with increased risk of obesity, many researchers have hypothesized that combining adolescents’ love for technology with health promotion could be leveraged for targeted obesity prevention interventions. The World Health Organization defines “mHealth” as “the use of mobile and wireless technologies to support the achievement of health objectives.” mHealth, and the use of other types of technologies to promote health, has the potential to be a novel platform for reducing health risks among many different populations, including overweight or obese children and adolescents.
3.1.2 Messaging Interventions

Health professionals, schools, and workplaces utilize short messaging services (SMS) as a mode to communicate about upcoming appointments, safety or emergency situations, or simple reminders and promotions. Multiple studies have utilized text messaging as the direct mode of communication for nutrition and health interventions. Reviewed below are studies which explore text messages as a tool for reaching adolescents for social support, information sharing and encouragement about health behaviors\(^{32}\).

A cluster, randomized obesity intervention for children and families involved twice-weekly text messages as well as phone coaching to the families regarding the behavior changes discussed at face-to-face visits\(^3\). Families were overall less satisfied with the text messaging services when compared to the telephone coaching. Positively, 92% of the families opted to receive the text messages, 68.8% of whom reported being “very satisfied” with the messages and 55.1% reporting the quality of the advice given to be “very good/excellent.” Due to the fact that these text messages were automated, there was no opportunity to tailor the messages like the health coach would tailor the advice verbally given over the phone. The results revealed that generic text messages may not be as effective as phone conversations when it comes to personalized health coaching, however it is still somewhat influential for more than half of the population who reported the excellent quality of the text message advice\(^3\).

The feasibility of usual pediatric obesity treatment combined with an Internet-based curriculum with phone call/text reminders was compared with a group who received this technology-based intervention plus nutritional counseling sessions. The control simply received the baseline pediatric obesity care with no additional education methods\(^4\). Different from the previous intervention\(^3\), the text messages were semi-personalized by a research assistant who set
aside time each week to send messages to all 16 child/parent dyads who opted to receive the messages. The response rate of the messages averaged 78% and the parents reported the texts to be “useful” or “very useful” in regards to improving attitudes and behaviors related to their child’s obesity. Although this study did not test for differences in adiposity, physical activity or health attitudes and behaviors over the twelve-week study duration, the results suggest that more personalized and tailored messages may be better received by participants than automated generic messages.

Secondary analysis of a pilot behavioral-based intervention with parents of preschoolers examined text messages as a social support tool. The intervention was a 7-week long program called “TEXT2COPE” for 15 parents of overweight and obese children between the ages of 3-5 years old recruited from a pediatric primary care office. There were three message groupings where the parents either received generic messages, tailored messages (to the individual), or targeted messages (to a specific subgroup). The tailored and targeted groups also received complementary print handouts and resources. Parents reported the cognitive behavior skills building-based text messages to be “100% helpful” in creating new and healthy attitudes and/or behaviors that support obesity prevention. Parents also reported that they would recommend the TEXT2COPE program to fellow families. The noteworthiness of this study stems from the statistically significant changes in the measured healthy attitudes and behaviors at the end of the 7-week intervention period.

Although not in a health care setting, a randomized controlled trial tested the effectiveness of a text messages based on fruit and vegetable intake (FVI) in adolescents (14-19 years old). Adolescents were randomized to a control group (received no messages), an affective message group or an instrumental message group. FVI was assessed through a food-frequency questionnaire.
at baseline and at the end of the two-week intervention period. Students in the intervention group received 14 text messages total (one each morning) during the study period either promoting affective benefits (e.g., increase in energy, mood, optimism, decrease in anxiety, nervousness, stress) or instrumental benefits (e.g., decreased risk of chronic diseases, improved digestion). The researchers found a significant increase in FVI in both intervention groups when compared to the control group, although effects were much stronger in the affective message group.

The summarized health messaging research illustrates the feasibility of SMS-based or technologically-driven messages to aid in providing obesity prevention education to both children of many ages and their parents. Furthermore, results support the idea that young people are responsive to personalized short health messages and even more receptive to information that emphasizes immediate benefits to the self. Shaping messages based on age group and topic appears to be extremely well-received, however tailoring to an additional degree of mental capacity and readiness to make a health behavior change would be even more beneficial, supporting the use of behavior change theories in similar messaging interventions for the pediatric population.

3.1.3 Theories of Behavior Change for Obesity Prevention in Children

Based on the review of literature, there have been multiple research efforts to assess the effect of tailored feedback grounded in theories of behavior change in adult health promotion programs yet few that deal with children. This section aims to describe the feasibility of nutrition messaging programs for the pediatric population in clinical settings based on theories of behavior change, specifically the Transtheoretical Model (TTM). Additional models, such as the Information-Motivation Behavioral Skills Model (IMB), will be discussed to support the use of such theories in this research project.
A randomized controlled trial was used to evaluate an education program grounded in the TTM, *Team Up for Health*, for well-child visits in a pediatric primary care setting. Reported was the assessed feasibility of implementing a tailored nutrition education paper handout from a survey the participants would complete prior to visiting the doctor’s office. Well-child visits are very short (10-20 minutes) and do not allow much time for the provider to assess the patient’s physical health *as well as* do a social and behavioral assessment of their current health habits, followed by personalized recommendations⁹.

Integrating a pre-visit survey that automatically generates tailored education (based on parent’s topic of interest and stage of change) could be an efficient and effective tool to improve well-child visits for preventive care. In this study, tailored messages before visits were deemed feasible based on measures of physician and patient acceptability (89%), accuracy of measurement of behaviors (85%) and ease of implementation (80%), showing promise for incorporating theory-driven tailored health and nutrition interventions for the pediatric population in the primary care setting⁹.

The tailored messaging system in our research is grounded in two behavior change theories in order to be as personalized as possible for each participant. The Transtheoretical Model (TTM), developed by Proschka et. al, allows for seamless message adaptation based on the parent’s readiness to help change their child’s health behaviors¹². There have been many health behavior change studies in the past that utilized the TTM¹³⁻²¹, however there have been a limited number of TTM-based interventions that incorporate the TTM into technology-based messaging for changing child’s behaviors¹¹.

Nutrition messages can be tailored to the Transtheoretical Model, encouraging participants to move from pre-/contemplation to action toward behavior changes. Researchers developed messages to reach Korean elementary children from reported consumption of food groups
(vegetables, fruits, sugar-sweetened beverages, fast/convenience foods, snacks) and confidence to make behavior changes. Each message had three versions based on stage of change. The 3000+ messages were content validated by experts, revised and embedded in a smartphone app.

In addition to the TTM, the Information-Motivation-Behavioral Skills Intention Model has broad application to health promotion and can inform tailored message interventions for adolescents. This model depicts information as a pre-requisite for behavior change, coupled with motivational factors (depicted through attitudes, beliefs, feelings, and self-efficacy). Information and motivation work together to influence the behavioral skills necessary for the behavior to occur. However, it is possible for a behavior change to occur directly from information and motivation, if the skills are already familiar or uncomplicated. Although the majority of applications for the IMB Model deals with high-risk behaviors, such as HIV/AIDS and other STD prevention, research suggests the model supports a broad application to many areas of health promotion, including pediatric nutrition behaviors like increasing fruit and vegetable consumption. Messages that incorporate both information and motivational characteristics may be more effective in increasing adherence to the new behavior change when both information and motivation are present rather than just information alone.

For the research study at hand, information and motivational factors determine the behavioral skills that are taught (i.e. health messages tailored to topic, stage of change, self-efficacy and importance of behavior) and given (i.e. additional educational resources provided to the participants throughout the study) in order to accomplish the behavior change. If the behavioral skills necessary for the behavior change to occur are very simple (i.e. drinking more water), the information and motivational factors can bypass the skills and directly influence the change in behavior. The IMB Model allows a more comprehensive explanation of the variety of variables that may influence one’s ability to make a behavior change. Please refer to Figure 1 below for the IMB Model’s role in this project.
The purpose of this research is 1) to formulate the framework for a tailored messaging program for children and their parents based on PALS responses; 2) to assess the short-term outcomes of online tailored health messages through reported acceptability, relevance and usefulness; and 3) to develop a follow-up protocol to assess the utility of the tailored messages in the home on intent to change behaviors, as well as making concrete behavior changes in child/parent dyads in order to create a successful and easy tool to increase obesity risk screening and nutrition education in the pediatric health care system.

3.2 METHODS

3.2.1 Tailored Messaging Development

Messages were developed and tested between 2016 and 2017 by registered dietitians, other health professionals and undergraduate and graduate dietetic students at the University of Connecticut in coordination with children reached through SNAP-Ed activities. A variety of types of messages were created (e.g. positively or negatively worded, focusing on effects on the body or mood, informative messages with “fun facts,” affective messages, instrumental messages, or messages with
suggestions/tips/quick recipes). An average of eight messages were created for each topic and subsequently tested with groups of middle school students and high school students. The message testing occurred in the health classrooms for the middle school groups. Alternatively, the discussion with the high school students was held at a semi-regular meeting of those who are interested in the medical field (this particular group convened at the children’s hospital utilized for data enrollment, CCMC). This group has also been previously involved in the research study at hand by serving as practice enrollment participants during the research assistant (RA) training.

In the message testing, students were presented with a series of activities and interactions regarding the message topic (e.g., fruits or sugary drinks) (refer to Appendix E: Documents I-N for an overview of message testing materials). The first activity had the children complete a set of forced-response questions to select which of two items they preferred (e.g., plain milk versus chocolate milk; 100% fruit juice versus a flavored fruit drink (i.e. fruit punch); whole fruit versus a fruit roll up). Next, the students were given the list of an average of eight messages that had been created for the topic to rank from most liked (=1) to least liked (=8). The message that was ranked most often in the “most liked” spot was selected for use in the finalized initial phase of tailored messaging in the PED.

3.2.2 Tailored Message Algorithms through Qualtrics

The parent/child PALS responses were developed into algorithms to generate tailored messages. Algorithms for the tailored messages were based on a previous dataset of 925 child/parent dyads who completed the PALS survey on paper and pencil in the CCMC PED. Response cut-offs to generate a message were selected by determining the median score of each food or activity group and ensure that at least 50% of the dyads would receive the tailored message. For the “healthy” food groups (fruit, vegetables, high fiber, dairy, and physical activity), there was both a positive scoring criteria (indicating high liking) in order to display a positive reinforcement message and a negative scoring criteria (indicating low liking) in order to display a message with
motivating suggestions for improvement. “Unhealthy” groups (sweets, sugary drinks, salty, and technology/sedentary behaviors) only had a positive scoring criteria (indicating high liking) in order to display improvement messages. Table 1 shows the tailored message scoring criteria for all groups, along with a sample message targeted at the child. The cut-offs to generate a message will be evaluated using the online Qualtrics platform as some of the median scores may change from paper/pencil to tablet-based survey.

<table>
<thead>
<tr>
<th>Group</th>
<th>Scoring Criteria</th>
<th>Sample Message (Child) for Initial PED Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit</td>
<td>&gt;65 (high liking)</td>
<td>Fruits pack vitamins to make your skin glow and body grow! Keep eating fruit at most meals and snacks.</td>
</tr>
<tr>
<td></td>
<td>&lt;65 (low liking)</td>
<td>Fruits are packed with vitamins that make your skin glow and your body grow! Eat fruits at most meals and snacks – add some fruit to your cereal or yogurt!</td>
</tr>
<tr>
<td>Vegetables</td>
<td>&gt;30 (high liking)</td>
<td>Keep crunching on veggies! The more you eat the better – they’re packed with good vitamins and help you stay full.</td>
</tr>
<tr>
<td></td>
<td>&lt;30 (low liking)</td>
<td>Get crunching on more veggies at every meal! Snack on baby carrots and bell pepper strips with dip.</td>
</tr>
<tr>
<td>High Fiber</td>
<td>&gt;30 (high liking)</td>
<td>Keep chewing on whole grains like whole wheat breads, cereals and popcorn!</td>
</tr>
<tr>
<td></td>
<td>&lt;30 (low liking)</td>
<td>Get chewing on more whole grains – try foods like whole wheat bread, air-popped popcorn or Cheerios!</td>
</tr>
<tr>
<td>Sweets</td>
<td>&gt;65 (high liking)</td>
<td>Have a sweet tooth? Try eating fruit like strawberries or pineapple for a sweet treat!</td>
</tr>
<tr>
<td>Sugary Drinks</td>
<td>&gt;55 (high liking)</td>
<td>Water is the original energy drink! Stop your thirst with water – sugary drinks will only make you thirstier.</td>
</tr>
<tr>
<td>Salty Snacks</td>
<td>&gt;40 (high liking)</td>
<td>Snacks like chips and French fries have a lot of salt, which will make you thirsty. Try choosing a snack your body will thank you for like a juicy orange with a fun cheese stick!</td>
</tr>
<tr>
<td>Dairy</td>
<td>&gt;45 (high liking)</td>
<td>Yogurt, milk and cheese make your smile bright and your bones strong! Keep choosing these foods to have a happy body.</td>
</tr>
<tr>
<td></td>
<td>&lt;45 (low liking)</td>
<td>Try choosing more yogurt, milk and cheese to make your smile bright and your bones strong and healthy!</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>&gt;65 (high liking)</td>
<td>Whether you are playing a sport or just running around outside with your friends and family, keep it up! Your body loves it when you get up and be active.</td>
</tr>
<tr>
<td>Sedentary Behaviors</td>
<td>&gt;65 (high liking)</td>
<td>TV and video games are fun to play but try to limit them to 2 hours a day. Instead, get up and play with your family, friends or pets! Aim for 1 hour of activity every day.</td>
</tr>
</tbody>
</table>
3.2.3 Testing the feasibility, acceptability, and relevance of tailored messaging

**Recruitment and enrollment procedure** Participants for this phase of the research project have been recruited and enrolled using the same procedure presented in Chapter Two. Convenience samples of child/parent dyads who were receiving non-urgent care were recruited from the PED of Connecticut Children’s Medical Center (CCMC) in Hartford, CT. Enrollment and data collection for the tailored messaging phase of the study occurred between September 2017 and April 2018 by trained research assistants (RAs) (please refer to Appendix A in Chapter Two for the RA training procedure). Children were approached to participate if they were between ages 5-17 years old (up until their 18th birthday) and if a parent/guardian was present. Exclusion criteria included previous participation, history of psychiatric/behavioral health issue (except ADHD), history of a diagnosed eating disorder, if they were too sick to participate, or non-English speaking. This tailored messaging phase of the study was approved by both the University of Connecticut (UConn) and CCMC Institutional Review Boards (IRB). Parents/guardians signed informed consent and children older than 7 years of age signed assent forms prior to beginning data collection.

Mimicking the first phase of the study, the RAs initiated the enrollment on the tablet by collecting variables including the parent/guardian name and address, as well as the child’s age, sex, race/ethnicity, type of insurance, history of chronic medical condition (e.g., asthma, diabetes), child’s dental health, and questions regarding home internet access. Additional variables including anthropometric measures, responses to the PALS survey, online tablet usability/feasibility, and questions about tailored message relevance and acceptability were then collected. After PALS completion, tailored messages were presented on the tablet screen to both the child and parent aligned with their unique PALS responses. At the end of the enrollment, parents received two
handouts. All participants received the handout entitled “Understanding Your Child’s Weight,” (Chapter Two: Appendix B: Document A) as the RA explained the child’s BMIP status to the parent/guardian using the simple “My Weight Ruler”, depicted in Figure 2 below. Additionally, dyads were given the handout that corresponds to their favorite reported tailored message topic which was also further explained by the RA in detail (Chapter Two: Appendix B: Documents B-H— “Water First for Your Thirst;” “Fruits & Vegetables: More Matters;” “Skip the Sweets;” “Get Up and Go;” “Daily Dose of Dairy;” “Have Fun with Fiber;” or “Smart Snacking”).

3.2.4 Data Analysis

All data was analyzed using Microsoft Excel (version 15.13.1) and SPSS statistical software (version 22.0.0) with a significance level set at $p<0.05$ for all analyses. Descriptive statistics (frequencies, means) were used to describe basic demographic and anthropometric data of participants who received tailored messages and the average characteristics of children who received specific types of messages. Frequencies were also utilized to determine the number of messages received per participant as well as the most frequently displayed messages. Crosstabs were used to determine the most common messages displayed for children of each BMIP category (underweight, normal weight, overweight, obese, extremely obese).
3.3 RESULTS

3.3.1 Tailored Messaging Development

Described below are the message development testing sessions - one for sugary beverages and one for fruits. The two groups that participated in the sugary beverage message testing consisted of 131 children and adolescents: one group of middle school students (n=110, average age 13 years old) and one group of high school students (n=21, average age 15.5 years old). The sample was 57% female with an overall age range of 8-20 years old. The children completed questions regarding their daily beverage choices, a forced response worksheet which made them choose one beverage or another from a pair of healthy and unhealthy beverages, a ranking of reasons as to why they choose to drink beverages, and finally a ranking of their most to least liked sugary drink messages (Appendix E).

The students reported that water, milk and 100% juice were the most consumed beverages, and soda and sports drinks the least consumed. Even though 81% of the sample reported that their daily beverages were of the healthy variety, 58% still reported liking sugary drinks by choosing the less healthy beverage options over the healthy options on the forced-response questionnaire (Appendix E: Document I). Students indicated their reasons for choosing a beverage, from most important to least important: (taste; makes you feel good; gives you energy; easy to get; helps you perform better during sports; brand name; color of the drink; design on the bottle; and what friends are drinking/peer pressure) (Appendix E: Document J). Table 2 depicts the ranking of the eight proposed messages from most liked (=1) to least liked (=8), with the favorite message being “If you’re thirsty, drink water instead of something sweet, because sugar will make you even thirstier!” (Appendix E: Document K).
Table 2. Ranking of proposed sugary drink messages from most to least liked by children ages 8-20 years old (n=131)

| Sugary Drinks Message Ranking |  
|-------------------------------|---|
| 1                             | *If you’re thirsty, drink water instead of something sweet, because sugar will make you even thirstier!*
| 2                             | *Did you know that more than half of your body is made up of water? Choose water over sugary drinks to keep your body happy and healthy.*
| 3                             | *Water is the original energy drink! Choose it over sugary beverages.*
| 4                             | *All of the sugar in sweetened drinks may give you a burst of energy, but will eventually make you more tired. Try water infused with fresh fruit instead!*
| 5                             | *If you want an energy boost, grab a bottle of water instead of a sports drink or soda!*
| 6                             | *Drinking too many sweet drinks on a daily basis may increase your risk of having diabetes in the future. Water is your best choice to keep your body healthy.*
| 7                             | *If you like the taste and bubbles from soda, try mixing 100% juice and seltzer together for a fun drink instead!*
| 8                             | *The extra sugar from sweetened drinks will be stored in your body may lead to extra body weight as you grow up. Instead, try water or seltzer mixed with 100% juice!*  

1 = most liked; 8 = least liked

The second example of message testing occurred with a group of 118 elementary and middle school students from grades 4, 5, 7 and 8 for the topic of fruits. Similar to the testing of sugary drink messages, students completed questions regarding a forced response worksheet which made them choose one fruit choice or another from a pair of healthy and unhealthy items, a ranking of reasons why they choose to eat or not eat fruits, and finally a ranking of their most to least liked fruit messages (Appendix E: Documents L-N). On the forced response worksheet, fresh fruits and 100% fruit juice were compared to unhealthier items such as fruit-flavored candies, fruit in heavy syrup or fruit-flavored ice creams, yogurts and drinks (not 100% juice) with a high level of added sugar.

Approximately 60% of students chose the fresh fruit/100% juice option over the unhealthy item on the forced-response worksheet (Appendix E: Document L). The most cited reasons behind why children choose to eat fruit is healthfulness, followed closely by taste and availability. The least important quality is related to what friends eat or like/peer pressure and color of the fruit (Appendix E: Document M). Table 3 depicts the ranking of the eight proposed messages from
most liked (=1) to least liked (=8), with the favorite message being “Fruit is an important part of your day! It packs vitamins and minerals for a healthy body and fiber for healthy digestion.” (Appendix E: Document N).

Table 3. Ranking of proposed fruit messages from most to least liked by middle school-aged children (n=118)

<table>
<thead>
<tr>
<th>Fruit Message Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

1 = most liked; 8 = least liked

The results from these two message testing groups were used to determine which fruit and sugary drink messages were to be used in the finalized PED survey and it also aided in determining the types of messages to create for the remainder of the message groups. The final decision included tailored messaging that either consists of positive reinforcement (e.g., if a child reports loving vegetables) or phrased as a suggestive/improvement message (e.g., if a child reports they love sugary drinks). The finalized fruit message and sugary drink message resulted in a combination of the top-liked messages for each group. The tailored messages also include relevant picture items of the topic with age-appropriate applications to reinforce the information as education accompanied by visual aids or pictures are much more likely to be remembered and more easily recalled in the future. Please refer to Table 1 and Appendix J, which shows all of the messages offered in the PED to the child and parent.
3.3.2. Testing the feasibility, acceptability, and relevance of tailored messaging

The sub-sample of participants from the Chapter 2 dataset who participated in the tailored messaging phase were diverse in age, sex, race, health insurance type and adiposity level (Table 4, n=270). Compared to the initial sample (n=535), the mean age was nearly identical (10.9 vs. 11.0 years), and there was an even distribution of age, sex, and insurance type. In agreement with the cumulative dataset, this messaging sub-set also contained a highest percentage of Caucasian participants (57.8%). There was a similar distribution of adiposity levels when looking at both BMIP and waist circumference percentiles (WCP). By BMIP, 15.2 percent were obese, which is just below 17% reported for the NHANES 2011-2014\(^{36}\).

| Table 4. Characteristics of CCMC PED patients who received messages |
|-----------------------------------|-------|-----|
| Age [Avg. 11.0 y]                 | N=270 | %* |
| 5 - <9 y                          | 83    | 30.7|
| 9 - <13 y                         | 87    | 32.2|
| 13 – 17 y                         | 100   | 37.0|
| Sex                               |       |     |
| Male                              | 130   | 48.1|
| Female                            | 138   | 51.1|
| Other                             | 2     | 0.7 |
| Race/Ethnicity                    |       |     |
| Caucasian                         | 156   | 57.8|
| Black                             | 30    | 11.1|
| Hispanic                          | 27    | 10.0|
| Mixed Race                        | 19    | 7.0 |
| Other                             | 38    | 14.1|
| Insurance                         |       |     |
| Private                           | 132   | 48.9|
| Public                            | 129   | 47.8|
| Self-Pay                          | 3     | 1.1 |
| Other                             | 6     | 2.2 |
| BMIP                              |       |     |
| Underweight                       | 15    | 5.6 |
| Normal Weight                     | 168   | 62.2|
| Overweight                        | 46    | 17.0|
| Obese                             | 32    | 11.9|
| Extremely Obese                   | 9     | 3.3 |
| WCP                               |       |     |
| Underweight                       | 25    | 9.3 |
| Normal Weight                     | 194   | 71.9|
**Overweight** 30 11.1
**Obese** 16 5.9

*Percentages ≠ 100 due to missing data

**Tailored Message Descriptives** - The subset of 270 children and parents received an average of three tailored messages after completing the PALS in the PED, with no limit to the number received (range 1-9). If participants did not meet the scoring criteria to receive any tailored messages, a generic message about water was displayed to ensure all participants received at least one message (“Did you know that more than half of your body is made up of water? Make sure to drink enough water each day to stay healthy!”).

The most received tailored messages for children were about salty snacks (received by 52% of the sample) and positive reinforcement for dairy foods (47% of the sample). Messages about physical activity, sugary drinks and sedentary behaviors/technology were tied for the third most received message, each received by 44% of the child sample. Similar to their children, parents most-often received tailored messages also related to salty snacks (63%) and positive reinforcement for dairy foods and sedentary behaviors/technology, both reaching 46% of participants. Table 5 shows the ranking of most to least received messages for both children and parents. The current scoring criteria is based on the previous dataset. Due to the larger proportion of individuals receiving the messages about salty foods, Qualtrics algorithms should be re-analyzed to adjust to the present dataset to assure a more normalized distribution of messages.

Based on child-received messages, the topic with the oldest average age was for high liking of fibrous foods (11 years old), whereas the youngest average age was a tie of 9.6 years old between high liking for sugar-sweetened beverages and low-liking for vegetables. Parent-received messages differed, with the highest average child age of 12 years old for the physical activity message and the lowest average child age of 9.5 years old for high fruit liking (Tables 6 & 7).
Table 5. Frequency of tailored messages received for children and parents by % sample

<table>
<thead>
<tr>
<th>Ranking of Frequency of Tailored Messages</th>
<th>Child</th>
<th>Parent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Topic</td>
<td>% of sample (n=269)</td>
<td>Message Topic</td>
</tr>
<tr>
<td>Salty snacks (+)</td>
<td>52</td>
<td>Salty snacks (+)</td>
</tr>
<tr>
<td>Dairy (+)</td>
<td>47</td>
<td>Dairy (+)</td>
</tr>
<tr>
<td>Sedentary behaviors/tech (+)</td>
<td>44</td>
<td>Sedentary behaviors/tech (+)</td>
</tr>
<tr>
<td>Physical activity (+)</td>
<td>44</td>
<td>Physical activity (+)</td>
</tr>
<tr>
<td>Sugary drinks (+)</td>
<td>44</td>
<td>Sweets (+)</td>
</tr>
<tr>
<td>Sweets (+)</td>
<td>43</td>
<td>Vegetables (+)</td>
</tr>
<tr>
<td>Vegetables (+)</td>
<td>40</td>
<td>Sugary drinks (+)</td>
</tr>
<tr>
<td>Fruit (+)</td>
<td>38</td>
<td>High fiber (+)</td>
</tr>
<tr>
<td>High fiber (+)</td>
<td>34</td>
<td>Fruit (+)</td>
</tr>
<tr>
<td>Vegetables (-)</td>
<td>14</td>
<td>High fiber (-)</td>
</tr>
<tr>
<td>High fiber (-)</td>
<td>12</td>
<td>Vegetables (-)</td>
</tr>
<tr>
<td>Dairy (-)</td>
<td>2</td>
<td>Dairy (-)</td>
</tr>
<tr>
<td>Fruit (-)</td>
<td>0.4</td>
<td>Fruit (-)</td>
</tr>
</tbody>
</table>

“(+)” indicates a message received due to high liking of the group; “(-)" indicates a message received due to low liking

Table 6. Average child characteristics of child-received messages by topic

<table>
<thead>
<tr>
<th>Message Topic</th>
<th>Avg. Age</th>
<th>% Female</th>
<th>%Cauc.</th>
<th>%Public ins</th>
<th>Avg. BMIP</th>
<th>Avg. WCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salty snacks (+) (N=167)</td>
<td>10.3</td>
<td>54.5</td>
<td>54.5</td>
<td>52.1</td>
<td>60.9</td>
<td>51.6</td>
</tr>
<tr>
<td>Dairy (+) (n=128)</td>
<td>10.3</td>
<td>45.3</td>
<td>56.3</td>
<td>47.7</td>
<td>63.6</td>
<td>55.6</td>
</tr>
<tr>
<td>Sedentary behaviors/tech (+) (N=119)</td>
<td>10.0</td>
<td>51.3</td>
<td>58.8</td>
<td>53.8</td>
<td>58.7</td>
<td>54.6</td>
</tr>
<tr>
<td>Physical activity (+) (n=118)</td>
<td>10.9</td>
<td>53.4</td>
<td>62.7</td>
<td>45.8</td>
<td>62.2</td>
<td>51.2</td>
</tr>
<tr>
<td>Sugary drinks (+) (n=121)</td>
<td>9.6</td>
<td>47.1</td>
<td>55.4</td>
<td>52.1</td>
<td>63.1</td>
<td>54.7</td>
</tr>
<tr>
<td>Sweets (+) (n=118)</td>
<td>9.8</td>
<td>52.5</td>
<td>53.4</td>
<td>54.2</td>
<td>61.7</td>
<td>54.2</td>
</tr>
<tr>
<td>Vegetables (+) (n=107)</td>
<td>10.6</td>
<td>50.5</td>
<td>64.5</td>
<td>43.9</td>
<td>62.9</td>
<td>56.5</td>
</tr>
<tr>
<td>Fruit (+) (n=102)</td>
<td>10.6</td>
<td>51.0</td>
<td>58.8</td>
<td>52.0</td>
<td>64.7</td>
<td>56.7</td>
</tr>
<tr>
<td>High fiber (+) (n=92)</td>
<td>11.0</td>
<td>50.0</td>
<td>60.9</td>
<td>44.6</td>
<td>61.2</td>
<td>51.6</td>
</tr>
<tr>
<td>Vegetables (-) (n=40)</td>
<td>9.6</td>
<td>52.5</td>
<td>40.0</td>
<td>70.0</td>
<td>58.0</td>
<td>44.3</td>
</tr>
<tr>
<td>High fiber (-) (n=34)</td>
<td>9.9</td>
<td>61.8</td>
<td>58.8</td>
<td>50.0</td>
<td>62.1</td>
<td>55.0</td>
</tr>
<tr>
<td>Dairy (-) (n=6)</td>
<td>10.5</td>
<td>33.3</td>
<td>66.7</td>
<td>50.0</td>
<td>56.5</td>
<td>56.5</td>
</tr>
<tr>
<td>Fruit (-) (n=1)</td>
<td>8.0</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>81.0</td>
<td>76.7</td>
</tr>
</tbody>
</table>

“(+)” indicates a message received due to high liking of the group; “(-)" indicates a message received due to low liking

Table 7. Average child characteristics of parent-received messages by topic

<table>
<thead>
<tr>
<th>Message Topic</th>
<th>Avg. Age</th>
<th>% Female</th>
<th>%Cauc.</th>
<th>%Public ins</th>
<th>Avg. BMIP</th>
<th>Avg. WCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salty snacks (+) (N=170)</td>
<td>10.8</td>
<td>52.4</td>
<td>54.1</td>
<td>47.1</td>
<td>61.8</td>
<td>53.0</td>
</tr>
<tr>
<td>Dairy (+) (n=128)</td>
<td>10.3</td>
<td>44.5</td>
<td>53.9</td>
<td>49.2</td>
<td>61.7</td>
<td>53.4</td>
</tr>
<tr>
<td>Sedentary behaviors/tech (+) (N=123)</td>
<td>10.2</td>
<td>42.3</td>
<td>58.5</td>
<td>52.8</td>
<td>61.5</td>
<td>57.1</td>
</tr>
<tr>
<td>Physical activity (+) (n=63)</td>
<td>12.0</td>
<td>58.7</td>
<td>61.9</td>
<td>38.1</td>
<td>62.7</td>
<td>44.6</td>
</tr>
<tr>
<td>Sugary drinks (+) (n=81)</td>
<td>9.9</td>
<td>42.0</td>
<td>46.9</td>
<td>58.0</td>
<td>60.7</td>
<td>56.9</td>
</tr>
<tr>
<td>Sweets (+) (n=114)</td>
<td>10.3</td>
<td>48.2</td>
<td>50.9</td>
<td>51.8</td>
<td>60.3</td>
<td>51.2</td>
</tr>
<tr>
<td>Vegetables (+) (n=89)</td>
<td>10.6</td>
<td>50.6</td>
<td>61.8</td>
<td>46.1</td>
<td>66.5</td>
<td>57.1</td>
</tr>
</tbody>
</table>
A small selection of parents (n=81) were asked what their favorite or most useful health message was at the end of the enrollment. Interestingly, the majority of parents reported their top message as the generic water message (reported by 26% of the sample), which is the only message offered to all participants that is not tailored. However, this high proportion of liking is most likely because all participants received this message. The water message was closely followed by the physical activity (21%) and vegetable messages (14%). The least liked/least useful messages were about sweets (reported by one participant) and dairy (two participants), both of which did not undergo message testing.

With the generic message being the most popular, this suggests that either the sugary drinks message is being confused with the generic water message or the Qualtrics algorithm scoring criteria needs to be adjusted based on the current dataset. The generic water message was generated during the sugary drink message testing groups, so it is no surprise that it is a well-liked message. As for the least favorite messages, testing was not done with either the sweets or dairy group, which may be the reason behind the low liking of these message topics compared to other message groups which went through testing with the pediatric population. Additionally, participants may be receiving too many messages, all of which may not be as relevant to them as others. Creating a more selective scoring criteria may decrease the number of tailored messages offered, making it possible for the children and parents to focus on the information.
3.3.3 Messages vs. Adiposity

Weight status appears to show an association with the message frequency. Underweight, normal weight, overweight and obese children all received the message about decreasing salty foods most frequently, based on both child and parent-reported responses. However, extremely obese children and their parents did not meet the same criteria for the tailored messages they each received. Children with extreme obesity received tailored health messages regarding sugary beverages (child) and positive reinforcement for high liking of vegetables (parent) most frequently. Conversely, parents of extremely obese children received messages about sugary drinks least often, whereas the child received this message most frequently. Extremely obese children received messages about low liking for fibrous foods least frequently indicating the majority enjoy high fiber foods (healthy cereals, whole wheat bread and beans/lentils). Similar to their extremely obese peers, children between the 5th-100th BMIP (i.e. underweight → obese) also received messages due to low liking of healthy groups (fiber, vegetables, fruit, dairy) least often, supporting the idea that a large proportion of the sample reported general acceptability or liking of these healthier foods (PALS score > -30) (Table 8). Appendix K: Tables 1-5 depict the entire frequency ranking for each BIMP category for both child- and parent-received tailored health messages.

As can be seen in Tables 6 & 7, messages based on high fruit liking had the highest BMIP of 64.7, whereas the messages based on low liking of vegetables had the lowest average BMIP of 58. Negative dairy and fruit messages had extreme high (81.0 – fruit) and low (56.5 – dairy) average BMIP, however the number of children who received those messages were low in comparison to the other groups. Therefore, the sample who received these messages were not necessarily large enough to make a general comparison. The parental message with the highest BMIP again had a high liking for fruit (66.8) similar to the child’s messages. However, the message
with the lowest BMIP was not for low liking of vegetables as was seen with the children, but rather low liking for high fiber foods (58.1). Mimicking the child’s results, the messages regarding low liking for dairy and fruit had a small receipt rate and therefore were not included in these conclusions.

Table 8. Most and least received message for both child and parent vs. BMIP category

<table>
<thead>
<tr>
<th>BMIP Category</th>
<th>Most Received Message</th>
<th>Least Received Message</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Child</td>
<td>Parent</td>
</tr>
<tr>
<td>Underweight (n=15)</td>
<td>Salty +</td>
<td>Salty +</td>
</tr>
<tr>
<td>Normal Weight (n=166)</td>
<td>Salty +</td>
<td>Salty +</td>
</tr>
<tr>
<td>Overweight (n=46)</td>
<td>Salty +</td>
<td>Salty +</td>
</tr>
<tr>
<td>Obese (n=32)</td>
<td>Salty +</td>
<td>Salty +</td>
</tr>
<tr>
<td>Extremely Obese (n=9)</td>
<td>Sugary Drinks +</td>
<td>Vegetables +</td>
</tr>
</tbody>
</table>

+ = due to high liking; - = due to low liking

3.3.4 Tailored Message Relevance & Acceptance

Tailored message relevance and acceptance were measured through three questions on a 5-point scale from strongly agree to strongly disagree among all 270 child/parent dyads who received the messages (Figure 3). The reliability of the 3 evaluation questions was 0.735 for children and 0.841 (Cronbach’s alpha), suggesting that the items could be summed for an overall score.

For both children and parents, ~60% reported they learned new information from the messages. Approximately 70% of both children and parents agreed that the messages were helpful. Children may have been more drawn to the messages as 64% reported they would like to receive similar messages in the future, versus only 52% of parents were in strong to normal agreement with this statement. Figures 4-6 below and Appendix L: Figures 21-23 show the differences in agreement between children and parents for the tailored message evaluation parameters.

The scatter plots depicted in Figures 7-10 reveal there are no major differences in messages acceptability or relevance when stratified for child age or BMIP for both the child and parent. Although messages are not yet tailored to age or BMIP, this may not be necessary based on the
cumulative evaluation score where 3 indicates strongly agree, 12 indicates neither agree nor disagree and 21 indicates strongly disagreeing with the statements from Table 9.

Table 9. Message evaluation questions answered on a scale from strongly agree \( \rightarrow \) strongly disagree

<table>
<thead>
<tr>
<th>Statement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I learned new information about food and nutrition from these messages.</td>
<td></td>
</tr>
<tr>
<td>The messages I received were helpful.</td>
<td></td>
</tr>
<tr>
<td>I would like to receive more messages like these in the future.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 3. Example of an online-formatted message evaluation question with the sliding Likert scale

Figure 4. Bar graph comparing child and parent responses for message evaluation question #1.
Figure 5. Bar graph comparing child and parent responses for message evaluation question #2.

Figure 6. Clustered bar chart comparing child and parent responses for message evaluation question #3.

Figure 7. Scatter plot of child message evaluation questions by age.
Figure 8. Scatter plot of child message evaluation questions by BMIP.

Figure 9. Scatter plot of parent message evaluation questions by child age.

Figure 10. Scatter plot of parent message evaluation questions by child BMIP.
3.4 Proposed Message Follow-Up and Evaluation of Short-Term Impact

The goals of the proposed message follow-up phase are to: 1) reinforce the tailored messages to the children and family initially given in the PED; 2) determine the impact, usefulness and relevance of the initial message and the paper handouts given in the PED; 3) offer further tailored messages based on chosen health behavior and parental readiness to change; 4) evaluate parental perceived self-efficacy and importance of making the chosen behavior change for their family; 5) provide additional nutrition resources through our website; and 6) assess intent to make a change and any concrete behaviors changes that may have occurred over the 4-week follow-up period.

To address these goals, we will focus on children (between 8-13 years old)/parent dyads who are stratified by adiposity status based on BMIP (normal weight, overweight and obese). These dyads will have completed all aspects of the initial PED survey (demographics, anthropometrics, child/parent Pediatric-Adapted Liking Survey (PALS), child/parent online tablet usability/feasibility, child/parent message evaluation, and tailored messaging) and will voluntarily agree to participate in the follow-up phase upon initial PED survey completion.

Procedure - The proposed follow-up procedure was constructed in order to best evaluate the impact and relevance of the tailored health messages offered to children and families in the PED, and to determine if brief online messages and follow-up surveys over a one-month period either effected behavioral health intentions or instilled concrete behavior changes. Figure 11 shows the interaction between the parent, Qualtrics survey and RA for inclusion/exclusion in the follow-up study and determination of parental stage of change based on the TTM.

In the PED, parents and children will select their favorite topic from between two and three tailored messages and one generic message. The RA will ask the parents if they would like to
participate with their child in the one-month follow-up portion of the project. With an information sheet (see Appendix F), the RA will explain that they will receive the additional surveys, links, and messages through email or text messages, after which they provide their contact information (email address or cell phone number/provider). If they agree to participate, parents work with their child to select a specific behavior to work on over the one-month period, consistent with the message topic they deemed their favorite/most useful (fruit, vegetables, physical activity, dairy, sugary drinks, sweets, high fiber foods or snacking). On the tablet, parents will be asked to respond to five questions using a Likert scale on their readiness to change and self-efficacy in initiating the selected positive behavior change for their child (Table 10). If they deem the “behavior is too hard to change,” they are given the opportunity to tell us why in a free text box following the question.

*Figure 11 - Flow of Transtheoretical Model logic for determining parental Stage of Change during the PED survey*
in order to add to the quality of our data. The responses from these questions will allow us to assess the initial parental stage of change (SOC) and compare this to a secondary SOC assessment during the Week 2 follow-up survey.

Table 10. Questions to assess parental stage of change for the follow-up phase

<table>
<thead>
<tr>
<th>Question (Likert scale: Strongly Disagree → Strongly Agree)</th>
<th>Corresponding Stage of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>This behavior is too hard to change.</td>
<td>Precontemplation</td>
</tr>
<tr>
<td>It is important to me that my child participates in this healthy behavior.</td>
<td>Contemplation</td>
</tr>
<tr>
<td>I am going to make changes regarding this behavior after reading the health message.</td>
<td>Preparation</td>
</tr>
<tr>
<td>I have already started to make improvements to this behavior before reading this message.</td>
<td>Action</td>
</tr>
<tr>
<td>I have already started this new behavior and I plan on continuing it.</td>
<td>Action/Maintenance</td>
</tr>
</tbody>
</table>

By addressing a specific behavior and the dyads’ stage of change, a message is created by Qualtrics programming that is tailored to their: 1) reported diet/physical activity behavior that did not align with recommendations based on the PALS responses (initial message and Weeks 1-3); 2) selection of most relevant from a 2 to 3 messages (initial message and Weeks 1-3); and 3) stage of change (Week 2). Parent/child dyads who report pre-contemplation would be filtered out pre-emptively by not selecting to continue the study past the first phase (Figure 11).

One-week post-enrollment, parents will receive an email or text with a link to an online Qualtrics survey, which can be completed on a smartphone, tablet or computer/laptop. Table 11 outlines the question and purpose of week 1. See Appendix G for a screenshot of the Week One survey.
### Table 11. Week 1 follow-up study question and purpose

<table>
<thead>
<tr>
<th>Question</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you take a survey last week in the PED – Y/N</td>
<td>Participation recall</td>
</tr>
<tr>
<td>Did you receive a paper handout after the survey – Y/N;</td>
<td>Handout recall</td>
</tr>
<tr>
<td>If yes, which ones (choose from list)</td>
<td>Handout recall</td>
</tr>
<tr>
<td>- I learned something new;</td>
<td>Handout usefulness and re-assessment of stages of change for subsequent tailored messages</td>
</tr>
<tr>
<td>- I thought the information was interesting but I had heard it before;</td>
<td></td>
</tr>
<tr>
<td>- I thought about improving my child’s health behaviors;</td>
<td></td>
</tr>
<tr>
<td>- I tried one or more of the suggestions;</td>
<td></td>
</tr>
<tr>
<td>- I looked at some of the online resources;</td>
<td></td>
</tr>
<tr>
<td>- I did not try any of the health tips as nothing applied to me;</td>
<td></td>
</tr>
<tr>
<td>- None of the above apply</td>
<td></td>
</tr>
<tr>
<td>Did you and your child receive a health message in the PED – Y/N</td>
<td>Message recall</td>
</tr>
<tr>
<td>If yes, which ones (choose from list)</td>
<td>Message recall</td>
</tr>
<tr>
<td>Selection of favorite message</td>
<td>Message reinforcement and relevance, including changing their message if desired</td>
</tr>
<tr>
<td>New tailored message</td>
<td>Reinforcement</td>
</tr>
</tbody>
</table>

Two weeks post-enrollment, parents will receive another email or text to complete the Week 2 follow-up survey online through a Qualtrics link. See Appendix G for a screenshot of the Week Two survey.

### Table 12. Week 2 follow-up study question and purpose

<table>
<thead>
<tr>
<th>Question</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you receive any health message(s) on any of these topics from our past two surveys? Please select all that apply (choose from list)</td>
<td>Message recall</td>
</tr>
<tr>
<td>Which was your favorite or the most important/useful message to you? (choose from list)</td>
<td>Message reinforcement and relevance, including changing their message if desired</td>
</tr>
<tr>
<td>Did the message(s) make you think about you or your child’s health habits?</td>
<td>Message impact</td>
</tr>
<tr>
<td>Please select the statement that is most applicable to you and your child right now. Please keep the topic of [chosen topic] in mind when selecting your response:</td>
<td>Secondary assessment of parental stage of change (2 of 3)</td>
</tr>
<tr>
<td>- It is important to me that my child participates in this healthy behavior, but I have not yet started to make changes or prepare to make changes.</td>
<td></td>
</tr>
<tr>
<td>- I have a plan to make changes after reading my health messages.</td>
<td></td>
</tr>
<tr>
<td>- I have already started to make improvements after receiving my health messages, but the changes are still very new.</td>
<td></td>
</tr>
<tr>
<td>- I/my child have been successful in practicing this new and healthy behavior and I/we plan to continue it.</td>
<td></td>
</tr>
<tr>
<td>- This behavior is too hard to change, and I don’t think I will change it</td>
<td></td>
</tr>
<tr>
<td>- I did not try any of the health tips as nothing applied to me.</td>
<td></td>
</tr>
<tr>
<td>New message tailored to topic and stage of change</td>
<td>Reinforcement</td>
</tr>
<tr>
<td>What did you just receive a message about? (choose from list)</td>
<td>Message recall</td>
</tr>
<tr>
<td>Would you like to receive an email or text with a link for more tips about [chosen topic]?</td>
<td>Offering of additional resources</td>
</tr>
</tbody>
</table>
Participants will again be asked to recall the messages they received and again pick their most important topic. Parents will be assessed for current stage of change by answering the same question as they had during the baseline survey (Figure 12). The parents will again receive an additional message tailored to their topic of choice and current stage in the Transtheoretical Model.

Figure 12 – Week 2 follow-up; secondary stage of change assessment (topic left blank)

Please select the statement that is most applicable to you and your child right now. Please keep the topic of in mind when selecting your response.

- It is important to me that my child participates in this healthy behavior but I have not yet started to make changes or prepare to make changes.
- I have a plan to make changes after reading the health messages.
- I have already started to make improvements after receiving my health messages, but the changes are still very new.
- I have been successful in practicing this new and healthy behavior and I plan to continue it.
- This behavior is too hard to change and I don't think I will change it.

Three weeks post-enrollment, parents will receive an email or text with a new tailored health message. This message will have additional resources attached such as a link for a recipe or an interactive game or video for the child to watch on the topic. No additional surveys will be taken this week. See Appendix H for an example of a Week Three message.

Four weeks post-enrollment, dyads will receive a follow-up email with an identical liking survey as they completed in the PED to complete at home to assess whether any changes have been made to their preferences and therefore attitudes, to be completed by both the child and the parent. An open-ended question regarding behavior change will be answered by the parent to directly assess behavior change in addition to the proxy of the PALS. See Appendix G for a screenshot of the Week Four survey.
### Table 13. Week 4 follow-up study question and purpose

<table>
<thead>
<tr>
<th>Question</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child PALS</td>
<td>Reassessment of food and activity preferences and possible changes in attitudes towards survey items</td>
</tr>
<tr>
<td>Parent PALS (asking about child likes)</td>
<td>Reassessment of food and activity preferences and possible changes in attitudes towards survey items</td>
</tr>
<tr>
<td>Which health behavior did you and your child choose to work on over the past month?</td>
<td>Behavior recall</td>
</tr>
<tr>
<td>Please use the sliding scales below from strongly disagree to strongly agree. Please keep the behavior you described above in mind when answering the next 5 questions.</td>
<td>Final assessment of parental stage of change (3 of 3)</td>
</tr>
<tr>
<td>- It is important to me that my child participates in this healthy behavior.</td>
<td></td>
</tr>
<tr>
<td>- I have not yet begun, but I plan on making changes regarding this behavior.</td>
<td></td>
</tr>
<tr>
<td>- I have already started to make improvements to this behavior.</td>
<td></td>
</tr>
<tr>
<td>- I plan on continuing this new healthy behavior.</td>
<td></td>
</tr>
<tr>
<td>- This behavior is too hard to change.</td>
<td></td>
</tr>
<tr>
<td>Please write down any changes you’ve made to your child’s (or your own) nutrition and health behaviors over the past month, even if it is not about the topic you chose to work on during these surveys. (free text box)</td>
<td>Assessment of concrete behavior changes</td>
</tr>
</tbody>
</table>

Throughout the follow-up phase, participants will have access to the research study’s website situated on the UConn domain. The website contains additional valuable resources such as tips about how to facilitate each selected behavior change, recipes for each food group, printable activities for children and links to educational nutrition games. The site also includes resources for those who are food-insecure and links for locations of farmer’s markets and fun activities for children and families throughout the state. Appendix I depicts follow-up communications through text or email that will be sent to participants with links to additional surveys, resources, messages and other information.

### 3.5 DISCUSSION

The goal of this research phase was to pilot-test a tailored messaging program based on child food preferences in the clinical setting in order to increase chances for effective and feasible opportunities for childhood obesity-preventative measures. The secondary aim of this project was to develop a follow-up protocol for children and parents based on the initial message acceptability and relevance results from the PED in order to further personalize the health messages to foster
healthier attitudes and the intent to change behaviors and possibly concrete behavior change in the long-term.

Results of the tailored message evaluation revealed that the majority of both children (60%) and parents (58%) learned something new from the displayed messages. The communication of new health information is extremely important because it may elicit the desired behavior or attitude change more effectively than if repeat information is presented time and time again. Furthermore, 72% of kids and 71% of parents thought the health messages they received were helpful (even if the information was not necessarily new to them). More than half of children (64%) and parents (52%) revealed that they would like to receive similar messages in the future. This positive feedback made it feasible to begin development on the follow-up protocol of the study presented in this chapter, where parents will have four additional opportunities over a one-month period to take surveys and receive further tailored messaging based not only on a specific behavior change of their choice, but also messages that will be in line with their readiness to make said behavior change and self-efficacy. Previous research has supported that interventions taking stage of change into account are more successful in creating long-lasting behavior changes than those interventions that do use any theory-based protocol\textsuperscript{11}.

3.5.1 Strengths & Limitations

The major strength of this pilot study is it is one of the first to offer tailored health messaging in a non-urgent care setting to both children and parents at the same time on an mHealth platform. The ability to offer these services during child healthcare visits is an invaluable resource to both patient and practitioner as it offers an additional opportunity for effective nutrition education which may have otherwise not occurred without this tool. The pilot follow-up phase of the tailored messaging program is innovative in that it is one of the only projects in the US (other
studies have been conducted in Asia) that utilizes the Transtheoretical Model and stages of change combined with mHealth and tailored messaging for the pediatric population. Behavior change theory-driven modes of intervention are extremely important as they allow the messages to be optimally tailored to the participants in order to create significant motivation and opportunity to create a concrete behavior change.

A main limitation of this study is that it is not yet offered in Spanish. Ten percent of Connecticut’s population consists of solely Spanish-speaking households, therefore the study population may be somewhat limited. Even if the child participant is fluent in English, they cannot enroll in the study if their parent or guardian who is present is only Spanish-speaking as the consent form, the parent survey and messages are currently only available in English. To reach a wider range of individuals in the future, the survey and messages should be translated into additional languages.

The tailored messaging results of the PED sample (n=270) revealed that the message targeting high liking of salty foods (i.e. French fries, salty snacks, adding salt to foods) garnered the highest frequency for both children and parents and children of all BMIP categories, other than the extremely obese. Furthermore, a very low percentage of participants received messaging in regards to improving behaviors related to healthier food consumption (i.e. vegetables, fruits, high fiber foods and dairy). These outcomes may indicate that the scoring criteria should be closely evaluated using the present data in order to create a more normalized distribution of tailored messaging across the sample.

When testing for tailored message recall in both children and parents (n=81), the results were eye-opening in that only 24% of children and 21% of parents were able to accurately recall 100% of the tailored messages they had received less than five minutes prior. The majority of
children and parents over-reported the messages they had believed they had seen, indicating that for some participants, too many messages are being displayed which may be interfering with their effectiveness. For the present study, researchers were unable to find a solution for displaying too many messages on Qualtrics. However, in the future, efforts should be put forth to optimize message effectiveness and retention rates. Another option to improve this measure would be to automatically send out the messages through text or email to the participants not long after survey completion. This method would allow the children and parents to go back and look at the messages any time they choose. Currently, the tailored messages are only able to be viewed once during the survey, which may be a reason for low-message recall.

Another limitation of this study is the lack of face-to-face follow-up education the participant receives. Previous studies have found that a combination of face-to-face and mHealth education sessions is most effective\(^\text{26}\). These participants are only getting face-to-face education one time in the PED (as they would not come back to the same setting for a follow-up), and all recurring education is taking place through email and online messages and resources. Future research should utilize this survey in a setting where face-to-face follow-ups can be done, possibly in a pediatric primary care center where patients return on a more regular basis.

A final limitation of this study is that it is limited to the population of children that presents to the CCMC PED for non-urgent care. This population may not be reflective of the overall target population. For example, previous research in the CCMC PED revealed an over-representation of overweight and obese children compared to the national average\(^\text{23}\). Additionally, this study sample had an extremely high proportion of Caucasian children (57.8%) compared to national statistics where the projected percentage of white children for 2020 is only 49.8%, with 25.7% Hispanic and 13.5% being Black\(^\text{27}\). These combined factors may limit generalizability of the findings.
3.5.2 Areas for Future Research

This project can act as a jumping-off point for many areas of future research. The pediatric primary care office presents as a promising setting to utilize the PALS as an assessment tool for obesity risk and subsequent delivery of tailored messaging. Parents and children could easily complete the survey while waiting to see the pediatrician and receive a check-list depicting which messages were received. This could save time for the pediatrician as they could simply glance at the message list to assess which health and nutrition topics would be relevant to discuss with the family, versus taking valuable appointment time starting a conversation to determine which topics are necessary to review – this step could easily be replaced with the PALS messaging program.

Discussion amongst stakeholders, the emergency department physicians, and support staff at CCMC has sparked the idea of integrating the nutrition education from the study enrollments into the electronic medical record (EMR). Currently, there is no documentation within the EMR that the enrolled patient receives any sort of nutrition education. If the URAP students were able to input a short note regarding the education, this could create an excellent continuous flow of care within the hospital as well as amongst providers connected to the EMR network.

In terms of further tailoring the messages, additional message testing should be conducted for all message topics, as only the topics of sugar-sweetened beverages and fruits were explored for this research phase. More formal methods, such as focus groups, could be utilized for all food groups. Furthermore, all age groups should be addressed, especially children between the ages of 5-7 years old as they were not able to be included in the initial phase of message testing. Involving parents in the focus groups, separate from the children, would also be extremely beneficial as they are receiving the tailored messages as well. Understanding what is most effective for both groups is imperative in creating the best possible tailored health messages for this population.
Additionally, only the follow-up phase messages are currently tailored to stage of change. Further efforts to edit the colored handouts participants receive upon initial completion of the PED survey to depict different suggestions based on varying stage of change would be beneficial. The RA could simply note their reported readiness to change on the online tablet survey and circle or highlight the corresponding section on the education handout. This would allow for an earlier phase of tailoring to stage of change to make any possible improvements in attitude or behaviors more likely.

Another area for future research involves targeting the child directly for these tailored health messages. The current proposed research focuses on the parent as feasibility of the project is still being assessed. Once the messaging system is finalized and piloted, older children who have access to their own devices and email addresses and/or phone numbers, could be targeted with the tailored nutrition messaging rather than the parents. The results from this method could then be compared to the parental messaging system in order to determine which mode of communication is most successful in creating an attitudinal or behavior change.

3.6 CONCLUSION

It is clear that effective but feasible tools are needed to screen for poor dietary behaviors in children and adolescents and subsequently create a tailored nutrition intervention. A tool such as this could be especially useful in our nation where obesity is considered an epidemic. Previous research has shown that tailored information is more likely to bring about eventual behavior change compared to generic information, therefore, this proposed research shows promise as it is tailored across many personalized aspects and is grounded in health communication theories which incorporate readiness to change and additional motivational factors. In the long term, the goal of this research is to create a valid and reliable obesity prevention tool to begin tailored and personalized nutrition education at a
young age in a variety of settings (PED, primary care physician offices, community health centers, schools).

3.7 APPENDIX

3.7.1 Appendix E: Message Testing Group Materials

**Sugary Sweetened Beverage Message Testing**

*Document I. Forced response choice between drinks*

| Name ___________________________ |
| Age _______ |

What is your gender?
- Male
- Female

What do you usually drink with breakfast, lunch or dinner?

---

Of the following, which would you be more likely to choose?

- Plain Milk
- Chocolate Milk

Of the following, which would you be more likely to choose?

- Gatorade
- Water

Of the following, which would you be more likely to choose?

- 100% Fruit Juice
- Fruit Flavored Drink

Of the following, which would you be more likely to choose?

- Lemonade
- Water with Lemon

Of the following, which would you be more likely to choose?

- Soda
- Water

Of the following, which would you be more likely to choose?

- Vitamin Water
- Water
Document J. Reasons to choose a drink ranking activity

Please rate the following by what is most important to you when choosing a drink

1=most important; 10=least important

___ It makes me better at sports
___ Taste
___ It makes me feel good
___ The design of the container
___ It’s what my friends drink
___ Color
___ It’s easy to get
___ Brand Names (ex. Vitamin Water, Coke, Gatorade)
___ It gives me energy
___ _______________________
___ _______________________

Document K. Favorite drink message ranking activity

Please rank the following messages from 1 to 8. 1 being your most favorite and 8 being your least favorite.

___ If you want an energy boost, grab a bottle of water instead of a sports drink or soda!
___ If you like the taste and bubbles from soda, try mixing 100% juice and seltzer instead, to limit added sugar.
___ Water is the original energy drink! Choose this over sugary beverages.
___ The extra sugar from sweetened drinks will be stored in your body which may lead to an unhealthy weight.
___ Drinking too many sweetened beverages on a daily basis may increase your risk of having diabetes in the future.
___ Did you know that more than half of your body is made up of water? Choose water over sugary drinks to stay happy and healthy.
___ All of the sugar in sweetened beverages may give you a burst of energy, but will eventually make you more tired.
___ If you’re thirsty, drink water instead of something sweet, because sugar will make you even thirstier.
Fruit Message Testing

Document L. Forced response choice between fruit items

Initials: _________

Age: _________

Gender (circle one): Male/Female

1. Which would you be more likely to choose (circle one)?
   - Fruit Yogurt
   - Starburst

2. Which would you be more likely to choose (circle one)?
   - Cuties
   - Orange Juice

3. Which would you be more likely to choose (circle one)?
   - Fruit Punch
   - Fruit Juice

4. Which would you be more likely to choose (circle one)?
   - Strawberry Smoothie
   - Whole Strawberries

5. Which would you be more likely to choose (circle one)?
   - Skittles
   - Raisins

6. Which would you be more likely to choose (circle one)?
   - Watermelon Wedges
   - Watermelon Coolata

7. Which would you be more likely to choose (circle one)?
   - Apple Wedges
   - Apple Jolly Rancher

8. Which would you be more likely to choose (circle one)?
   - Peach Yogurt
   - Sliced Peaches
Document M. Reasons to choose fruit ranking activity

1. The middle list contains qualities that may help determine if you eat fruit and how much fruit you eat. Rank these qualities, in order of importance, from 1 to 10. Use the column on the far right, titled, “Ranking.”

1. Read the middle list again.
   * Place an x in the left column, titled “Why I eat fruit,” for reasons why you eat fruit.
   * Place an x in the right column titled “Why I don’t eat fruit,” for reasons why you don’t eat fruit.

<table>
<thead>
<tr>
<th>Why I eat fruit</th>
<th>Why I don’t eat fruit</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________</td>
<td>Availability (school, home, etc.)</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>Time to prepare/peel</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>Level of fun</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>Taste/sweetness</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>Texture</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>Color</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>How it makes me feel</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>Healthy</td>
<td>_______</td>
</tr>
<tr>
<td>__________</td>
<td>What my friends like</td>
<td>_______</td>
</tr>
</tbody>
</table>
Please rank the following messages from 1 to 8. 1 being your most favorite and 8 being your least favorite.

___ Get creative with your fruit. Fruit can be nutritious when eaten fresh, frozen, canned, dried, pureed or chopped!
___ If you love fruit juice, try mixing half a glass of fruit juice with half a glass of water to reduce your sugar intake!
___ Fruit helps to keep you feeling fuller longer. Choose whole fruit over fruit juice!
___ The extra sugar from fruit juice will be stored in your body which may lead to an unhealthy weight.
___ Drinking too much fruit juice on a daily basis may increase your risk of having diabetes in the future. Try fruit instead.
___ Fruit is an important part of your diet! Fruit contains vitamins and minerals for a healthy body, and fiber for healthy digestion.
___ Eat a rainbow of fruit! Different colors of fruit have unique health-boosting properties!
___ Fruit is fun! Eat it on the go, pack it in your lunch, or combine your favorite chopped fruits to make a fruit salad!

3.7.2 Appendix F: Follow-up Survey Information Sheet for Participants

CCMC ED NUTRITIONAL SURVEY STUDY
INFORMATION FOR THE FOLLOW-UP PHASE

Each week following this survey, you will receive an email or text with a message, link for another survey, or additional resources:
WEEK ONE: survey - 5 minutes
WEEK TWO: survey - 5 minutes
WEEK THREE: no survey, just a message and links for additional resources
WEEK FOUR: survey – 15-20 minutes (your child MUST be present for this survey)

These surveys are meant to be fun, informative and completed with your children!
Please open the survey on a device you are comfortable with.

You will receive an email or text with the code for your $10 gift card after you complete all surveys. If you have any questions please send an email to nurtitioned@connecticutchildrens.org

THANK YOU FOR YOUR CONTINUED PARTICIPATION!
3.7.3 Appendix G: Qualtrics Screenshots of Follow-Up Surveys

Week One Follow-Up Survey

Flow Sheet

Name of Person Completing Survey

First Name

Last Initial

Preferred E-Mail Address:

Is your child here to take the survey with you? If not, please share any new information or health messages you’ve learned with them today.

○ Yes
○ No

What type of device are you on right now?

○ Computer/laptop
○ Tablet
○ Smartphone
○ Other

Did you take a survey last week when your child was in the emergency department? The survey was about food and activity likes and dislikes.

○ Yes
○ No
○ Not sure
Do you recall receiving any nutrition handouts after completing the survey?

- Yes
- No
- Not Sure

After reading the paper handouts... (select all that apply)

- I learned something new.
- I thought the information was interesting, but I had heard it before.
- I thought about improving my child’s health behaviors.
- I tried one or more of the suggestions.
- I looked at some of the online nutrition resources.
- I did not try any of the health tips because nothing applied to me.
- None of the above apply

Did you receive health messages on the tablet after you or your child completed the survey?

- Yes
- No
- Not sure

Did you receive messages on any of these topics? Please select all that apply.

Vegetables  Fruits  Fiber  Milk/Dairy  Physical Activity  Sugary Drinks  Sweet Foods  Salty Foods/Snacks  Not sure/don’t remember
Of the message topics you selected in the last question, which was your favorite or the most important/useful message to you? (Please select only one).

- Vegetables
- Fruits
- Fiber
- Milk/Dairy
- Physical Activity
- Sugary Beverages
- Sweet Foods
- Salty Foods/Snacks

Thank you for completing this survey. Please be sure to complete the remaining follow-up surveys that you will receive through email or text message. You will receive the next survey one week from now and the final survey three weeks from now. After the final follow-up survey is completed you will receive a link for a $10 gift card. We thank you for your continued participation!

*Week Two Follow-Up Survey*

This survey asks about health messages you received. Please be as truthful and honest as possible. There are no right or wrong answers. Please try to include your child in taking this survey. If they are not here, please share any new information you have learned with them. This survey should take you no more than five minutes to complete.

Upon completion of this survey, you will be sent the last follow-up survey two weeks from now. After that, you will receive a link for a $10 gift card for completing all three follow-up surveys. We thank you for your continued participation!
Name of person completing this survey:

First Name
Last Initial

Preferred E-Mail Address:

Is your child here to take the survey with you? If not, please share any new information or health messages you’ve learned with them today.

☐ Yes
☐ No

What type of device are you on right now?

☐ Computer/laptop
☐ Tablet
☐ Smartphone
☐ Other

Did you receive health message(s) on any of these topics from our past two surveys? Please select all that apply.

☐ Vegetables
☐ Fruits
☐ Fiber
☐ Milk/Dairy
☐ Physical Activity
☐ Sugary Drinks
☐ Sweets
☐ Salty Foods/Snacks
☐ Not sure/don’t remember
Which was your favorite or the most important/useful message to you? (Please select only one).

- Vegetables
- Fruits
- Fiber
- Milk/Dairy
- Physical Activity
- Sugary Drinks
- Sweets
- Salty Foods/Snacks

Did the message(s) make you think about you or your child’s health habits?

- Yes
- No
- Not sure

Please select the statement that is most applicable to you and your child right now. Please keep the topic of in mind when selecting your response.

- It is important to me that my child participates in this healthy behavior but I have not yet started to make changes or prepare to make changes.
- I have a plan to make changes after reading the health messages.
- I have already started to make improvements after receiving my health messages, but the changes are still very new.
- I have been successful in practicing this new and healthy behavior and I plan to continue it.
- This behavior is too hard to change and I don’t think I will change it.
What did you just receive a message about? (Please select only one).

- Vegetables
- Fruits
- Fiber Foods
- Dairy Foods
- Physical Activity
- Sugary Drinks
- Sweet Foods
- Snacking

Thank you for completing this survey. Please be sure to complete the remaining follow up survey that you will receive through email or text message. You will receive the final survey two weeks from now. After the final follow up survey is completed, you will receive a link to a $10 gift card. We thank you for your continued participation!
Week Four Follow-Up Survey

Directions

Your child must be present to complete this final survey. Please complete the following likes and dislikes survey according to the same directions you and your child completed it in the hospital four weeks ago. It should take no more than 15-20 minutes to complete. After completion of this survey, you will be sent a text or email within two weeks in order to get your $10 gift card. We thank you for your continued participation!

Name of person completing the survey:

First Name
Last Name

Preferred E-Mail Address to receive gift card:

What type of device are you on right now?

- Computer/laptop
- Tablet
- Smartphone
- Other

Child Liking Questions

CHILD: Please tell us how much you like or dislike these foods, drinks and activities. There are no right or wrong answers, only what you feel. If you have never tried the item or done the activity, please check the "Never tried or done" box.
Please be sure to click the center dot on the scale to activate the question (it will turn from gray to black), even if you would like to keep your response neutral.

Practice using the slider to tell us how much you like or dislike fun parks.

Love it  Really like it  Like it  It's okay  Dislike it  Really dislike  Hate it  Not Applicable

Fun Parks

Love it  Really like it  Like it  It's okay  Dislike it  Really dislike  Hate it  Not Applicable

Cheerios/Kix Cereal

Love it  Really like it  Like it  It's okay  Dislike it  Really dislike  Hate it  Not Applicable

Playing Video Games

Love it  Really like it  Like it  It's okay  Dislike it  Really dislike  Hate it  Not Applicable
French Fries

Love it
Really like it
Like it
It's okay
Dislike it
Really dislike
Hate it
Not Applicable

Apple

Salty Snacks

Dancing

Not Applicable
Candy

French Fries

Playing Sports

Really
Orange

Beans/Lentils

Sweet Cereal
Parent Liking Questions

**Parent:** Please tell us how much you believe YOUR CHILD likes or dislikes these foods, drinks and activities. There are no right or wrong answers, only what you feel. Please complete this survey on your own without any input from your child. If you believe your child has never tried the item or done the activity, please check the “Never tried or done” box.

Practice using the slider to tell us how much you believe your child likes or dislikes **fun parks**.

*Parent completes same liking questions about their child... (not shown)*
Which health behavior did you choose to work on over the past month?

Please use the sliding scales below from strongly disagree to strongly agree. Please keep the topic you described in the above questions in mind when answering the next 5 questions.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is important to me that my child participates in this healthy behavior.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have not yet begun, but I plan on making changes regarding this behavior.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have already started to make improvements to this behavior.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I plan on continuing this new healthy behavior.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This behavior is too hard to change.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write down any changes you’ve made to your child’s (or your) nutrition and health behaviors over the past month, even if it is not about the topic you chose to work on during these surveys. Please be as descriptive as possible.
3.7.4 Appendix H: Example of Message Email for Follow-Up Week 3 – Fruits

Hi Sam,

We thought you’d enjoy this tip about fruit!

Try fresh, canned, or frozen fruits this week! Canned fruits provide health benefits just like fresh; just make sure to avoid canned fruits in heavy or light syrup. Look for those in 100% fruit juice! Try the recipe below for a fun way to add frozen fruits to your day!

http://email.uconn.edu/frozen-yogurt-drops.html

Keep your eyes open for the last survey coming next week!

Thank you,
CT Children’s Medical Center & UCONN Nutrition Research Team

3.7.5 Appendix I: Follow-Up E-Mail & Text Examples

Week One (post-enrollment) Email:

Hello (insert name here), Thank you for taking the nutrition survey at CCMC one week ago. Please click this link in order to complete the first of three follow-up surveys: First Follow-Up Survey. We ask that you and your child complete this survey together. This survey should take you no more than 5 minutes.

Please do not respond to this text message/email directly. If you have any further questions, please email ccmcnutritionstudy@gmail.com.

Thank you for your continued participation,
CT Children’s Medical Center Research Team

Week Two (post-enrollment) Email:

Hello (insert name here), Thank you for taking the first follow-up survey last week. Please click this link to complete the second of three follow-up surveys: Second Follow-Up Survey. We ask that you and your child complete this survey together. This survey should take you no more than 5 minutes.

Please do not respond to this text message/email directly. If you have any further questions, please email ccmcnutritionstudy@gmail.com.

Thank you for your continued participation,
CT Children’s Medical Center Research Team
Week Three (post-enrollment) Email:

Hello (insert name here), Thank you for your continued participation in the CCMC nutrition study! We thought you might like this message about (health message topic).

(Health message + links/resources/pictures)

Please do not respond to this text message/email directly. If you have any further questions, please email ccmcnutritionstudy@gmail.com. Remember to take the final survey when it is sent to you next week!

Thank you,
CT Children’s Medical Center Research Team

Week Four (post-enrollment):

Hello (insert name here), Thank you for taking the second follow-up survey two weeks ago. Please click this link to complete the final follow-up survey: Last Follow-Up Survey. Your child MUST be present to complete this survey. It will take you and your child approximately 15-20 minutes. You will receive a link for your $10 gift card within one week.

Please do not respond to this text message/email directly. If you have any further questions, please email ccmcnutritionstudy@gmail.com.

Thank you for your continued participation,
CT Children’s Medical Center Research Team

Follow-Up Text Examples
3.7.6 Appendix J: All messages with corresponding pictures for initial PED survey

CHILD MESSAGES – will appear onscreen immediately after child liking survey

Fiber Group:
If ≥ 30: Keep chewing on whole grains, like whole wheat breads cereals and snacks!
If ≤ -30: Get chewing on more whole grains - Try foods like whole wheat bread, popcorn and Cheerios!

Fruit Group:
If ≥ 65: Fruits pack vitamins to make your body grow and skin glow.
Keep eating fruits at most meals and snacks!
If $\leq -65$: Fruits pack vitamins to make your body grow and skin glow. Eat fruits at most meals and snacks - Try adding some fruit to your cereal or yogurt.

Snack Group:
If $\geq 40$: Snacks like chips and French fries have a lot of salt. Try choosing a snack that your body will thank you for, such as fruit or whole grain crackers!
Veggie Group:
If ≥ 30: Keep crunching on vegetables! The more you eat the better - they're packed with vitamins and fiber!
If ≤ -30: Get crunching on more veggies! Try snacking on baby carrots and bell pepper strips with a low-fat ranch dressing.

Sugar-Sweetened Beverages Group:
If ≥ 55: Tame your thirst with water - sugary drinks will just make you thirstier!
If ≤ -55: Water is the original energy drink! Keep choosing water over sugary beverages.
Dairy Group:
\textbf{If $\geq 45$:} Yogurt, milk and cheese are great ways to get calcium into your body to make your bones healthy and strong!
\textbf{If $\leq -45$:} Try choosing more yogurt, milk and cheese to get enough calcium to make your bones healthy and strong.

Sweets:
\textbf{If $\geq 65$:} Cookies and candy have extra sugar that your body doesn’t need. Instead, try eating fruit for a sweet treat!
Sedentary:

If ≥ 65: TV and video games are fun to play but try to limit them to 2 hours a day. Instead, get up and play with your family, friends or pets! Aim for 1 hour of activity per day.

Physical Activity:

If ≥ 65: Whether you are playing a sport or just running around with friends, keep it up! Your body loves when you get up and be active!
Overall Healthy:
If PA ≥ 65, Fiber ≥ 30, Veggies ≥ 30, Fruit ≥ 65, Dairy ≥ 45, Water > 50

It looks like you're making lot of great food and activity choices to make your body happy and healthy! Keep up the good work!

Water:
Everyone receives:
Did you know that more than half of your body is made up of water? Make sure to drink enough water each day to stay hydrated!
PARENT MESSAGES – will appear onscreen immediately after parent liking survey about what they believe their child likes/dislikes (not the parent’s own liking)

Fiber Group:
If $\geq 30$: Keep having your child eat whole grains, like whole wheat bread and brown rice to give their body the energy and fiber it needs!
If $\leq -30$: Your child’s body needs energy and fiber from whole grains. Have them try foods like whole wheat bread, brown rice and Cheerios!

Fruit Group:
If $\geq 65$: Fruits are packed with vitamins and fiber to help you grow!
Make sure half of your plate is fruits or vegetables.
If \( \leq -65 \): Fruits are packed with vitamins and fiber to help your child grow! Make sure half of their plate is fruits and/or vegetables. Try adding some fruit to cereal or yogurt.

Salty Group:
\[ \text{If } \geq 40: \] Snacks like chips and French fries have a lot of salt. Try choosing a snack that your child’s body will thank you for, such as fruit or whole grain crackers!
Veggie Group:

If $\geq 30$: Keep having your child eat vegetables! The more they eat the better - they're packed with vitamins and fiber!

If $\leq -30$: The more vegetables your child eats the better - they're packed with vitamins and fiber! Try having them snack on baby carrots and bell pepper strips with low-fat ranch dressing.

Sugar-Sweetened Beverages Group:

If $\geq 55$: If your child is thirsty, have them drink water instead of something sweet. Sugar will make them even thirstier and it is not beneficial to their growing body!

If $\leq -55$: Water is the original energy drink! Keep encouraging your child to choose water over sugary beverages.
Dairy Group:

If ≥ 45: Yogurt, milk and cheese are great ways to get calcium into your child's body to make their bones healthy and strong!

If ≤ -45: Encourage your child to choose more yogurt, milk and cheese to get enough calcium to make sure their bones healthy and strong.
Protein Group:
If \( \geq 45 \) or \( \leq -45 \): Protein helps you build strong muscles. Serve your child lean proteins like chicken, fish and beans!

Sweets:
If \( \geq 65 \): Cookies and candy have a lot of added sugar that the body doesn’t need. Instead, try serving your child fruit for a sweet treat with only natural sugars!

Sedentary:
If \( \geq 65 \): TV and video games are fun to play but try to limit them to 2 hours a day. Instead, encourage your child to get up and play with family, friends or pets! Aim for 1 hour of physical activity per day.
Physical Activity:
If $\geq 65$: Whether your child is playing a sport or just running around with friends, make sure they keep it up! Their body loves when they get up and be active!

Overall Healthy:
If $PA \geq 65$, $Fiber \geq 30$, $Veggies \geq 30$, $Fruit \geq 65$, $Dairy \geq 45$, $Water > 50$
It looks like your child is making lot of great food and activity choices to keep their body happy and healthy! Keep up the good work!
Water:
Everyone receives:
Did you know that more than half of the human body is made up of water? Make sure your child drinks enough water each day to stay hydrated, especially when they are active and when it is hot outside!

3.7.7 Appendix K: Tables 1-5 depict entire frequency ranking of messages received for children and parents based on BMIP/WCP category

<p>| Table 1. Underweight BMIP Message Rankings (n=15) |</p>
<table>
<thead>
<tr>
<th>Child</th>
<th>Parent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salty (n=12)</td>
<td>Salty (n=12)</td>
</tr>
<tr>
<td>2. Fiber + (n=8)</td>
<td>Dairy (n=8)</td>
</tr>
<tr>
<td>3. SSB (n=8)</td>
<td>Activity (n=6)</td>
</tr>
<tr>
<td>4. Sweets (n=8)</td>
<td>Sedentary/tech (n=6)</td>
</tr>
<tr>
<td>5. Sedentary/Tech (n=7)</td>
<td>Fiber + (n=5)</td>
</tr>
<tr>
<td>6. Activity (n=6)</td>
<td>SSB (n=5)</td>
</tr>
<tr>
<td>7. Vegetable + (n=6)</td>
<td>Sweets (n=5)</td>
</tr>
<tr>
<td>8. Dairy + (n=6)</td>
<td>Vegetables + (n=4)</td>
</tr>
<tr>
<td>9. Fruit + (n=6)</td>
<td>Vegetables – (n=4)</td>
</tr>
<tr>
<td>10. Vegetable – (n=4)</td>
<td>Fruits (n=4)</td>
</tr>
<tr>
<td>11. Fiber – (n=1)</td>
<td>Fiber – (n=2)</td>
</tr>
</tbody>
</table>

<p>| Table 2. Normal Weight BMIP Message Rankings (n=166) |</p>
<table>
<thead>
<tr>
<th>Child</th>
<th>Parent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salty (n=103)</td>
<td>Salty (n=100)</td>
</tr>
<tr>
<td>2. Sedentary/Tech (n=81)</td>
<td>Dairy (n=81)</td>
</tr>
<tr>
<td>3. Dairy + (n=77)</td>
<td>Activity (n=81)</td>
</tr>
<tr>
<td>4. Sweets (n=73)</td>
<td>Sedentary/tech (n=80)</td>
</tr>
<tr>
<td>5. SSB (n=72)</td>
<td>Sweets (n=72)</td>
</tr>
<tr>
<td>6. Activity (n=70)</td>
<td>Vegetables + (n=51)</td>
</tr>
<tr>
<td>7. Vegetables + (n=63)</td>
<td>Fiber + (n=50)</td>
</tr>
</tbody>
</table>
8. Fruit + (n=61) | SSB (n=48)
9. Fiber + (n=52) | Fruits + (n=46)
10. Vegetables – (n=28) | Fiber – (n=29)
11. Fiber – (n=26) | Vegetables – (n=29)
12. Dairy – (n=4) | Fruits – (n=1)
13. Fruit – (n=1) | Dairy – (n=1)

<table>
<thead>
<tr>
<th>Table 3. Overweight BMIP Message Rankings (n=46)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child</strong></td>
</tr>
<tr>
<td>1. Salty (n=26)</td>
</tr>
<tr>
<td>2. Dairy + (n=25)</td>
</tr>
<tr>
<td>3. Activity (n=25)</td>
</tr>
<tr>
<td>4. Sweets (n=21)</td>
</tr>
<tr>
<td>5. Fruit + (n=19)</td>
</tr>
<tr>
<td>6. SSB (n=19)</td>
</tr>
<tr>
<td>7. Vegetables + (n=18)</td>
</tr>
<tr>
<td>8. Sedentary/tech (n=17)</td>
</tr>
<tr>
<td>9. Fiber + (n=16)</td>
</tr>
<tr>
<td>10. Fiber – (n=4)</td>
</tr>
<tr>
<td>11. Vegetables – (n=4)</td>
</tr>
<tr>
<td>12. Dairy – (n=2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4. Obese BMIP Message Rankings (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child</strong></td>
</tr>
<tr>
<td>1. Salty (n=20)</td>
</tr>
<tr>
<td>2. Dairy + (n=16)</td>
</tr>
<tr>
<td>3. Vegetables + (n=15)</td>
</tr>
<tr>
<td>4. SSB (n=15)</td>
</tr>
<tr>
<td>5. Activity (n=13)</td>
</tr>
<tr>
<td>6. Fiber + (n=12)</td>
</tr>
<tr>
<td>7. Sweets (n=11)</td>
</tr>
<tr>
<td>8. Fruit (n=11)</td>
</tr>
<tr>
<td>9. Sedentary/technology (n=9)</td>
</tr>
<tr>
<td>10. Fiber – (n=2)</td>
</tr>
<tr>
<td>11. Vegetables – (n=1)</td>
</tr>
<tr>
<td>12.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5. Extremely Obese BMIP Message Rankings (n=9)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child</strong></td>
</tr>
<tr>
<td>1. SSB (n=7)</td>
</tr>
<tr>
<td>2. Salty (n=6)</td>
</tr>
<tr>
<td>3. Vegetables + (n=5)</td>
</tr>
<tr>
<td>4. Sweets (n=5)</td>
</tr>
<tr>
<td>5. Fruit + (n=5)</td>
</tr>
<tr>
<td>6. Sedentary/technology (n=5)</td>
</tr>
</tbody>
</table>
7. Fiber + (n=4)  
8. Dairy + (n=4)  
9. Activity (n=4)  
10. Vegetables – (n=3)  
11. Fiber – (n=1)  

| 7. Fiber + (n=4) | Fiber + (n=4) |
| 8. Dairy + (n=4) | Sweets (n=3) |
| 9. Activity (n=4) | Vegetables – (n=2) |
| 10. Vegetables – (n=3) | SSB (n=1) |
| 11. Fiber – (n=1) | |

**3.7.8 Appendix L:** Figures 21-23. Message acceptability questions, child vs. parent report in bar charts.

Figure 21.
Figure 22

"The messages I received were helpful"

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree nor Disagree
- Somewhat Agree
- Agree
- Strongly Agree

Count

Figure 23

"I would like to receive more messages like these in the future"

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Neither Agree nor Disagree
- Somewhat Agree
- Agree
- Strongly Agree

Count
3.8 REFERENCES


CHAPTER FOUR

4.1 CONCLUSION

Due to the current elevated rates of childhood obesity in the United States, the purpose of this research was to investigate and combine two modes of assessment and intervention targeting childhood obesity preventative measures in a clinical setting. The modes of assessment and intervention included 1) surveying child food preferences through an online platform and 2) subsequently offering tailored health messages to the child and parent based on previous food preference survey responses. The primary goal of this research is to eventually improve attitudes and behaviors towards healthy eating and activities of children and their parents through the tailored health messages. The assessment measure utilized in this research, the Pediatric-Adapted Liking Survey (PALS) has been validated as an accurate tool to screen and predict for dietary quality in a variety of populations, including children. Furthermore, results from the liking survey have been correlated with multiple dietary markers including cardiovascular disease risk factors, adiposity measures and skin carotenoid status.

In the first phase of the present study, we found that the online-formatted PALS demonstrated both usability and feasibility in an urban clinical Pediatric Emergency Department (PED) setting. The PALS was completed quickly and easily on the tablet with few reported errors and high participant-reported acceptance and likability. Furthermore, the tablet-based survey tool did not interrupt regular medical care and demonstrated relevance to the participants through the survey items, initiating self-reflection of behaviors which could eventually lead to changes in attitudes or behaviors in the long-term. The tablet-based PALS demonstrated value by providing obesity risk screening and free nutrition education to children and their families that they may not otherwise receive. Secondly, the tablet-based responses appear to provide more complete
utilization of the PALS scale, as there was less of a ceiling effect in responses when compared to previous paper-and-pencil data. This is promising as children may report more accurately on technology-based platforms compared to other modes of assessment due to decreased pressure to answer in a socially-acceptable manner\textsuperscript{1,2}. Lastly, we were able to conclude that parental perceptions of their child’s food preferences are very accurate, indicating that they may be used as a proxy for their child if necessary. These results did not vary significantly based on age or gender of the child, which contradicts previous research that states agreement between child and parent responses may have increased discordance as the child gets older\textsuperscript{3}.

In the second phase of the present study, we found that the tailored health messages based on PALS responses offered to both the child and the parent were effective in providing new and useful information. Furthermore, the majority of dyads revealed they would like to receive similar messages in the future through an mHealth platform (texting or email). These results supported the development of the proposed follow-up phase of the study, where parents and their children would receive three additional surveys and tailored health messages targeting a behavior that the dyad chose to work on. Further messaging will be most effective through not only tailoring to health topic, but also to parental readiness to make a change by grounding messages in behavior change theories, thereby increasing motivation.

This research focused on multi-tiered approaches towards improving obesity risk prevention efforts in an urban PED by increasing the opportunities for BMIP screening and nutrition education. Due to the high acceptability, usability and feasibility of the tablet-based PALS, a tool such as this could be seamlessly integrated into the basic electronic medical record system and thus be extrapolated to other settings such as primary care offices, dental clinics and schools. This will create for a continuity of obesity preventative care that is much needed in our
society. This tool should be further developed by examining which types of tailored health messages are most accepted by children of each age, gender and race in order to be most effective in encouraging positive health attitudes at a young age, and therefore increasing the possibility of a healthier young generation.

4.2 REFERENCES