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## Use of a Novel Parental Engagement Tool in an After-school Obesity Prevention Program

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To the Graduate Council:

I am submitting herewith a thesis written by Lindsay Schloesser Miesel entitled "Use of a Novel Parental Engagement Tool in an After-school Obesity Prevention Program." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Nutrition.

Marsha L. Spence, Major Professor

We have read this thesis and recommend its acceptance:

Hollie A. Raynor, Katie Kavanagh

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

**Use of a Novel Parental Engagement Tool in an After-school Obesity Prevention Program**

A Thesis Presented for the

Masters of Science

Degree

The University of Tennessee, Knoxville

Lindsay Schloesser Miesel

May 2013

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## ABSTRACT

**Objective:** To assess the impact of parental health messages delivered via two avenues on children's reported food/drink exposure and child/parent goal setting.

**Design:** Pre- and post-test quasi-experimental design with two treatment groups and one historical control group.

**Setting:** Two elementary schools in East Tennessee.

**Participants:** Seventy-seven parents of participating fourth and fifth graders.

**Methods:** Messages were delivered to parents as the home component of an after-school program via digital home message centers (digital message group) or a more traditional method using a web-based platform and/or handouts of messages (traditional enhanced group) with results compared to a historical control with no parental engagement component. Dietary exposure was measured with child surveys, and goal card returns were tallied.

**Main Outcome Measures:** Pre- and post-child exposure to fruits, vegetables, whole grains, 1% and fat-free milk, healthy and unhealthy breakfast items, sugar-sweetened beverages, and solid fats and sugars; parent and child goal card returns.

**Analysis:** Repeated measure ANOVAs using a mixed model approach to assess changes over time and by group (significance set at 0.006) and Mann-Whitney test for goal card returns (significance set at 0.05).

**Results:** Total of 34 historical control group cases, 23 digital message group cases, and 20 traditional enhanced group cases. Treatment groups reported greater exposure to sugar-sweetened beverages and unhealthy breakfast ( $p < 0.001$  for both). Traditional enhanced group reported higher exposure to vegetables when compared to the historical control group ( $p = 0.004$ ). Both treatment groups had greater goal card returns ( $p < 0.001$ ). Parents in the digital message

group reported viewing the health messages frequently and attempting to incorporate changes in the majority of the topic areas weekly.

**Conclusions and Implications:** Although outcomes were mixed, parental messages increased engagement as evidenced by the increase in returned goal cards, and added health messages were valued and frequently used by the parents. Future studies should further examine avenues of delivery for acceptability and effectiveness in increasing nutrition knowledge.

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Example Goal Card and Health Messages .....Example\_Goal\_Card\_and\_Health\_Messages.docx

## CHAPTER 1: BACKGROUND

### Childhood Obesity

Obesity is a growing epidemic nationwide. Obesity rates have increased exponentially within the past few decades; in 2009-2010, 16.9% of United States children and adolescents aged 2-19 years were obese, though the rapid increase in obesity prevalence has stabilized during the most recent decade<sup>1,2</sup>. However, to illustrate the longer-term magnitude of the obesity rate increases, between 1963-1965 and 2007-2008, obesity rates doubled for preschoolers, tripled for school-aged children, and nearly quadrupled for adolescents<sup>3</sup>. Adulthood health problems associated with obesity, such as type 2 diabetes and early signs of cardiovascular disease, such as hyperlipidemia and hypertension, are becoming more common among children due to childhood obesity. Not only are these children at risk for conditions associated with cardiovascular disease, but they are more likely to be obese as adults<sup>4</sup>. This again underlines the children's future risk for all of the deleterious conditions associated with adulthood obesity. Other non-physical, negative risk factors associated with obesity include a decreased self-image, bullying from peers, and exclusion<sup>4</sup>.

The risk for future adulthood morbidities and mortalities due to childhood obesity appears to occur independently of adulthood obesity<sup>5</sup>. This indicates that childhood is a key period during the life course in terms of prevention of future adverse health outcomes and complications. To circumvent the wide array of conflicting information regarding weight loss that is available through the media, it is important to use evidence-based approaches when intervening on childhood obesity. In an attempt to outline evidence-based nutrition targets to reduce childhood obesity, an expert committee comprised of professional organizations, scientists, and clinicians was formed<sup>6</sup>. Areas that were identified included increasing fruit and

vegetable intake, fiber intake in the form of whole grains, breakfast intake, and physical activity levels, while decreasing sugar-sweetened beverage intake, energy-dense snack intake, portion sizes, and sedentary behaviors<sup>6</sup>. Though clinical trial evidence isolating the individual or combined effects of these behaviors on child weight status is limited, research in community and school settings and epidemiological studies suggest that targeting these areas through interventions may improve child weight outcomes<sup>6-14</sup>.

### **Interventions in Schools**

Research is aimed at interventions in the school setting for the prevention of childhood obesity. In a 2005 survey of 1,047 representative US households, 94% of respondents reported that they thought schools should be required to teach students healthy eating and physical activity behaviors<sup>15</sup>. In addition to being a desired avenue for the promotion of nutrition and physical activity, because most children spend a majority of their time at school, it is a vital avenue through which obesity prevention can be targeted to children. Furthermore, schools can be convenient places to provide interventions since the sites provide immediate access to many useful resources. The school provides access to children, contains physical and educational resources, and employs the trained staff needed to teach children. Increased access to resources makes interventions in schools a particularly cost-effective option<sup>16</sup>.

There are a variety of interventions that can address obesity and can be held in the school setting. As described by the Academy of Nutrition and Dietetics' position paper on interventions for pediatric overweight, programs can either provide primary, secondary, or tertiary intervention<sup>17</sup>. Primary prevention programs include obesity prevention programs for a more generalized population of children who may not be overweight or obese, while secondary prevention identifies and provides intervention for children who are at risk for being overweight

or obese<sup>16</sup>. Tertiary prevention programs include obesity reduction programs as treatment for children who are already overweight or obese<sup>17</sup>. An additional type of intervention that may be conducted in schools is the nutrition education intervention, which provides general information on foods and nutrients, meal planning, and overall healthy living<sup>17</sup>. Furthermore, there are key distinctions between the types of programs held in the school setting. For example, many programs and interventions conducted in schools, such as general nutrition and physical activity education in classroom settings or during after-school programs typically involve activities that are focused on individual and interpersonal behavioral changes, whereas school-based programs and interventions incorporate school-wide changes, such as modification of school nutrition standards, food service policies and/or expanded physical activity opportunities and may also target individual and interpersonal behavioral changes as well<sup>17</sup>.

Indeed, multi-component programs that target multiple levels of the socio-ecological model in order to enhance the content and delivery of nutrition promotion and/or obesity prevention messages and to create a more supportive environment may be more able to impact children's health as compared to single-level programs<sup>18-20</sup>. For example, Chomitz's and colleagues' community-based Healthy Living Cambridge Kids program involved 1,858 kindergarten-fifth grade children along with their parents, their schools, and the community for the prevention of obesity<sup>20</sup>. This multi-component program spanned three years; incorporated enhancements to traditional physical education classes and food service policies, farm-to-school-to-home programs, family outreach, and community awareness campaigns; and succeeded in decreasing BMI z-scores ( $p < 0.001$ ), increasing prevalence of healthy weight ( $p < 0.05$ ), and decreasing prevalence of underweight and obesity (both  $p < 0.05$ )<sup>20</sup>.

School nutrition interventions consisting of multi-component programs have demonstrated positive results and are therefore marked as the gold standard for childhood obesity intervention by the Academy of Nutrition and Dietetics<sup>17,18,20-26</sup>. In particular, Shaw Perry's study analyzed the success of a 14-week school-based diabetes prevention program involving 58 fourth grade African American students<sup>27</sup>. The program involved components in multiple settings: the school setting during the school day, the school setting during after-school hours, the school cafeteria, and the home<sup>27</sup>. Results from the study showed increases in fitness laps ( $p < 0.0001$ ), decreases in fasting blood glucose levels ( $p < 0.0001$ ), and decreases in body fat percentage ( $p < 0.5$ ) from pre- to post-assessment<sup>27</sup>. By reinforcing messages in multiple settings, creating a supportive environment with food service changes, and involving parents in the home, improved outcomes may be attained.

### **After-School Programs**

Despite the demonstrated success of both school-based and multi-component programs, these are often difficult to implement due to strict time requirements throughout the school day and high start-up costs<sup>1</sup>. A feasible alternative is to offer after-school programs, which provide the advantage of avoiding interruption of academic lessons held during the school day<sup>28</sup>. Furthermore, a cost-effectiveness analysis of an after-school obesity prevention program involving physical activity and healthy snacks by Wang and colleagues indicated that the program was a good use of public funds when results were taken into consideration; the intervention cost \$558 per student for the first year in comparison to the usual after-school care cost of \$639 per student<sup>29</sup>. Although after-school programs may target fewer children since they are voluntary, research suggests that these programs still have beneficial effects on nutrition knowledge, behaviors, and biomarkers<sup>29-33</sup>.

Story's 2003 study evaluated the preliminary effects of a Minnesota after-school obesity prevention program for 54 African-American girls aged 8-10<sup>30</sup>. This program held after-school classes twice per week for 12 weeks and focused on healthy eating and physical activity<sup>30</sup>. The program resulted in increased levels of physical activity and increased healthy eating<sup>30</sup>. After-school nutrition programs have shown positive effects on anthropometrics and bone density as well. Yin's study evaluated the Medical College of Georgia FitKid project, which involved 447 third graders in an eight-month after-school program focusing on healthy snacks and physical activity for the prevention of obesity<sup>31</sup>. This evaluation showed decreases in body fat percentage, increases in bone mineral density, decreases in heart rate response to exercise<sup>31</sup>. In addition, Speroni's evaluation of the Kids Living Fit project, a 12-week after-school intervention for 185 second through fifth graders that included a weekly fitness program and monthly nutrition presentations, demonstrated decreases in BMI percentile and waist circumference<sup>32</sup>. These results show a direct effect on nutrition-related physical measures, indicating that after-school nutrition programs are well-suited for producing change in children's risk of obesity.

After-school programs can serve an additional advantage by taking into consideration recent increases in sedentary behaviors among children. Within the past few decades, the dynamic of children's ways of life has changed drastically, which may contribute to the increasing rates of obesity. For example, in a 2009 study of 2,380 households containing 3,563 youth, Sturm discovered that there have been recent trends in decreased free time due to after-school programs and daycare ( $p < 0.01$ )<sup>28</sup>. Because children's schedules are more likely to contain organized and scheduled activities than in the past, it is possible that children have less time to be active. By utilizing after-school programs and including more physical activity during these after-school hours, this trend can be used in a positive way. Furthermore, these after-school

programs can affect change in children's lives by utilizing their free time when otherwise they may be participating in sedentary behaviors<sup>28</sup>.

Another 2009 study by He and colleagues examined factors that may contribute to increased screen-related behaviors among a random sample of 508 fifth and sixth graders, which is a recent trend that may be increasing children's risks for obesity<sup>34</sup>. Children who participate in more screen-related behaviors involving television and video games may be more sedentary than their more active peers. Furthermore, results from He's questionnaire revealed that fifth and sixth graders who participated in sports or after-school activities (regression coefficient [g] = -0.56 for activities in-school, g = -0.49 for activities out of school); had a positive attitude towards physical activity (g = 0.48); and whose parents have strict rules about computer use (g = -0.27) tended to engage in less screen-related behavior<sup>34</sup>. Although after-school programs have the potential to decrease unstructured playtime, they also may decrease a child's amount of screen-related behaviors, thereby making them an appropriate setting for obesity prevention messages and interventions targeting increased healthy behaviors.

### **Parental Involvement**

Many successful childhood obesity prevention programs in the school setting contain components that incorporate parental engagement and/or involvement<sup>22,24,30,35-37</sup>. An example of such a program is Grey's 16-week program to prevent type 2 diabetes among adolescents<sup>35</sup>. In addition to featuring weekly during-school nutrition education classes and after-school physical activity training twice per week, the program invited parents to participate in the children's nutrition education program<sup>35</sup>. Furthermore, school administration indicates that parental involvement is important. In one 2006 study of 669 foodservice directors, teachers, and principals, 96% of foodservice directors, 88% of teachers, and 89% of principals responded that

they agree that parents should be involved in nutrition education lessons delivered in a school setting<sup>38</sup>. In a Canadian assessment of the enforcement of school nutrition policies, focus groups with 41 students and interviews with 12 parents revealed a major theme stating that the strongest enforcers of health policies in the school were parents, and that communication with and education of parents helped improve this enforcement<sup>39</sup>.

The acceptability of a program to parents may increase their involvement. Children benefit from parental support in two ways, with the first being an improvement in parental knowledge of nutrition. A study by Bathgate and Begley involving focus groups of parents of children attending low socioeconomic schools in Perth, Australia, found that while parents desire to provide healthy meals for their children, they note that it is difficult to know what is nutritious, cost-effective, and safe to prepare and are welcoming of education<sup>40</sup>. Interventions involving parental education can enable them to be aware of healthy choices, thereby assisting them in making more informed choices in the home. To illustrate, Heim and colleagues' study of a 12-week garden-based elementary school program enrolled 43 fourth through sixth graders and involved parents through weekly newsletters containing motivational tips, recipes, and suggested activities<sup>41</sup>. This program increased parents' favorable opinions towards fruits and vegetables ( $p < 0.01$ ) and home availability of fruits ( $p < 0.05$ ) and vegetables ( $p < 0.001$ )<sup>41</sup>.

Second, parents can benefit from nutrition education in that they may improve their own diets, which may increase the likelihood that they will model for their children making better decisions in the home. This concept stems from the Social Learning Theory, which explains that people learn from not only their own experiences, but also from the observation of others and their experiences<sup>42</sup>. To illustrate, Inman, in his research, stressed the importance of developing programs that support families in promoting health within their homes<sup>43</sup>. The success generated



by this additional parental component can help establish a healthful home environment through increased home availability of healthy foods and role modeling, thereby further facilitating children's success<sup>30,37,44</sup>.

Childhood obesity interventions that incorporate a parental component demonstrate improved outcomes when compared to control programs that do not contain a parental component<sup>24,36,43</sup>. However, particular care must be devoted to developing a component that thoroughly involves the parents, or results may not be successful<sup>16,19,45</sup>. Research suggests that strong parental components should involve direct contact, such as requiring parental presence at meetings to establish face-to-face connection with the researcher and program staff, as well as offering opportunities for frequent participation, evaluation, and feedback<sup>46,47</sup>. Additionally, the Academy of Nutrition and Dietetics' position statement on interventions for pediatric weight management suggests that successful interventions should involve parental components combining nutrition education, behavioral counseling methods, and parent training/modeling education<sup>17</sup>.

Despite the widespread suggestion of the importance of parental involvement in school nutrition interventions, studies rarely incorporate parental participation in an intervention as predictor variables or mediators of outcome measures<sup>48</sup>. For example, a review conducted by Kitzman-Ulrich and colleagues determined that although interventions with parental involvement demonstrated improved behavioral outcomes in children in the form of youth weight loss and improved youth health behaviors, the direct effects of parental involvement on specific outcomes is unclear<sup>48</sup>. Additionally, few studies evaluate the effects of parental role modeling on child behavioral measures<sup>48</sup>. In order to examine the true effect parental involvement has on a child's

food options and choices at home, intervention studies would benefit from specific evaluation of parental components.

Although parental participation in childhood obesity interventions have been shown to be successful in a multitude of studies, many studies show that participation rates are often low and may be explained by the typical indirect methodology of the study design<sup>16,18,19,21,45,46</sup>. For example, a study conducted by Haines and colleagues involved a multi-component, school-based program that included an after-school program, a theater program, and school environment components in an attempt to reduce weight-associated teasing and to improve weight-related behaviors among fourth to sixth graders<sup>22</sup>. The program featured a parental component involving take-home materials and a theater production; however, minimal face-to-face contact with the researcher was noted<sup>22</sup>.

Similarly, in a two-year school-based nutrition and physical activity intervention for middle school children, parental involvement was targeted in addition to enhanced and expanded physical activity opportunities in the school, nutrition education, and improved food service policies for the promotion of fruit, vegetable, and water consumption<sup>19</sup>. Results indicated that involving parents did not produce successful outcomes, which researchers suggest may be because parents were involved in only one face-to-face meeting beyond take-home materials<sup>19</sup>. Furthermore, Edwards' and colleagues' study examined the effects of an obesity reduction program in the school setting that incorporated nutrition education and physical activity opportunities every other day throughout the school year<sup>16</sup>. This program involved parents but demonstrated similar low involvement rates found in other studies<sup>16</sup>. This low participation may be explained by the program design, because beyond the receipt of materials and the option to

attend children's classes, parents only participated by way of events such as skits and social nights, which did not focus on changing targeted behavior<sup>16</sup>.

In addition to program design involving indirect methodology, inconvenience is cited as a major factor in low participation rates among parents<sup>47</sup>. If face-to-face meetings or events are offered as a component of the program, it may be difficult for parents to find time to participate due to busy schedules. Other issues that may have contributed to low participation rates included inadequate communication with parents, limited face-to-face contact, and limited access to transportation<sup>16,19,22,39</sup>. By not attempting to factor these inconveniences into program design, researchers may further discourage parents from participating in the intervention and its activities. Proper attention and resources should be dedicated to the development of a parental component that is feasible, accessible, cost-effective, convenient, and pleasing for parents.

### **Web-based Interventions**

An increasingly innovative avenue through which to provide obesity prevention intervention is the Internet. Web-based interventions have been shown to be just as effective as face-to-face interventions<sup>49,50</sup>. In one study by Neuenschwander, 123 adults within 14 counties in Indiana were randomized to receive traditional face-to-face nutrition education or web-based nutrition education in the areas of fruits and vegetables, Nutrition Facts label reading, and whole grains<sup>49</sup>. Intakes of fruit, vegetable, and whole grains; use of nutrition facts labels; and frequency of meal planning and breakfast intake improved for both groups ( $p < 0.05$ ) over the course of the program, which indicates that web-based nutrition education was comparable to face-to-face delivery<sup>49</sup>. In a similar study located at Fort Bragg, North Carolina, 48 soldiers were randomly assigned to either a web-based or face-to-face nutrition education lecture<sup>50</sup>. Results indicated no significant differences by education method on knowledge scores or acceptance of delivery

method, which again illustrates that the web-based option was just as effective as its counterpart<sup>50</sup>.

Providing Internet interventions allows researchers and practitioners alike to rapidly provide relevant information in a format that does not overwhelm participants<sup>51,52</sup>. Furthermore, the material can be delivered in an interactive format that engages the participant with both the researcher and potentially other participants<sup>51,53-55</sup>. Because Internet access is becoming cheaper and more widespread, barriers to Internet access are decreasing, making these interventions increasingly accessible for a wide variety of people<sup>51</sup>. In 2006, 73% of American adults were Internet users, with 53% of low-income adults having access to the Internet<sup>51</sup>. An additional increased comfort with computers and the Internet was noted<sup>56</sup>. Increased Internet access lends researchers and practitioners a novel approach to combat obesity.

Web-based interventions have demonstrated the ability to overcome many of the barriers to compliance associated with interventions involving parents<sup>51,53,55,57,58</sup>. In particular, web-based interventions tend to be more convenient by making it easier for participants to be involved on their own time, at their own speed, and without the arrangement of transportation and/or child-care<sup>51,53,55</sup>. To illustrate, in a nutrition education intervention for 155 low-income European American and African American mothers receiving education via a computer game, a website, or a pamphlet, the website modality scored higher on acceptability ( $p < 0.05$ )<sup>59</sup>. Additionally, interventions that are delivered via the web are less costly and less intimidating for participants who are not comfortable with face-to-face interaction<sup>51,55,57,58,60</sup>. Individuals may tend to feel less stigmatized when they are not meeting with the interventionist and other individuals in person; therefore, they may be more inclined to participate<sup>58</sup>.

Beyond providing a more convenient, inexpensive, and comfortable avenue of intervention for the participant, web-based interventions may result in greater improved outcomes when compared to non-web-based interventions<sup>53,59,61-66</sup>. A meta-analysis of 11,754 web-based interventions conducted by Wantland and colleagues showed that web-based interventions resulted in a multitude of improved outcomes, including increased exercise time, increased knowledge of nutritional status, increased knowledge of asthma treatment, increased participation in healthcare, slower health decline, improved body shape perception, and 18-month weight loss maintenance when compared to non-web-based interventions<sup>53</sup>. In addition, in Silk's aforementioned intervention involving low-income European American and African American mothers, participants in the web-based group experienced increased knowledge outcomes such as knowledge about MyPyramid ( $p < 0.01$ ), knowledge about food serving sizes ( $p < 0.01$ ), and overall nutrition knowledge ( $p < 0.05$ )<sup>59</sup>.

As documented in research, participation is a vital part of any intervention, and this is also true for web-based interventions. In a 16-week walking program of 324 participating adults, the percentage of completers was 13% higher among individuals with an Internet component containing graphs of walking progress, individually-tailored motivational messages, and weekly calculated goals when compared to a control group with no Internet component ( $p = 0.02$ )<sup>55</sup>. Additionally, individuals in the Internet-based group remained engaged longer throughout the program when compared to the control group ( $p = 0.02$ )<sup>55</sup>. Increased initial participation in a program or intervention may lead to increased investment, thereby sustaining engagement throughout the length of the program.

Additionally, participants who demonstrated greater participation in web-based interventions achieved greater outcomes than those who participated less<sup>54,61,67-70</sup>. Participation

in an intervention targeted around one's health increases value for and investment in the program, potentially leading to reduced attrition and more successful outcomes. In particular, greater participation in the form of increased website visits is documented to improve behavioral outcomes such as increased physical activity, increased weight loss, and decreased blood pressure<sup>61,68,71</sup>. For example, in a 12-week web-based obesity reduction intervention conducted by Bennett and colleagues, the 101 primary care participants had access to a comprehensive website that offered tailored behavior change goals, behavioral skills training, and coaching/support<sup>56</sup>. Participants who had higher website utilization attained greater weight loss by the end of the study ( $p = 0.0007$ )<sup>56</sup>. Additionally, in a web-based family program for 18 overweight eight- to 12-year olds, participants had web-based access to background information on obesity and health behaviors, information on assessment of nutrition and physical activity behaviors, interactive games, and instruction in goal setting and monitoring<sup>70</sup>. Those who visited the website more had greater reductions in zBMI ( $p = 0.02$ ) and greater improvements in dietary intake ( $p = 0.04$ ), which demonstrates the importance of participation<sup>70</sup>.

Despite the presence of web-based intervention and its successes in literature, to date this particular design has not been utilized within childhood obesity prevention interventions. Furthermore, although interventions in the school setting have demonstrated positive outcomes when parents are involved, participation rates are documented to be low due to a majority of factors, including inconvenience and indirect methodology<sup>16,47</sup>. An innovative avenue to target these parents is to incorporate a unique, parental, web-based intervention within the overall childhood obesity prevention or nutrition education program. By directly involving parents in the intervention in a unique web-based design, there may be a potential for increased successful outcomes in children.

## Other Media

For the 27% of all American adults and 48% of low-income American adults who do not have access to the Internet, web-based interventions are not a feasible or acceptable method of intervention, and other avenues are necessary<sup>51</sup>. A new wave of studies is looking at the effect of electronically delivered messages' impact on health behavior, namely with the use text messaging using cell phones<sup>72</sup>. Health professionals and researchers are increasingly utilizing alternative, technological-based methods when other methods have failed to demonstrate improved outcomes in order to enhance medical adherence and health behaviors<sup>73,74</sup>. This method has been proposed as a more feasible alternative to reach a larger proportion of participants while still using technology in a convenient fashion.

In addition to the benefit of convenience that technology-based interventions offer, they are shown in numerous studies to be acceptable to research participants and medical patients<sup>72,74-78</sup>. For example, after completing an intervention that involved the use of text message reminders to improve sunscreen use, 89% of the 35 participants in the treatment group reported that they would recommend the text messaging system to others<sup>74</sup>. In another study assessing the delivery of family meals educational messages via digital photography receivers in a waiting room, nearly 94% of the 125 respondents indicated that the slides helped them think about family meals<sup>79</sup>. In addition, in Gold and Whittaker's studies involving text messaging interventions targeting sexual health promotion and smoking cessation, respectively, survey and focus group participants indicated that they viewed messages delivered via text as acceptable, informative, and easy to use<sup>75,80</sup>. By involving participants in an intervention that directly suits them, there may be an increased potential for success.

In addition to participants' high regards towards technologically delivered interventions regarding acceptability and ease of use, these interventions also have demonstrated successful outcomes<sup>72,80-82</sup>. In Gold's intervention targeting sexual health promotion among 587 young adults, the delivery of four health promotion messages via text messaging increased participants' knowledge about sexual behaviors ( $p < 0.01$ ) and degree of STI testing ( $p < 0.05$ ) from pre- to post-assessment<sup>77</sup>. Similar improvements in the form of increased screenings for colorectal cancer among 1,103 patients in ambulatory health centers were seen in Sequist's study of involving the receipt of an electronic message reminder ( $p < 0.001$ )<sup>81</sup>. Furthermore, Fry's review of interventions involving healthy message prompts delivered electronically showed that 11 of 19 studies reported positive findings on health behaviors, demonstrating the impact of these types of interventions<sup>82</sup>.

Despite the high acceptability and successful outcomes associated with health promotion interventions delivered electronically, it is still a relatively new area of study, and further research is needed in order to determine specific details of the interventions that impact changes in knowledge and health behavior outcomes<sup>75,82</sup>. Whittaker's randomized controlled trial involving 226 participants in an intervention that tested the effect of mobile-delivered videos on smoking cessation did not achieve a high enough sample size in order to detect sensitive changes, suggesting the need for further research in this area<sup>75</sup>. Furthermore, in their review of the use of electronic prompts and reminders in health promotion interventions, Fry and Nett determined that more research is needed to explore other options for electronic health delivery as well as to determine what types of prompts are most effective in promoting change<sup>82</sup>.



## Development of Health Messages

The proper development and framing of educational materials is important for sustaining interest and participation in an intervention. An effective way to provide health promotion education in interventions is to frame the information as succinct health messages<sup>77,83</sup>.

Zarcadoolas describes the importance of considering the “simplicity complex” when creating health messages, which stresses that messages need to be simple in order to combat low literacy rates and to enhance retention in an intervention<sup>83</sup>. Furthermore, a study conducted by Gold indicated that focus group participants value messages that are informal, useful, brief, creative, positive, and cover a wide variety of topics<sup>77</sup>. Lastly, the messages should cover information that the participants deem important and be delivered via an avenue that participants find acceptable<sup>84</sup>.

Another important avenue to consider when attempting to increase the chances that health messages will be read, remembered, and utilized is the relevance of the material to the reader or user<sup>77</sup>. Tailoring the messages to the individual’s interests, concerns, or current intake levels/current health status is one way to increase the personal relevance of the health message. In lieu of generalized messages that are the same for every participant, more interventions are delivering tailored messages to improve participation, engagement, retention, and program outcomes<sup>85,86</sup>. In Gans’ study, 1,841 adult participants assigned to nutrition education groups that delivered information personalized by name and tailored to their individual intake levels demonstrated decreased fat intake at four months post-intervention ( $p < 0.001$ ) and increased fruit and vegetable intake at seven months post-intervention ( $p < 0.001$ )<sup>85</sup>. Furthermore, in a study targeting fat intake, a sample of 442 Dutch adults was randomized to an interactive CD-ROM-based intervention tailored to individual intake levels, a print-based intervention tailored to

individual intake levels, or a print-based non-tailored intervention<sup>86</sup>. Information that was tailored was specific to each participant's current intake level for major nutrient groups<sup>86</sup>. One month after the intervention, individuals in both tailored conditions had lower intakes of energy, total fat, and saturated fat when compared to the non-tailored group<sup>86</sup>. Using messaging personalized by name or tailored to current nutrient intake level within child-based programs may be an avenue to increase parental involvement and engagement.

### **After-school Program Overview**

The CARDIAC Kids Initiative was a health screening project sponsored by the Mercy Health Partners Foundation and was designed to screen area fourth and fifth graders for risks associated with heart disease, obesity, and insulin resistance. The program followed the protocol set forth by the Coronary Artery Risk Detection in Appalachian Communities (CARDIAC) program, which was first established in West Virginia. Students, particularly those attending underserved and low-income schools, were screened for BMI, blood pressure, total cholesterol, HDL, blood glucose, and acanthosis nigricans, a marker for insulin resistance. Results were sent to parents providing contact information and instructions to aid them in follow up with a primary care provider.

From the CARDIAC Kids Initiative, an East Tennessee local school district's Coordinated School Health Program in collaboration with Mercy Health Partners and the University of Tennessee Department of Nutrition and College of Nursing founded an after-school nutrition and physical activity intervention program designed for any fourth and fifth graders at a local elementary school. This school was chosen as a pilot school for multiple reasons: 1) its large proportion of low-income families and at-risk children, and 2) its high incidence of overweight and obese children. In 2008, 59% of the students were economically

disadvantaged, and 49% received reduced or free lunches<sup>87</sup>. Furthermore, in 2008, a health department and school district in East Tennessee indicated that 44% of students aged nine and 43% of students aged 10 within this district were overweight or obese, marking this specific student group as an important target for a nutrition and physical activity intervention<sup>88</sup>.

Researchers and staff involved in the after-school program included a variety of professionals, such as classroom and physical activity teachers from the school district; Coordinated School Health Program personnel; University of Tennessee Department of Nutrition and College of Nursing faculty and research assistants; Mercy Health Partners community nurses; Special Program in Food For Youth (SPIFFY); and Tennessee Nutrition and Consumer Education Program (TNCEP) nutrition educators.

The primary objectives of the program were to:

- 1) Provide all fourth and fifth grade participants the tools needed to achieve or maintain a healthy weight;
- 2) Improve dietary and physical activity behaviors of participating children; and
- 3) Involve families of participating children in learning about better eating habits and activity levels.

Participants were recruited among all fourth and fifth graders. Recruitment efforts included flyers, fruit and vegetable characters visits to the school, school announcements, and materials sent home with the children to the parents. As a result, any students could participate, regardless of weight status, which helped eliminate any social stigmas attached to a nutrition and physical activity intervention specifically for overweight and obese children. While all fourth and fifth graders were eligible, children were excluded from the program if their schedules conflicted with either of the weekly sessions or if their parents did not agree to attend two

mandatory meetings. At the first parent meeting, researchers and staff explained the program and its risks/benefits before obtaining informed parental consent and child assent.

The program utilized three components, nutrition education, physical activity education and opportunities, and parental involvement. The program spanned 10 weeks with eight weeks of content. The first week involved collection of pre-surveys and assessments, while the last week involved a celebratory carnival and the collection of post-surveys. There were two sessions per week; each session lasted two hours and incorporated a nutrition lesson, physical activity exercises, a healthy snack, and a weekly taste test linked to trying a new, healthy food. Program components are described as follows:

- 1) Nutrition lessons used materials obtained from the United States Department of Health and Human Services' Dietary Guidelines for Americans<sup>89</sup>, MyPlate<sup>90</sup>, the Whole Grains Council<sup>91</sup>, More Matters<sup>92</sup>, Team Nutrition<sup>93</sup>, Coordinated Approach to Child Health (CATCH)<sup>94</sup>, and National Heart Lung & Blood Institute<sup>95</sup> references, and the sessions were taught by University of Tennessee Extension staff. Lessons covered included an overview of MyPlate, food safety, sugar-sweetened beverages/juice/water, whole grains, vegetables, fruits, milk, lean meats/meat alternative, fats/oils, breakfast, and sweets and snacks. The first weekly session introduced nutritional concepts, and the second session reinforced these concepts through games and activities. Goal cards were issued for selected topics, and children and parents were encouraged to fill these out together and return them for raffle tickets to use at a final carnival.
- 2) Physical activity sessions were modeled after the SPARK (Sports, Play, and Active Recreation for Kids) program, an evidence-based, NIH-supported program, which uses equipment and active participation activities designed to improve fitness, skills, and

enjoyment of activity<sup>96</sup>. SPARK methods were also combined with innovative equipment such as Geo Fit mats and Wii Fit games, as well as active play, fitness classes, walking/step counting, sit-up exercises, shuttle runs, and team games and challenges. Parents were also encouraged to monitor children's physical activity and goals by reviewing and signing their physical activity logs and goal cards.

- 3) Parents received a notebook of materials that correlated with the information that children learned throughout the program. In addition, parents participated in activities held throughout the program, including two mandatory one-hour sessions and the final carnival. The second meeting occurred in the tenth week of the program and incorporated a voice-recorded discussion facilitated by trained research assistants in focus group and facilitated discussion protocols. The facilitated discussion aimed to collect parental stories regarding the impact of the program in their homes and children and was designed around four broad topic areas: food and food environment, home physical activity, screen time, and impact of medical screening on parents' attitudes and behaviors.

Process and outcome evaluations of past implementations of the program identified limitations of the program, particularly related to parental engagement. In the 2010 implementation of the program, only 53% of the 45 parents returned goal cards for their children's nutrition goals<sup>97</sup>. Furthermore, no parents participated in every lesson, and 75% of the 24 participating parents returned goal cards for less than half of the nutrition lessons<sup>97</sup>. These results indicated a lack of parental involvement with children in establishing nutrition goals, which was a crucial component of the program. Therefore, it was hypothesized that the addition of a parental component involving nutrition and physical activity messages delivered to parents would increase children's exposure to fruits, vegetables, 1% and fat-free milk, and healthy

breakfast; maintain baseline exposure to sugar-sweetened beverages, unhealthy breakfast, and solid fats and sugars; and increase parent/child goal card returns as compared to a historical control group with no parental component.

## CHAPTER 2: MANUSCRIPT

[This chapter is an expanded version of a planned manuscript for the Journal of Nutrition Education and Behavior as a Research Brief (maximum of 14 double-spaced pages or 3,000 words, including figures, tables, and references).]

### **Introduction**

Between 1963-1965 and 2007-2008, obesity rates doubled for preschoolers, tripled for school-aged children, and nearly quadrupled for adolescents<sup>1</sup>. The newest national prevalence rates show that the childhood and adolescent obesity have stabilized, but they remain high and are still a public health priority<sup>2</sup>. Current research is aimed at school interventions for the prevention of childhood obesity in order to alleviate the risks for secondary complications, chronic diseases, and adulthood obesity. Research shows that parental engagement in childhood obesity prevention programs is particularly important for supporting children's healthy eating and activity levels<sup>3</sup>. However, parental participation is documented to be difficult to achieve and maintain<sup>4</sup>. Barriers to study participation reported in the intervention literature, such as lack of time, inconvenience associated with completing study activities, and issues of transportation to study sites may also play a role in the difficulty of engaging parents<sup>5,6</sup>. However, in an effort to reduce these barriers, researchers are increasingly experimenting with digital-based interventions<sup>7</sup>.

This study involved an eight-week (10 weeks total with assessment weeks included) after-school intervention designed to improve nutrition and physical activity knowledge and behaviors of participating fourth and fifth graders. The program held two classes per week on topics around healthy eating and physical activity and provided time for participants to be physically active and consume healthy snacks. Although, historically, the program has improved

children's weight and fitness outcomes and some dietary intake outcomes, parental involvement has been low. Therefore, the research question of this study was to determine if the use of an added parental component, which consisted of digital nutrition and physical activity messages personalized with children's names and targeted to parents, improved children's reported food/drink exposure and child/parent goal setting when compared to a historical control and a traditional enhanced parental component.

## **Methods**

Parents of children participating in the program were automatically eligible for inclusion in this study. Parents of children who participated at School 1 during Year 1 served as historical controls, as the earlier iteration of the program did not include a parental engagement component beyond a preliminary meeting to introduce the program and collect baseline data and a final session meeting to collect post-program data and conduct facilitated discussions about the program with parents. Parents of children who participated during Year 2 received a novel parental engagement component as the treatment group; these parents (digital message group) received personalized messages via digital home message centers, while those at School 2 (traditional enhanced group) received personalized messages via a password-protected website or paper handouts upon request.

Messages prepared for the parental component reflected content of the student program and were chosen to target desired outcomes. Each message was personalized with the child's name and focused on a singular topic with accompanying descriptions, examples, and practical tips. Using a 30-sentence sample, the readability level of the health messages were assessed with the SMOG Readability Test, which determined them to be written at a ninth grade reading level. Similarly to the health messages, goal cards reflected content of the children's program and were



sent home regularly throughout the intervention as each topic was covered. Children in all three groups were asked to complete the cards with their parents and return them back in exchange for raffle tickets to be used at the end-of-the-program carnival. In addition, both the digital message and traditional enhanced groups received access to a calendar that provided reminders of when goal cards were distributed and due.

Children's pre- and post-exposure outcomes for food/drink categories were collected via child surveys that were designed and modified based upon a combination of the SPAN (School Physical Activity and Nutrition) Survey, a validated tool used to determine multiple factors for school-aged children, and a tool used in a fruit and vegetable garden pilot project<sup>8,9</sup>. Because surveys used for the historical control group did not collect "frequency" data for all food categories, "ever eaten/drunk" scores were used in order to obtain exposure information for all three groups. Data from survey questions assessing if food/drink items were "ever eaten/drunk" were collected for each food item and used to calculate "ever eaten/drunk" totals for each food category (fruits, vegetables, whole grains, 1% and fat-free milk, healthy and "unhealthy" breakfast items, sugar-sweetened beverages, and solid fats and sugars). Results for all food/drink exposure variables were statistically analyzed using repeated measure ANOVAs with a mixed model approach to assess changes over time and by group. Non-parametric ANOVAs were conducted for the 1% and fat-free milk variables, since these contained bi-variate data (i.e. the child either has or has not drunk the milk) as opposed to the other variables which collected totals for multiple types of foods/drinks. Parent and child goal card returns were tallied and used to calculate the final percentage of total possible goal cards returned.

An additional parent participation survey, which was created by modifying an Induction Training Evaluation used at the University of Tennessee's College of Social Work, was

administered at the post-parent meeting for the digital message group to assess the value of each individual health message. The survey assessed whether parents were or were not familiar with each particular health message before the program (“familiar” variable), how often they referred to the message per week (“refer” variable), how often per week they attempted to make improvements in that area (“effort” variable), and how important that area was to their families (“importance” variable). For the “refer” and “effort” variables, responses were measured on a five-point Likert Scale (rarely, once a week, two-three times a week, three-five times a week, and daily). Similarly, for the “importance” variable, responses were measured on a five-point Likert scale (unimportant, not very important, somewhat important, important, and very important). This survey was not administered for the traditional enhanced group due to very low participation rates online (n=1).

All statistical tests were conducted using SAS 9.3 for Windows (SAS Institute Inc., Cary, NC) and SPSS 20.0 for Windows (IBM Corporation, Somers, NY). To account for the increased risk of Type 1 errors due to multiple testing, the level of significance was set at an alpha of 0.006 for the repeated measure ANOVA tests, and for all other tests the significance was set at an alpha level of 0.05. Effect size was reported for each significant finding related to child food/drink exposure outcomes. Effect sizes were obtained from partial eta-squared scores and were calculated using G\*Power<sup>10</sup>. This project was reviewed and approved by the University of Tennessee Institutional Review Board. Parent consent and child assent were obtained for all data collected.

## **Results**

The final sample consisted of 34 historical control group cases, 23 digital message group cases, and 20 traditional enhanced group cases (see Figure 1 in Appendix B). Original enrollment

in the program included 38 digital message group cases and 26 traditional enhanced group cases; however, cases were removed from the database if a child or parent did not complete a pre- or post-survey or if at least three components of the surveys were unanswered. In addition, 11 digital message group cases were removed from analysis due to participation the previous year as part of the historical control group. Although it was originally intended that traditional enhanced group parents receive the parental component via the Internet, only one parent accessed the website during the course of the intervention. Because the web-based component was not successfully implemented, paper copies of the parental component were sent home with the children during the sixth week of the program to the remainder of the parents who did not initially indicate that they wished to receive paper copies.

Table 1 in Appendix B contains the demographic profile of parents and children by group. Although all three groups were similar for parent gender and child age and grade, there was a significant difference in child race/ethnicity ( $p = 0.008$ ) among the groups, with parents and children in the traditional enhanced group being more racially/ethnically diverse. In particular, this group had greater representation of American Indian and black race/ethnicity and less representation of white race/ethnicity than the historical control and digital message groups. However, although child race/ethnicity significantly differed by group, there were no significant correlations between race/ethnicity and child food/drink exposure, so this demographic variable was not included as a covariate in statistical analysis.

There were significant differences in child exposure to sugar-sweetened beverages ( $p < 0.001$ ), unhealthy breakfast ( $p < 0.001$ ), and vegetables ( $p = 0.004$ ) by group. Both treatment groups had significantly increased exposure to sugar-sweetened beverages than the historical control group, though exposure did not differ between the two. Similarly, both treatment groups

had significantly increased exposure to unhealthy breakfast than the historical control group, and this did not differ between the two treatment groups. However, exposure to vegetables was significantly higher among the traditional enhanced group as compared to the historical control group. See Table 2 for above information and Table 3 for differences in pre- and post-means among all groups. Lastly, there was a significant difference in the percentage of total parent and child goal cards returned for the historical control group as compared to both treatment groups ( $p < 0.001$ ). This included 24% of total returns for the historical control group, 45% of total returns for the digital message group, and 49% of total returns for the traditional enhanced group, though there was no significant difference in returns between treatment groups.

Results from the parent participation survey administered to the digital message group are shown in Table 4. Several key categories were more highly ranked in regards to how often parents referred to the messages and how often they attempted to make improvements in those areas. Messages that a majority of parents indicated that they referred to at least two to three times per week were those related to fruits and vegetables (68% of parents), dark green and orange vegetables (60%), breakfast (64%), food groups (60%), and family meals (60%). Furthermore, areas where a majority of parents indicated that they attempted to make improvements at least two to three times per week included fruits and vegetables (80% of parents), dark green/orange vegetables (76%), breakfast (80%), and family meals (76%).

Key topic areas that parents were not as familiar with prior to the program included MyPlate (48% parents unfamiliar), unsaturated fats (20%), and screen-related activities (32%), while areas that parents were more familiar with included whole grains (88% parents familiar), fruits and vegetables (96%), dark green and orange vegetables (92%), dairy (88%), and breakfast (96%). In addition, areas that a majority of parents indicated as very important included fruits

and vegetables (60% of parents), breakfast (68%), and food groups (56%), while areas that were more likely to be marked as unimportant, not very important, or somewhat important included role modeling (20% of parents), screen-related behaviors (36%), and meats/meat alternatives (20%).

## **Discussion**

Many successful multi-component school nutrition programs contain parental components that incorporate parents' involvement in the programs<sup>11</sup>. In this study, children whose parents were recipients of the added parental component were more likely to report an increased exposure to sugar-sweetened beverages, unhealthy breakfast, and vegetables when compared to the historical control. The increases in sugar-sweetened beverages and unhealthy breakfast did not differ between the two treatment groups, which suggests that the parental component was not effective in stabilizing exposure to these categories. The increase in exposure to unhealthy breakfast foods/drinks may be explained by the program's emphasis on the overall importance of eating breakfast, thereby motivating children to try new breakfast food/drink items regardless of nutrient composition. By further targeting consumption of healthy breakfast foods, future programs may more successfully educate parents on how to provide convenient healthy breakfasts for their children.

Similarly, both treatment groups indicated an increased exposure to sugar-sweetened beverages when compared to the historical control group. Although this differs from what would be expected since the children's programming and the parental health messages both encouraged the minimization of sugar-sweetened beverage intake, these high consumption patterns are commonly found in the literature and may indicate that sugar-sweetened beverage intake is increasing in general<sup>12,13</sup>. Sherry's 2005 examination of dietary behaviors to prevent and treat

pediatric overweight throughout the literature indicated that there was a gap in evidence for the effectiveness of feasible interventions to decrease intake of common foods/drinks that are linked to childhood weight gain<sup>12</sup>. Results from this study indicate that additional research is needed to determine what types of interventions decrease sugar-sweetened beverage intake. Furthermore, a study by Perkins and colleagues determined that there tend to be strong cultural norms tied to sugar-sweetened beverage consumption among secondary school students, which indicates that these behaviors may take longer to change<sup>13</sup>. To demonstrate, 76% percent of 3,831 sixth-twelfth graders overestimated the daily norm of sugar-sweetened beverage intake in their schools, and an additional 24% believed that the norm was at least three sugar-sweetened beverages per day, which may lead to increased consumption among students<sup>13</sup>.

In addition to similar increases in sugar-sweetened beverage and unhealthy breakfast exposure, exposure to vegetables was higher among children in the traditional enhanced group when compared to children in the historical control group. Though we cannot ascertain why this was not the case for both treatment groups, studies show mixed results when assessing childhood consumption of vegetable intake<sup>14-16</sup>. For example, Freedman and Nickell's examination of results from after-school nutrition workshops held for children aged nine to twelve showed that while intake of vegetables increased at the three-week post-test, this increase did not extend to the follow-up measurement three months later<sup>14</sup>. Furthermore, although Iversen's and colleagues' analysis of a year-long after-school nutrition and physical activity program for fourth through sixth graders demonstrated significant increases in fruit and vegetable intake, the two categories were combined, which does not allow for an isolation of successful outcomes<sup>15</sup>. In fact, Evans' and colleagues' review of school-based interventions to improve fruit and vegetable intake in children aged five to twelve showed that combined increases in fruit and vegetable

intake are largely due to increases in fruit consumption<sup>16</sup>. When variables are separated, vegetable consumption was only increased by 0.07 portions as compared to 0.24 portions for fruit<sup>16</sup>. These mixed results indicate that more research is needed to discover interventions that successfully increase vegetable consumption.

A greater number of goal cards were returned in both treatment groups as compared to the historical control. This may indicate that parental messaging increased engagement in the program. Parents in the treatment groups received reminders of the importance of goal setting, examples of goals to set, and when goal cards were sent home and to be returned, which may have aided their increased participation in goal setting. However, this study does not suggest that the avenue of parental component delivery impacts goal setting, merely that involvement in any form is important. As suggested by research, future studies should focus on messaging that further encourages parents to build a healthy home environment and model healthy behavior to children to reinforce through behavior what they are learning in schools<sup>17,18</sup>.

Results from the parent participation survey administered to the digital message group highlight the value of the health messages among this group of parents. Overall, parents indicated that they referred to most of the health messages and attempted to make improvements in many of the areas at least two to three times per week, which suggests that the health message topics were useful to the parents. Furthermore, specific topic areas that a large percentage of parents rated as very important included fruits and vegetables, breakfast, and food groups, which suggests that additional targeting of these areas may be helpful in promoting behavior change. It may also be important to further target areas which parents indicated they were previously unfamiliar with, such as MyPlate, unsaturated fats, and screen-related activities, as awareness and knowledge may need to be established before behavior changes can occur.

While the health message topics were largely valued by the parents as indicated by the frequency with which they referred to the messages as well as the frequency with which they attempted to make changes in these areas, it is possible that better outcomes may be seen if fewer topic areas are featured. Because parents in the digital message group ranked certain health message areas as less important, future programs may benefit from conducting pre-tests to assess parental knowledge and perceived importance of program aspects prior to developing messages. Furthermore, parents noted that they were already familiar with the topics of whole grains, fruits and vegetables, dark green and orange vegetables, dairy, and breakfast, which may indicate that even if parents realize these areas are important, they already feel that they possess the knowledge and behaviors needed to make improvements in these areas. Because research shows that parents need to value health messages to find them acceptable, care should be taken in future programs to formulate messages in a way that appeal to parents and introduce the content in a unique way<sup>19</sup>.

As mentioned, a set-back of this study was low web-based participation rates among the parents involved in the traditional enhanced group. Although this low participation makes it difficult to determine what may have led to particular outcomes in this group, the presence of a second treatment group with higher parental involvement serves as a comparison. The participation among the digital message group may indicate that receiving messages via digital home message centers is a more convenient, cost-effective, and accessible method for involvement than the Internet, though it did not lead to improved outcomes in all areas. Furthermore, the increased exposure to vegetables among the traditional enhanced group may suggest that print-based materials are still more convenient and accessible to parents than digital technology. Other studies using digital media that have demonstrated success have used text



messaging, which may be another more feasible avenue to deliver quick, highly personalized messages<sup>20</sup>. Future studies may examine comparisons among print-based materials, materials via digital home message centers, and messages via text messaging to further isolate media that are successful and acceptable.

A strength of this study is that it features enhanced external validity, since this is an example of a parental component that can be applied to existing programs in order to enhance parental involvement. Because this study used digital home message centers as a novel technology, it serves as a pilot test that provides insight upon which researchers and program planners can build for future programs. Since research shows there is a current lack of evidence as to which components of parental involvement impact outcomes, it is important that programs continue to feature strong evaluation tools<sup>21</sup>. For example, future programs using digital-based parental components should include the evaluation of nutrition knowledge into its analyses to determine whether changes in food/drink exposure were in fact preceded by changes in knowledge. Furthermore, evaluation tools should survey about specific topic areas to isolate determining factors of child outcomes. By continuing to use evidenced-based program curricula, and related outcome measures as this study does, future programs will be better equipped to establish links between program components, parental involvement levels, and behavioral outcomes and to further improve the success of the programs.

### **Implications for Research and Practice**

Although this study shows that an added parental component produced mixed effects, it does suggest a possible link with increased parental awareness and goal setting with their children. This is an important first step to behavior change, and further studies are needed to explore this mechanism of change. Furthermore, results from the parent participation survey

indicate that digital message group parents valued the content of the health messages by viewing them frequently and by attempting to incorporate key improvements within the respective topics areas. This study adds to the literature by serving as an example of how parental health messages can be incorporated as a component of childhood obesity prevention programs to increase parental involvement in joint goal setting for improved child behaviors, though further research is needed to determine whether digital-based or print-based messages are more acceptable. By strengthening programming of the parental component and continuing to examine acceptable digital-based avenues of delivery, future implementations may be more successful in encouraging parents to support their children in improving dietary choices.

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**APPENDICES**

**Appendix A: Expanded Research Methods and Procedures**



## **Innovation**

Research centered on childhood obesity prevention points towards an integrated, multi-level approach for increased successful intervention<sup>17,18,20-26</sup>. Literature cites that it is difficult to attain and maintain parental involvement, and incorporating parents into a program or intervention requires increased planning, efforts, physical and fiscal resources, and time<sup>16,19,22,39,47</sup>. This project goal was to establish a feasible, repeatable, and effective method for encouraging parents to get involved with their children's health through the promotion of improved nutrition and physical activity behaviors.

The parental component of this study was implemented in an existing after-school nutrition and physical activity intervention program designed for fourth and fifth graders at local elementary schools in East Tennessee. Primary goals of the program included: providing all fourth and fifth grade participants the tools needed to achieve or maintain a healthy weight, improving dietary and physical activity behaviors of participating children, and involve families of participating children in learning about better eating habits and activity levels. Traditional methods of involving parents in the program included inviting parents to pre- and post-meetings and sending them a notebook of materials related to the children's program. Twice-per-week lessons for the children included an overview of MyPlate, food safety, sugar-sweetened beverages/juice/water, whole grains, vegetables, fruits, milk, lean meats/meat alternative, fats/oils, breakfast, and sweets and snacks. Goal cards were issued for selected topics, and children and parents were encouraged to fill these out together and return them for raffle tickets to use at a final carnival.

This project placed sole focus on the design, delivery, and evaluation of an innovative parental component and its effect on goal card returns and child health behavioral outcomes in

the areas of increased exposure to fruits and vegetables, whole grains, 1% and fat-free milk, and healthy breakfast and the maintenance of baseline exposure to unhealthy breakfast, sugar-sweetened beverages, and solid fats and sugars. This project tested the impact of nutrition and physical activity health messages and reminders on parental behaviors with the use of two distinct avenues of delivery. In the traditional enhanced group, health messages and a program calendar were intended to be delivered through a web-based program; however, handouts of the messages and calendar were distributed to parents because the website component was only accessed by one parent. In the digital message group, the messages and program calendar were delivered via a slideshow which was uploaded onto a digital home message center. A third group of parents from a previous program year, who received no health messages, served as a comparison group.

It was hypothesized that children in the treatment groups would have increased goal card returns; increased exposure to fruits and vegetables, whole grains, 1% and fat-free milk, and healthy breakfast; and maintained baseline exposure to unhealthy breakfast, sugar-sweetened beverages, and solid fats and sugars in comparison to the historical control group. It was believed that these outcomes would be associated with the added parental component featuring health messages that targeted parents and were personalized with the children's names. A secondary aim was to determine whether a digital-based or web-based formatting was more effective in further improving child outcomes. However, due to lack of participation in the web-based treatment group, this could not be determined as planned.

### **Approach**

The project involved the creation, delivery, and evaluation of two distinct methods of elicitation of parental involvement as part of an after-school nutrition and physical activity

program. One method consisted of use of a digital home message center, provided to parents (digital message group) to deliver health messages and reminders, while the other provided the same messages and reminders through parental access to a password-protected website (traditional enhanced group). The aim was to determine which, if any, mode of delivery was most feasible, acceptable, and effective in improving child outcomes during the after-school program.

### **Study Design and Groups**

The project involved a pre-post test, quasi-experimental design with three groups (two treatment groups and one historical control group). Behavioral outcomes of child exposure to fruits, vegetables, whole grains, 1% and fat-free milk, healthy and unhealthy breakfast, sugar-sweetened beverages, and solid fats and sugars were measured before and after the program via child surveys, and goal card count were collected throughout the program and assessed at the end of the program. Children were automatically enrolled in the program held at their respective schools, thereby eliminating the possibility of randomization to a group. Because the treatment groups were dependent upon which school the parent's child attends, parents were unable to be randomly assigned to a group.

Three study groups were involved in this project, with two serving as treatment groups and one as a historical control. Two schools in an East Tennessee school district with similar population demographics participated in the after-school program during the fall of 2011. Parents of participating children from these two schools participated in the treatment outlined in this paper; parents at school 1 were supposed to receive the health messages via the Internet, but due to lack of parental participation in the online component, ultimately paper handouts of the messages were used (traditional enhanced group). Parents at school 2 received the messages via

digital home message centers (digital message group). Data from the fall 2010 implementation of the program at school 2 without the parental messaging served as a historical control to determine if an added parental component resulted in increased outcomes beyond the traditional program.

### **Participants and Recruitment**

Flyers, teacher announcements, and co-primary investigator/assistant advertising of the program by dressing as fruit and vegetable characters were used to recruit fourth and fifth graders to participate in the after-school program at each respective school. Parents of children participating in the after-school program were automatically eligible to participate. Information concerning the study, its processes, and the benefits were communicated to parents at the school-specific parent meetings held during the first week of the program after participation consent had been obtained. Detailed instructions on how to access the parental messages using the respective delivery methods were provided via handouts. Parents in the traditional enhanced group who did not want to participate online still received paper copies of the parental materials.

### **Eligibility and Exclusion Criteria**

All parents of children who are participants in the after-school program in both schools were eligible to participate in this study.

### **Procedures**

Development of parental component: Before creating the parental health messages, the primary and co-primary investigators met with program personnel to determine what key content should be included. Furthermore, the co-primary investigator reviewed lessons used in the children's component to obtain key messages. These strategies were used to determine which key content areas should be included. Per the request of program personnel, the same

terminology that children were given in their lessons (such as “solid fats” and “sugar-sweetened beverages”) was used in the parents’ health messages.

A total of 19 health messages were created in order to encourage parents to promote specific healthy behaviors in the home. All health messages were created as pairs of electronic slides with the first slide containing the message’s key topic and the second slide providing a description, practical tips, and a self-efficacy question (i.e. “Can you serve more fruits in the home?”). In addition to messages pertaining to a specific nutrient or activity area, some messages also contained activity templates to be completed as a family. Activity examples included a goal-setting assignment and a menu planning form. Furthermore, a calendar that spanned the length of the program was developed to remind parents to complete the goal cards with their children and return them on assigned dates.

The content of the health messages covered areas of general nutrition, physical activity, and food safety and specifically focused on the topics of MyPlate/balanced meals, solid fats and sugars, sugar-sweetened beverages, whole grains, fruits and vegetables, dark green/orange vegetables, dairy, breakfast, meat/meat alternatives, unsaturated fats, food groups, physical activity, screen-related activities, food safety, family meals, role modeling, meal planning, and goal setting/monitoring.

Examples of health messages are indicated as follows:

- Sugar-sweetened beverages can cause cavities and weight gain for [Child’s Name]. I will cut down on the amount of these beverages that I have at home.
  - Sugar-sweetened beverages include sodas, energy drinks, sports drinks, fruit drinks with added sugar, and chocolate or strawberry milk. These drinks add a lot of calories and sugar to the diet without providing the nutrients your child needs.

Because these calories are “hidden” in your drink, it is sometimes hard to realize how much you are taking in. Drinks such as water and fat-free or 1% milk are a healthier choice for your child.

- Will you provide less sugar-sweetened beverages in your home?
- Dairy has the calcium and protein that is so important for Hannah’s growing bones and muscles. I will provide fat free or 1% fat dairy daily.
  - Calcium is needed for kids to grow to their normal height, build strong bones, and strengthen muscles. Your child needs 3 cups/servings of dairy a day. Good examples of calcium-containing dairy foods and drinks are:
    - Milk
    - Cheese
    - Yogurt
  - Dairy foods can be high in fat, so make sure to buy fat free or 1% fat options!
  - Will you serve your child 3 cups/servings of fat free or 1% fat dairy per day?

Existing, reputable resources were used in formulating the specific detailed content of the health messages. Specific resources included MyPlate<sup>90</sup>, HealthierUS School Challenge<sup>99</sup>, MyPyramid for Kids<sup>100</sup>, Let’s Move!<sup>101</sup>, Maryland Cooperative Extension<sup>102</sup>, Kansas State University Extension<sup>103</sup>, Alliance for a Healthier Generation<sup>104</sup>, CATCH<sup>94</sup>, Team Nutrition<sup>105</sup>, and We Can!<sup>106</sup>

After the message topics and key content were developed, the parental messages were personalized with the name of each parent’s child in an attempt to further motivate the parents to incorporate key behaviors and goals for their children’s health. Using a 30-sentence sample from the health messages, a SMOG Readability Test was conducted, which determined that the health

messages were written at a ninth grade reading level. The final messages and their key content were approved by the primary investigator and program personnel.

For participants in the traditional enhanced group, the health messages were uploaded to the web server for access. However, to compensate for low web-based participation rates in the traditional enhanced group, reminder letters with repeated access information and paper handouts of the messages were sent home with the children during the sixth week of the program. For participants in the digital message group, the health messages were loaded onto personalized digital home message centers and then sent home with the children during the third week of the program. For this project, Audiovox Homebase Digital Message Centers, which retailed for approximately \$225.00, were used for parents in the digital message group. These message centers featured erasable white boards for note-taking, calendars with memo features, and USB ports for loading of content.

Server space on Blackboard was acquired from the Office of Information Technology at the University of Tennessee, Knoxville, to house the web-based parental component that the traditional enhanced group received. Blackboard is course management software that allows for learning in a secured online environment<sup>107</sup>. Once parental consent was obtained and information was collected at the parent meeting during the first week of the program, these individuals were given access to the web-site with a username and a password generated by the Office of Information Technology. Content was protected so participants could only access information that was personalized with their own children's information.

Both treatment groups were given access to a nutrition helpline that participants could use to email the co-primary investigator questions or concerns about the program or implementing program goals, though no e-mails were received over the course of the study. This

was established to extend support and feedback to participants regarding any problems or questions they may have had, as well as to guide them in making healthy choices in the home. For the digital message group, a slide was included on the message center that contained the e-mail address for the helpline. Likewise, the traditional enhanced group had access to an e-mail address hotlink on the home page of the website.

Program: The program spanned 10 weeks with eight weeks of nutrition and physical activity programming held for participating children two days per week after school (survey collection occurred during the first and tenth weeks). Pre- and post-parent meetings were held in conjunction with the first and last days of the program, and these meetings were used to administer surveys to parents and children, perform child fitness assessments, and collect feedback from both parents and children. At the first parent meeting, parents at their respective schools were given a brief introduction to the parent components with parents in the traditional enhanced group receiving a brief demonstration on how to access the online messages. After usernames and passwords were acquired through the Blackboard website during the third week of the program, letters featuring a brief tutorial on how to access the Blackboard website and its content were sent home with children in the traditional enhanced group. Likewise, during the same week information letters on how to use the digital home message centers along with the message centers were sent home with children in the digital message group.

Parents in both treatment groups had access to all health messages throughout the duration of the program. The e-mail helpline was monitored throughout the 10 weeks of the program for any questions that were e-mailed to the co-primary investigator. The co-primary investigator and trained assistants were present at each session to distribute goal cards and to



collect returned goal cards. After the program, digital home message centers were collected from the parents in the digital message group to be re-used in future programs.

Goal cards mirrored topics covered in the children's programming and additional parental component and included the areas of sugar-sweetened beverages, whole grains, fruits and vegetables, dairy, meats and meat alternatives, breakfast, fats and oils, solid fats and sugars, and parent participation in child health goals. Goal cards were sent home with the children in all three groups as each accompanying topic was covered in the after-school classes, and children were asked to complete the cards with their parents and return them in exchange for raffle tickets to use at the end-of-the-program carnival.

Data collection: Behavioral measures were selected from self-reported, pre- and post-surveys already used by the after-school program. These surveys were created by a dietitian associated with an East Tennessee school district and were designed and modified based upon a combination of the SPAN (School Physical Activity and Nutrition) Survey, a validated tool used to determine multiple factors for school-aged children, and a tool used in a fruit and vegetable garden pilot project<sup>108,109</sup>. Each survey collected demographic, nutrition knowledge, and exposure/intake/home food environment information.

Child surveys collected "ever eaten/drunk" scores for every food category. The "ever eaten/drunk" indicator collected information based on whether the child had or had not ever tasted an item. Because surveys used for the historical control group did not collect "frequency" data for all food categories, "ever eaten/drunk" scores were used in order to obtain child food/drink exposure information for all three groups. Demographic information in parent pre-surveys was collected at the first parent meetings, which were held during the first week of the program. Information collected included parental gender, age, and race/ethnicity; and child age,

grade, and race/ethnicity. Similarly, the children's pre-surveys were collected during the first session of the program at each school. Post-surveys were collected from the parents at the second parent meetings that occurred at the end of the program at each school, though this information was not used in this study. Additionally, post-surveys were collected from the children during the last session of the program. Goal cards were collected from the children by the co-primary investigator and research assistants throughout the duration of the program. To encourage return of goal cards and completion of other program activities, children were given tickets for post-program carnival activities.

An additional parent participation survey, which was created by modifying an Induction Training Evaluation used at the University of Tennessee's College of Social Work, was administered and collected at the post-parent meeting for the digital message group to assess the value of each individual health message. The survey assessed whether parents were or were not familiar with each particular health message before the program ("familiar" variable), how often they referred to the message per week ("refer" variable), how often per week they attempted to make improvements in that area ("effort" variable), and how important that area was to their families ("importance" variable). For the "refer" and "effort" indicators, responses were measured on a five-point Likert Scale (rarely, once a week, two-three times a week, three-five times a week, and daily). Similarly, for the "importance" indicator, responses were measured on a five-point Likert scale (unimportant, not very important, somewhat important, important, and very important).

## **Measures**

Outcome measurements included counts of completed goal card returned and changes in self-reported child exposure to fruits, vegetables, whole grains, 1% milk, fat-free milk, healthy

and unhealthy breakfast items, sugar-sweetened beverages, and solid fats and sugars. Because surveys used for the historical control group did not collect “frequency” data for all food categories, “ever eaten/drunk” scores were used in order to obtain exposure information for all three groups. Data from survey questions assessing if food/drink items were “ever eaten/drunk” were collected for each food item and used to calculate “ever eaten/drunk” totals for each food category (fruits, vegetables, whole grains, 1% and fat-free milk, healthy and “unhealthy” breakfast items, sugar-sweetened beverages, and solid fats and sugars). Table 5 in Appendix B describes how dependent measures were scored, while Table 6 outlines the maximum score that could be achieved per outcome.

### **Statistical Analyses**

When preparing survey databases for statistical analysis, information was double-entered and validated for accuracy. Children who provided information for four or more categories of food/drinks were included in the analysis. Therefore, children who answered three or fewer sections on both pre- and post-surveys were removed from the database along with the corresponding parent survey information. Furthermore, if children were not available to fill out a complete pre- or post-survey, those cases were removed from this study’s analysis. Because the historical control group and digital message group were both located at the same school, there was the possibility that children in the digital message group had also participated the year before as part of the historical control group. To account for any differences in behaviors due to familiarity with program content, these children and corresponding parents were removed from the study’s analyses.

Cross-tabulations and chi-square tests were conducted on parent/child demographic data as indicated on parent pre-surveys in order to collect descriptive data for the samples as well as

to determine if there were significant differences among the three groups. These demographic characteristics included factors such as parental gender and race/ethnicity as well as child grade level and race/ethnicity. If differences in pre-post child food/drink exposure differed by treatment group, Spearman's correlate tests were conducted to determine whether parent and/or child race/ethnicity was correlated with child food/drink exposure outcomes. If any significant correlations were found for any indicated variable, it was included as a covariate variable in statistical analysis. Although child race/ethnicity significantly differed by group, there were no significant correlations between race/ethnicity and child food/drink exposure, so this demographic variable was not included as a covariate.

For major statistical analyses, the independent variable was the historical control or treatment group, which differed by mode of parental component delivery. Dependent variables included child behavioral measures of goal card counts and exposure to major food categories of sugar-sweetened beverages, whole grains, fruits, vegetables, 1% and fat-free milk, healthy breakfast, unhealthy breakfast, and solid fats and sugars. Self-reported child exposure per food category was indicated by the child pre- and post-surveys. Results were statistically analyzed using repeated measure ANOVAs with a mixed model approach to assess changes over time and by group. Non-parametric ANOVAs were conducted for the 1% and fat-free milk variables, since these contained bi-variate data (i.e. the child either has or has not drank milk).

In order to test the assumptions of the repeated measure ANOVA tests, the residuals of the pre- and post-exposure variables from the child surveys were first tested to determine if the data were normally distributed. Variables were considered to contain skewed data if the Shapiro-Wilk statistic was less than 0.9. Variance and covariance were also tested to determine homogeneity. If differences in variance between groups was greater than fivefold, the variables

were considered to be heterogeneous. For variables that were normally distributed and had homogeneity of variance and covariance, repeated measure ANOVAs using a mixed model approach were conducted to assess within-group differences (time), between-group differences (group), and factors of interaction between group and time. For variables that violated assumptions of normality and homogeneity of variance and covariance, data were transformed to conduct either ranked or logged tests. If significant differences by group were found, Tukey's post hoc tests were then conducted to determine between which two or three groups these differences occurred. Furthermore, pre- and post-means in food/drink exposure by group were measured and reported for each variable.

In order to determine whether mode of parental delivery impacted the number of goal card returns, results were analyzed using a Mann-Whitney test, a nonparametric test used to account for a skewed population. Data were analyzed as percent of total possible goal cards returned, since number of possible returns differed between year 1 and year 2 of program implementation. Bonferonni tests were then used to determine for which groups the differences were significant.

All statistical tests were conducted with SAS 9.3 for Windows (SAS Institute Inc., Cary, NC) and SPSS 20.0 for Windows (IBM Corporation, Somers, NY). Because multiple repeated measure ANOVAs were conducted, the risk for Type I error was increased. To account for this, the level of significance was set at an alpha level of 0.006 for the repeated measure ANOVA tests. For all other tests, the significance was set at an alpha level of 0.05. After this study's completion, effect size was reported for each significant finding related to child food/drink exposure outcomes. Effect sizes were obtained from partial eta-squared scores and were calculated using G\*Power<sup>110</sup>.

## **Effect Size and Power**

Effect sizes were calculated using partial eta-squared scores to accommodate for three study groups and the effect on child food/drink exposure outcome. Overall, this study had a medium effect size between study group and child food/drink exposure outcome. The effect sizes between study group and significant child exposure outcomes varied by food category, with the effect size between study group and sugar-sweetened beverage exposure being 0.545 and the effect sizes between study group and vegetable exposure/unhealthy breakfast exposure being 0.095 and 0.101, respectively. While the effect sizes between study group and vegetable/unhealthy breakfast exposure were small, the effect size between study group and sugar-sweetened beverage exposure was large. When using the large effect size, the power of this study is 1.00, though it is lower at 0.09 and 0.10 when using the effect sizes between study group and vegetable exposure/unhealthy breakfast exposure, respectively.

## **Impact**

The proposed project sought to increase parental engagement in an existing after-school nutrition and physical activity program in order to create positive changes in child exposure to targeted foods and increases in goal card returns. It was proposed that encouraging parents to improve home food availability of healthful foods and to be involved with children's health goals would improve children's exposure to healthful foods and maintain baseline exposure to less healthful foods. If these nutrition outcomes improved in either of the treatment groups in comparison to historical control data, the results would help support the value of providing parental health messages to encourage and remind parents to assist their children in improving dietary choices. Furthermore, group differences between the traditional enhanced group and the

digital message group would help determine which mode of delivery is more feasible and effective.

Any successful outcomes observed in the treatment groups would underline the importance of engaging parents with health messages to improve the home food environment and to support children in making healthy food and activity choices. Future programs could benefit from methodologies that incorporate parental involvement via nutrition and physical activity messages that target parents and are personalized with the children's names.

### Timeline

#### Tasks

Tasks	A	B	C	D	E	F	G	H	I
1) Attain web server space and create nutrition help-line	X								
2) Develop and load/upload health messages, activities, calendar of reminders, and instructional information		X							
3) Advertise and promote after-school program at schools			X						
4) Introduce parent components at parent meetings, collect pre-surveys from children and parents				X					
5) Pass out digital picture frames for the digital message group					X				
6) Answer questions from helpline e-mail and collect goal cards						X			
7) Collect post-surveys from children and parents							X		
8) Data entry and statistical analyses								X	
9) Completion of manuscript and thesis									X

A – Month of April 2011

B – Months of July – August 2011

C – Week of August 15, 2011

D – Week of September 12, 2011

E – Week of September 26, 2011

F – Months of September – November 2011

G – Week of November 14, 2011

H – Months of January – December 2012

I – Months of January – April 2013

### Risk and Hazard Management

The after-school program was already established before the planning and implementation of this study. Because this is the first implementation of the parental component, it will be important to maintain close communication with program educators to obtain feedback for future repeated implementations of the parental component. The methodology behind this

project, including the component created and the material covered, posed no real hazards for the parents involved. The website housing the parental messages for the traditional enhanced group was encrypted and password-protected so only approved users could access the server.

Nevertheless, parents in this group were made well aware of privacy issues associated with online information through the use of an opening instructional session.

Pre- and post-surveys were kept in a secured research lab and entered into a database on password protected computers and then saved on a secure password protected server. Only the primary investigatory, co-primary investigator, and researchers involved in this project and approved to work with the after-school program had access to this information. Children and their parents were identified by a number on pre- and post-surveys, in addition to any other materials kept. An identification sheet was kept in a separate location to maintain separation of identification from program data.

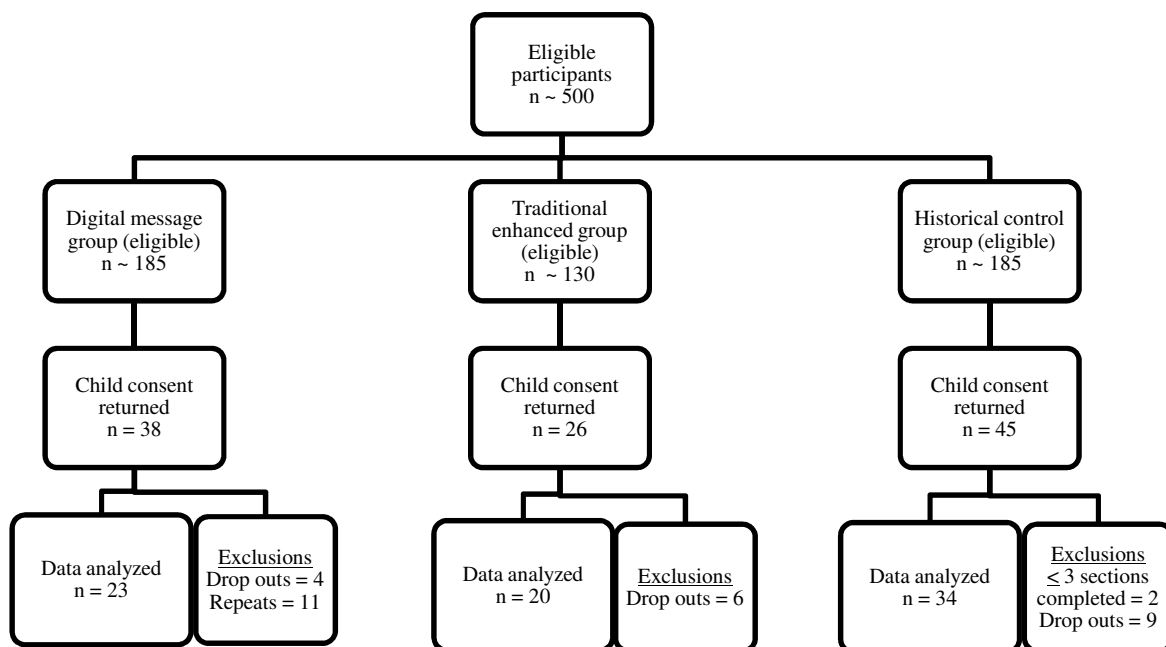
### **Preliminary Studies**

At the time of the implementation of this parental component, the after-school nutrition and physical activity program was beginning its fourth implementation. The primary investigator and her research assistants had been continuously involved with the program via program facilitation and evaluation, data entry and management, and analysis of results. Data management for this particular program is well-established. Results from previous sessions of the program indicate its success in changing some health behavioral outcomes as well as physiological outcomes<sup>97</sup>. Results from the 2010 implementation of the after-school program demonstrated significant improvements in the following areas: time of mile run (35/39 children), number of push-ups (28/39 children), decrease in BMI (-2.48%), decrease in home availability of solid fats and sugars, increase in knowledge of MyPyramid, increase in reading of food labels,



and a strong correlation between parent and child surveys on home food availability<sup>97</sup>. These results illustrate the impact of the after-school program and attest to the success of its design.

**Appendix B: Figure and Tables**



**Figure 1: Flow Diagram of Parent Eligibility and Participation Details by Treatment**

**Group**

**Table 1: Child Age/Grade and Parent-Child Race/Ethnicity Data at Baseline by Group**

Characteristics	Digital Message Group		Traditional Enhanced Group		Historical Control Group	
	M	SD	M	SD	M	SD
Child age in years (n = 63)	9.79	0.63	10.07	0.43	9.57	1.75
	N	%	N	%	N	%
Parent gender (n = 73)						
Male	4	17.39	2	10.00	5	16.67
Female	15	65.22	14	70.00	24	80.00
Not Indicated	4	17.39	4	20.00	1	3.33
Child grade (n = 73)						
Fourth	15	65.22	8	40.00	14	46.67
Fifth	4	17.39	8	40.00	15	50.00
Not indicated	4	17.39	4	20.00	1	3.33
Parent race/ethnicity (n = 73)						
American Indian	0	0.00	1	5.00	0	0.00
Black	0	0.00	4	20.00	2	6.67
White	15	65.22	10	50.00	24	80.00
Hispanic	4	17.39	1	5.00	3	10.00
Not indicated	4	17.39	4	20.00	1	3.33
Child race/ethnicity (n = 73)*						
American Indian	0	0.00	1	5.00	0	0.00
Black	0	0.00	6	30.00	2	6.67
White	15	65.22	8	40.00	24	80.00
Hispanic	4	17.39	1	5.00	3	10.00
Not indicated	4	17.39	4	20.00	1	3.33

\*p &lt; 0.05.

**Table 2: Child Pre-Post Survey Mixed Analysis of Variances by Time, Group, and Group X Time (n = 77)**

<b>Variables</b>	<b>Time</b>	<b>Group</b>	<b>Group X Time</b>
Sugar-sweetened beverages	1.95 (1, 67.4)	7.80 (2, 71.7)*	3.25 (2, 67.5)
Whole grains	0.78 (1, 144.0)	1.37 (2, 144.0)	0.46 (2, 144.0)
Fruits	0.05 (2, 147.0)	0.05 (2, 147.0)	0.35 (2, 147.0)
Vegetables	0.00 (1, 147.0)	5.67 (2, 147.0)*	0.05 (2, 147.0)
1% milk	0.00 (1, 143.0)	1.97 (2, 143.0)	0.62 (2, 143.0)
Fat-free milk	0.00 (1, 71.1)	4.83 (2, 72.2)	0.35 (2, 71.3)
Healthy breakfast	0.16 (1, 72.0)	0.16 (2, 74.5)	0.79 (2, 71.2)
Unhealthy breakfast	0.01 (1, 140.0)	8.66 (2, 140.0)*	2.78 (2, 140.0)
Solid fats and sugars	2.88 (1, 144.0)	3.23 (2, 144.0)	2.49 (2, 144.0)

\* p < 0.006.

**Table 3: Pre- and Post-Mean Differences in Child Food/Drink Exposure by Group**

Variables	Digital Message Group Mean (SD) n = 23		Traditional Enhanced Group Mean (SD) n = 20		Historical Control Group Mean (SD) n = 34	
	Pre	Post	Pre	Post	Pre	Post
Sugar-sweetened beverages	4.30 (.82)	4.39 (.72)	4.35 (.75)	4.20 (1.06)	3.07 (1.27)	3.74 (1.31)
Whole grains	7.04 (2.93)	6.91 (3.19)	6.40 (2.54)	6.85 (3.07)	5.67 (2.44)	6.56 (2.44)
Fruits	14.35 (4.15)	13.26 (3.86)	13.85 (4.94)	14.25 (4.60)	13.91 (6.06)	14.32 (5.71)
Vegetables	10.83 (4.77)	10.78 (5.61)	11.50 (3.80)	11.80 (4.18)	8.94 (4.34)	8.68 (4.20)
1% milk	0.65 (.49)	0.52 (.51)	0.45 (.51)	0.55 (.51)	0.38 (.49)	0.41 (.50)
Fat-free milk	0.83 (.39)	0.74 (.45)	0.45 (.51)	0.50 (.51)	0.48 (.51)	0.53 (.51)
Healthy breakfast	4.00 (1.09)	3.96 (.93)	3.90 (1.02)	3.80 (1.44)	3.69 (1.44)	4.00 (1.21)
Unhealthy breakfast	10.09 (2.15)	8.52 (3.13)	9.15(2.46)	9.10 (2.94)	6.23 (3.66)	7.56 (3.84)
Solid fats and sugars	5.77 (.53)	5.70 (.76)	5.60 (.75)	4.95 (2.04)	4.61 (1.61)	4.71 (1.66)

**Table 4: Parent Participation Survey Results for Digital Message Group (n = 25)**

Survey Question	Were you familiar with the content of this health message before the program?			How often did you refer to this health message?						
	Category	No	Yes	No answer	Rarely	Once a week	2-3 times a week	3-5 times a week	Daily	No answer
<b>MyPlate</b>										
%	48	44	8	24	20	20	12	12	12	12
n	12	11	2	6	5	5	3	3	3	3
<b>Sugar-sweetened beverages</b>										
%	12	80	8	16	24	20	4	28	8	8
n	3	20	2	4	6	5	1	7	2	2
<b>Whole grains</b>										
%	0	88	12	12	28	16	16	24	4	4
n	0	22	3	3	7	4	4	6	1	1
<b>Fruits and vegetables</b>										
%	0	96	4	16	16	20	12	36	0	0
n	0	24	1	4	4	5	3	9	0	0
<b>Dark green and orange vegetables</b>										
%	4	92	4	20	20	20	20	20	0	0
n	1	23	1	5	5	5	5	5	0	0
<b>Dairy</b>										
%	0	88	12	12	24	4	20	32	8	8
n	0	22	3	3	6	1	5	8	2	2
<b>Breakfast</b>										
%	0	96	4	20	16	0	12	52	0	0
n	0	24	1	5	4	0	3	13	0	0
<b>Meats/meat alternatives</b>										
%	8	76	16	12	24	8	20	24	12	12
n	2	19	4	3	6	2	5	6	3	3

Table 4 (continued)

Survey Question	Were you familiar with the content of this health message before the program?			How often did you refer to this health message?						
	Category	No	Yes	No answer	Rarely	Once a week	2-3 times a week	3-5 times a week	Daily	No answer
<b>Unsaturated fats</b>										
%	20	68	12	12	20	24	4	24	16	
n	5	17	3	3	5	6	1	6	4	
<b>Food groups</b>										
%	12	80	8	16	20	28	8	24	4	
n	3	20	2	4	5	7	2	6	1	
<b>Screen activities</b>										
%	32	48	20	20	16	20	12	12	20	
n	8	12	5	5	4	5	3	3	5	
<b>Food safety</b>										
%	12	72	16	16	16	12	8	36	12	
n	3	18	4	4	4	3	2	9	3	
<b>Family meals</b>										
%	0	88	12	16	12	12	8	40	12	
n	0	22	3	4	3	3	2	10	3	
<b>Role modeling</b>										
%	8	76	16	16	16	12	12	28	16	
n	2	19	4	4	4	3	3	7	4	
<b>Meal planning</b>										
%	4	84	12	20	20	20	12	20	8	
n	1	21	3	5	5	5	3	5	2	
<b>Goal setting/ monitoring</b>										
%	12	72	16	24	16	8	28	12	12	
n	3	18	4	6	4	2	7	3	3	



Table 4 (continued)

Survey Question	Because of the message, how often did you work towards making improvements in this area?						How important is this area to you and your family?					
	Category	Rarely	Once a week	2-3 times a week	3-5 times a week	Daily	No answer	Unimportant	Not very important	Somewhat important	Important	Very important
<b>MyPlate</b>												
%	20	16	8	20	24	12	4	0	12	24	44	16
n	5	4	2	5	6	3	1	0	3	6	11	4
<b>Sugar-sweetened beverages</b>												
%	12	12	20	8	40	8	4	4	4	40	40	8
n	3	3	5	2	10	2	1	1	1	10	10	2
<b>Whole grains</b>												
%	8	24	16	20	28	4	4	0	4	40	48	4
n	2	6	4	5	7	1	1	0	1	10	12	1
<b>Fruits and vegetables</b>												
%	8	12	24	20	36	0	4	0	0	32	60	4
n	2	3	6	5	9	0	1	0	0	8	15	1
<b>Dark green and orange vegetables</b>												
%	8	16	24	24	28	0	4	0	4	36	52	4
n	2	4	6	6	7	0	1	0	1	9	13	1
<b>Dairy</b>												
%	8	12	12	32	28	8	4	0	0	44	40	12
n	2	3	3	8	7	2	1	0	0	11	10	3
<b>Breakfast</b>												
%	12	8	16	16	48	0	4	4	4	16	68	4
n	3	2	4	4	12	0	1	1	1	4	17	1
<b>Meats/meat alternatives</b>												
%	12	8	36	8	24	12	4	0	16	32	36	12
n	3	2	9	2	6	3	1	0	4	8	9	3

Table 4 (continued)

Survey Question	Because of the message, how often did you work towards making improvements in this area?						How important is this area to you and your family?						
	Category	Rarely	Once a week	2-3 times a week	3-5 times a week	Daily	No answer	Unimportant	Not very important	Somewhat important	Important	Very important	No answer
<b>Unsaturated fats</b>													
%	12	4	20	12	28	24	4	0	8	20	52	16	
n	3	1	5	3	7	6	1	0	2	5	13	4	
<b>Food groups</b>													
%	12	8	20	12	36	12	4	0	4	32	56	4	
n	3	2	5	3	9	3	1	0	1	8	14	1	
<b>Family meals</b>													
%	8	8	28	20	28	8	4	0	4	28	52	12	
n	2	2	7	5	7	2	1	0	1	7	13	3	
<b>Screen activities</b>													
%	12	12	16	20	20	20	4	4	28	24	16	24	
n	3	3	4	5	5	5	1	1	7	6	4	6	
<b>Food safety</b>													
%	8	16	16	12	36	12	4	0	4	28	52	12	
n	2	4	4	3	9	3	1	0	1	7	13	3	
<b>Role modeling</b>													
%	8	8	12	12	36	24	4	0	16	24	44	12	
n	2	2	3	3	9	6	1	0	4	6	11	3	
<b>Meal planning</b>													
%	8	16	12	16	40	8	4	0	8	28	48	12	
n	2	4	3	4	10	2	1	0	2	7	12	3	
<b>Goal setting/monitoring</b>													
%	8	16	8	24	32	12	4	0	4	44	36	12	
n	2	4	2	6	8	3	1	0	1	11	9	3	

**Table 5: Scoring of Dependent Measures**

	<b>Child Food/Drink Exposure</b>	<b>Goal Card Returns</b>
Score assignment	<p>Totals for each food category</p> <p>“Have you ever eaten this food/had this beverage/had this milk product/had this for breakfast?”</p> <p>No = 0</p> <p>Yes = 1</p>	<p>Frequency counts of returns (used to calculate percent of total possible returns)</p>

**Table 6: Maximum Scores of Dependent Measures**

<b>Dependent Measure</b>	<b>Maximum Score</b>
Child food/drink exposure	
Fruits	22
Vegetables	22
Whole grains	13
1% milk	1
Fat-free milk	1
Healthy breakfast items	5
Unhealthy breakfast items	11
Sugar-sweetened beverages	5
Solid fats and sugars	6
Goal cards	16 (historical control), 21 (treatment groups)

## VITA

Lindsay Schloesser Miesel was born and raised near New Orleans, Louisiana, where she first developed a passion for culture, community, diversity, and a love for food. She then moved to the mountains of East Tennessee to pursue a Bachelor of Science in Foods, Nutrition, and Dietetics at Carson-Newman University in Jefferson City, which she completed in 2009. Through this experience, Lindsay gained a further appreciation for the role of family and community in promoting individual nutrition behaviors, which motivated her to continue her graduate education at the University of Tennessee in Knoxville. To increase her knowledge, skills, and experience in public health nutrition, Lindsay began to pursue a Master of Science degree in Nutrition with a concentration in Public Health Nutrition and a Master of Public Health degree with a concentration in Community Health Education. While at the University of Tennessee, she developed leadership skills as a funded trainee of the Maternal and Child Health Nutrition Leadership Education and Training Program. Additionally, through her thesis and lab work, Lindsay discovered a strong interest in school approaches to combat and prevent childhood obesity. Upon completing her dietetic internship and receiving her dual degrees in 2013, Lindsay hopes to work as a public health nutritionist in a school-based or community arena.