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Use of Stimulus Management Techniques to Reduce Sedentary Behaviors of Overweight Children

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USE OF STIMULUS MANAGEMENT TECHNIQUES TO REDUCE SEDENTARY BEHAVIORS OF OVERWEIGHT CHILDREN

by

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ABSTRACT

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An epidemic proportion of children and adolescents is currently overweight or at-risk of being overweight. This is associated with many negative outcomes, including short-term and long-term health risks, as well as increased psychosocial problems. The etiology of this problem is likely complex, though environmental factors (i.e., factors related to decreased physical activity and increased consumption of calories) have been implicated in previous research. Providing effective, easy-to-implement treatment strategies for children who are overweight or at-risk of being overweight could be helpful to reverse the current epidemic and to decrease current health care costs associated with pediatric obesity. The overall purpose of this study was to determine if use of stimulus management techniques were effective in reducing daily screen time behaviors of children who were overweight or at-risk of overweight (BMI percentile $\geq$ 85th perecentile). In addition to this primary research objective, secondary objectives addressed the following: (a) whether decreases in screen time were related to increases in physical activity and decreases in unhealthy snacking behaviors, (b) determining if decreases in screen time led to clinically meaningful improvements in BMI percentile, and (c) determining prospectively if treatment adherence was related to clinically meaningful improvements in BMI percentile. Results indicated that stimulus management techniques were helpful in reducing screen time behaviors and these changes were related to increases in physical activity. Screen time reductions were not associated with clinically meaningful changes in BMI percentile, nor was treatment adherence.

(198 pages)

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To my friends I also want to say a very big thank you. Being in “the program” the past six years has brought me such a wonderful array of classmates, many of whom are now some of my best friends. We have had some very memorable times--whether they were at any of the various parties over the last few years, Vegas, the White Owl, karaoke at the Eagles, laughing at one of Mark’s alter egos, or just sitting in class writing notes. We have had some very memorable times indeed. This year will bring significant changes as many of “the gang” will be heading their separate ways, while Stephen and I will remain firmly planted in Logan. My heart hurts to know that there will be many people I will no longer hang out with on a regular basis, but I am comforted by the knowledge that many of the friendships I have formed will truly be lifelong friendships.

As I get older I marvel at the fact that some of my best friends outside of “the program” have been in my life for well over 10 years and I know that they will always be a part of my life. Their influence on me has been so positive and I am sure that I owe many of them a significant chunk of change for therapy services rendered over the past six years. As Stephen and I move forward to the next exciting chapter of our lives it brings a smile to my face to know that our son will have such an amazing network of “aunties” and “uncles” to turn to for life advice throughout the years.

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CHAPTER I

INTRODUCTION

Childhood obesity has reached epidemic status within the United States (Council on Sports Medicine and Fitness and Council on School Health, 2006), with approximately 9 million children over the age of 6 currently considered obese (Krishnamoorthy, Hart, & Jelalian, 2006). Additionally, there is evidence that childhood obesity may be becoming a worldwide epidemic, as rates are rising in other developed countries (Anderson & Butcher, 2006; Swinburn, Caterson, Seidell, & James, 2004). Furthermore, according to a recent United States report (Ogden et al., 2006), the number of overweight children and adolescents rose significantly from 1999 to 2004. This suggests that the epidemic is likely to continue until effective prevention and intervention strategies are created and disseminated to all children.

This epidemic is particularly concerning given the serious short-term and long-term health risks associated with obesity, which include: Type II diabetes mellitus, insulin resistance, cardiovascular problems, gallbladder disease, and obstructive sleep apnea (Daniels, 2006; Krishnamoorthy et al., 2006; Swinburn et al., 2004; Zametkin, Zoon, Klein, & Munson, 2004). As a result of these health risks, there are extensive medical costs associated with pediatric obesity. Estimates suggest that the hospital-related costs of pediatric obesity have tripled in the United States over the past 20 years, rising to $127 million (Zametkin et al.). Additionally, being an overweight child significantly increases the likelihood of being an overweight adult. Extensive data have shown that obesity in adulthood is associated with increased risk of morbidity and mortality. This is particularly concerning given that adult obesity is often difficult to treat (Krishnamoorthy et al.). Furthermore, recent findings have led to the astounding possibility that the current generation of children could face a shorter life span than their parents, likely a result of obesity-related diseases and health problems. This would represent the first reversal in the trend of lifespan during modern history (Daniels).

In addition to health risks, overweight children are also at higher risk for psychosocial problems. Lower self-esteem is the most commonly implicated psychological problem, though some researchers have suggested that lower self-esteem in overweight children is better accounted for by poor body image (Zametkin et al., 2004). In addition to low self-esteem and poor body image, childhood obesity has been associated with social problems, and various psychological disorders (e.g., depression, anxiety, binge eating, and somatoform disorders; Krishnamoorthy et al., 2006; Zametkin et al). However, there is evidence that the psychological problems of overweight children may be better predicted by parents' psychological problems, than by the child's weight status (Epstein, Klein, &Wisniewski, 1994; Zeller, Saelens, Roehrig, Kirk, & Daniels, 2004).

While there is evidence that genetic factors substantially contribute to children being overweight, there is increasing evidence that environmental factors have played the greatest role in the dramatic rise in the prevalence of pediatric obesity over the past two decades (Anderson & Butcher, 2006; Barness, Opitz, & Gilbert-Barness, 2007; Harper, 2006; Krishnamoorthy et al., 2006; Zametkin et al., 2004). In particular, various factors specific to the changing United States culture have been implicated as etiological factors in the pediatric obesity epidemic. These factors can be placed into two categories: those related to decreases in physical activity (e.g., increased preference for sedentary activities; less access to safe environments in which children can engage in active play; communities not planned for ample walking access; decreased time spent in physical education at school; Council on Sports Medicine and Fitness and Council on School Health, 2006; Harper; Krishnamoorthy et al.), and those related to changes in diet (e.g., increased consumption of more energy-dense foods; increased snacking; increase in families eating foods outside the home; Council on Sports Medicine and Fitness and Counsel on School Health; Krishnamoorthy et al.).

Of the aforementioned possible etiological factors, television watching has increasingly garnered national and international research attention, as it represents a potentially easy-to-modify causal factor in children's weight status (e.g., Faith et al., 2001; Hancox, Milne, & Poulton, 2004; Lowry, Wechsler, Galuska, Fulton, & Kann, 2002; Salmon, Campbell, & Crawford, 2006; Vereecken, Todd, Roberts, Mulvihill, & Maes, 2006). Based on recommendations from the American Academy of Pediatrics to limit children's total media time (including TV watching time) to less than two hours each day, researchers have attempted to establish a link between children who watch two hours or more of TV per day and overweight status. Excessive TV watching is often cited as a major contributor to children being overweight or obese (e.g., Krishnamoorthy et al., 2006; Zametkin et al., 2004), and there are data that support this association, though there has been debate about the clinical meaningfulness of the association (e.g., Berkey, Rockett, Gillman, & Colditz, 2003; Hancox & Poulton, 2006; Marshall, Biddle, Gorely, Cameron, & Murden, 2004). Additionally, it was noted by Marshall and colleagues, that there is a lack of randomly controlled trials to evaluate the effects of TV on children's weight, with most previous research being correlational in design.

Clearly, given the pediatric obesity epidemic, and the current emphasis on environmental etiological factors that can be manipulated, there is a need for effective interventions to help reduce the prevalence of pediatric obesity. Two important reviews (Epstein, Myers, Raynor, & Saelens 1998; Jelalian & Saelens, 1999) have examined recent intervention studies conducted, successful intervention techniques, and areas for future research. According to Epstein and colleagues, it is necessary to integrate important treatment components, including dietary, physical activity, and behavior change strategies. As noted by Jelalian and Saelens, according to the Chambless criteria for determining empirically supported treatments, a multicomponential behavioral treatment meets the "well-established" treatment guidelines; however, Jelalian and Saelens also indicated that it would be useful for future research to attempt to identify the specific behaviorally based treatment components that are most useful in treating pediatric obesity. Despite this suggestion, it appears to be a continued trend across many of the recent pediatric obesity intervention studies to continue to offer multicomponential, comprehensive, behaviorally based treatment packages for pediatric obesity. While this is a logical approach given the multiple etiological factors that contribute to pediatric obesity, it makes drawing conclusions about specific treatment components difficult, and it may not be a practical solution for all children in need of immediate intervention services, due to the costs of offering such services. Additionally, the intensity and complexity of the interventions may make it difficult for participants to consistently implement all of the intervention components. For example, multicomponential treatments require simultaneous behavior changes in multiple areas (e.g., diet; physical activity), and often require sophisticated tracking of these behavior changes over a lengthy period of time. While the comprehensive nature of these interventions is ideal, it may not be realistic to believe that all families will be able to consistently implement and persist with numerous behavior changes.

Consistent implementation of intervention components (i.e., treatment adherence) is necessary for treatment success when intervening with pediatric obesity (Denzer, Reithofer, Wabitsch, & Widhalm, 2004; Wrotniak, Epstein, Paluch, & Roemmich, 2005). Additionally, it has been suggested by leading researchers in the area of pediatric obesity that reducing the work parents need to do in order to implement intervention strategies may be beneficial to treatment outcomes (Epstein, Paluch, Kilanowski, & Raynor, 2004). As suggested by Epstein and colleagues and by Faith and colleagues (2001), modifying the child's environment through stimulus management techniques in order to impact a child's activity level (e.g., decreasing sedentary behaviors and/or increasing participation in physical activities) could be an easy-to-implement intervention strategy. While stimulus management techniques often comprise one of the many components of pediatric obesity interventions (Epstein et al., 1998; Jelalian & Saelens, 1999), only one known study (Epstein et al., 2004) investigated the effects of stimulus management in comparison to another treatment component, as part of a multicomponential treatment package for a sample of overweight children. This study found that when implemented as part of package, stimulus management techniques were as effective as positive reinforcement

techniques in reducing sedentary behaviors, with the suggestion that stimulus management techniques may be easier for families to implement.

In summary, pediatric obesity prevalence rates have continued to drastically rise over the past two decades, resulting in a current epidemic in the United States. While the etiology of obesity in children is multiply determined, environmental factors are consistently cited as the major contributors to the sharp rise in prevalence rates. In the context of these environmental factors, behavioral interventions often simultaneously focus on several possible etiological factors (e.g., diet, physical activity, restructuring the child's environment), which is supported by current recommendations for empirically supported treatments. However, given the complexity of some multicomponential interventions, and the need to provide parents and children with interventions that they can easily adhere to, it would be useful for future studies to test the effectiveness of easy-to-implement treatment components.

The purpose of this study was to evaluate the effectiveness of stimulus management techniques to reduce sedentary behaviors (i.e., screen time) in a sample of children who were overweight, or at risk of being overweight, as part of a multiple baseline single subject design. Stimulus management is one of the typical components of multicomponential intervention studies, but it has not received sole research attention in any known study of overweight children. Stimulus management techniques have the potential to be easy-to-implement techniques, which will likely increase treatment adherence. In this study parents were targeted to implement the stimulus management techniques within the home environment, as parents have been found to play an important role in the intervention process and in treatment outcomes (Golan & Crow, 2004; Golan, Fainaru, & Weizman, 1998; Jelalian & Saelens, 1999; Wrotniak, Epstein, Paluch, & Roemmich, 2004; Young, Northern, Lister, Drummond, & O'Brien, 2007).

CHAPTER II

REVIEW OF LITERATURE

Defining Overweight and Obesity in Children

The terms "overweight" and "obese" are often employed in research studies with children, and it appears that most researchers favor the term obesity. However, guidelines for defining weight criteria vary based on the study. Additionally, the criteria used by researchers often differ from national criteria for defining overweight and obesity. The Centers for Disease Control and Prevention (CDC) provides guidelines for defining overweight and obesity in both children and adults (Ogden, 2004). In both age groups, the Body Mass Index (BMI) is used as a proxy estimate of body fatness and is calculated based on height and weight. Adults are considered overweight if they have BMI values of 25.0 to 29.9, and are considered obese if they have BMI values of 30 or higher. In children and adolescents, there is not a category assigned for being obese. Instead, there are categories for being "at risk of overweight" and for being "overweight" (Ogden). An additional difference from the categorization of adults is that the BMI values for children and adolescents are plotted on CDC BMI-for-age growth charts, which are different for boys and girls. Therefore, for children and adolescents the influence of age and sex are taken into consideration, resulting in a BMI percentile score. Based on the CDC guidelines, a child is considered at risk of being overweight if he or she has a BMI percentile score between the 85^{th} to the 95^{th} percentile, while a child with a BMI percentile score equal to, or greater than the 95^{th} percentile is considered overweight

(Ogden).

The CDC BMI-for-age growth charts were recently updated in 2000 (Kuczmarski et al., 2002). These charts were derived from data from five, cross-sectional, nationally representative United States health surveys. These surveys include data collected as early as 1963 and as late as 1994. While the BMI-for-age growth charts represent the most current growth charts that are used by pediatricians and researchers, it should be noted that they still do not reflect the most recent prevalence estimates, thus the most recent prevalence estimates will not completely match up with the BMI-for-age percentile cut-offs that are used to determine if a child is at-risk of overweight or overweight.

Additionally, although CDC guidelines indicate the appropriate method for identifying children and adolescents who are at risk of being overweight and those who are overweight, few intervention studies (e.g., Berkey et al., 2003) have adhered to these guidelines as part of their inclusionary criteria. Instead, some researchers have allowed great variation in weight requirements for child participants (e.g., requiring children to be 20 - 100% overweight; e.g., Epstein, Saelens, & Giancola O'Brien, 1995; Epstein, Paluch, Gordy, & Dorn, 2000). Additionally, some studies (e.g., Nemet et al., 2005) do not identify specific inclusionary criteria regarding weight, opting instead to use a general descriptor for child participants, such as "obese." Therefore, it appears that there is great variation in the guidelines used to define overweight and obesity in previous intervention studies, and there is also variation in terminology used (i.e., "overweight" versus "obese"). With regard to the current study, the terms overweight and at risk of overweight were utilized and will be used throughout, unless denoted otherwise.

Prevalence of Overweight and Obesity in Children

The most recent prevalence estimate, from a national health survey, indicated that 17.1% of children were overweight (Ogden et al., 2006). According to this report, the number of overweight children has tripled in the United States between 1980 and 2002. In this study, height and weight were measured as part of the National Health and Nutrition Examination Survey (NHANES). The BMI was then calculated from these measurements. Per CDC guidelines, the researchers in this study defined children and adolescents as being at risk for overweight ($\geq$ 85th BMI percentile and < 95th BMI percentile) or overweight ($\geq$ 95th BMI percentile). Based on comparisons between the 1999-2000 NHANES data and the 2003-2004 NHANES data, the number of overweight children and adolescents has increased significantly for both males and females, with no significant differences in the rate of increase amongst different races (i.e., non-Hispanic white, non-Hispanic black, and Mexican American), age groups (i.e., 2-5 years old, 6-11 years old, and 12-19 years old), and genders. Specifically, prevalence of overweight in female children and adolescents rose from 13.8% in 1999-2000 to 16.0% in 2003-2004, while prevalence of overweight in male children and adolescents rose from 14.0% in 1999-2000 to 18.2% in 2003-2004. Prevalence of being at risk for overweight in female children and adolescents rose from 27.4% in 1999-2000 to 32.4% in 2003-2004. For male children and adolescents, prevalence of being at risk for overweight rose from 28.9% in 1999-2000 to 34.8% in 2003-2004. Overall, the statistics from this nationally representative study indicated that over one third of children are at least at-risk of becoming overweight.

According to Krishnamoorthy and colleagues (2006), pediatric obesity, which they did not define regarding BMI percentile cut-offs, has reached the level of a national epidemic. Additionally, there is evidence suggesting that the prevalence of pediatric obesity has reached epidemic status within other developed countries. For example, Ogden and colleagues (2006) cited research indicating that the prevalence of obesity in preschool children in urban Chinese locations rose from 1.5% in 1989 to 12.6% in 1997. Additionally, recent research has suggested that one quarter of Australian children are considered obese (Salmon et al., 2006). Therefore, it appears that overweight/obesity in children and adolescents is not only a national epidemic, but likely an international epidemic, particularly for Westernized nations.

Etiology of Overweight and Obesity in Children

Genetic Contributions

It is widely recognized that genetics contribute to variability in BMI. In a review spanning 10 years of research on pediatric obesity, Zametkin and colleagues (2004) highlighted important research regarding how much genetic factors contribute to pediatric obesity. According to the authors, based on previous twin studies, genetic factors account for approximately 50-90% of the variability in BMI. Other family-based research (e.g., adoption studies, studies of parents and their offspring, and sibling research) has indicated that genetic factors account for 20-80% of the variance in obesity. Zametkin and colleagues also reported on research regarding the correlation between BMI scores in monozygotic twins (r = .74), dizygotic twins (r = .32), and non-twin siblings (r =.25), which supports the theory that BMI is largely influenced by genetic contributions. Additionally, in research utilizing both human and mouse models, over 200 genes have been linked to weight-related functions (e.g., metabolism; food intake). Though genetics likely play a role in which individuals are more susceptible to weight gain, as noted by Anderson and Butcher (2006), the gene pool does not change quickly enough to explain the dramatic increase in the prevalence of overweight in children.

Additional information about genetics suggests that humans likely possess a "thrifty gene" that was advantageous for our ancestors who had to survive significant food shortages (Barness et al., 2007). This gene appears to regulate storage of fat for later times of food scarcity and possible starvation. While this gene would have offered evolutionary advantages in the past, it may now contribute to the rise in obesity, as humans in Westernized cultures now exist in a primarily sedentary environment in which food is readily available. According to Barness and colleagues,

> the combination of a susceptible individual, with certain lifestyle choices, and a pervasive social environment act synergistically to create the vicious cycle of obesity and decreased physical activity, leading to complications that further impair the ability to exercise and worsen obesity and its complications. (p. 3025)

Environmental Contributions

While genetics clearly contribute significantly to variability in BMI, researchers have suggested that environmental factors have contributed the most to the dramatic rise in prevalence of overweight in children over the past two decades (Krishnamoorthy et al., 2006). As suggested by Zametkin and colleagues (2004), "Although genes may set biological limits for metabolism and other weight-related mechanisms, behavior and environment influence variations within these limits" (p. 139). Specifically, it has been suggested that changes in the United States culture have greatly influenced children's eating and physical activity habits and have thus resulted in the increase in prevalence of overweight/obesity in children (Krishnamoorthy et al.). As suggested by Anderson and Butcher (2006), at the heart of this issue are changes that have resulted in disruptions in energy balance for children. Specifically, "weight is gained when energy intake exceeds energy expenditure" (p. 24). However, there are numerous factors that have likely influenced this disruption in energy balance, which have significantly contributed to the epidemic of overweight children in the United States.

Dietary changes over the past several decades have been associated with increases in weight. Dietary factors that have received the greatest research attention include the consumption of more energy-dense foods and high fat foods (Krishnamoorthy et al., 2006; Swinburn et al., 2004). Researchers have suggested that these negative dietary changes could be the result of families eating outside of the home more regularly, which has been associated with a greater percentage of both parents working outside the home (Anderson & Butcher, 2006). According to Zametkin and colleagues (2004), it is estimated that Americans eat one third of their meals outside the home, with a majority of these meals eaten at fast-food establishments. It is estimated that fat constitutes approximately 45- 55% of the caloric content of fast food choices. Additionally, food prepared outside the home is typically higher in cholesterol and sodium and contains less fiber and calcium than food prepared at home (Swinburn et al.). Furthermore, Krishnamoorthy and colleagues noted in their recent review that eating outside of the home is associated with the consumption of more calories, while eating meals at home as a family is associated with the consumption of more nutritious foods. There is also evidence that the large portion sizes associated with eating food outside the home have also contributed to the increasing epidemic of overweight children (Swinburn et al.).

In addition to overall changes in the types of food eaten and the locations in which food is eaten, evidence suggests that other dietary changes have also influenced the sharp rise in prevalence of overweight in children. As suggested by Swinburn and colleagues (2004), snacking appears to be a possible contributor to the increasing prevalence of overweight children. According to previous research, snacking frequency is increasing for United States children (Jahns, Siega-Riz, & Popkin, 2001).

Jahns and colleagues (2001) investigated snacking frequency, as well as the nutritional and caloric content of snacks consumed in a large (N = 21, 236) sample of children, ages 2 to 18 in 1977-1978 and compared this with statistics from 1994-1996. The researchers reported the results stratified by age group (i.e., ages 2 - 5; ages 6 - 11; ages 12 - 18). The results indicated that from 1977-1978 to 1994-1996, average snacking frequency rose significantly ($p < .01$) for all age groups. Additionally, the average calories obtained per day from snacks rose significantly ($p < .01$) for all age groups. Furthermore, the researchers found that the percentage of daily fat from snacking rose significantly ($p < .01$) for all age groups. Specifically, for children ages 2 - 5, the percentage of daily fat from snacking rose from 17% to 22%, while for 6 - 11-year-olds it rose from 16% to 22%, and for 12 -18-year-olds it rose from 18% to 22%. Similar trends regarding snacking frequency, average calories from snacks, and percentage of daily fat from snacks were also found for young adults, ages 19 - 29 (Zizza, Siega-Riz, & Popkin, 2001).

With regard to cultural changes that have negatively influenced children's exercise habits, several areas have received research attention. One overall change that has been linked to the increased prevalence of overweight children is the decrease in physical activity that children currently engage in, when compared with earlier decades. Decreased physical activity results in a decrease in energy expenditure. This decrease, coupled with the increase in energy intake noted previously, could account for significant increases in weight over time (Anderson & Butcher, 2006). A recent review by the Council on Sports Medicine and Fitness and Council on School Health (2006) included the recommendation that children and adolescents should engage in moderate physical activity for at least 60 minutes each day, though the activity does not need to be continuous. Suggested activities included, "sports, recreation, transportation, chores, work, planned exercise, and school-based PE classes" (Council on Sports Medicine and Fitness and Council on School Health, p. 1840). Additionally, as recommended in the review, physical activities should include mostly unstructured, fun activities so that children will be more apt to comply with them. Unfortunately, according to this review, children are more sedentary than ever. Specifically, it was noted that over one quarter of the children in the United States watch at least 4 hours of television each day, and these children are less likely to engage in vigorous physical activity. As noted in this review, findings from a recent longitudinal survey indicated that based on parent and child reports, 61.5% of children ages 9 - 13 did not participate in any organized physical activities, and 22.6% did not participate in any nonorganized physical activity, outside of physical activity obtained at school.

According to several recent reviews (Council on Sports Medicine and Fitness and Council on School Health, 2006; Harper, 2006; Krishnamoorthy et al., 2006) there are numerous reasons that have been hypothesized to have contributed to children's decline in physical activities. As suggested by the Council on Sports Medicine and Fitness and Council on School Health, the availability of stimulating sedentary activities such as television, videos, video games, and computers is one major contributing factor. Other factors that may be related to decreasing levels of physical activity for children include: decreased frequency of physical education received at school, having parents and siblings who model inactive behaviors, lack of recreational opportunities within communities, and unsafe communities in which active outdoor play needs to be limited (Council on Sports Medicine and Fitness and Council on School Health; Harper; Krishnamoorthy et al.; Zametkin et al., 2004). With regard to the hypothesis that decreased physical education in school is associated with decreased physical activity, several cross-sectional school-based prevention studies have found that increased physical education instruction is associated with reductions in BMI for overweight girls and increased fitness levels in girls, but not boys (Council on Sports Medicine and Fitness and Council on School Health). Hypotheses regarding communities have also been supported through previous research. According to Krishnamoorthy and colleagues, safe communities that are considered “walkable” have been associated with increases in physical activity.

As noted previously, increased sedentary behaviors have been linked to the increased prevalence of childhood obesity (Council on Sports Medicine and Fitness and Council on School Health, 2006; Harper, 2006; Krishnamoorthy et al., 2006). A study by Arluk, Branch, Swain, and Dowling (2003) supported this hypothesis. These researchers utilized self-report and parent-report questionnaires to study the association between sedentary behaviors and childhood obesity in a sample of 101 children, ages 9 - 12. Of these children, 39 (60.2%) were at the 95th BMI percentile or above and were classified as "obese" by the researchers. The remaining 59 children (39.8%) were not obese. Arluk and colleagues found that the average time spent in all sedentary activities across both obese and nonobese children (i.e., watching television, using the computer, playing video games, doing homework, and taking a nap) was 7.0 hours per day. Significant relationships were found between child obesity and the following factors: hours spent watching television ($\chi^2 = 14.58$, $p < 0.01$) and computer usage ($\chi^2 = 13.68$, $p < 0.01$). The researchers also noted that the strongest independent predictor of child obesity was maternal obesity; however, greater participation in sedentary behaviors was also strongly associated with child obesity. Unfortunately, statistical values were not provided for these predictors. In this study total caloric intake was surprisingly found to not be significantly associated with child obesity.

Of the sedentary behaviors that have been hypothesized to be associated with the sharp increase in the number of children who are overweight, television has received the most media and research attention. While the American Academy of Pediatrics (AAP) recommends that school-age children should not watch more than 120 minutes of television per day and that children under two should not watch any television, there is ample evidence that many children are watching more than the recommended amount of television. Researchers who conducted a longitudinal study based in Iowa (Janz, Burns, & Levy, 2005) reported that at the baseline assessment the 176 male participants ($M = 5.6$ year old, $SD = .05$) watched an average of 124 minutes of television each day ($SD = 66$ minutes), while the 202 female participants ($M = 5.7$ year old, $SD = .05$) watched an average of 128 minutes of television each day ($SD = 83$ minutes). While the average number of minutes of television watched per day decreased at the 3-year follow-up for both boys ($M = 110$ minutes each day, $SD = 66$) and girls ($M = 108$ minutes each day, $SD = 62$), average number of minutes spent playing video games increased for males from 25 ($SD = 31$) to 45 minutes ($SD = 38$ minutes) and remained stable for girls ($M = 18$, $SD = 24$). The researchers noted that children who maintained a high level of vigorous activity (> 30 minutes of vigorous activity each day, on average) and low level of television watching (< 120 minutes of television watched each day, on average) were less likely than peers to be in the upper quartile for percent body fat at follow-up. The researchers measured physical activity through accelerometry and used a cut-off of 6 METs (metabolic equivalents) or above to define vigorous physical activity.

In an international study, researchers with the World Health Organization (Vereecken et al., 2006) investigated the typical television viewing habits of children in 35 countries. Of the 4,794 United States children surveyed (ages 11, 13, and 15), the average hours of television watched per day was 3.0, with approximately 30% of children watching at least four hours of television each day, and another 30% watching between two and four hours each day. Overall, this suggests that approximately 60% of 11-, 13-, and 15-year-old children are watching more than the recommended two hours of television per day. Additionally, the results of this survey indicated that children who viewed more television each day were significantly more likely to consume sweets and /or soft drinks containing sugar. As indicated by these researchers, and a recent review (Krishnamoorthy et al., 2006; Vereecken et al.), the increased consumption of these foods may be linked to children eating while they watch television and/or may be related to children requesting sweet, sugary foods and drinks that are advertised on television.

A study conducted by Francis, Lee, and Birch (2003) with 173 non-Hispanic white female children (ages 5, 7, and 9) supported the theory that television watching may be a cue for increased eating. In this longitudinal study, dietary intake, physical activity, and demographic information (including height and weight) were collected at all time points (i.e., ages 5, 7, and 9), while television viewing information was collected at ages 7 and 9, and information on snacking while watching television was collected only at age 9. The researchers grouped children as those from overweight families (i.e., at least one parent with a BMI $\geq$ 25) or nonoverweight families (i.e., both parents had a BMI < 25).

Results of this study (Francis et al., 2003) indicated that for children from overweight families (n = 72) snacking frequency was positively associated with amount of daily television viewing ($r = .30$, $p < 0.05$) and the number of snacks consumed while watching television ($r = .27$, $p < 0.05$). These associations were not found for children from nonoverweight families. However, daily television viewing was positively associated with number of snacks consumed while watching television for children from both overweight (r = .33, $p < 0.05$) and nonoverweight families (r = .29, $p < 0.05$). Additionally, snacking frequency was positively associated with intake of fat from energy dense snacks for all children (r = .26, $p < 0.05$ for children from overweight families; r = .29, $p < 0.05$ for children from non-overweight families). For children from overweight families, the amount of fat consumed from snacks was the only predictor that was significantly associated with change in BMI from age 5 to age 9 (r = .26, $p < 0.05$), while amount of daily television watching was the only significant predictor in change in BMI for children from nonoverweight families (r = .29, $p < 0.05$). The results of this study suggest that daily television viewing is indirectly associated with BMI increases for children from overweight families. For these children the indirect relationship appeared to be related to increased snacking, higher frequency of snacking, and higher fat intake from energy dense snacks. However, for children from nonoverweight families there was a direct relationship between daily television viewing and increases in BMI.

A study conducted with 74 overweight adult women (M = 54.2 years old, SD = 10.9) also provided support for the theory that television watching is associated with increased eating (Gore, Foster, DiLillo, Kirk, & Smith West, 2003). On average, participants watched 3.1 hours of television each day and reported eating 9.1 meals in front of the television per week. The researchers found that snacking in front of the television was positively associated with total caloric intake (r = .38, $p < .01$) and fat intake (r = .40, $p < .01$). Additionally, frequency of snacking was negatively associated with choice of a low-calorie, low-fat snack while watching television (r = -.32, $p < .01$).

Therefore, as frequency of snacking increased, participants were less likely to choose low-calorie, low-fat snacks while watching television.

As was found in the aforementioned study by Francis and colleagues (2003), television watching has been associated with body fatness in numerous other studies (Marshall et al., 2004). A recent meta-analysis conducted by Marshall and colleagues utilized 52 different samples (i.e., 52 independent samples of participants from different studies) in which the association between television viewing and body fatness was investigated and 6 different samples (i.e., 6 independent samples of participants from different studies) in which the association between video/computer game use and body fatness was evaluated. Grouping all of these together resulted in 46% of samples with participants from 7 - 12 years of age, 8% of samples with participants less than 7 years old, 23% of samples with participants from 13 - 18 years of age, and 23% of samples with a combination of age ranges (e.g., those including younger children and those including adolescents). Marshall and colleagues did not utilize studies investigating the association between sedentary behaviors and body fatness in adults.

The results of this meta-analysis indicated that there are significant associations between television watching and body fatness and between video/computer game use and body fatness though the associations are not clinically meaningful (ES = .084 for television viewing; ES = .128 for video/computer game use). Additionally, there is a significant, negative association between television watching and physical activity and between video game/computer use and physical activity. These associations were also found to not be clinically meaningful (ES = -.129 for television viewing; ES = -.141 for video/computer use). These associations suggest that increased television watching and increased video/computer use may displace physical activity. The overall results of this study suggest that media use (i.e., television, video game, and computer use) is associated with body fatness and lack of physical activity. However, these associations may only account for a very small amount of the variance in body fatness/physical activity.

Though the association between television watching and body fatness may be small with regard to clinical meaningfulness, a prospective longitudinal study by Hancox and colleagues (2004) suggested that childhood television viewing may be associated with negative, long-term health consequences. These researchers found that average television viewing in New Zealand youth between ages 5 and 15 was associated with several negative health outcomes at age 26, including: higher BMI ($\beta = .54$, SE = .17, $p = .0013$); lower cardiorespiratory fitness ($\beta = -.11$, SE = .03, $p = .0003$); increased serum cholesterol ($\beta = .11$, SE = .04, $p = .0037$); and increased likelihood of cigarette smoking (OR = 1.36, 95% CI = 1.17 – 1.58). Unfortunately, Hancox and colleagues did not provide estimates of clinical meaningfulness for the associations found.

In a recent study Hancox and Poulton (2006) used data from the aforementioned 2004 study to better assess the relationship between television and BMI in childhood and adolescence. The authors determined that reported television viewing was a significant predictor of BMI for girls at all ages assessed (i.e., ages 5, 7, 9, 11, 13, and 15), even when accounting for socioeconomic status, and both parents' BMI values. For boys, television was only a significant predictor of BMI at age 7. The correlations between reported weekday television viewing hours and BMI were statistically significant at all ages, for both sexes; however, the correlations were small (i.e., ranging from a low r = .07 at age 9 to high r = .15 at age 7).

While these results seem to support the theory that association between television watching and body fatness may be small with regard to clinical meaningfulness, the authors argued against this for several reasons. First, they indicated that self- and parent-reports of television viewing, particularly when done infrequently (as was the case in this study) will result in inaccuracies that decrease the strength of the association. Second, only a small percentage (i.e., 11%) of the sample were considered overweight or obese (i.e., 1%) at age 15, as assessed using the standards of the International Task Force on Obesity, which describes overweight as the equivalent of "at-risk of overweight" according to CDC guidelines and obese as the equivalent of the CDC's "overweight" category. Thus, children and adolescents from this sample were largely of average weight or below and this could affect a true measurement of the relationship between television and BMI. Third, the authors noted that all children in the sample watched at least some television and thus all children in the sample were exposed to television as a risk factor. They indicated that this has the potential of underestimating the true strength of the association between television viewing and BMI. Lastly, the authors indicated that comparatively speaking, based on previous research findings, television viewing appears to be a stronger predictor of BMI than dietary intake or physical activity (Hancox & Poulton, 2006). Taken together, these arguments suggest that measurements to date may have underestimated the true strength of the relationship between television viewing and BMI.

If this is the case, interventions aimed at reducing television viewing would likely be effective at reducing the prevalence of overweight children.

Problems Associated with Overweight and Obesity in Children

Health Risks and Economic Costs

There are serious short-term and long-term health risks associated with obesity. According to Zametkin and colleagues (2004) many health risks do not manifest until adulthood; however, examples of short-term health risks include “cardiovascular disease, endocrine and pulmonary problems, and orthopedic, gastroenterological, and neurological difficulties” (p. 135). As noted by Daniels (2006), improved technology has allowed for the accumulation of evidence that cardiovascular damage such as hardening of arteries can begin in childhood. Furthermore, overweight children are approximately three times more likely than their average weight peers to have high blood pressure (Daniels). Overweight children are also at increased risk for Type II diabetes in childhood, insulin resistance, gall stones, orthopedic problems, and obstructive sleep apnea (Daniels; Krishnamoorthy et al., 2006; Swinburn et al., 2004; Zametkin et al.). The primary long-term health risk associated with being an overweight child is the increased chance of being an overweight adult. As Swinburn and colleagues indicated in their review, evidence suggests that approximately 80% of obese children between the ages of 10 and 14 will remain obese through adulthood, particularly if they have at least one obese parent. There are extensive data that have shown that obesity in adulthood is associated with increased risk of morbidity and mortality. For example, obese adults are at increased risk for cardiovascular problems (e.g., greater risk of cardiovascular disease, hypertension, elevated total cholesterol, elevated LDL cholesterol, lowered HDL cholesterol, and elevated triglyceride levels; Krishnamoorthy et al.; Zametkin et al.). Furthermore, adult obesity is typically difficult to treat (Krishnamoorthy et al.). While adults are often able to lose weight, maintenance of weight loss is typically very challenging. Due to the increased health risks and unhealthy lifestyles associated with being an overweight child and adult concern has recently been raised that the current generation of children may have a lower life expectancy than their parents. Though this possibility has been debated, particularly considering ongoing improvements in health care technology, if this occurred it would be the first time in modern history when lifespan decreased for a generation of children (Daniels).

As a result of these health risks, there are extensive medical costs associated with pediatric obesity. Estimates suggest that the hospital-related costs of pediatric obesity have tripled in the United States over the past 20 years, rising to $127 million (Zametkin et al., 2004). As noted by Krishnamoorthy and colleagues (2006), this estimate does not include the costs of doctors' visits, medication, and other indirect health care costs associated with pediatric obesity. Therefore, it is a safe assumption that the total health care costs associated with pediatric obesity are much higher than $127 million.

There is also evidence of indirect economic costs of being overweight. For example, Daniels (2006) noted that there is support for negative stereotyping and discrimination of overweight individuals, which typically begins in childhood and adolescence. Research has shown that women who were overweight as adolescents "became adults with less education, lower earning power, a higher likelihood of poverty, and a lower likelihood of marrying" (Daniels, p. 89), while overweight adolescent males seem to have somewhat better outcomes. There is evidence to suggest that discrimination likely contributes to the aforementioned negative outcomes.

Psychosocial Risks

In addition to health risks, overweight children are also at higher risk for psychosocial problems. Lower self-esteem is the most commonly cited psychological problem for overweight children; however, research findings in this area have been inconsistent (Zametkin et al., 2004). Researchers using community-based samples have suggested that obese children and adolescents have moderately lower self-esteems, when compared with non-obese children and adolescents (Allen, Byrne, Blair, & Davis, 2006; French, Story, & Perry, 1995; Zametkin et al.). Additionally, international longitudinal research utilizing a prospective cohort design has suggested that being an overweight child may play a causal role in developing lower self-esteem (Hesketh, Wake, & Waters, 2004). Hesketh and colleagues found that higher baseline BMI predicted poorer self-esteem later in life. However, a major limitation of this study was that self-esteem data were derived from parent-reports on a child health questionnaire. A United States-based longitudinal study that did acquire children's self-reports of self-esteem also found that as obese children moved into adolescence, self-esteem decreased (Strauss, 2000). This suggests that obesity might result in lower self-esteem as children get older. Though other community-based studies have also found lowered self-esteem to be associated with obesity, these studies indicated that lowered self-esteem may be better explained by negative body image (Zametkin et al.). Additionally, Allen and colleagues found that concerns about weight and body shape appeared to mediate relationships between BMI and low self-esteem and body dissatisfaction, suggesting that these factors may be most important in mediating the relationship with psychological distress in overweight children. Overall, within this area of research the most consistent finding appears to be a significant relationship between obesity and a negative body image (Zametkin et al.).

While the relationship between self-esteem and childhood obesity appears to often be better explained by body image in population-based studies, there is more evidence for a clear association between obesity and self-esteem in clinically referred overweight children (Zametkin et al., 2004). This finding could be explained by the possible greater severity in obesity of children seeking treatment. According to Zametkin and colleagues, this hypothesis is supported by other research, which has demonstrated that more severely obese female children had lower self-esteems than moderately obese female children.

In addition to self-esteem, overweight children appear to be at risk for other psychosocial problems, including peer difficulties, peer rejection, marginalization, and risk of psychological disorders (Krishnamoorthy et al., 2006; Zametkin et al., 2004). Zeller and colleagues investigated the presence of externalizing and internalizing problems through self-report and parent-report measures completed by clinically referred overweight children and their mothers. They found that over one third of the children reported clinically significant problems, while two thirds of the children were reported to have clinically significant problems by their mothers. However, these problems were better predicted by maternal psychological distress than by child percent overweight or by race. Previous researchers have also found that children's psychological problems were better predicted by parents' psychological problems than by children's obesity status (Epstein et al., 1994). With regard to specific psychological disorders, there is mixed evidence regarding comorbidity rates in overweight children (Zametkin et al.). While some studies have found no increased risk of psychological disorders for obese children, other studies have found significantly higher risk of depression, binge eating disorders, anxiety disorders, and somatoform disorders, when compared with nonobese children (Krishnamoorthy et al.; Zametkin et al.), though these were also better predicted by maternal psychopathology.

Interventions for Children Who Are Overweight

Current Prevention/Intervention Information and Recommendations

Prevention. As noted previously, recent prevalence estimates have indicated that over one third of United States children are currently overweight or at risk of being overweight (Ogden et al., 2006). While effective intervention strategies are needed to immediately deal with the pediatric obesity epidemic, effective prevention strategies are also needed to prevent the epidemic from worsening and to hopefully reverse the current prevalence trends. However, it appears that research on prevention strategies has been lagging behind the substantial intervention research conducted to date (Krishnamoorthy et al., 2006). Despite the lag in research, some prevention studies, both community-based and school-based have been conducted. These studies have varied in their focus, with some aimed at improving children's diets and/or levels of physical activity, and others centered on reducing television watching. To date it appears that school-based prevention programs typically result in short-term improvements in targeted behaviors, but do not consistently result in reductions in children's BMIs (Krishnamoorthy et al.). Community-based prevention programs have shown some success in promoting healthy dietary changes, though results of programs aimed at increasing physical activity have been mixed. While some have shown no significant improvements in children's physical activity, others have resulted in increases in daily physical activity (Krishnamoorthy et al.).

Recently Stice, Shaw, and Marti (2006) conducted a meta-analysis of obesity prevention programs for children to determine the type of interventions that appear to be most effective. This meta-analysis included examination of a number of moderator variables including those related to participant characteristics (i.e., age, gender, ethnicity,obesity risk status), intervention characteristics (i.e., duration of intervention, parental involvement, psychoeducational content, dietary improvement, increased activity, reduced sedentary behavior, number of behavior targets), intervention delivery characteristics (i.e., teacher vs. professional interventionist, didactic versus interactive format), design characteristics (i.e., whether it was/was not a pilot study, recruitment methods, use of random assignment, issues related to appropriate analyses). Stice and colleagues reviewed a total of 64 obesity prevention programs, with the majority being school-based programs (n = 53), that used random assignment (n = 51), and included both male and female participants (*n* =48).

The results of this meta-analysis indicated that the average *r* value effect size across all studies was quite small, though statistically significant, when using change in BMI as the outcome variable (ES = .04; range = -0.24 to 0.50). According to the authors, only 21% (*n* = 13) of the programs found positive intervention effects, based on an alpha level of .05. With regard to moderators, results indicated that larger effects emerged for studies that targeted children older than 11 (ES = 0.07, $p <.05$, $n = 20$) and females (ES = 0.13, $p < .01$, $n = 14$), programs that were fairly brief (i.e., programs below the median of 16 weeks; ES = 0.06, $p < .01$, $n = 31$), programs that solely targeted weight behaviors (as opposed to other health and risk behaviors; ES = 0.09, $p < .001$, $n =27$), programs that were pilot studies (ES = 0.14, $p < .001$, $n = 18$), and programs in which participants self-selected to take part in the program (ES = 0.14, $p < .001$, $n = 16$). However, though many of these moderators resulted in statistically significantly larger effect sizes, it should be noted that these effect sizes were small or not clinically meaningful. All other moderator variables analyzed did not result in significantly larger treatment effects.

Intervention. With regard to interventions for pediatric obesity, at least two reviews have been conducted (Epstein et al., 1998; Jelalian & Saelens, 1999). These reviews provided comprehensive information on intervention studies that had been conducted prior to the publication of the reviews. They also provided important information regarding recommendations for future treatment of obesity in children and adolescents. This section will focus on the findings and recommendations of these reviews, while the next section will review individual empirical studies aimed at reducing sedentary behaviors in overweight children, as this is the focus of the current study.

In their narrative review, Epstein and colleagues (1998) noted that overweight and obesity in children may be easier to change than obesity in adults, as children's unhealthy eating and activity patterns are less entrenched than those of adults, and the entire family can often be utilized to support children in making positive lifestyle changes. According to Epstein and colleagues, many interventions for overweight and obese children have been promising, resulting in positive short-term changes. These changes vary based upon the methods used to assess treatment outcomes in the different studies. Epstein and colleagues reported on the following methods of measuring treatment outcomes: changes in percent overweight, changes in BMI, changes in body weight, and changes in percentage of body fat. While this review did not specify a preference in methods used to measure treatment outcomes, it appears that in a majority of previous intervention studies researchers assessed changes in percent overweight or BMI when assessing treatment outcomes. These methods are likely the most appropriate, as they take into account developmental issues specific to children (i.e., typically developing children would be expected to grow taller and heavier over time). In addition to the established short-term efficacy of pediatric obesity interventions, Epstein and colleagues also noted that two research groups have found significant maintenance of treatment success over 5- and 10-year periods.

The review by Epstein and colleagues (1998) also provided recommendations for treatment of pediatric obesity. According to the authors, dietary and exercise components utilizing behavior change principles comprise the most common and successful elements of interventions for children who are overweight. The authors also indicated that the integration of these components appears to result in the greatest treatment efficacy. With regard to dietary changes, various types of intervention components have been studied, though most focused on reducing caloric and fat intake, and changing eating habits to fit with current dietary recommendations. Typically another goal of previous dietary intervention components was to improve the overall nutritional quality of food eaten by children who are overweight. As indicated in their review, Epstein and colleagues found that comprehensive interventions that included a dietary change component typically resulted in positive short- and long-term results; however, interventions involving only dietary changes and no changes in physical activity did not result in weight loss.

With regard to treatment components focused on changing physical activity, several approaches have been studied (Epstein et al., 1998). Typically the goal with physical activity treatment components was to increase energy expenditure. As noted by Epstein and colleagues, in previous studies increased energy expenditure was typically combined with decreased energy intake through dietary intervention components that reduced caloric intake. According to Epstein and colleagues' review, lifestyle-based exercise interventions that focused on increasing energy expenditure in daily activities showed superior short-term reductions in percent overweight, when compared with programmatic exercise interventions such as aerobic exercise programs; however, in at least one study, long-term effects were approximately the same when compared to a diet plus calisthenics control group. Additionally, as noted by Epstein and colleagues, in at least one study, a lifestyle-based exercise intervention component was not found to result in additional short- or long-term benefits over a dietary intervention component. Epstein and colleagues also noted another previous intervention study in which increased physical activity did not appear to positively impact weight without an additional dietary change component. The overall conclusion made by Epstein and colleagues was that changes in physical activity and diet are superior to changes in either area alone; however, there have been a small number of studies in which the results did not support this overall conclusion. Jelalian and Saelens's (1999) review also supported the information and recommendations presented by Epstein and colleagues (1998). Utilizing the Chambless criteria to determine empirically supported treatments, Jelalian and Saelens reviewed 26 clinic-based intervention studies for children under 13 years of age. Based on their review of these studies, a comprehensive behavioral treatment targeting eating and physical activity is a well-established treatment for pediatric obesity, specifically for children ages 8 through 12. In addition to eating and physical exercise treatment components, these comprehensive treatments often incorporated behavior change components such as self-monitoring of diet and activity, stimulus control (i.e., what is referred to as stimulus management in the current study) techniques, and contingency management. The authors termed this a "multicomponential behavioral treatment" and reported that this treatment was superior to a wait-list control or only a nutrition educational component, in promoting short-term weight loss. Additionally, as reported in the review by Epstein and colleagues, Jelalian and Saelens also reported that in at least four previous research studies that utilized a multicomponential behavioral treatment approach positive results were maintained over 5 to 10 years.

Though both reviews (Epstein et al., 1998; Jelalian & Saelens, 1999) recommended a multicomponential behavioral treatment approach for treating pediatric obesity, previous research studies that have utilized this format have been complex, long-term, and intensive. As mentioned previously, multicomponential treatments require simultaneous behavior changes in multiple areas (e.g., diet, physical activity) and often require sophisticated tracking of these behavior changes over a lengthy period of time. This suggests that a multicomponential behavioral treatment may not be a feasible treatment option for the multitude of children who are overweight. Specifically, it may not be feasible due to the cost and resources needed to provide such comprehensive services to all children who are overweight. Additionally, previous studies implementing multicomponential behavioral treatments have typically been conducted in urban or suburban locations at university-based research facilities. Such facilities may not be available in rural locations. Furthermore, as suggested by Jelalian and Saelens (1999) in their review, given the current body of research, it is difficult to determine the particular components of multicomponential behavioral treatments that are most effective and necessary. Currently there is no known research study that has evaluated the effectiveness of individual components of multicomponential behavioral treatments.

A more recent brief review of select randomized control trials (Jelalian, Wember, Bungeroth, & Birmaher, 2007), similarly reflects findings from the two aforementioned reviews. Specifically, this review also indicated that comprehensive behavioral interventions that include dietary prescription, physical activity increases and/or decreases in sedentary behaviors, and behavior modification targeted at children and parents, are the most effective treatments for pediatric obesity. However, this review suggested several limitations of existing interventions for pediatric obesity. First, the authors noted that a majority of the randomized control trials were completed in the 1980s and 1990s and thus may not be as generalizable to current pediatric populations. Additionally, these trials were primarily completed by one research team and have not been replicated by subsequent researchers. Second, previous trials typically included homogeneous samples and thus may not generalize as well to children from diverse cultural backgrounds. Lastly, most research has excluded participants with psychological problems. Given that there is evidence that overweight children may be at increased risk for psychological problems, current treatment recommendations may not generalize to this population of overweight children.

Methodological shortcoming. In assessing the studies included in the aforementioned reviews, it became clear that most intervention studies employed either a randomized control trial design or a nonrandomized pre- postformat. Surprisingly only one single subject design (Coates & Thoresen, 1981) was included in either of the two reviews. After searching the literature through systematic review of online databases, as well as hand searches of reference lists included in numerous articles, more recent examples of single-subject designs were not found. As noted by Horner and colleagues (2005) single-subject design research plays a very important role in determining effective special education interventions and is considered a methodologically sound design for outlining evidence-based research. It is therefore surprising that single-subject design research has not been commonly used to investigate behavioral treatments for overweight children, as it appears to be an ideal method for investigating the effectiveness of individual treatment components of multicomponential treatment packages. This area of research appears to be greatly lacking in the area of pediatric obesity research and it seems important that future research studies employ single-subject design methods, as part of establishing the effectiveness of treatment components.

Interventions to reduce sedentary activities. One treatment component that has gained increasing attention is a focus on reducing sedentary activities instead of overtly trying to increase physical activity (e.g., Epstein, Valoski, et al., 1995; Epstein et al., 2000, 2004). According to researchers who have employed this treatment strategy, sedentary behaviors may displace available time to be active (Epstein et al., 2004). Previous research has supported this theory in that an inverse relationship between sedentary behaviors (e.g., television watching) and physical activity has been found (Epstein, Paluch, Consalvi, Riordan, & Scholl, 2002). Additionally, sedentary activities such as television watching have been associated with increased snacking and increased consumption of unhealthy foods in both children (Salmon et al., 2006; Vereecken et al., 2006) and adults (Gore et al., 2003). Furthermore, there is a well-established positive, though possibly small, correlation between television watching and body fatness (e.g., Berkey et al., 2003; Marshall et al., 2004). Therefore, reducing sedentary behaviors such as television watching may increase the amount of time available for physical activity and/or may decrease a child's energy intake, thus leading to reductions in BMI or percent overweight.

Several studies have investigated the effectiveness of various types of interventions designed to decrease sedentary behaviors in children (Epstein, Valoski et al., 1995; Epstein et al., 2000, 2004; Epstein, Saelens, & Giancola O'Brien, 1995) and within these studies, several researchers (Epstein, Saelens, Giancola O'Brien; Epstein et al., 2000, 2004) utilized a multicomponential behavioral treatment design. Examples of the methods used to reduce sedentary behaviors include reinforcement of reduced sedentary behaviors (Epstein, Saelens, Giancola O'Brien; Epstein et al., 2004) and use of stimulus management techniques (Epstein et al., 2004).

In their randomized control study, Epstein, Valoski, and colleagues (1995) investigated the short-term and long-term effects of having children increase exercise, decrease sedentary behaviors, or both. These treatment conditions were tested in the context of treatment features that were common to all three groups and included the following: use of the Traffic Light Diet to decrease energy intake and promote a balanced diet; written manuals describing the benefits of increasing activity and the negative aspects of sedentary behaviors; contracted rewards contingent upon behavior change goals; self-monitoring of weight, as well as food and caloric intake; use of stimulus control methods to decrease availability and consumption of high energy/high fat foods, including parental decrease in consumption of high energy/high fat foods, as well as strategies to encourage increase in physical activity (e.g., having exercise equipment available), and strategies to discourage sedentary activities (e.g., turning the TV toward the wall; Epstein, Valoski, et al.). Children ages 8 through 12 (M = 10.1) were required to be between 20% and 100% overweight (M = 51.8% overweight). Additionally, at least one parent had to participate in the study and the parent could not be more than 100%

overweight (M = 29.8%

overweight for mothers; *M* = 33.4% overweight for fathers). The intervention included 4 months of weekly meetings, 2 monthly meetings, and a follow-up meeting at 1 year.

The results of the study by Epstein, Valoski, and colleagues (1995) indicated that there were significant between-group differences for percent overweight at posttreatment, F (4, 102) = 3.14, $p = .026$. Post-hoc analyses indicated that children in the treatment group aimed at reducing sedentary behaviors were significantly less overweight ($p < .05$) than children in the treatment group aimed at increasing exercise, at the 4-month assessment period. Specifically, children in the sedentary behaviors group had an average reduction in percent overweight of 19.9%, while children in the physical activity group had an average reduction in percent overweight of 13.2%. At the 1-year follow-up, children in the sedentary behavior group were also significantly less overweight ($p < .05$) than children in the physical activity group and the combined sedentary behavior/physical activity group. The sedentary behavior group had an average reduction in percent overweight of 18.7%, the physical activity group had an average reduction in percent overweight of 8.7%, and the combined group had an average reduction in percent overweight of 10.3% (Epstein, Valoski, et al.). Because it was surprising that the combined group was not superior to the other groups, the authors noted a possible explanation that the multiple changes required in the combined group (i.e., changing physical activity and sedentary behaviors) may have diluted the effects of the changes.

In other studies researchers have investigated the effectiveness of reducing sedentary activities when treating overweight children, as part of a multicomponential treatment package (Epstein et al., 2000, 2004). In their study Epstein and colleagues

(2000) tested the hypothesis that reducing sedentary behaviors would be as effective, or better, than increasing physical activity at producing weight loss for overweight children, ages 8 to 12 (*M* = 10.5 years old, *SD* = 1.2). Additionally, according to the researchers, they also sought to "test whether there was a dose-response relationship between the amount of reduction in sedentary behaviors and weight loss and fitness outcomes" (p. 221). Child participants were required to be between 20% and 100% overweight (*M* = 62.0%, *SD* = 17.1) and at least one parent was required to participate (*M* = 33.9% overweight, *SD* = 26.0), though parent participants were not required to be overweight. Children were randomly assigned to one of four groups: (a) low sedentary behavior (decrease of 10 hours/week of sedentary behaviors), (b) high sedentary behavior (decrease of 20 hours/week of sedentary behaviors), (c) low physical activity (increase of 10 miles/week of physical activity), and (d) high physical activity (increase of 20 miles/week of physical activity). As in the previously mentioned study (Epstein, Valoski, et al., 1995), participants in all treatment groups shared common treatment elements (i.e., special diet to restrict caloric intake and promote a balanced diet; self-monitoring; behavioral contracting; stimulus control techniques; use of positive reinforcement). The treatment lasted 6 months, which included 4 months of weekly meetings, followed by 2 biweekly meetings, and 2 monthly meetings. Two follow-up periods, at 12 and 24 months, were included (Epstein et al., 2000).

Children in all four groups exhibited significant reductions in percent overweight at both the 6-month and 24-month assessment periods (statistics were not provided for the 12-month assessment), with no significant between-group differences in decreased percent overweight (Epstein et al., 2000). Across all four groups, there was a 25.5% decrease in percent overweight at the 6-month posttreatment assessment, while at the 24-month follow-up there was a 12.9% decrease. The change in percent overweight at the 24-month follow-up was measured from pretreatment to 24 months. As noted by the researchers, at the end of the 6-month treatment, there was an average child growth of 3.5 cm and an average weight loss of 6.0 kg, while at the 24-month follow-up there was an average child growth of 11.4 cm and an average child weight gain of 9.0 kg, which still resulted in a significant, maintained reduction in percent overweight. Additionally, as indicated by Epstein and colleagues (2000), the results of this study contrasted with the results of the previously mentioned study (Epstein, Valoski, et al., 1995) in that children in the two treatment groups aimed at increasing physical activity reduced their percent overweight approximately as much, on average, as children in the treatment groups aimed at decreasing sedentary activities (Epstein et al.).

A study similar to the two previously mentioned sedentary behavior interventions also investigated the effectiveness of reducing sedentary behaviors, as part of a multicomponential behavioral treatment for overweight children (Epstein et al., 2004). However, in this study, the primary aim was to test two different techniques to help reduce sedentary behaviors (i.e., positive reinforcement of reduced sedentary behaviors versus use of stimulus control techniques to prevent children from engaging in sedentary behaviors). As in the previously mentioned studies (Epstein, Valoski, et al., 1995; Epstein et al., 2000), the target age range was 8 to 12 years (*M* = 9.8 years, *SD* = 1.3; *N* = 62), though the weight criteria were different (Epstein et al., 2004). In this study, children were required to be above the 85th BMI percentile, placing them in at least the “at risk of overweight” category, according to current CDC guidelines (Ogden, 2004). As in the previously mentioned study (Epstein et al., 2000), at least one parent participated in the study, and the length of treatment was 6 months, with a follow-up at 12 months. This study (Epstein et al., 2004) also utilized common treatment components for both treatment groups and those were the same as the treatment components mentioned in the previous studies (Epstein, Valoski, et al., 1995; Epstein et al., 2000). Another component held in common between the two treatment groups was the goal of reducing targeted sedentary behaviors to 15 hours or fewer per week (Epstein et al., 2004).

Results of this study (Epstein et al., 2004) indicated that children in both treatment groups evidenced significant and equivalent decreases in standardized BMI, suggesting that positive reinforcement and stimulus control are equally effective ways to decrease sedentary behaviors. Though the two methods appeared equally effective, the researchers suggested that using stimulus control techniques to alter the environment to help reduce sedentary behaviors may be easier for parents to implement, as these techniques do not require parents to provide consequences for individual behaviors. Additionally, as part of this study, researchers monitored whether children substituted active behaviors for sedentary behaviors and whether children reduced consumption of high energy foods during the treatment phase. One interesting finding was that children who substituted active behaviors for sedentary behaviors had significantly larger decreases in standardized BMI (-1.05) when compared to children who did not substitute active behaviors for sedentary behaviors (-0.51). Boys were twice as likely as girls to substitute active behaviors for sedentary behaviors (54% vs. 27%, respectively). Additionally, children who reduced intake of high energy foods had significantly larger decreases in standardized BMI (-0.93) when compared to children who did not (-0.51).

In a laboratory-based, brief intervention Epstein, Saelens, Myers, and Vito (1997) tested various methods for decreasing sedentary behaviors. This study involved a sample of 34 children (20 girls, 14 boys) ages 8 through 12, who were considered "obese." The criteria used to determine obesity status were not provided. In this study children were randomly assigned to one of four groups: a reinforcement group that received positive reinforcement for not engaging in their two most-preferred sedentary activities (n = 8), a punishment group that received punishment for engaging in their two most-preferred sedentary activities (n = 9), a group in which access to their two most-preferred sedentary activities was removed (n = 8), and a control group that received reinforcement for attendance, but no other contingencies based on sedentary activities (n = 9). Reinforcement was provided by earning one point for each minute that the children did not engage in their two most-preferred sedentary activities. Punishment was provided on a response-cost basis by subtracting one point for every minute the children engaged in their two most-preferred sedentary activities. Children in both the restriction and control groups were given a predetermined amount of points that did not change based on activity choices; however, children in the restriction group had access to four physically active activities and their two lowest-preferred sedentary activities, while children in the control group had access to all of the available activities (four physically active and four sedentary).

The results of this study (Epstein et al., 1997) indicated that the children in the reinforcement and punishment groups were significantly more physically active on intervention days than children in the control group, F (1, 30) = 6.53, p = .016 for the reinforcement group; F(1, 30) = 7.72, p = .009 for the punishment group; however, children in the reinforcement and punishment groups did not significantly differ from each other. Children in the restriction group did not significantly differ on physical activity, when compared with children in any of the other groups. Additionally, children in the reinforcement, punishment, and restriction groups spent significantly less time engaged in high-preference sedentary activities on intervention days than children in the control group, F(12, 120) = 9.97, $p < .001$. However, children in the reinforcement, punishment, and restriction groups engaged in significantly more low-preference sedentary activities than children in the control group during the intervention days, F(12, 120) = 3.26, $p < .001$.

The researchers (Epstein et al., 1997) also measured how much participants liked activities to determine if this changed after the intervention. Results indicated that liking of high-preference sedentary activities increased for the restriction and control groups, decreased for the reinforcement group, and remained stable in the punishment group. Overall, these results indicated that reinforcement and punishment are both effective strategies to reduce children's engagement in high-preference sedentary activities and to increase their engagement in physical activities; however, positive reinforcement may be more useful, as it also resulted in decreased liking of high-preference sedentary activities.

If children like their initial high-preference sedentary activities less, it may be easier for them to reduce these behaviors over time.

Epstein, Saelens, and Giancola O'Brien (1995) also examined the issues of preference and choice in influencing children's participation in sedentary activities. Epstein and colleagues randomly assigned 27 obese children ages 8 through 12 (*M* = 70.6% overweight, *SD* = 14.2; *M* = 10.0 years of age, *SD* = 1.4) to one of three groups: reinforced for increased activity; reinforced for decreases in the two most-preferred sedentary activities; no reinforcement control. Results indicated that children in both the sedentary group, $F(1, 24) = 8.01$, $p = .009$, and activity group, $F(1, 24) = 19.41$, $p < .001$, displayed significantly more time in active behaviors than children in the control group during the intervention phase. Children in the sedentary and activity groups did not significantly differ from each other with regard to active behaviors displayed during the intervention phase. Results also indicated that children in the sedentary group, $F(1, 24) = 22.79$, $p < .001$, and activity group, $F(1, 24) = 12.47$, $p < .001$, spent significantly less time in high-preference sedentary activities than children in the control group. Again, the two treatment groups did not differ significantly from each other. Children in the two treatment groups did significantly differ in time spent in low-preference sedentary activities, with the sedentary group spending significantly more time in low-preference sedentary behaviors than the activity group, $F(1, 24) = 10.37$, $p = .004$.

The results of this study (Epstein, Saelens, and Giancola O'Brien, 1995) suggested that reinforcing decreases in sedentary activity or increases in activity both result in a significant increase in active behaviors. However, reinforcing decreases in most-preferred sedentary activities can result in children engaging in more low-preference sedentary activities. Another main finding of this study was that obese children in the control group, when given equal access to physical activities, high-preference sedentary activities, and low-preference activities, consistently chose high-preference sedentary activities, as they were likely more inherently reinforcing.

In the area of prevention research, Robinson (1999) conducted a randomized control study that tested the effectiveness of a school-based obesity prevention program aimed at reducing sedentary behaviors. Children from Grades 3 and 4 in one elementary school were randomly assigned to receive an 18-lesson, 6-month classroom-based curriculum aimed at reducing television, video, and video game use. Children in Grades 3 and 4 of another elementary school did not receive the curriculum and served as a control group. Robinson noted that within the age range of child participants, BMI values were expected to increase over the course of the study, as a part of normal growth. Therefore, relative differences were analyzed between changes in children in the intervention group and children in the control group. As explained by Robinson, "A negative difference is termed a *relative decrease* in comparison with the controls, even if the actual value increased as a result of normal growth and development" (p. 1563). Given this explanation, children in the intervention group had statistically significant relative decreases in BMI when compared to children in the control group. Specifically, the average BMI for children in the intervention group was 18.38 (SD = 3.67) at baseline and increased to 18.67 (SD = 3.77) at posttreatment, while the average BMI for children in the control group was 18.10 (SD = 3.77) at baseline and increased to 18.81 (SD = 3.76) at posttreatment (p = .002). The results of this study indicated that a school-based curriculum aimed at helping children reduce television, video, and video game use may be helpful in preventing pediatric obesity.

Stimulus management interventions. Previous research with overweight adults utilized stimulus control techniques to promote positive changes in weight. The term stimulus control was typically used to refer to "techniques aimed at reducing the salience and prevalence of environmental stimuli which cue eating" (Carroll & Yates, 1981). Stimulus control is now commonly included as a vital component in multicomponential behavioral treatments for overweight children. As explained by Varni and Banis (1985), initially stimulus control typically addressed attempts to modify children's eating behaviors. For example, the authors noted that antecedent stimuli (e.g., a cookie jar left in reach of a child) can exert control over specific eating-related behaviors (e.g. eating high-fat and high-sugary foods such as cookies) such that after multiple pairings of the antecedent and the behavior, the likely consequences of the health behavior can be predicted. The authors indicated that an antecedent associated with probable reinforcement is known as a discriminative stimulus. Thus in the aforementioned example, the accessible cookie jar becomes a cue to the child that he/she will be reinforced and it would be considered a powerful discriminative stimulus for eating several cookies (Varni & Banis). Thus, traditional stimulus control techniques are those that help to change discriminative stimuli by changing the parent and/or child's behaviors (e.g., having the parent store low-fat cookies in a cabinet that is out of reach of the child).

More recent research studies have also included stimulus control techniques to help decrease children's sedentary behaviors. For example, removing the television from a child's bedroom removes an environmental cue to watch television. Additionally, reducing television watching may reduce the cue to eat unhealthy snacks, thus reducing energy intake and opening up the opportunity for more active energy expenditure. In the current study, stimulus management will be the term used for techniques involving management of environmental stimuli that act as cues for particular screen time behaviors; however, to maintain integrity of prior research the term stimulus control will be used, if it was the term used by the researchers.

As mentioned previously, stimulus control is one of several behavior change components typically included in multicomponential behavioral treatments for overweight children. However, this technique has garnered little research attention outside the context of a multicomponential behavioral treatment. This section will primarily review several adult studies in which stimulus control was used as an intervention to promote weight loss, as stimulus control has not received sole research attention outside the context of multicomponential behavioral treatments for overweight children. The study by Epstein and colleagues (2004; previously reviewed) is the only study that compared stimulus control techniques to another intervention (i.e., positive reinforcement) for reducing sedentary behaviors for a sample of overweight children; however, this was done within the context of a multicomponential behavioral study. As noted previously, stimulus control was found to be as effective as positive reinforcement in reducing sedentary behaviors for overweight children, though it may be easier to implement than positive reinforcement techniques.

Other researchers have investigated the effectiveness of stimulus control as a primary, individual treatment component to aid in weight loss for adults (Beneke & Paulsen, 1979; Beneke, Paulsen, McReynolds, Lutz, & Kohrs, 1978; Carroll & Yates, 1981; Dunkel & Glaros, 1978; Fremouw, Callahan, Zitter, & Katell, 1981; Loro, Fisher, & Levenkron, 1979). The most recent adult-focused studies of stimulus control techniques (i.e., Carol & Yates; Fremouw et al.) both found positive results. In their single-subject design study, Fremouw and colleagues investigated the effectiveness of stimulus control instructions (i.e., various specific changes in antecedents for eating, which included avoiding all other activities while eating), contingency contracting (i.e., subjects received $2.50 of their own predeposited money plus $2.50 from the experimenter for each week they met their goal of 1.5 pounds weight loss), and combined stimulus control with contingency contracting. Results of this study (Fremouw et al.) indicated that stimulus control techniques worked to improve all targeted behaviors (i.e., eating in designated areas; eating appropriate, healthy snacks; slowing the bite rate per minute; keeping utensils down for longer periods of time) and to facilitate weight loss. Contingency contracting also facilitated weight loss but it resulted in changes to only some of the targeted eating behaviors. Thus the authors concluded that contingency contracting did not seem to add additional positive treatment effects above those achieved through stimulus control techniques.

Caroll and Yates (1981) investigated the role of stimulus control training to help adults maintain weight loss following behavioral therapy. In this study 24 female participants were assigned to either behavior therapy with, or without, additional stimulus control training. The behavior therapy included 10 weekly 90-minute sessions focused on self-monitoring, self-reinforcement, self-punishment, response chaining, substitution, nutrition, and exercise. Participants who also received stimulus control training were provided instructions to reserve one room and chair for eating, to eat at the same times each day, to do nothing else while eating, to store no food within sight, and to cover food in the refrigerator by storing it in opaque containers or brown paper bags. Overall, the stimulus control training focused on how external stimuli can control caloric consumption. Results indicated that the group receiving behavior therapy and stimulus control training lost significantly more weight ($p < .05$), but only when assessed at the 8-month follow-up period. Immediately following treatment both groups lost approximately the same amount of weight. These results suggest that stimulus control training may be important to maintaining weight loss and producing additional weight loss. However, given this study focused only on adults, the generalizability to a pediatric population is limited and similar research specific to children is needed.

Prior research investigating use of stimulus control techniques with adults (Beneke & Paulsen, 1979; Beneke et al., 1978; Dunkel & Glaros, 1978; Loro et al., 1979) found mixed results. Some researchers (Dunkel & Glaros; Loro et al.) found that stimulus control techniques (e.g., having participants eat alone, having participants not engage in other activities while eating, preplanning and preparing meals, and storing food out of sight) were not as effective as other techniques (e.g., using self instruction and self-initiation) in promoting weight loss for participants. However, other researchers (Beneke & Paulsen; Beneke et al.) found that stimulus control techniques (e.g., using opaque food storage containers) resulted in significant weight loss that was maintained for up to 18 months.

Treatment adherence. Treatment adherence has also been implicated as an important predictor of treatment effectiveness in pediatric obesity interventions (Denzer et al., 2004; Wrotniak et al., 2005). Denzer and colleagues reported on the role that adherence to frequent treatment visits had for obese (BMI $\geq 90^{th}$ percentile and $< 99^{th}$ percentile) and excessively obese (BMI $\geq 99^{th}$ percentile) children participating in an outpatient weight loss program. The researchers noted that in both the obese and excessively obese groups, children who had more frequent visits to the program (visit intervals < 60 days) lost significantly more weight than children who visited the clinic less frequently (visit intervals > 120 days). In fact, children in both the obese and excessively obese groups did not achieve significant weight loss if the treatment interval time was > 120 days. Though not mentioned by the researchers, presumably treatment programs that are easier to adhere to would result in more frequent treatment visits and greater treatment protocol adherence. Likely this would result in greater weight loss for overweight children.

Wrotniak and colleagues (2005) conducted the only known assessment of treatment adherence in multicomponential behavioral treatments for obese children. Specifically, the researchers assessed adherence to treatment components in two separate multicomponential behavioral treatments for overweight children. In the first study (described in detail earlier in this section), Epstein and colleagues (2000) randomly assigned obese children to one of four treatment conditions (high versus low sedentary behavior reductions or physical activity increases). In the second study Epstein, Paluch, Gordy, Saelens, and Ernst (2000) randomly assigned obese children to either parent and child problem solving, child problem solving, or standard treatment without problem solving. To assess treatment adherence in the two studies Wrotniak and colleagues used parent and child questionnaires completed at the 24-month follow-up periods. These questionnaires were designed to assess frequency of compliance with treatment components (e.g., dietary changes, some stimulus control techniques regarding eating behaviors, use of praise) over the previous month.

The results of this study (Wrotniak et al., 2005) indicated that child adherence to daily weighing and to planning ahead for celebrations with high energy-dense foods, as well as parent adherence to praising the child at nightly meetings and to modeling healthy eating habits were predictors of child percentage overweight change at the 24-month follow-up, $F(4, 105) = 10.86$, $p < .001$, multiple $r^2 = 0.29$. These results suggested that some components of multicomponential behavioral treatments for overweight children may be particularly important in predicting treatment success. However, a major limitation of this study was that it assessed adherence retrospectively. Additionally, the study did not assess particular techniques (e.g., the full array of stimulus control strategies) used specifically to decrease sedentary behaviors.

Role of parents in interventions. Another important aspect of interventions for overweight children is the role that parents play. According to Jelalian and Saelens (1999), interventions that have yielded the greatest and most long-term decreases in percent overweight for overweight children have included parents as essential components of a multicomponential behavioral treatment package (Epstein, Valoski et al., 1994). Two studies investigated the effectiveness of targeting parents as the agents of change in treatments for overweight children (Golan & Crow, 2004; Golan et al., 1998). Golan and colleagues (1998) investigated the effectiveness of using parents as the sole agents of change (experimental group) versus using children as the sole agents of change (conventional treatment group) in producing weight reduction for children ages 6 through 11 ($M = 9.2$ years of age, $SD = 1.0$). Sixty overweight children were included in the study, all of whom were at least 20% overweight. Participants were randomly assigned to the experimental group, in which parents participated in 14 hour-long sessions or the conventional treatment group, in which children participated in 30 sessions. Results indicated that children in both groups significantly decreased in percent overweight, when compared with baseline statistics, $t = 7.35$, $p < .001$ (experimental group); $t = 3.74$, $p < .01$ (conventional treatment group); however, children in the experimental group showed significantly greater decreases in percent overweight (14.6%) than those in the conventional treatment group (8.4%), $F(1, 57) = 5.0$, $p < .05$. This suggested that treatments for overweight children in which parents are the primary agents of change will likely result in greater reductions in percent overweight than treatments in which children are the primary agents of change.

Golan and Crow (2004) also reported on the long-term effects of targeting parents exclusively in the treatment of pediatric obesity. The researchers contacted the 60 participants from the original study (Golan et al., 1998) 7 years after completion of the study and were able to gain follow-up data from 50 of the 60 original participants. At the 7-year follow-up children were between the ages of 14 and 19 ($M = 16.0$, $SD = 0.5$ years). According to the researchers, at the 7-year follow-up, children from both the experimental group (parents targeted as the agents of change) and conventional treatment group (children targeted as the agents of change) lost a substantial amount of weight, with a mean percent overweight reduction of 29% in the experimental group and a mean percent overweight reduction of 20.2% in the conventional treatment group (Golan & Crow); however, children in the experimental group reduced their percent overweight significantly more than children in the conventional treatment group ($p < .05$). At the 7-year follow-up, 60% of children from the experimental group had reached "nonobese" status, while only 31% of children from the conventional treatment group had reached "nonobese" status. The researchers concluded that parents should be targeted as the main agents of change in interventions for overweight children because parents are able to create a healthier family environment and are able to model appropriate eating and activity behaviors to help improve children's long-term weight statuses.

A recent meta-analysis (Young et al., 2007) also investigated the role that families play in the treatment of overweight children. This review employed the following inclusion criteria: children ages 5 - 12, interventions with the primary goal of weight loss, use of behavioral or cognitive-behavioral techniques, and having at least one parent or guardian participate in the study. These criteria resulted in review of 16 separate experimental studies in which the role of the parents varied from that of "helpers" to the actual targets of treatment. Effect sizes were calculated for all family-behavioral treatment groups and for control groups (8 of 16 studies included a true control group). A large, statistically significant effect size was found for family-behavioral treatment groups (ES = -0.89, SD = 0.68, 95% CI = -1.06 to -0.73), while a nonsignificant effect size was found for control groups (ES = -0.18, SD = 0.47, 95% CI = -0.75 to 0.39). Young and colleagues noted that few of the studies reported follow-up data; however, for those family-behavioral studies that did report such data, the effect size using percent overweight as the outcome variable was large and statistically significant (ES = -0.84, SD = 0.97, 95% CI = -1.06 to -0.61). Overall, these results suggest that inclusion of parents in family-based behavioral treatments for overweight children produces large, positive effects that appear to be maintained over several months.

Summary of Literature Review/Research Questions

Epidemic proportions of children and adolescents are currently overweight or at-risk of being overweight, as classified by CDC growth charts (Council on Sports Medicine and Fitness, 2006; Ogden et al., 2006). This is a pressing health care concern given the serious short- and long-term health risks that are associated with being overweight (Krishnamoorthy et al., 2006), as well as the significant health care costs associated with treating the direct and indirect effects of childhood obesity (Zametkin et al., 2004). In addition to health risks, being overweight appears to also place children at increased risk for psychosocial problems, including poor body image, social problems, and psychological problems (Zametkin et al.).

Environmental factors, such as television watching, have been implicated in the sharp increase in prevalence of children who are overweight (e.g., Faith et al., 2001; Hancox et al., 2004), although there has been increased debate about the strength of these relationships (Marshall et al., 2004). Recent successful interventions have typically focused on decreasing sedentary behaviors, such as television watching, and have included a comprehensive set of treatment components, as part of long-term research studies (e.g., Epstein, Valoski et al., 1995; Epstein, Paluch et al., 2000). These studies typically yield successful results in the short- and long-term in terms of producing significant decreases in percent overweight. However, these studies have been limited in that they have not attempted to isolate the most effective and easiest to implement treatment strategies. Given the comprehensive and sometimes complex nature of these studies, treatment adherence and feasibility may be an issue for applying these treatments to all of the children who are overweight or at-risk of being overweight. Additionally, these studies have been limited to just group-based experimental designs, with no known single-subject studies being conducted to date.

If there truly is a clinically meaningful relationship between television viewing and weight, reducing television watching for overweight children represents a promising intervention strategy. Specifically, it has the potential to be an easy-to-manipulate environmental variable, which parents and children could monitor through simple tracking systems. Research suggests that most pediatricians are aware of the current AAP guidelines to reduce television watching to 2 hours per day, that they agree with these guidelines, and that they often discuss the guidelines with families (Gentile et al., 2004). However, some families may require more information about specific strategies to reduce television watching. If there were easy-to-implement strategies to reduce television watching, it seems likely that pediatricians would be willing and able to quickly disseminate information about these strategies to families during routine office visits. To test the effectiveness of a simple strategy to reduce television watching and overall screen time, and to address limitations in the designs of previous studies, the current study sought to address the following research questions:

1a. Will overweight children and children at risk of being overweight (BMI ≥ 85th percentile, based on CDC growth chart guidelines, specific to age and sex) who receive a brief stimulus management-based intervention focused on reducing average daily screen time (i.e., amount of TV watched, computer time, time spent playing videos games, time spent watching movies or other videos) show a greater reduction in screen time behaviors during an active treatment phase than during a baseline, "tracking-only" phase, as part of a multiple baseline, single-subject design?

While no known intervention research studies of overweight children have solely focused on use of stimulus management to reduce average daily screen time, there have been multicomponential behavioral studies that have focused on use of stimulus management techniques (e.g., making rules to restrict sedentary activities) to reduce sedentary behaviors, in combination with other treatment components (e.g., changes in diet). Outcomes of these multicomponential behavioral studies indicated that stimulus management techniques were effective in reducing sedentary behaviors for overweight children and children at risk of being overweight; however, because stimulus management techniques were included in the context of several other treatment components, true effectiveness is unknown. Based on these results, it was hypothesized that the active treatment phase focusing on stimulus management techniques would be significantly more effective than only tracking screen time in reducing average daily screen time. However, it should be noted that these studies relied on use of large group experimental designs and none employed a multiple baseline, single-subject design.

1b. Will children in the active treatment phase increase their participation in physical activities and decrease their snacking more than during the baseline phase? To assess this, participation in physical activities and snacking frequency, number of snacks consumed during screen time activities, and number of high-fat or high-sugar snacks consumed (all based on parent reports), were graphed over the weeks of the baseline and treatment phases.

Previous research suggests that sedentary activities may displace physical activities and may act as cues for increased unhealthy snacking. It was hypothesized that the treatment phase would result in greater reduction of screen time behaviors than the baseline phase. Therefore, it was hypothesized that physical activities would increase over the course of the treatment phase, while snacking frequency, number of snacks consumed during sedentary activities, and number of high-fat/high-sugar snacks consumed would all decrease over the course of the treatment phase, and that these changes would be more prominent during the treatment phase than during the baseline phase.

2. Will children maintain a reduction in average daily screen time behaviors at a 2-month follow-up? The outcomes of previous multicomponential behavioral studies that included a focus on reducing sedentary behaviors indicated that children in treatment groups aimed at reducing sedentary behaviors maintained significant reductions in percent overweight over time (e.g., at 12-month and 24-month follow-ups); however, information was not provided on whether children maintained reductions in sedentary behaviors. Therefore, no hypothesis was made regarding this research question.

3. At a 2-month follow-up will there be differences in BMI percentile values when comparing data obtained just prior to the baseline period and data obtained at the 2-month follow-up visit? As mentioned previously, there are no known research studies that have focused solely on use of stimulus management techniques to reduce average daily screen time in a group of overweight children; however, in research that utilized a multicomponential behavioral treatment design (with stimulus management as one treatment component) significant changes in *z*-BMI scores were maintained over 6- and 12-month follow-up periods. Therefore, it was hypothesized that children would be significantly less overweight (based on reductions in BMI percentile values) at the 2-month follow-up.

4. For children who experience reductions in BMI percentile, is there also a decrease in average daily screen time, as measured following completion of treatment and again at the 2-month follow-up? It was hypothesized that children who experienced decreases in BMI percentile would also experience a decrease in average daily screen

time.

5. For children who experienced decreases in BMI percentile, is better treatment adherence (as measured by parent rating) related to greater reduction of screen time, as measured following the treatment phase? Treatment adherence was assessed concurrently, as previous research was limited by use of a retrospective recall-based method of assessing treatment adherence. It was hypothesized that for children who experienced decreases in BMI percentile, greater treatment adherence would be present when there was also a reduction in screen time.

CHAPTER III

METHODS

Experimental Design

A multiple baseline (across participants) design was selected because the behaviors taught during the treatment phase were irreversible with subsequent treatment withdrawal. Specifically, the intervention strategies taught during the treatment phase included increased awareness and knowledge about screen time that would be impossible to remove if a subsequent baseline phase would be implemented. By varying the amount of time cohorts spent in baseline, this design was used to evaluate the efficacy of the treatment by investigating whether daily screen time consistently decreased only when the experimental variable (i.e., training on use of stimulus management techniques) was applied. Time and measurement error, which are potential threats to internal validity, were reduced by visually inspecting multiple data points to determine whether the impact of the treatment phase differed from baseline trend, variability, and level. Use of a cohort design that included a total of 10 participants improved external validity which is an inherent issue in single-subject designs.

Participants

Cohorts 1, 2, and 3

A total of 11 sets of parents and children participated in this study, though one set from Cohort 2 dropped out during the baseline phase of the study leaving 10 participants who completed the study. There were four sets of participants in Cohort 1, four in Cohort 2 and three in Cohort 3. Demographic characteristics of the parent and child participants were assessed with the Demographic Form (see Instrumentation section below) parents filled out at the initial baseline assessment session. See Table 1 for a description of the child and parent participants from each cohort.

Instrumentation

Telephone Screening Questionnaire

Interested parents contacted the study coordinator and completed a brief telephone screening questionnaire created for this study (see Appendix A) after being informed of the purposes of the study. The questionnaire typically took 15 minutes for parents to complete. Parents were asked a series of questions based on the inclusionary and exclusionary criteria of the study. The questionnaire contained six sections that addressed all of the inclusion and exclusion criteria of the study (see Procedures section for detailed information regarding the inclusion and exclusion criteria). If, after a section, the parent or child was found to be ineligible for the study, this information was conveyed to the parent and the study coordinator did not go on to the next section of the questionnaire.

Demographic Form

At the baseline assessment all parents completed the Demographic Form (see Appendix B) that assessed both parent and child demographic information. Information provided by each parent about him/herself included whether the parent is the biological

Table 1 goes here

parent, adoptive parent, step-parent, legal guardian or "other." In addition, information about the parent's highest level of education was obtained, as well as the parent's current marital status, and ethnicity. Contact information was also obtained. The Demographic Form contained sections for information about both mothers and fathers. However, information is only reported in this study for parents who participated by attending the treatment sessions. Parents provided the following information about their child: age, grade level, biological sex, and ethnicity.

Tracking of Daily Screen Time

The Daily Screen Time Log (see Appendix C), created for the study, was used by parents during all weeks of the study (i.e., the baseline tracking-only phase, treatment phase, 2-month follow-up) to track children's daily screen time for all weekdays and weekend days. Screen time, as defined by the American Academy of Pediatrics (AAP) includes time spent by children watching television, watching videos (i.e., watching movies, either at a movie theater or on DVD or VHS), playing video games, and using a computer for nonschool related purposes (e.g., using the internet, chatting with friends online, playing computer games). Parents provided information from the Daily Screen Time Log either during weekly phone calls during the baseline phase or by turning in the completed logs at the parent group sessions during the treatment phase. Parents were required to turn in a "hard copy" of all Daily Screen Time Logs completed. All parents who provided weekly tracking information for at least 6 out of 7 days were entered into weekly drawings for a $25 gift card to a local department store for all weeks of the study.

Weekly Telephone Questionnaire

During the weeks of the baseline and treatment phases, including one week following the final treatment session, parents received weekly telephone calls from the study coordinator. The study coordinator utilized two different versions of the Weekly Phone Tracking Questionnaire (see Appendix D) during each call depending on whether it was during the baseline or treatment phase. These telephone calls were made in order to gain information about treatment adherence, children's physical activity, and children's snacking habits. With regard to treatment adherence, parents were given the opportunity to report problems they encountered in implementing the treatment strategies so these problems could be addressed in the next group session.

Treatment Satisfaction Questionnaire

Following the treatment phase, all parents completed the Treatment Satisfaction Questionnaire (see Appendix E), which was created by the study coordinator. Because there have been no known single-subject design studies of stimulus management methods to reduce screen time in children at risk of being overweight or children who are overweight, it was necessary to determine if parents were satisfied with this type of intervention. Additionally, the questionnaire was used to assess parents' beliefs about whether the intervention helped to reduce their children's screen time behaviors and whether the intervention appeared to promote healthy lifestyle changes (i.e., increases in physical activity, decreases in snacking frequency; decreases in consumption of high-fat snacks). The questionnaire also asked parents about how their own behaviors (i.e., daily screen time, daily vigorous physical activity, snacking frequency, consumption of high-fat snacks) and weight changed over the course of treatment. The questionnaire has 13 questions assessing these various areas, each of which contains response choices on a 5-point Likert scale; however, the possible response choices differ based on the question.

Dependent Variables

There were several dependent variables of interest in the current study. These included daily screen time, physical activity, snacking behaviors, and BMI percentile. Daily screen time included total daily minutes of television watched, video games played, videos /movies watched, and use of a computer for nonschool related purposes. Information on daily screen time was tracked through use of the aforementioned Daily Screen Time Log and was collected for each day (i.e., both weekdays and weekends) of the baseline and treatment phases, as well as for an additional week during the 2-month follow-up phase. Typically screen time was tracked by parents for their children; however, in at least one case (i.e., Participant 09) the child also participated in tracking his own daily use of screen time. Tracking was completed by having parents write down screen time totals in the four categories (i.e., TV, video games, videos/movies, computer usage) for each day of the three study phases. To gain the most accurate assessment of daily screen time parents were asked to track screen time in minutes and to not round values up or down.

Information on physical activity and snacking behaviors was obtained during weekly telephone calls placed to parent participants during the weeks of the baseline and treatment phases. Parent participants were asked to report on the following for their child, based on a retrospective recall of the previous 24 hours: (a) estimate of the amount of time (in minutes or hours) the child spent in physical activities such as walking, running, swimming, and participating in team or individual sports; (b) estimate of how many times the child snacked between meals; (c) how many times the child ate a snack in front of the television or while engaged in another screen time activity; and (d) of the total times the child snacked, how many of those times included high-fat or sugary snacks, which would include things such as cookies, pastries, chips, regular/nondiet soda, and high sugar fruit juice.

BMI percentiles were calculated just prior to the baseline phase, one week following the treatment phase, and two months following the treatment phase measurement. BMI percentile values were determined by first weighing and measuring the child participants through use of a Health-o-Meter ® scale and a tape measure. Based on the child's age and sex, appropriate BMI percentile calculations were determined using the CDC's online BMI percentile value calculator for children.

Procedures

Initial Recruitment

Parents of children at risk of being overweight, or children who were overweight, were recruited through the following methods: (a) several advertisements placed in two local newspapers, (b) fliers advertising the study posted in local businesses and schools (with prior permission), (c) several web-based announcements about the study e-mailed to the faculty and students at Utah State University (USU) and posted for one week each on the USU homepage, (d) fliers posted at two local churches, (e) an e-mail announcement of the study sent to members of the Parent Teacher Association at a local elementary school, (f) fliers posted in two local pediatric practices, (g) referrals from study participants and faculty members at USU, and (h) a front-page article in the health section of a local newspaper.

Interested parents contacted the study coordinator via telephone or e-mail and the study coordinator explained the requirements of the study. A total of 26 parents contacted the study coordinator with interest in the study. After learning about the focus of the study and procedures, 17 parents remained interested in the study. Parents expressed the following reasons for no longer being interested in the study: they were already restricting their child's screen time (7 parents), they believed the study would require too much of a time commitment (1 parent), and they lived too far away from where the study was being conducted (1 parent).

Parents who were still interested then completed the Telephone Screening Questionnaire or scheduled a later phone appointment during which the questionnaire was completed. As previously mentioned, the screening questionnaire assessed the inclusion criteria for the study, which included the following: (a) child's age between 6-12 years, (b) child's BMI-for-age ≥ 85^{th} percentile, based on current CDC growth charts (see Appendix F), (c) parents and children able to attend all study-related assessment sessions, (d) at least one parent available to attend all group treatment sessions, (e) an available person/persons to consistently track the child's daily screen time for the duration of the study, and (f) the child's average daily screen time (as reported by the parent who completed the screening questionnaire) was ≥ 120 minutes. To assess average daily screen time parents were asked to provide an estimate of their child's total screen time (estimated in hours and minutes; later converted to minutes) for a typical weekday and a typical weekend day. These estimates were averaged by multiplying the typical weekday amount by 5 and multiplying the typical weekend amount by 2. These values were then summed and divided by 7n to provide the most accurate estimate of the child's average daily screen time. The following exclusion criteria were also assessed through the telephone screening questionnaire: (a) parents or children currently participating in a supervised weight loss treatment program, and (b) children for whom the parent endorsed four or more of the symptoms of oppositional defiant disorder (ODD), based on current diagnostic criteria from the *Diagnostic and Statistical Manual-Fourth Edition-Text Revision* (*DSM-IV-TR*; American Psychiatric Association, 2000).

Of the 17 parents who completed the Telephone Screening Questionnaire, 13 had children who were eligible for the study based on the inclusion and exclusion criteria. Children were not eligible due to the following: they did not meet the average daily screen time requirements (i.e., they were reported to engage in < 120 minutes/day of screen time, on average; 3 children fell into this category) and one child who was reported to have four symptoms of ODD.

The remaining 13 children were offered participation in this study. Of these, one parent later opted to not participate because she was no longer interested in the study due to the time commitment involved in participating. The 12 sets of parents and children were scheduled for an initial baseline assessment visit at the Utah State University Psychology Community Clinic. One set was found to be ineligible when they came in for the baseline assessment (see section below). See Figure 1 for a summary of participant flow through the study.

Baseline Phase

During the baseline assessment the study coordinator again went over the details of study participation and obtained written informed consent from all parents (see Appendix G for the initial consent form used in the study). Children and parents were then weighed on a Health-o-Meter® Professional Dial Scale and their heights were obtained by utilizing a tape measure mounted to a wall. Parents also completed the Demographic Form at this assessment session. However, after signing consent one participant (Participant 2) was found to be ineligible. This was due to her BMI-for-age percentile being below the 85^{th} percentile, which was determined upon verifying her height and weight measurements.

At the baseline assessment session parent and child participants in the first two cohorts were instructed that the study was a traditional experimental design in which approximately half the participants would be randomly assigned to a "treatment" group and half would be randomly assigned to a "tracking-only" group. Parents from the first cohort (n = 4) were initially randomly assigned to be in the treatment group, while parents in the second cohort (n = 4) were initially randomly assigned to be in the tracking-only group. Due to a low number of participants recruited it was determined that a single-subject, multiple baseline, cohort design would be an appropriate design to use to address

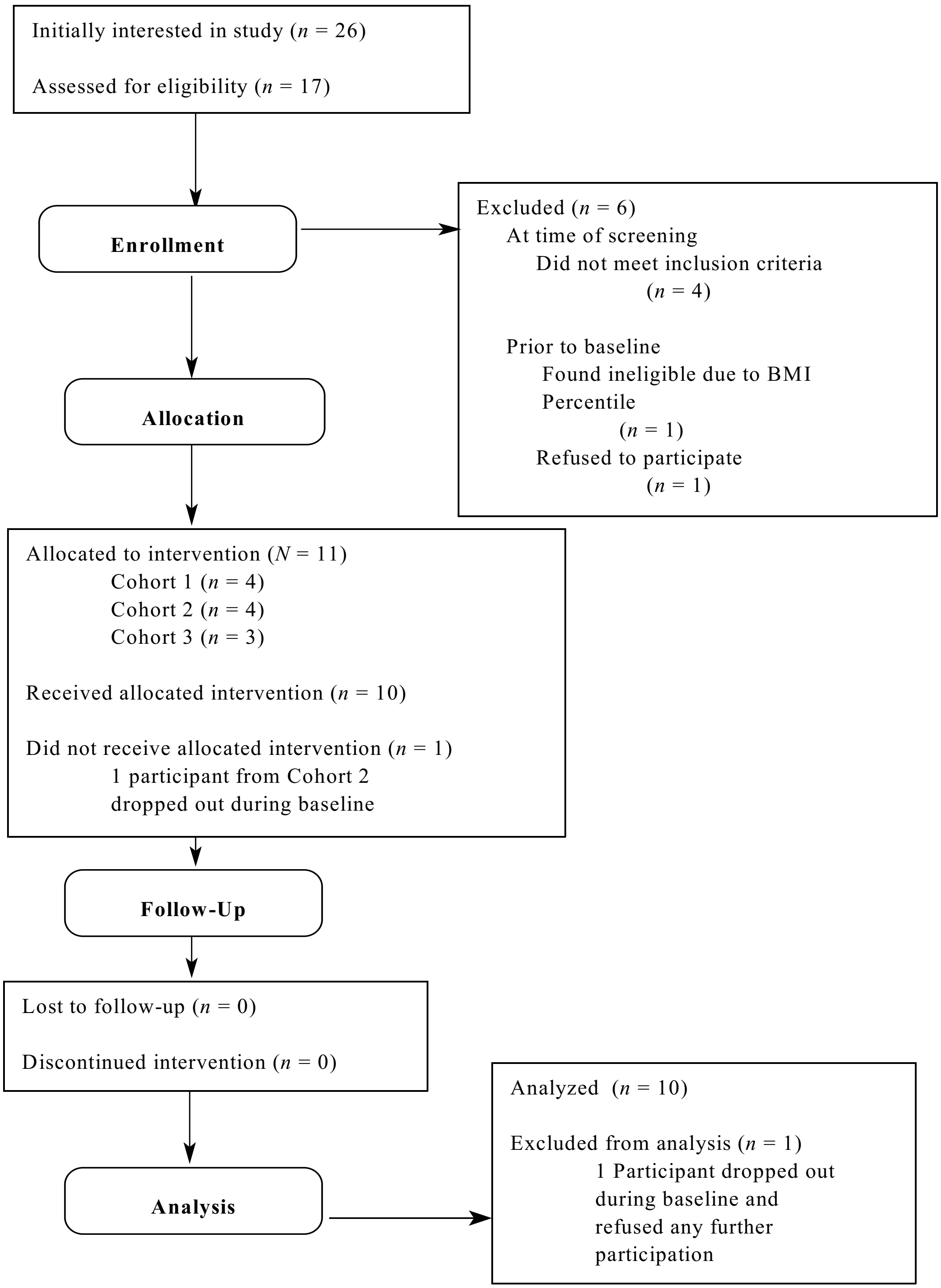

Figure 1: Flow chart of participant movement through study phases.

the research questions of this study. Therefore, Cohort 1 participated in two weeks of a baseline tracking-only phase in which they utilized the Daily Screen Time Log to track their child's daily screen time. These two weeks of baseline occurred for one week prior to commencement of the group treatment sessions and one week following Session 1, which was considered an introductory, nontreatment session. During baseline parents were instructed to track their child's daily screen time. Daily screen time was explained verbally and a written reminder of what constituted screen time was at the top of each Daily Screen Time Log. Screen time was defined based on the guidelines provided by the AAP and included the following: (a) watching TV, (b) watching movies/videos, (c) playing video games, and (d) using a computer for nonschool related purposes. During the baseline phase parents were given no other instructions regarding limiting screen time. Parents in Cohort 1 completed four weeks of additional tracking (i.e., tracking during the weeks following Sessions 2-5), and a final week of tracking one week prior to a 2-month follow-up assessment session.

After 4 weeks of tracking-only (i.e., tracking daily screen time with no other instructions regarding limiting the child's screen time) parents in Cohort 2 were offered participation in the treatment phase of this study. Three of the four parents agreed to participate in the treatment phase and they signed an informed consent form detailing the new changes in the study design. These changes, as well as the revised consent form, were approved by the USU Institutional Review Board (IRB; see Appendix H for the revised consent form). As mentioned previously, the parent who did not wish to participate in the treatment phase had previously withdrawn from the study after 3 weeks of participation, indicating that she no longer had time to dedicate to the study requirements. She was subsequently offered participation in the treatment phase, and still opted to remain withdrawn from further participation. The remaining three parents in Cohort 2 completed a total of 6 weeks of baseline tracking, followed by 4 weeks of tracking during the treatment phase (i.e., during the weeks following Sessions 2-5), and 1 week of follow-up tracking 2 months after the posttreatment assessment session.

Cohort 3 was recruited after the study was designated a single-subject design. Therefore, all participants in this cohort (*n* = 3) knew before the beginning of the baseline phase that they would solely track screen time for 7 weeks (i.e., one week longer than participants in Cohort 2 had tracked), and would then begin treatment sessions aimed at providing specific strategies to decrease children's screen time and increase time spent in physical activities (see Appendix I for the consent form used for Cohort 3 participants). As with the previous two cohorts, the week following Session 1 was treated as still being part of the baseline phase because specific stimulus management treatment techniques were not introduced until Session 2. Following the baseline phase participants in Cohort 3 tracked screen time during the 4 weeks following Sessions 2-5, and 1 final week one week prior to the 2-month follow-up assessment session.

At the baseline assessment session parents in all cohorts were instructed on procedures that were used to gain ongoing assessment information from them (i.e., weekly telephone calls to assess children's screen time, children's level of physical activity, and children's eating behaviors). Additionally, at the baseline session the study coordinator reviewed the proper way of documenting children's daily screen time on the Daily Screen Time Log.

Treatment Phase

Group treatment sessions (see Appendix J for treatment session outlines) were conducted with only parents present. Following their respective baseline periods all cohorts met once a week for 5 group sessions. All sessions lasted approximately 60 minutes in duration. They were conducted in one of several conference or large therapy rooms at the USU Psychology Community Clinic. Initial group sessions focused on discussing sedentary behaviors, defining screen time, discussing current pediatric guidelines about daily screen time, establishing the link between screen time and unhealthy lifestyles (including a discussion of the relationship between too much screen time and body fatness), presenting the treatment goal (i.e., reducing screen time to ≤ 2 hours each day), and defining stimulus management strategies that would be used as the primary treatment intervention.

In the context of this study, which primarily focused on decreasing children's screen time to less than 2 hours per day, stimulus management was explained in a consistent manner to each cohort. Specifically, it was noted that sedentary behaviors such as television, videos, and computer use are stimuli or environmental cues for being inactive and, for some children, for eating unhealthy foods. The following example was provided to each cohort: sitting in front of the TV can be a cue for eating a bag of chips, whether because you are bored or because you see a commercial for a bag of chips. It was also explained that in the context of this study stimulus management meant that parent participants would make changes to the family environment to prevent their children from engaging in the target behaviors (i.e., watching TV, watching movies/videos, playing video games, and using the computer for nonschool-related purposes). Each cohort was instructed that this would include making rules about use of screen time activities. Two examples of stimulus management techniques were provided to each cohort: (a) changing the family environment by unplugging the television, and (b) creating the rule that children can watch 1 hour of TV, but only after getting homework finished. The definition of stimulus management and examples provided were consistent with information provided by previous research conducted comparing stimulus control and positive reinforcement techniques within a multicomponential treatment for decreasing sedentary behaviors (Epstein et al., 2004). As a group each cohort was instructed to create two rules and two family environment changes that all group members agreed to implement; however, in Cohorts 2 and 3 parents generated three family environment changes and one rule because group members could not think of additional rules that would be appropriate in their families. In all cases an emphasis was placed on choosing stimulus management strategies that would be easy to implement in a "family-wide" fashion to facilitate adherence to use of the strategies.

The following family environment changes were generated by the cohorts: (a) planning ahead at the beginning of the week to be active and out of the house, particularly on weekends (Cohort 1); (b) having nonscreen time activities available in a visible location (Cohorts 1 and 2); (c) creating and displaying a list of alternative activities, including physically active choices (Cohorts 2 and 3); (d) instituting a shared family activity that is physically active, that would occur at least one time per week (Cohorts 2 and 3); and (e) use of a timer to limit screen time (Cohort 3). The following rules were generated by the cohorts: (a) for every show watched, the child was required to participate in 15 minutes of exercise (Cohorts 1 and 2); (b) the child could watch 30 minutes of TV (using the timer) and then had to do something active (Cohort 3); and (c) screen time had to be earned through completion of chores (Cohort 1).

Subsequent treatment sessions were spent brainstorming physical activities that could be used to replace excessive screen time, as well as problem solving solutions to difficulties that parents and children had in implementing stimulus management strategies. The remaining sessions focused on addressing issues related to generalizing the new skills to other situations (e.g., other seasons of the year) and issues related to maintaining progress. At the final group treatment session all parents completed the Treatment Satisfaction Questionnaire to assess whether they were satisfied with the treatment strategies offered. Specifically, this questionnaire assessed topics such as whether parents thought the treatment strategies were helpful in promoting a healthy lifestyle for their children and whether the strategies were helpful in reducing their children's daily screen time. See Table 2 for a summary of information covered in weekly sessions, as well as attendance at the sessions.

Posttreatment and Follow-Up Assessments

In addition to the baseline assessment period, assessment periods occurred for each

Table 2 goes here

cohort following the final treatment session, and again two months after the posttreatment assessment session. At each assessment period parents and children were weighed and their heights were obtained. Approximately three weeks prior to the 2-month follow-up, parents were contacted via a letter to notify them of the upcoming follow-up assessment. This letter also requested that parents track their child's screen time for a week prior to the follow-up visit. A tracking form was provided with the letter and this form was turned in at the follow-up visit. See Figure 1 for explanation of participant movement throughout the stages of the study.

Following completion of the treatment phase, participants in all cohorts who attended all group sessions and assessment sessions were eligible to earn a prize for their participation. These families were entered into a drawing for a $50 gift card to a local sports store. Following completion of the 2-month follow-up assessment, participating families were entered into a drawing for another $50 gift card to the same sports store.

CHAPTER VI

RESULTS

Overview

A variety of methods were used to analyze the study results including visual inspection of multiple baseline graphs, creation of simple graphs to determine change in trends over the course of the study, examination of changes in BMI percentile across the phases of the study, and correlational analyses.

Reduction in Daily Screen Time

The first objective of this study was to determine if children with a BMI $\geq 85^{th}$ percentile (i.e., at risk of being overweight or overweight, based on CDC growth chart guidelines, specific to age and sex) would show a reduction in screen time following a brief stimulus management-based intervention to decrease daily screen time. Results were analyzed using a multiple baseline design across participants. During the baseline phase participants tracked screen time Data were analyzed separately for weekdays and weekends/holidays due to different trends noted for each. Figures 2, 3, and 4 display the daily screen time totals for each weekday (i.e., each Monday - Friday of the study that was not identified as a national holiday or day that a child had off from school) of the study, across the three phases of the study--baseline, treatment, and the 2-month follow-up. Figures 5, 6, and 7 display the daily screen time totals for each weekend day and identified holidays or days off from school, across the three phases of the study. Daily screen time

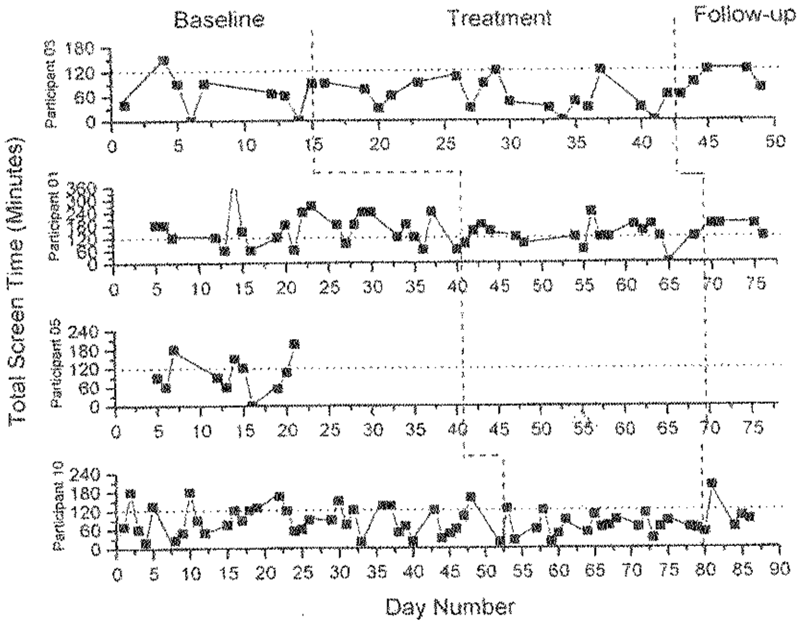

Figure 2. Weekday screen time totals for participants 03, 01, 05, and 10. *Note.* Participant 05 dropped out of the study during the baseline phase.

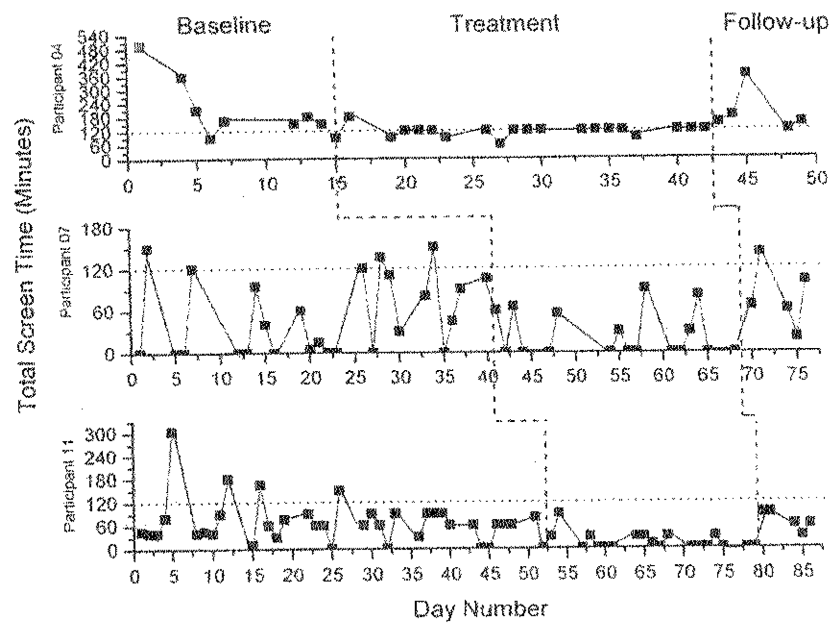

Figure 3. Weekday screen time totals for participants 04, 07, and 11.

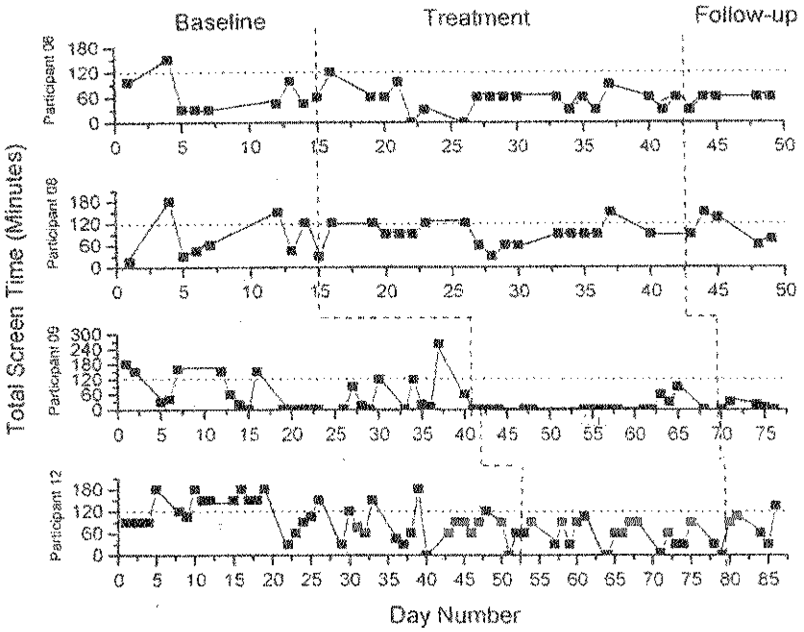

Figure 4. Weekday screen time totals for participants 06, 08, 09, and 12.

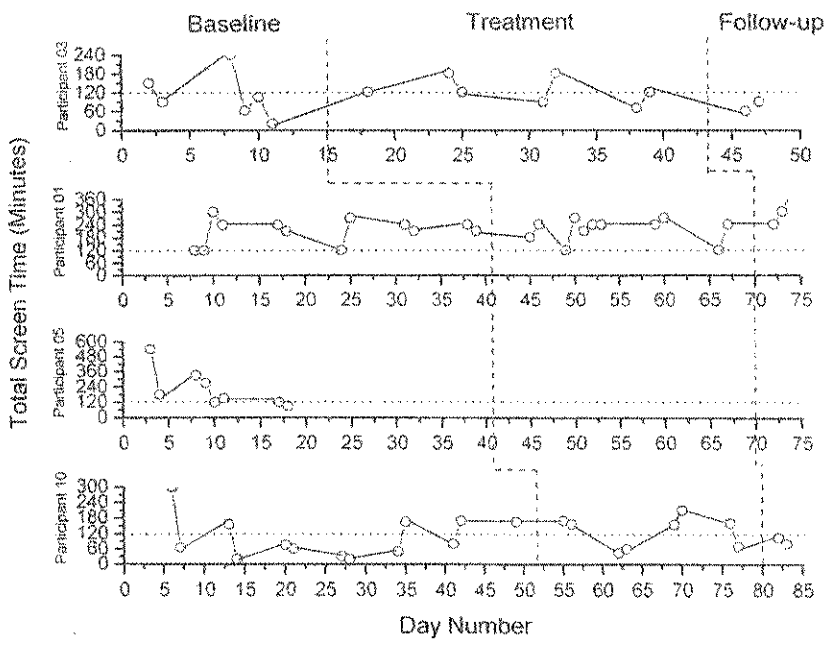

Figure 5. Weekend/holiday screen time totals for participants 03, 01, 05, and 10. *Note.* Participant 05 dropped out during the baseline phase of the study.

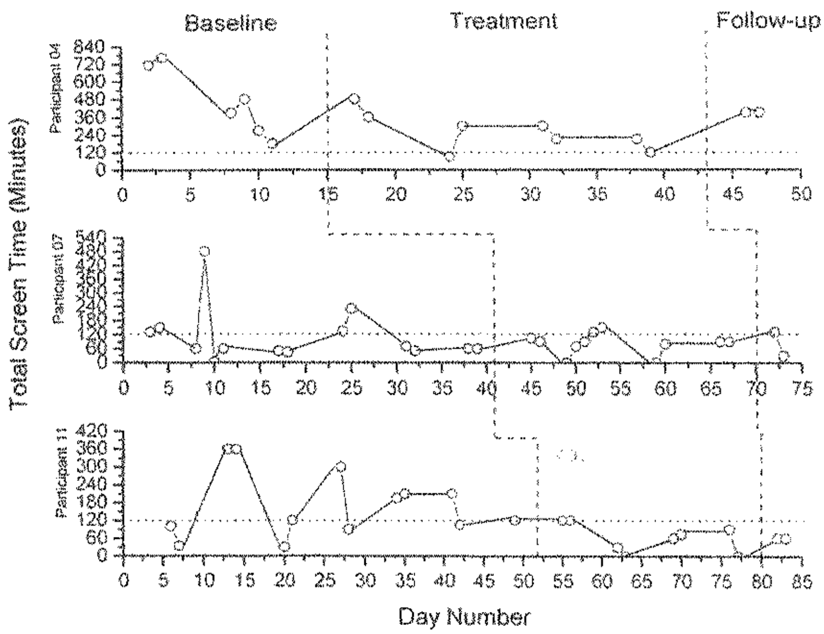

Figure 6. Weekend/holiday screen time totals for paarticipants 04, 07, and 11.

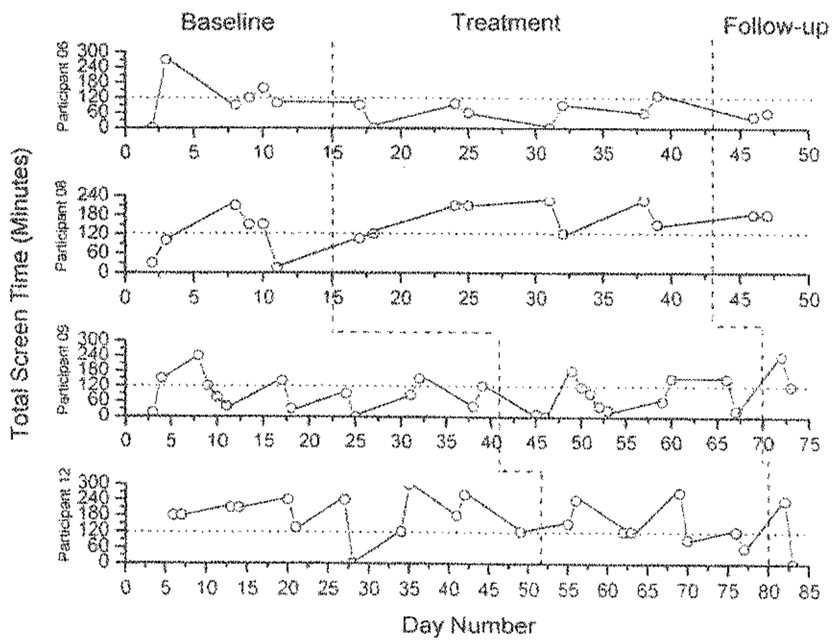

Figure 7. Weekend/holiday screen time totals for participants 06, 08, 09, and 12.

totals were calculated by summing the total daily minutes spent watching television, watching movies and/or videos, playing video games, and using the computer for nonschool related purposes. Figures 2 through 7 show comparisons between participants in the three cohorts, which differed only in length of baseline periods. Because the cohorts differed in number of participants these figures include differing numbers of participants from the three cohorts.

Changes in daily screen time were assessed using visual inspection of the daily data and by comparing screen time in relation to trend, level, and variability across baseline, treatment, and follow-up. In addition to visual inspection of the data, descriptive statistics were calculated and analyzed. Tables 3 and 4 depict average daily screen time for each participant, standard deviations, and range of daily screen time totals for each of the three phases of the study.

Change in Weekday Screen Time

Visual inspection of Figures 2, 3, and 4 revealed several common trends amongst the participants. Overall, all but two participants (i.e., Participants 03 and 08, both from Cohort 1) showed a trend toward decreased level of daily weekday screen time during the treatment phase. In the case of these two participants, baseline values were already well below the study goal of <120 minutes of screen time per day, and this trend continued into the treatment phase. This trend was prevalent for almost all participants in that daily weekday screen time averages were typically less than the study goal of 120 minutes per day during the baseline phase. Given all participants were screened prior to beginning the

Table 3

Average Weekday Screen Time Totals Across Study Phases

	Baseline phase			Treatment phase			Follow-up phase		
Participant/ cohort number	Average daily screen time (min)	*SD*	Minimum-maximum screen time values	Average daily screen time (min)	*SD*	Minimum and maximum screen time values	Average daily screen time (min)	*SD*	Minimum and maximum screen time values
Cohort 1									
03	61.88	50.00	0-150	60.00	37.42	0-120	93.00	26.83	60-120
04	225.00	134.40	90-495	114.00	23.03	60-180	192.00	96.28	120-360
06	65.50	44.32	30-150	54.30	28.97	0-120	54.00	13.42	30-60
08	80.63	61.03	15-180	88.33	31.67	30-150	102.00	38.83	60-150
Cohort 2									
01	161.25	86.14	60-420	128.82	53.84	0-240	165.00	30.00	120-180
05	100.45	58.11	0-195	N/A*	N/A	N/A	N/A	N/A	N/A
07	51.92	55.48	0-150	24.12	32.85	0-90	77.00	45.22	20-140
09	62.88	74.30	0-260	10.59	25.85	0-90	12.00	13.03	0-30
Cohort 3									
10	90.69	46.94	20-180	68.25	31.84	20-125	101.00	58.78	50-200
11	69.86	57.26	0-305	14.00	22.57	0-90	66.00	25.10	30-90
12	101.05	51.45	0-180	55.00	33.76	0-105	84.00	40.53	30-135

Note. Participant 05 dropped out after Week 3 of the study. Baseline data is therefore incomplete. Treatment and follow-up data is not available.

Table 4

Average Weekend Screen Time Totals Across Study Phases

	Baseline phase			Treatment phase			Follow-up phase		
Participant/ cohort number	Average daily screen time (min)	*SD*	Minimum - maximum screen time values	Average daily screen time (min)	*SD*	Minimum and maximum screen time values	Average daily screen time (in)	*SD*	Minimum and maximum screen time values
Cohort 1									
03	111.17	76.58	20-240	125.71	41.58	70-180	75.00	21.21	60-90
04	466.67	235.62	180-765	258.75	128.22	90-480	390.00	0.00	390-390
06	122.67	89.09	0-270	65.50	45.79	0-128	52.50	10.61	45-60
08	109.17	75.79	15-210	170.63	51.92	105-225	180.00	0.00	180-180
Cohort 2									
01	210.00	60.00	120-300	215.45	53.36	120-270	310.00	75.49	240-390
05	225.00	151.28	90-540	N/A*	N/A	N/A	N/A	N/A	N/A
07	113.21	120.20	5-480	81.36	41.16	0-150	80.00	70.71	30-130
09	92.50	65.92	0-240	76.82	63.53	0-180	180.00	84.85	120-240
Cohort 3									
10	104.23	81.75	20-300	128.13	60.77	45-210	92.50	17.68	80-105
11	171.92	112.26	30-360	61.88	48.40	0-120	60.00	0.00	60-60
12	182.69	77.10	0-300	146.25	72.49	60-270	120.00	169.71	0-240

Note. Participant 05 dropped out after Week 3 of the study. Baseline data is therefore incomplete. Treatment and follow-up data is not available.

study, to ensure that they participated in greater than 120 minutes of screen time per day, on average, this suggests that monitoring and tracking likely had a therapeutic effect for most participants.

Another prominent trend was that weekday screen time averages decreased when comparing the baseline and treatment phases, even if weekday screen time was already fairly low during the baseline phase. For example, this trend was quite evident for Participants 04, 09, 11, and 12. Independent of baseline values (i.e., whether they were high or low to begin with), these participants all evidenced decreased levels of weekday screen time during the treatment phase.

A third trend noted was a tendency for weekday screen time values to begin to decrease in level during the baseline phase. Participants 01, 04, 10, and 12 showed this trend, with baseline screen time values beginning to decrease during a point in the baseline phase. For example, Participant 12 had a noticeable decrease in daily weekday screen time that emerged approximately halfway through the baseline phase. Once this trend emerged, daily weekday screen time continued to further decrease during the treatment phase.

A final trend noted was that the level of weekday screen time varied less during the treatment phase than during the baseline phase. This trend was evident for almost all participants and was most prominent for Participants 04 and 11. As indicated by visual inspection, these participants evidenced little variability in level of weekday screen time during the baseline phase. Additionally, descriptive analyses indicated that standard deviation values for these participants were lower than for all other participants. Implementation of a study goal, in combination with tracking/monitoring of the targeted behaviors, may have decreased variability. Overall, based on visual inspection of the data and descriptive analyses, the results suggested that the treatment was more effective in decreasing daily weekday screen time than simple tracking of the behavior during the baseline phase.

Change in Weekend Screen Time Totals

Overall, the trends for weekend screen time were less consistent than the trends seen for weekday screen time. One trend noted through visual inspection was a decrease in level of weekend screen time when comparing the baseline and treatment phases. However, this trend appeared to be clinically meaningful (i.e., decreasing to primarily < 120 minutes of daily weekend screen time) only for Participants 06 and 11. For these participants decreases in weekend screen time during the treatment phase also resulted in less variability of data during the treatment phase. Other participants (i.e., Participants 04, 07, 09, and 12) also evidenced a trend toward decreased weekend screen time during the treatment phase; however, these decreases were less dramatic in comparison to the aforementioned participants.

Despite the trend for weekend screen time to decrease for some participants during the treatment phase, other participants showed slight to moderate increases in weekend screen time when comparing the baseline and treatment phases. In particular, Participant 08 showed a moderate increase in weekend screen time during the treatment phase, with a majority of weekend screen time treatment values exceeding the study goal of < 120 minutes of total screen time per day. The remaining participants evidenced just slight increases in weekend screen time during the treatment phase.

A final observation noted through visual inspection of Figures 5, 6, and 7, was greater overall variability in weekend screen time levels than variability in weekday screen time levels. Despite this, a few participants who evidenced decreases in weekend screen time during the treatment phase also evidenced less variability in weekend screen time values during the treatment phase. For example, Participant 06, who evidenced a moderate decrease in weekend screen time during the treatment phase, also evidenced little variability in weekend screen time values during the treatment phase. This conclusion was also supported by descriptive analyses, which showed that the standard deviation of weekend values for Participant 06 was much smaller in the treatment phase than in the baseline phase. Overall, based on visual inspection of the data and descriptive analyses, conclusions regarding the effectiveness of the treatment in decreasing daily weekend screen time were more difficult to draw given consistent trends in the predicted direction were only evident for approximately half of the participants.

Percentage of Nonoverlapping Data

The percentage of nonoverlapping data (PND) points between the baseline and treatment conditions is another method of determining treatment effect size, with a high PND value suggesting that the treatment condition was effective (Scruggs, Mastropieri & Casto, 1987). Typically, to calculate PND, the number of data points obtained during the treatment phase that fell below (or higher, depending on the expected direction of change in the dependent variable) the lowest baseline data point is divided by the total number of data points obtained during the treatment phase and then multiplied by 100. However, according to Scruggs and colleagues, PND will not be an accurate effect size estimate, and should not be calculated in the following conditions: when orthogonal slope changes are present, when there are inappropriate baseline trends, and when there are "floor" or "ceiling" effects, including when there are numerous zero baseline data points. Also, as noted by Scruggs and colleagues, there are other complex situations in which it would be inappropriate or ineffective to calculate PND. In the case of the current study, given the significant variability in data points, it is unlikely that PND would yield clearly interpretable results. However, it would be clinically meaningful to determine if there was a difference in the percentage of data points below the recommended guideline of ≤ 120 minutes screen time per day versus the baseline and treatment phases. Additionally, given the differences in observed changes in level for weekday versus weekend screen time, it may be useful to examine this separately for weekdays and weekends/holidays. Tables 5 and 6 summarize this information.

Table 5 shows that most participants were able to limit screen time to ≤ 120 minutes per day during weekdays, even without benefiting from the treatment phase of the study; however, participants experienced a further benefit from the treatment phase, and the percentage of weekdays for which daily screen time was limited to ≤ 120 minutes per day rose for all participants. As noted previously through visual inspection and descriptive analyses, the trend for weekends and holidays was less clear. While some participants were already fairly successful at limiting screen time (as determined through analysis of baseline

Table 5

Percentage of Weekday Data Points ≤ 120 Total Screen Time Minutes

Participant ID	Baseline phase %	Treatment phase %
Cohort 1		
03	87.5	100
04	0	95.5
06	100	100
08	87.5	94.7
Cohort 2		
01	45.8	55.6
05	72.7	NA[a]
07	88.5	100
09	73.1	100
Cohort 3		
10	77.1	95
11	87.5	100
12	67.6	100

[a]Data is not available for the treatment phase because the participant dropped out during baseline.

data), some were clearly struggling in this area. All but two participants who completed the study experienced an increase in the percentage of weekends/holidays for which daily screen time was limited to ≤ 120 minutes per day. This suggests that the treatment phase was also successful in helping most participants manage weekend screen time, which would be expected to be more difficult, especially during the school year.

Table 6

Percentage of Weekend Data Points ≤ 120 Total Screen Time Minutes

Participant ID	Baseline phase %	Treatment phase %
Cohort 1		
03	50	71.4
04	12.5	25
06	50	87.5
08	33.3	37.5
Cohort 2		
01	25	18.2
05	37.5	NA[a]
07	64.3	81.8
09	71.4	72.7
Cohort 3		
10	57.1	50
11	53.3	100
12	21.4	62.5

[a]Data is not available for the treatment phase because the participant dropped out during baseline.

Follow-up Data: Maintenance of Reduction of Daily Screen Time

Another objective of this study was to determine if children who decreased screen time throughout the treatment phase of the study would maintain decreases at a 2-month follow-up. This question was assessed through visual inspection. Descriptive analyses were not utilized because follow-up data contained very few data points (i.e., 7 points total) and averages could be skewed by outlier values. Because it was noted that participants evidenced different patterns in reduction of screen time for weekdays versus weekends and holidays, these time periods were also assessed separately for the follow-up data.

Maintenance of Reduction in Weekday Screen Time

Overall, participants who experienced decreased level of weekday screen time during the treatment phase tended to maintain this level during the 2-month follow-up phase. However, some participants experienced slight increases in level of weekday screen time during the follow-up phase. There was less variability in follow-up data, especially when compared to baseline data. For participants who did not show decreased level of weekday screen time during the treatment phase, level was typically maintained during the follow-up phase, without notable increases.

Maintenance of Reduction in Weekend Screen Time

As with weekend data from the treatment phase, results from the follow-up phase were inconsistent. Most participants maintained approximately the same level of screen time during the follow-up phase, when compared to the treatment phase; however, some of these participants had decreased level of screen time during the treatment phase, while others had not. Additionally, during the follow-up phase some participants increased their level of screen time when compared to the treatment phase, while still a few others decreased level of screen time.

Participation in Physical Activity and Snacking Frequency

A second objective was to examine if children would increase their participation in physical activities and decrease their snacking following implementation of the treatment.

To assess this, participation in physical activities and snacking frequency, number of snacks consumed during screen time behaviors, and number of high-fat or high-sugar snacks consumed (all based on parent reports), were graphed over the weeks of the baseline and treatment phases for each participant.

Physical Activity

As discussed previously, physical activity data were collected by calling participants' parents once a week and asking parents to estimate the amount of physical activity their child had participated in during the 24 hours prior to the phone call. Therefore, physical activity values do not represent weekly totals or averages. On all graphs mean daily physical activity is denoted separately for the basline and treatment phases. Also, because of the variability in minutes of daily physical activity reported for each participant each week, there is variability in the scales used for the graphs.

Figures 8 through 11 display the results for Participants 03, 04, 06, and 08 (Cohort 1. Figures 12 through 14 display the results for Participants 01, 07, and 09 (Cohort 2), respectively. Participant 05 dropped out during baseline so a figure was not created for this participant. Data are only available for the first three weeks of the treatment phase because participants were mistakenly not called following the last week of the treatment phase to gather data about physical activity and snacking. Figures 15 through 17 display the results for Cohort 3, which includes Participants 10, 11, and 12, respectively.

Visual inspection of Figures 8 through 17 revealed that a majority (i.e., 7 of 10) participants increased physical activity during the treatment phase. Current guidelines

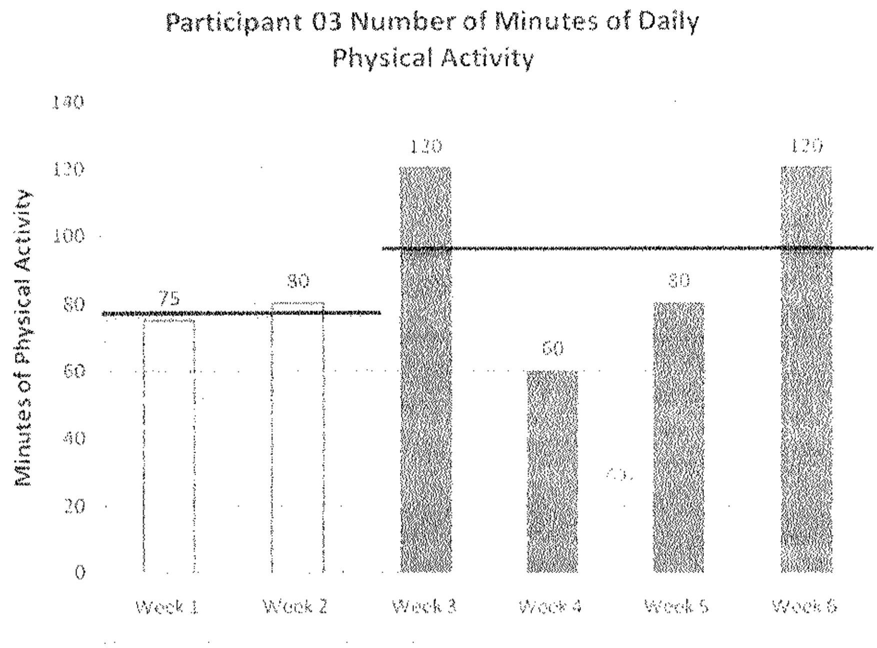

Figure 8. Comparison of baseline and treatment phase daily physical activity for partipants 03.

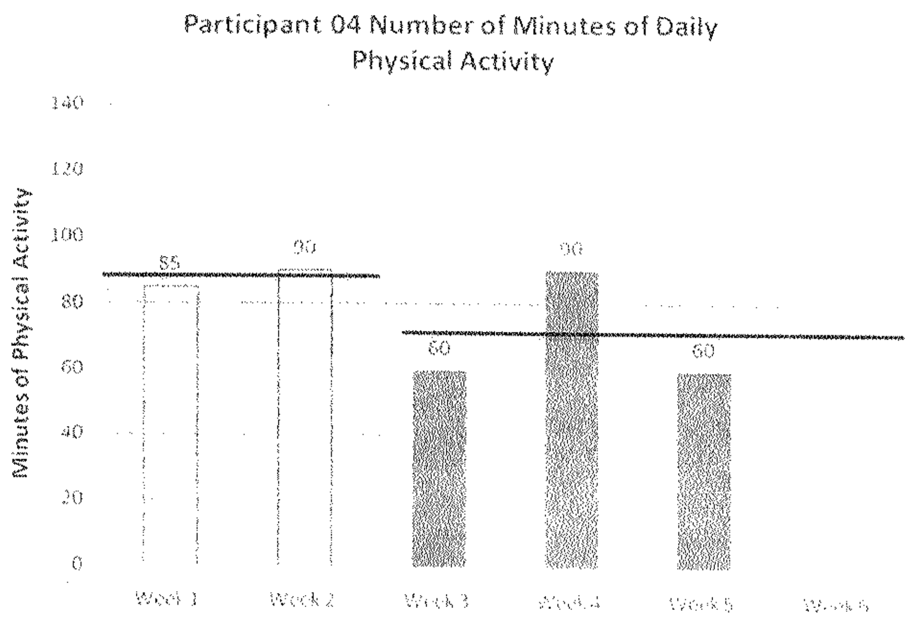

Figure 9. Comparison of baseline and treatment phase daily physical activity for participant 04.

*Note.*Participant 04 could not be reached by telephone to collect data for Week 6. Missing data were not included in the valculation of mean daily physical activity for the treatment phase.

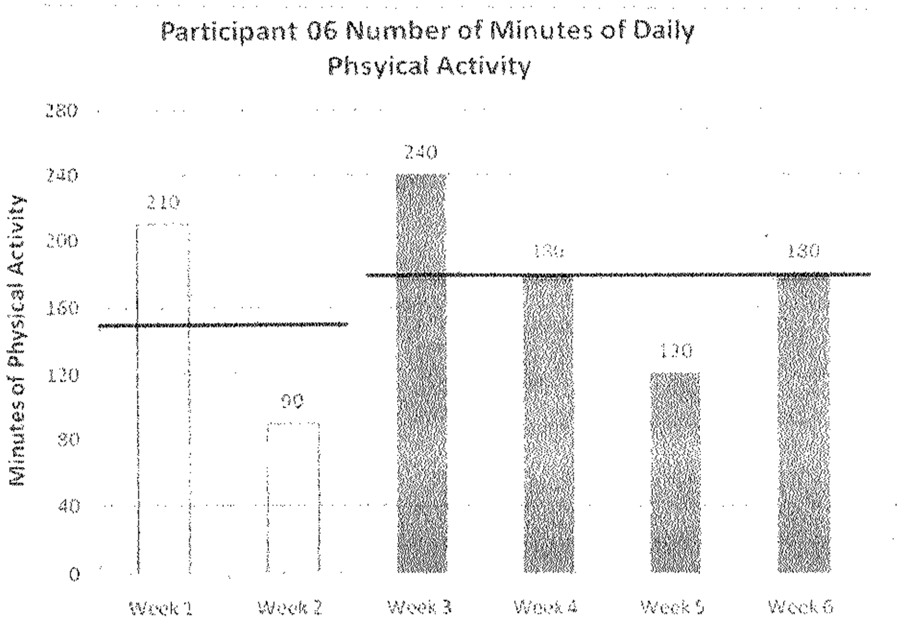

Figure 10. Comparison of baseline and treatment phase daily physical activity for participant 06.

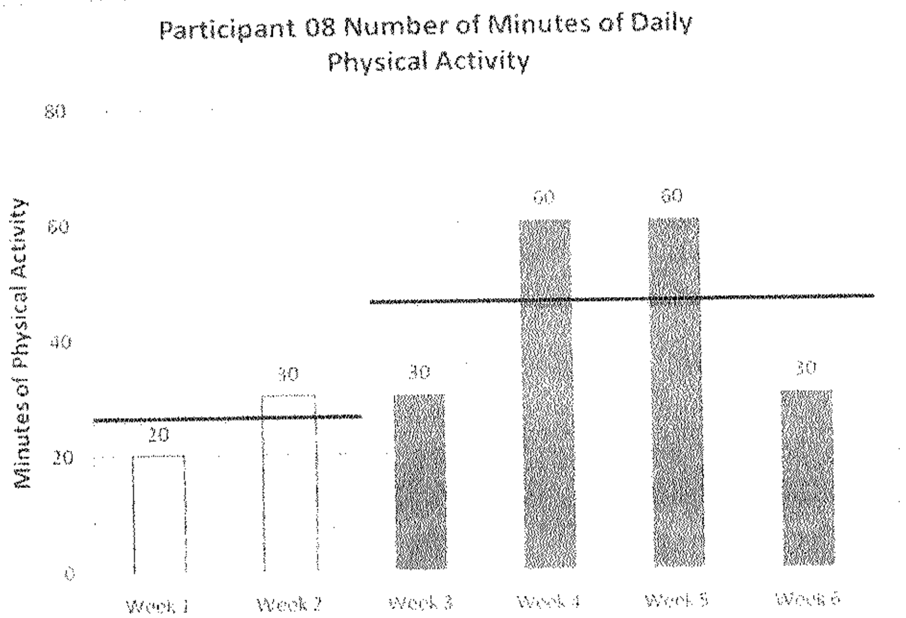

Figure 11. Comparison of baseline and treatment phase daily physical activity for participant 08.

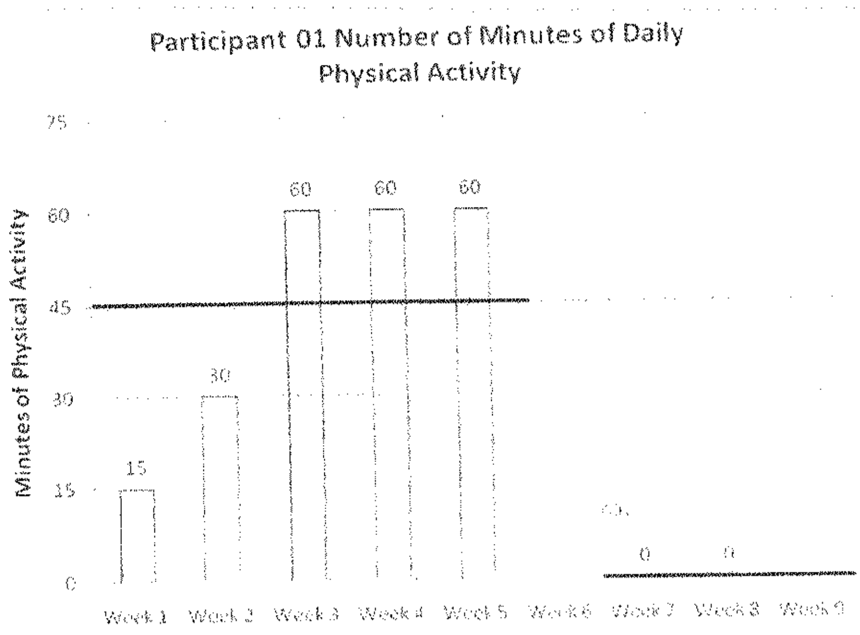

Figure 12. Comparison of baseline and treatment phase daily physical activity for participant 01.

Note. Participant 01 could not be reached by telephone to collect data for Week 6 and 9. Missing data were not included in the calculation of mean daily physical activity for either phase.

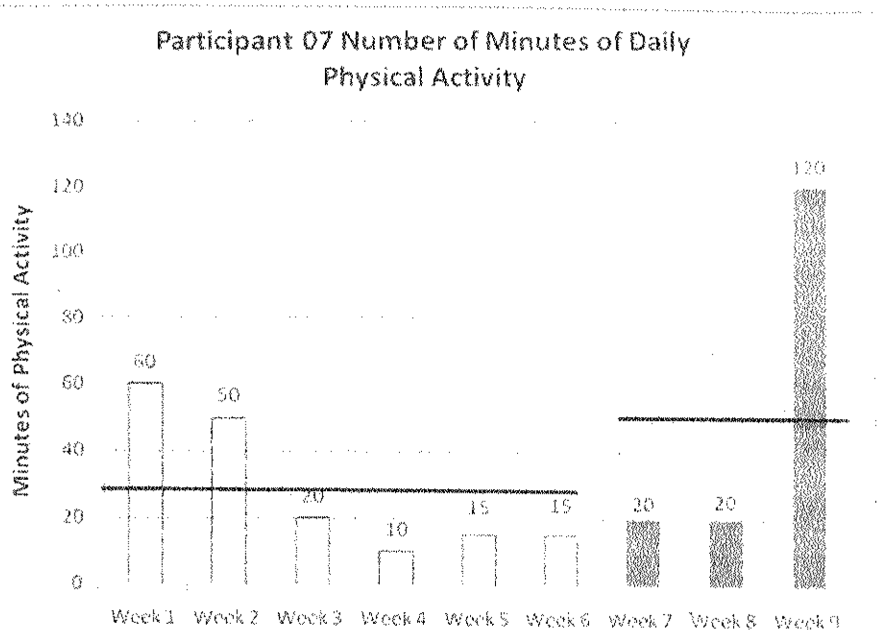

Figure 13. Comparison of baseline and treatment phase daily physical activity for participant 07.

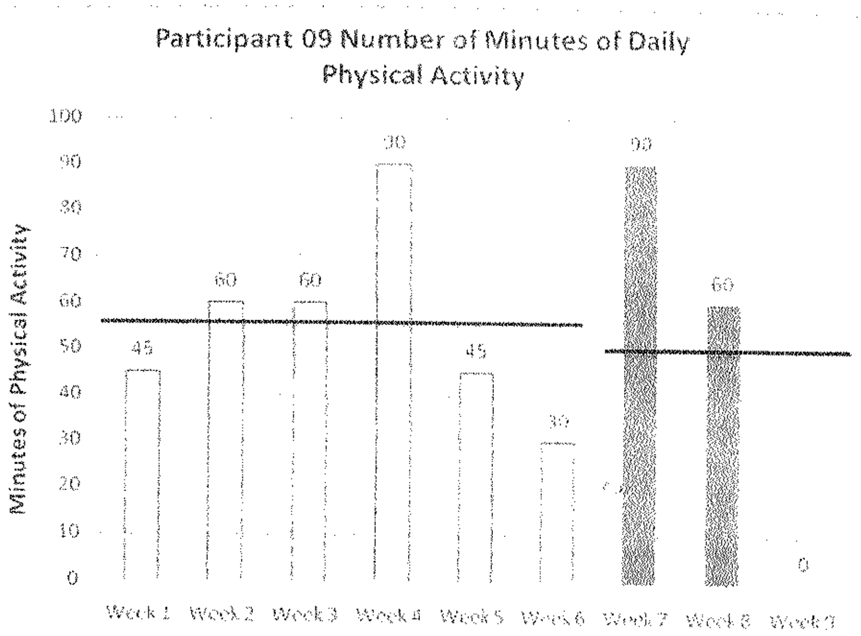

Figure 14. Comparison of baseline and treatment phase daily physical activity for participant 09.

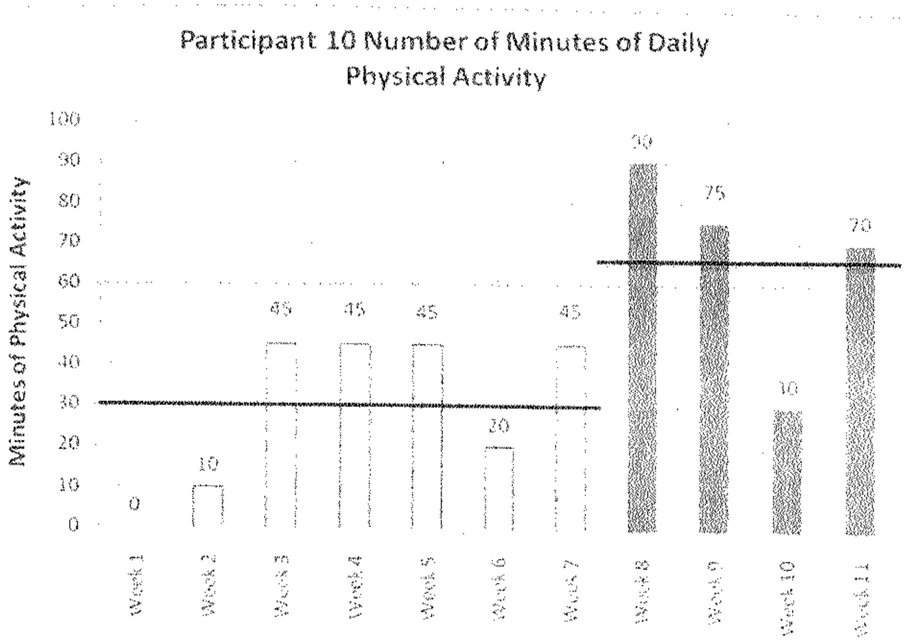

Figure 15. Comparison of baseline and treatment phase daily physical activity for participant 10.

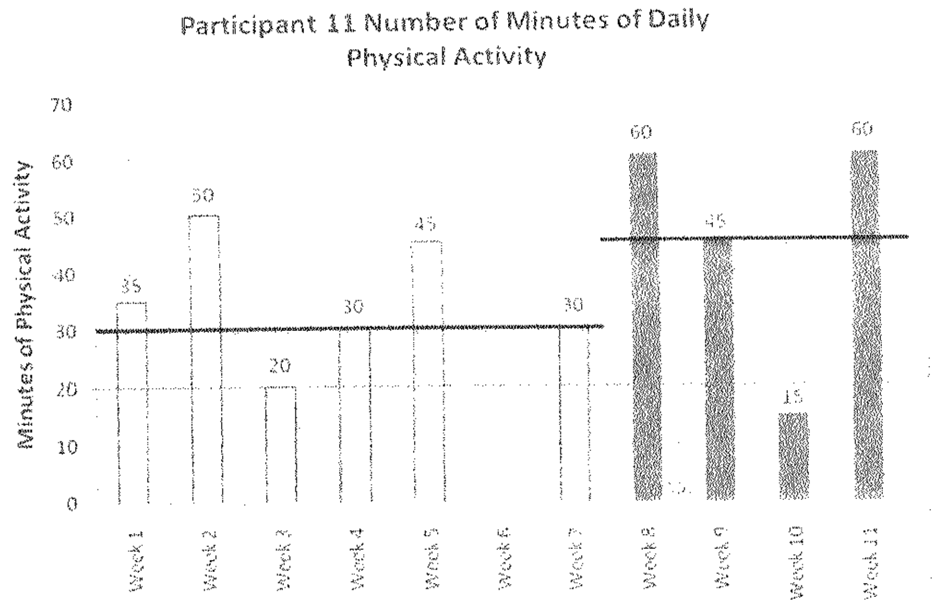

Figure 16. Comparison of baseline and treatment phase daily physical activity for participant 11.
Note. Participant 11 could not be reached by telephone to collect data for Week 6. Missing data were not included in the calculation of mean daily physical activity for the baseline phase.

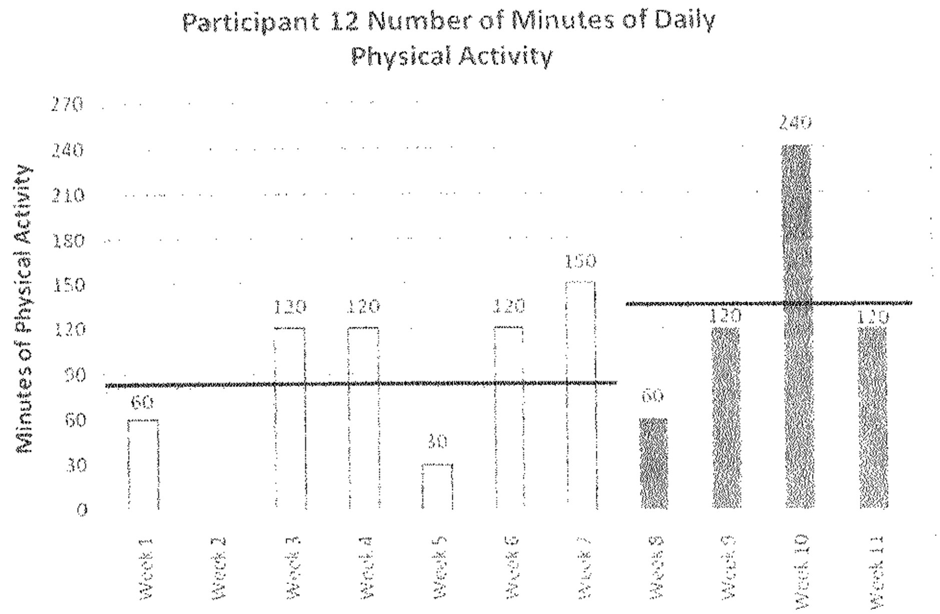

Figure 17. Comparison of baseline and treatment phase daily physical activity for participant 12.
Note. Participant 12 could not be reached by telephone to collect data for Week 2. Missing data were not included in the calculation of mean daily physical activity for the baseline phase.

suggest that children and adolescents should strive for a total of at least 60 minutes of physical activity per day and this was an informal goal of the current study. For 3 of the 7 participants who increased physical activity during the treatment phase, reported physical activity levels were already above the recommended 60 minutes or more per day. One participant who had an averae physical activity level of < 60 minutes

Visual inspection of Figures 8-17 revealed that a majority (i.e., 7 of 10) participants increased physical activity during the treatment phase. Current guidelines suggest that children and adolescents should strive for a total of at least 60 minutes of physical activity per day and this was an informal goal of the current study. For 3 of the 7 participants who increased physical activity during the treatment phase, reported physical activity levels were already above the recommended 60 minutes or more per day. One participant who had an average physical activity level of <60 minutes during the baseline evidenced an improvementto an average physical activity level of >60 minutes during the treatment phase. The remaining 3 participants also increased their physical activity levels during the treatment phase; however, they did not increase to an average of ≥ 60 minutes. However, Participant 08, for example, did reach a total of 60 minutes of daily physical activity on two of four measured days during the treatment phase, in contrast to none of the baseline days. These results suggest that most participants likely substituted physical activity for screen time, as most of the participants also evidenced reduced average daily screen time across the duration of the treatment phase.

The remaining 3 participants (i.e., Participants 01, 04, and 09) evidenced decreased physical activity during the treatment phase. This would suggest that these participants were not substituting physical activity for decreases in screen time; however, this conclusion has several limitations. First, data are missing for Participants 01 and 04 due to not being able to reach them for weekly check-in phone calls (i.e., two missed check-ins for Participant 01; one missed check-in for Participant 04). These missing values were not calculated in the physical activity averages. Thus, true averages are not available for these participants. Additionally, Participant 01 was sick during the remaining two check-ins completed, during which she was unable to engage in any physical activity. Although Participant 01 did show decreases in screen time during the treatment phase, she likely had fewer opportunities to substitute physical activity for screen time. Lastly, Participant 09, who also showed a decrease in screen time during the treatment phase, was injured for the final weekly check-in during the treatment phase. This resulted in him not being able to engage in any physical activity. Data gathered prior to the final week of treatment suggested that he may have otherwise shown an increase in physical activity during the treatment phase had he not been injured.

Overall, most participants, particularly those in Cohorts 1 and 3, showed increases in physical activity during the treatment phase. This suggested that decreases in screen time may have been replaced by increases in physical activity.

Snacking Behaviors

Previous research has found associations between snacking and screen time. In this study, an area of interest was whether unhealthy snacking behaviors (i.e., number of snacking episodes, number of snacks eaten in front of a screen, and number of unhealthy snacks consumed) would decrease as screen time decreased. As discussed previously, snacking data were collected by calling participants' parents once a week and asking parents to estimate the number of snacking episodes, snacking episodes eaten in front of a screen time activity, and number of snacking episodes that contained a high fat/high sugar snack during the 24 hours prior to the phone call. Therefore, note that snacking values presented do not represent weekly totals or averages. Also, because of the variability in snacking episodes reported for each participant each week, there is variability in the scales used for the graphs.

Figures 18-21 display results for Cohort 1, including Participants 03, 04, 06 and 08, respectively. Figures 22-24 display information for the participants from Cohort 2 that completed the study (i.e., Participants 01, 07, and 09, respectively). A figure was not created for Participant 05 because he only participated in 3 weeks of baseline before dropping out. All snacking behaviors were at a frequency of 1 during his 3 weeks of participation. As mentioned previously, participants from Cohort 2 mistakenly did not receive a weekly phone call following the last week of the treatment phase; therefore, data are only available for 9 total weeks instead of 10. Figures 25-27 display information for the participants from Cohort 2 that completed the study (i.e., Participants 10, 11, and 12, respectively).

One noteworthy trend across all cohorts was that few children were eating snacks while engaged in a screen time activity. This is the only clear trend that emerged. While most participants generally maintained similar total number of snacking episodes and snacking episodes containing unhealthy foods across the phases of the study, some

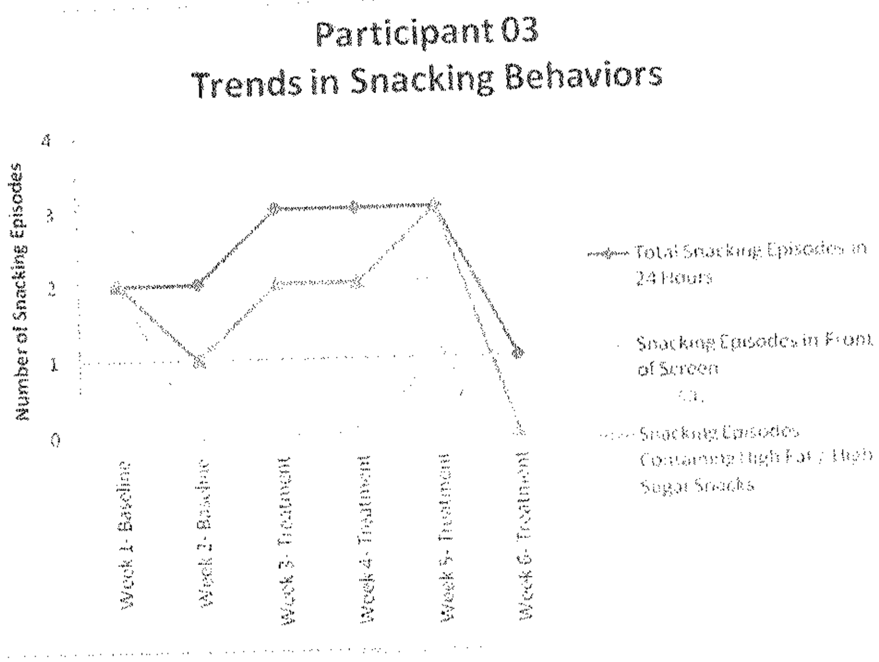

Figure 18. Comparison of snacking trends in the baseline and treatment phases for participant 03.

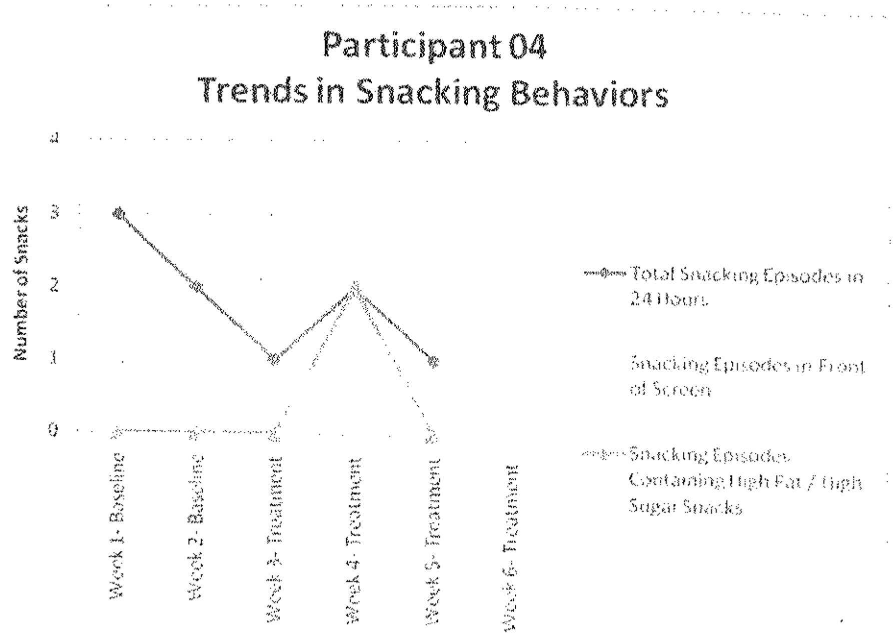

Figure 19. Comparison of snacking trends in the baseline and treatment phases for participant 04.
Note. Participant 04 could not be reached by telephone to collect data for Week 6.

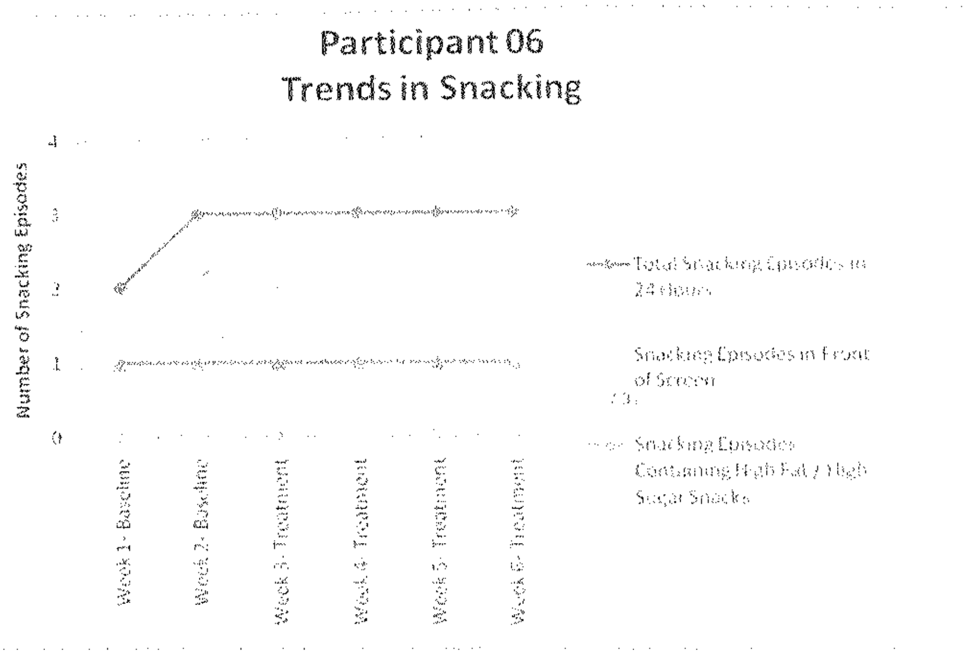

Figure 20. Comparison of snacking trends in the baseline and treatment phases for participant 06.

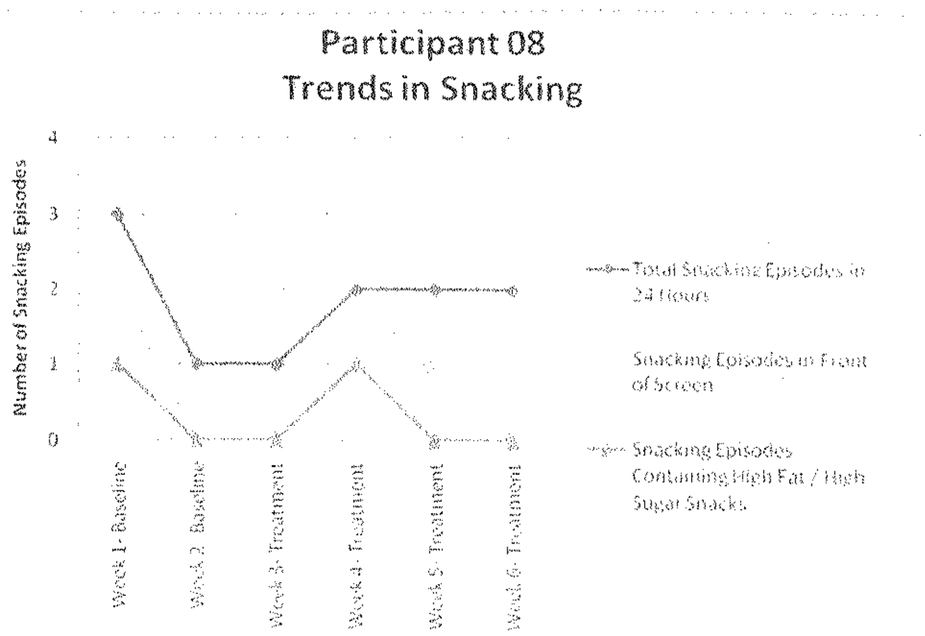

Figure 21. Comparison of snacking trends in the baseline and treatment phases for participant 08.

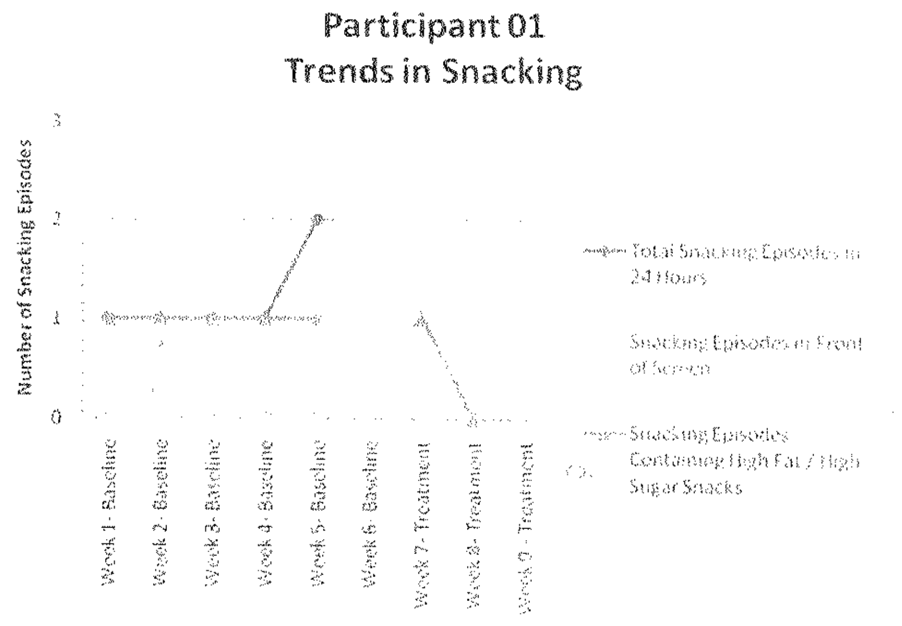

Figure 22. Comparison of snacking trends in the baseline and treatment phases for participant 01.
Note. Participant 01 could not be reached by telephone to collect data for Weeks 6 and 9.

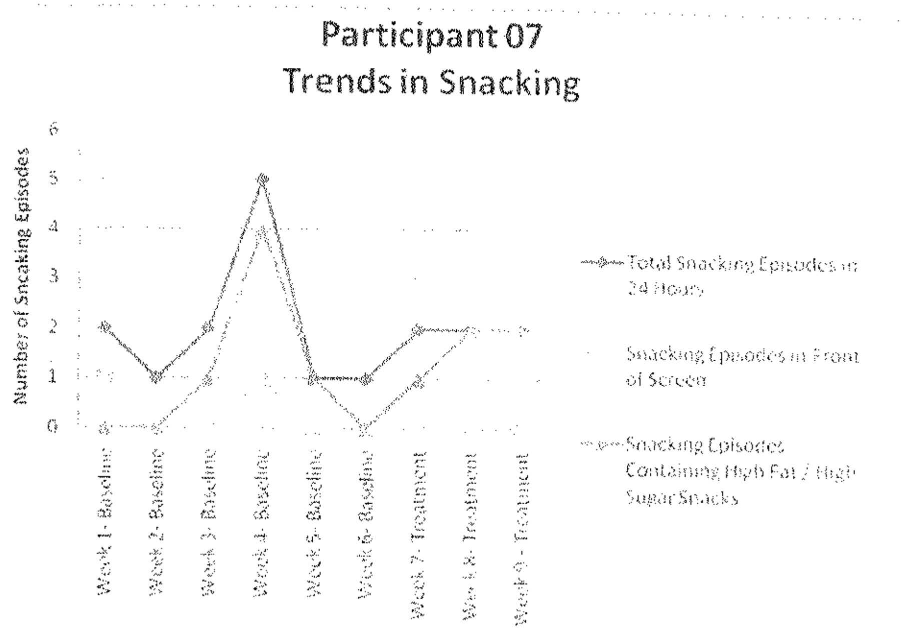

Figure 23. Comparison of snacking trends in the baseline and treatment phases for participant 07.

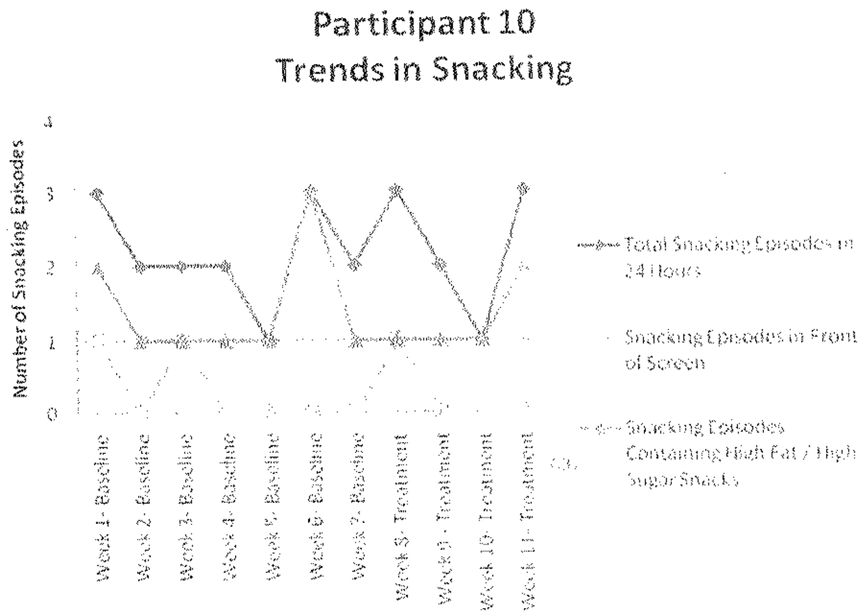

Figure 24. Comparison of snacking trends in the baseline and treatment phases for participant 09.

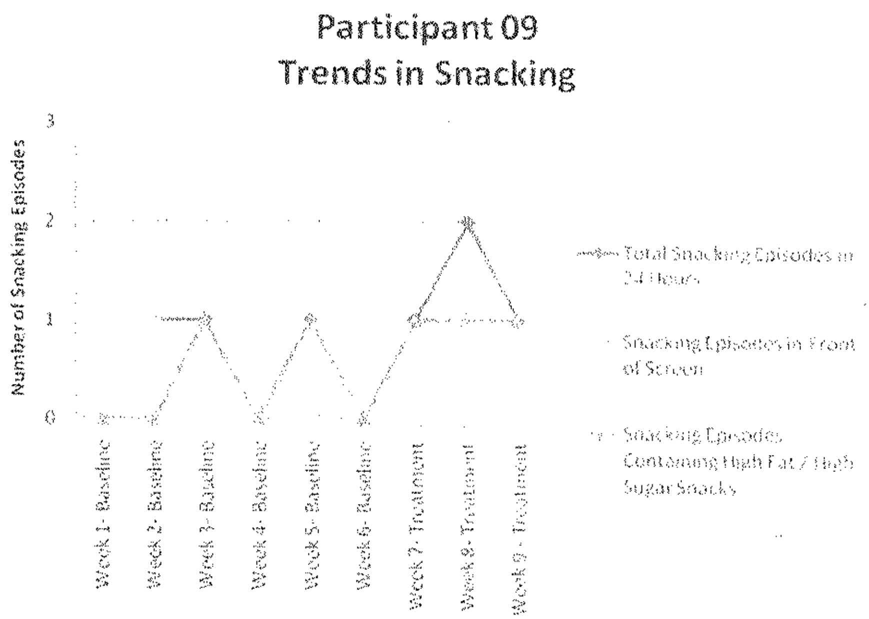

Figure 25. Comparison of snacking trends in the baseline and treatment phases for participant 10.

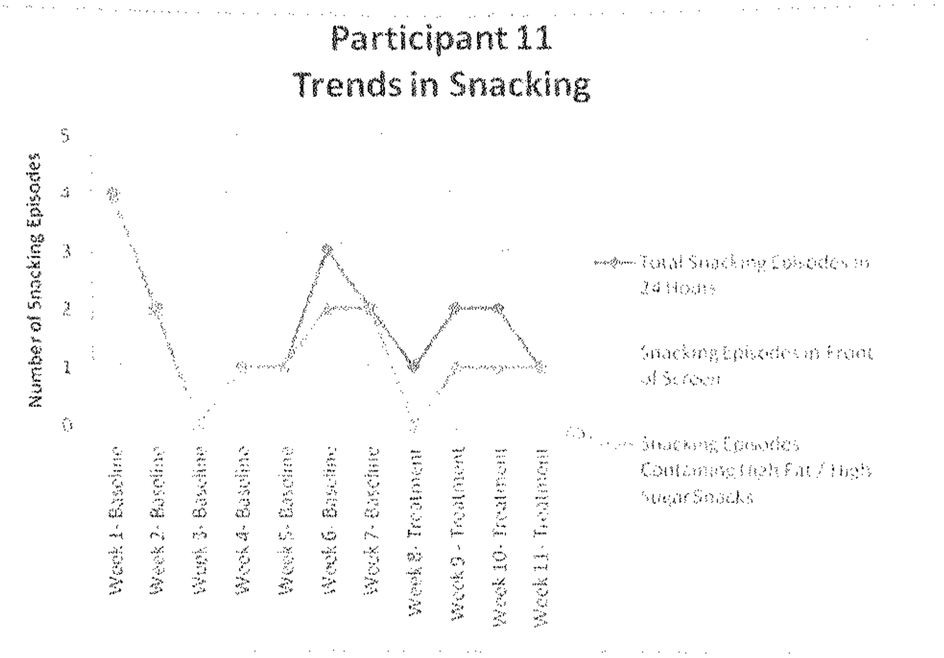

Figure 26. Comparison of snacking trends in the baseline and treatment phases for participant 11.

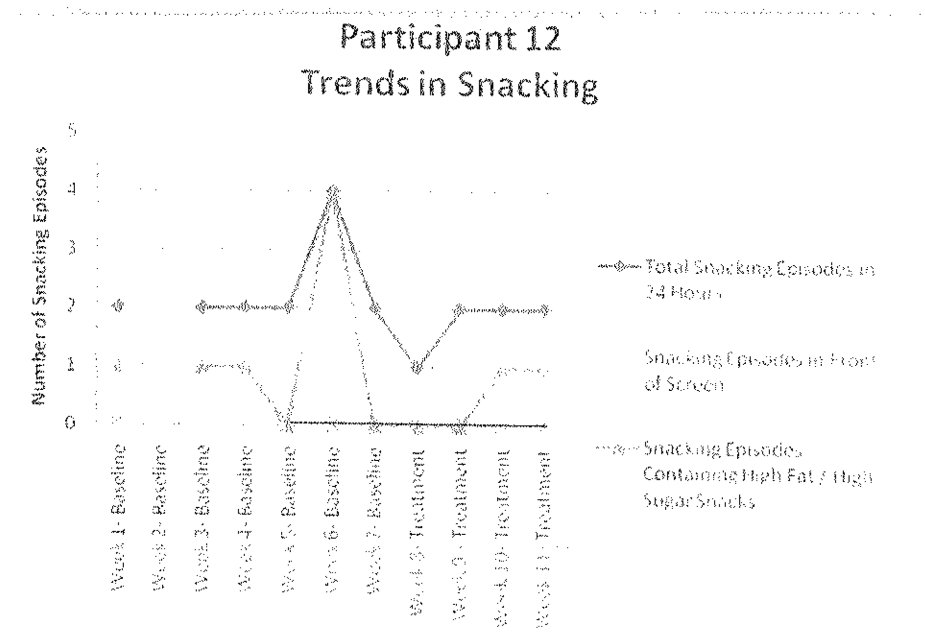

Figure 27. Comparison of snacking trends in the baseline and treatment phases for participant 12.
Note. Participant 12 could not be reached by telephone to collect data for Week 2.

appeared to show slight increases in snacking behaviors (e.g., Participant 07), while still others showed slight decreases (e.g., Participant 04). It is noteworthy that Participant 7 was called the day after Halloween for the Week 4 assessment, and her mother reported that this influenced the snacking totals reported.

Overall, visual inspection of data for the three cohorts did not provide strong evidence that snacking was positively impacted through treatment efforts. Additionally, these children were typically not snacking while engaged in screen time activities. Thus, for participants in this study, changes in screen time would likely not impact changes in snacking behaviors.

Follow-up Data: Improvement in BMI Percentile

A third objective of this study was to determine if participation in the study would result in improvements in BMI percentile for child participants. To assess this, height and weight data were obtained prior to start of the baseline phase, following completion of the treatment phase, and at the 2-month follow-up visit. BMI-for-age percentile values were then calculated from the height and weight data. Additionally, appropriate categories were assigned based on BMI percentiles for each child (i.e., "healthy weight," "at-risk of overweight," or "overweight"). Table 7 summarizes BMI percentile-for-age values and categories for each child participant at the three phases of the study.

As indicated in Table 7, with the exception of one participant (i.e., Participant 08), child participants maintained the same BMI percentile category across all phases of the study, with little variation in actual BMI-for-age percentile values. No participants became

Table 7

BMI Percentiles and Categories Across the Study Phases

Participant ID	Baseline BMI percentile	Baseline BMI percentile category	Post-treatment BMI percentile	Posttreatment BMI percentile category	Follow-up BMI percentile	Follow-up BMI percentile category
Cohort 1						
03	96	Overweight	96	Overweight	96	Overweight
04	97	Overweight	98	Overweight	97	Overweight
06	97	Overweight	97	Overweight	96	Overweight
08	93	At-risk of overweight	89	At-risk of overweight	80	Healthy weight
Cohort 2						
01	94	At-risk of overweight	93	At-risk of overweight	94	At-risk of overweight
05	99	Overweight	N/A	N/A	N/A	N/A
07	98	Overweight	99	Overweight	99	Overweight
09	95	Overweight	95	Overweight	95	Overweight
Cohort 3						
10	96	Overweight	96	Overweight	96	Overweight
11	89	At-risk of overweight	85	At-risk of overweight	86	At-risk of overweight
12	99	Overweight	99	Overweight	99	Overweight

Note. Participant 05 dropped out during the baseline phase. Therefore, posttreatment and follow-up BMI percentile information was not available.

worse across the study phases. For example, none of the participants in the at-risk of overweight category moved into the overweight category. However, many participants were already in the overweight category, with a very high BMI-for-age percentile; thus, they had little room for becoming clinically worse. Participant 08 was the only participant who evidenced an improvement in BMI percentile across the phases of the study. He moved from the 93rd percentile at baseline, to the 89th percentile following treatment, and then the 80th percentile at the 2-month follow-up. During the follow-up phase the participant moved into the healthy weight category.

Follow-up Data: BMI Percentile and Average Posttreatment Daily Screen Time

To ensure that change in BMI percentile was related to the independent variable (i.e., use of stimulus control techniques to decrease screen time), another objective of the study was to determine if children who experienced an improvement in BMI percentile also experienced a decrease in average daily screen time. Decrease in screen time was measured during the treatment phase and again during the follow-up phase. Visual inspection techniques were used to assess for decreases in daily screen time.

As mentioned above, only one participant (i.e., Participant 08) experienced an improvement in BMI percentile over the course of the study. Visual inspection suggested that this participant did not show decreases in level of either weekday or weekend screen time when moving from the baseline to treatment and follow-up phases. Participant 08 appeared to maintain a low level of weekday screen time across all phases of the study. However, visual inspection showed an increase in level of weekend screen time during the treatment phase, which appeared to be maintained at the follow-up. The weekend screen time results, in particular, contrast with what would have been expected given this participant's meaningful decrease in BMI percentile.

Due to the unexpected findings for Participant 08, correlational analyses were conducted for all participants to determine if standardized BMI (*z*-BMI) was associated with screen time at the outset of the study. Because participants from the three cohorts participated in baseline periods of differing lengths, the bivariate correlation was conducted for z-BMI at baseline and average screen time during the first week of baseline. This analysis resulted in an $r = .213$, which is not statically significant ($p = .529$), but is considered to be clinically meaningful but small correlation. To ensure that effects from tracking and monitoring screen time during the first week of baseline did not influence this correlation, another analysis was conducted between z-BMI and the self-reported average daily screen time estimate obtained during the telephone screening prior to beginning the study. This correlation resulted in an $r = -0.057$, which was not statistically or clinically significant ($p = .869$; $r^2 = 0.003$). These results suggested that for this sample of overweight and at-risk children, screen time was not related to BMI when evaluating statistical significance. However, there is evidence that there was a clinically meaningful relationship between screen time and BMI.

Treatment Adherence

Lastly, because previous research only assessed treatment adherence retrospectively, a final objective of this study was to determine if children who experienced an improvement in BMI percentile also had above average treatment adherence, as measured prospectively by parent rating. Additionally, an objective was to determine if greater treatment adherence was related to decreased screen time, as measured following the treatment phase.

Table 8 displays information about treatment adherence that was gathered prospectively during the course of the treatment phase. It lists parent self-report ratings made during the week following each treatment session. This information was gathered

Table 8

Average Parent Self-Report Ratings on Treatment Adherence

Participant ID	Average adherence rating
Cohort 1	
03	4.00
04	3.00
06	4.00
08	3.33
Cohort 2	
01	3.00
07	3.50
09	3.00
Cohort 3	
10	3.00
11	3.75
12	3.00
Overall average	3.06

Note. Ratings were made on the following scale: *extremely well*, *very well*, *somewhat well*, *a little bit*, and *not at all well*, which were converted to the following numeric scale: 5, 4, 3, 2, and 1, respectively.

during telephone calls placed to the parents. During the phone call parents were asked to rate how successfully they implemented treatment strategies discussed in the previous treatment session. Higher average parent adherence ratings correspond to parents' perceptions of greater treatment adherence. According to this data, the average overall rating across all parents was 3.06, which corresponds closest to the "somewhat well" category of adherence. Participant 08, the only participant to benefit from a decrease in BMI percentile, had an average treatment adherence of 3.33, which was slightly above the overall average for this group of participants.

To determine if greater treatment adherence, as measured through parent self-report ratings, was associated with decreased screen time, bivariate correlations were conducted. Parents' self-reports of adherence to the treatment strategies were moderately correlated with weekday ($r = -0.434$, $p = .210$) and weekend ($r = -0.453$, $p = .189$) screen time, though these correlations were not statistically significant. However, both correlations were found to be clinically meaningful, with medium effect sizes. This suggested that there is a clinically meaningful relationship between treatment adherence and screen time reductions; however, only one participant evidenced an improvement in BMI percentile. While Participant 08's mother did rate her treatment adherence as slightly above the overall average for all participants, it was not greatly above the average and there were other participants whose treatment adherences were higher than Participant 08's, though they did not show improvements in BMI percentiles.

Treatment Satisfaction

Though this was not a research question addressed in the current study, parents completed a survey following the last week of the treatment, to assess their satisfaction with the intervention. These surveys were completed anonymously using a Likert-based scale. Parent satisfaction with the treatment was specifically assessed by one question, which asked the following: "With regard to your satisfaction with the intervention to reduce your child's daily screen time, please choose the response that best describes how satisfied you are." Parents were given the following choice options: *not at all satisfied, a little satisfied, somewhat satisfied, very satisfied,* and *completely satisfied.* Of the 10 participants who completed the entire treatment phase, a majority were either *very satisfied* ($n = 6$) or *completely satisfied* ($n = 2$) with the intervention, while the remaining parents ($n = 2$) rated themselves as *somewhat satisfied*.

CHAPTER V

DISCUSSION

Overview

The overall purpose of this study was to determine if use of stimulus management techniques were effective in reducing daily screen time behaviors of children who were overweight or at-risk of overweight (BMI percentile ≥ 85^{th} perecentile). In addition to this primary research objective, secondary objectives addressed the following: (a) whether decreases in screen time were related to increases in physical activity and decreases in unhealthy snacking behaviors, (b) determining if decreases in screen time led to improvements in BMI percentile, and (c) determining prospectively if treatment adherence was related to improvements in BMI percentile. An advantage of the current study is that it utilized a single-subject design to provide a treatment components analysis (i.e., analysis of stimulus management techniques), which is a rare study design within the realm of research on children who are overweight.

Because a components analysis has not been completed previously within this area of research, hypotheses for the current study were developed for most research questions based on the findings of previous treatment studies that primarily used traditional treatment/control group designs and included numerous treatment components. In addition to simplifying the treatment design by focusing primarily on one treatment component, another deviation from previous research was the use of a shorter (i.e., four total weeks of treatment, compared with multicomponential studies that spanned several months) treatment design. A final deviation from previous research is that the current study results were analyzed separately based on day of week, with results analyzed and categorized based on whether they represented weekday values or weekend/holiday values. In the current study it was clear that trends differed according to day of week. Due to the aforementioned differences from previous research, results from the current study were difficult to directly compare to previous research.

The following sections will highlight each study objective including whether study hypotheses were supported or not, and relevant information to better understand factors that likely influenced whether hypotheses were or were not supported.

Reduction in Daily Screen Time

The first objective of this study was to determine if overweight children and children at risk of being overweight (BMI ≥ 85^{th} percentile) who received a brief stimulus management-based intervention focused on reducing average daily screen time would show a greater reduction in screen time behaviors during an active treatment phase than during a baseline, "tracking-only" phase. Previous multicomponential treatment studies (e.g., Epstein et al., 2004) involving stimulus management techniques in combination with several other techniques (e.g., dietary intervention; behavioral contracting and reinforcement) found that stimulus management techniques (in conjunction with the other study components) were effective in reducing "sedentary behaviors" for children with a BMI percentile ≥ 85^{th} percentile. In this study the focus was on screen time behaviors instead of the broader category of sedentary behaviors because the AAP has offered a specific guideline in relation to screen time (i.e., watching television, watching movies, using the computer for nonschool related purposes, and playing video games) that could be used as a benchmark in the current study (i.e., limiting daily screen time to < 120 total minutes).

Change in Weekday Screen Time

Overall, results from the current study supported previous research in that participants generally showed a decrease in level of weekday screen time during the treatment phase of the study, when compared to the baseline phase. This suggested that, as with previous multicomponential treatment studies, stimulus management-based techniques (without any major additional treatment components) are effective in helping overweight children reduce daily screen time behaviors. Therefore, the results of this study suggest that families would likely benefit from education about simple stimulus-management techniques (e.g., making simple environmental changes in the family, such as creating rules related to use of screen time) to help reduce children's screen time during the week.

However, it should be noted that in all cohorts the baseline and treatment phases of the study occurred during the school year; thus, weekday screen time was likely easier for parents to control given there was a smaller percentage of time children could be engaged in screen time activities, as they were attending school at least 6 hours each day. This assumption was supported from anecdotal evidence gathered while interacting with parents in the treatment groups. Overall, parents generally reported that weekdays during the school year were more structured and typically included time set aside for completion of homework, as well as time set aside for any extracurricular activities. Therefore, parents typically felt it was easier to track and limit screen time during school days because there was less time during which children could engage in screen time behaviors. This suggests that if provided as a recommendation from a pediatrician, parents would likely not view it as difficult to limit weekday screen time during the school year, thus making them more likely to implement this treatment strategy.

Change in Weekend Screen Time Totals

Results related to reduction of weekend screen time were less conclusive than results related to weekday screen time. While some participants decreased level of screen time more during the treatment phase, when compared to the baseline phase, others showed little to no change, or increased level of weekend screen time during the treatment phase. This suggests that the use of stimulus management techniques did not seem to be as effective in reducing weekend screen time, when compared to weekday screen time. However, in contrast to weekday screen time, daily weekend screen time totals were generally above the study goal of 120 minutes or less per day during the baseline phase. Thus, the weekend would be a time of particular importance in targeting for limits on screen time, as families appeared to clearly be struggling with limiting screen time prior to implementation of the treatment strategies. In contrast, for most participants, weekday screen time was already fairly low prior to implementation of the treatment strategies.

Overall, results related to weekend screen time do not support previous research, which found overall reduction of sedentary behaviors during implementation of multicomponential treatment packages. However, as noted previously, previous researchers did not analyze data separately for weekdays and weekends and instead aggregated mean data across all days of the week. Therefore, it is difficult to directly compare results of the current study to previous research to conclusively determine if the first research question was supported or not.

What is clear, though, is that results of the current study show that parents struggle more with reducing weekend screen time to the recommended daily limit of < 120 minutes. This was supported by anecdotal evidence gathered during the treatment group sessions. In all cohorts, several parents raised concerns about how to effectively reduce daily screen time when their children were out of school (i.e., summers, holidays, and weekends), given children were at home for a larger percentage of the day than when in school and these times were much less structured than school days. In each cohort a significant portion of time was dedicated to brainstorming effective stimulus-management techniques that could be useful in addressing this problem. However, given the results of the current study, it appears that parents could benefit from more powerful intervention strategies in order to address the problem of consistently limiting daily screen time to < 120 minutes per day on weekends, holidays, and during the summer.

Follow-up Data: Maintenance of Reduction of Daily Screen Time

Due to limitations in information provided by previous treatment studies, a hypothesis was not made regarding whether participants who reduced screen time during the treatment phase would maintain these reductions at a 2-month follow-up visit. However, maintenance of reduced screen time is an important issue to explore as short-term maintenance of positive behavior changes would suggest that overtime continued long-term maintenance of screen time reductions could contribute to significant health improvements (e.g., decreases in BMI percentiles).

Maintenance of Reduction in Weekday Screen Time

The overwhelming majority of participants maintained low levels of weekday screen time at the time of follow-up. In some cases slight increases were evidenced; however, generally the majority of values were at, or below, the recommended guideline of 120 minutes of daily screen time, with the exception of a few outliers. As mentioned previously, these findings are not surprising given parents' reports that screen time behaviors were easier to limit during school days; however, one interesting observation is that the follow-up phase for participants from Cohort 3 was the only data collection phase that occurred during the summer when school was no longer in session. Participants in Cohort 3 did not seem to have any more difficulty maintaining decreases in screen time at the follow-up session, when compared to participants from the other cohorts. This contrasts with the theory that children being out of school results in less structure and more time available to engage in screen time behaviors. A possible explanation for this confusing finding is that season and weather may have played a part in helping children maintain decreases in weekday screen time, as the summers in Utah are generally warm and dry. While the remainder of the study would have occurred during the winter and spring for participants in Cohort 3, the summer months may have provided additional opportunities to practice outdoor strategies for promoting increased physical activity and less screen time.

Maintenance of Reduction in Weekend Screen Time

Overall, results related to maintenance of reductions in weekend screen time were mixed. Most participants maintained treatment levels of weekend screen time, while others showed decreases, and still others showed slight increases. This maintenance trend reflects similar inconsistent findings when comparing weekend screen time in the baseline and treatment phases. This again supports the theory that parents may have a more difficult time consistently regulating screen time during weekends.

An interesting observation noted was that participants from Cohort 3 whose follow-up phase was in the summer, generally further decreased or maintained decreases in weekend screen time at follow-up. This lends support to the aforementioned theory that weather conditions in the summer may help promote outdoor physical activities which replace screen time behaviors. Unfortunately, physical activity was not measured during the follow-up phase so this theory cannot be further analyzed.

Participation in Physical Activity and Snacking Frequency

The second objective of this study was to determine if reducing screen time through use of stimulus management techniques resulted in increases in physical activity and decreases in snacking frequency.

Physical Activity

Results were analyzed through visual inspection of graphs that depicted parents' reports of children's physical activity, as gathered during weekly telephone calls during the baseline and treatment phases. Overall, results supported the hypothesis that physical activity would increase during the treatment phase. Specifically, 7 of 10 participants increased their average daily physical activity during the treatment phase of the study. Of these seven participants, results broke down into the following categories: (a) three participants (i.e., Participants 03, 06, and 12) increased physical activity during the treatment phase, but they had already been achieving meaningful levels of physical activity at, or above, the recommended 60 minutes or more per day; (b) one participant (i.e., Participant 10) increased physical activity from an average of less than 60 minutes during baseline to a meaningful average of >60 minutes during the treatment phase; and (c) three participants (i.e., Participants 07, 08, and 11) increased average physical activity from the baseline to treatment phase, but did not achieve meaningful average levels of physical activity (i.e., $\geq$ 60 minutes) during the treatment phase. However, in all cases the participants were close to achieving a meaningful level of average physical activity during the treatment phase and exhibited a trend in this direction that would have likely continued if data had been collected for a longer period of time.

The aforementioned results tentatively support previous research (e.g., Epstein et al., 2004) that showed some participants who decrease sedentary behaviors substitute more physically demanding activities for the sedentary activities. However, in the current study this was not directly measured. It was hypothesized that increased awareness of current physical activity guidelines, in combination with increased motivation to meet the requirements of current physical activity guidelines, contributed to the results. However, the impact of goal awareness and motivation were not directly assessed. Despite this, anecdotal evidence supports this hypothesis. Specifically, the current physical guidelines were provided as part of an educational segment of the treatment group sessions, with an emphasis on making 60 minutes or more of physical activity an informal goal of the current study. Most parents reported being unaware of this guideline prior to participation in the study. Additionally, significant time was spent during the treatment group sessions brainstorming stimulus management techniques that could be useful in not only reducing screen time, but also providing increased opportunities for physical activity. With regards to increased motivation, it was hypothesized that healthy "peer pressure" from group members may have increased motivation for parents to strive harder to make changes that would promote increased physical activity.

Of the 10 participants who completed the study, three showed decreases in average physical activity during the treatment phase. Further information may be useful in explaining these three situations. First, Participant 01 was only available by phone for two of the three phone check-ins to gather data on physical activity. It was reported that Participant 01 was sick during the two check-ins that were completed during the treatment phase, which contributed to her not engaging in any physical activity. Therefore, the physical activity values gathered during the treatment phase did not accurately reflect this child's typical average physical activity. Second, Participant 04 decreased slightly in physical activity during the treatment phase but it should be noted that the average physical activity during the treatment phase was still above the recommended 60 or more minutes per day. Additionally, Participant 04 was a member of Cohort 1 in which there were only two weeks of baseline during which data could be gathered; thus, the average physical activity level (which was quite high for this participant) may have reflected outlier values. Finally, Participant 09 appeared to be on track to maintain or increase average physical activity level during the treatment phase; however, he injured his hand prior to the final phone check-in, which resulted in the outlier value of zero minutes of physical activity. Given there were only two other values gathered during the treatment phase the zero value significantly impacted the overall average for physical activity during the treatment phase.

Snacking Behaviors

Results from the current study did not support previous research (e.g., Gore et al., 2003; Lowry et al., 2002), which found significant associations between screen time behaviors and unhealthy snacking behaviors. Relatedly, previous research has suggested that screen time acts as a cue for increased consumption of unhealthy snacks. However, in this study few participants were engaging in any snacking while in front of a screen. Anecdotal evidence gathered from parents indicated that almost all families had a preexisting rule that forbid eating in front of the television. This indicates that for this sample snacking would not have been influenced by decreases in screen time, as screen time and snacking were likely not influencing each other prior to the start of the study. These data imply that in general parents may typically employ a family rule that eating in front of the TV, or another type of screen, is not allowed. Conversely, the families from this study may represent outliers in that they could have been a sample that was already particularly interested in weight related issues, and as a result they had some knowledge about healthy snacking practices. Therefore, as suggested by other research, screen time activities may be more strongly associated with snacking than is implied by the results of this study.

Another issue that warrants further mention is the number of snacking episodes and the number of high sugar and/or high fat snacks reported by parents over the course of the study. Inspection of the graphs suggests that for an overwhelming majority of participants snacking frequency and consumption of unhealthy snacks remained fairly constant across the baseline and treatment phases of the study. Given these factors were not targeted directly in the current study and that most children were not snacking in front of a screen, screen time reductions would not be expected to change overall snacking behaviors. Therefore, this sample may have benefited from an educational component regarding overall healthy eating habits, including healthy snacking behaviors. This stems from data suggesting that the majority of children in the current study did not make meaningful changes in BMI percentile (see later discussion of this issue); thus, this sample of children may have benefitted from specific targeting of healthy eating behaviors, including snacking.

Follow-up Data: Reduction in BMI Percentile

Another objective of this study was to determine if there would be differences in participants' BMI percentile values at the 2-month follow-up, when compared to BMI percentile values obtained just prior to the baseline period. Overall, results did not support the hypothesis that participants would show improvements in BMI percentiles during the follow-up phase. This contrasts with previous research (e.g., Epstein, Valoski, et al., 1994) in which decreases in BMI percentile were obtained and maintained over several months to several years. However, an important difference is that previous research generally employed longer treatment and follow-up periods (e.g., 6 months, 1 year, and/or 2 years) than the current study. This could account for why similar trends were not seen in this study, as participants may not have had enough time for treatment-influenced behavior changes to influence health benefits. This theory is supported by the observation that all children (with the exception of one participant who did evidence improvements in BMI percentile) appeared to maintain their BMI-for-age percentiles over the course of the treatment and follow-up phases, with none getting worse.

As noted previously, one participant did show reductions in BMI percentile across the treatment and follow-up phases of the study, moving from the at-risk of overweight range (BMI percentile: 93^{rd}) at baseline to the at-risk of overweight range (BMI percentile: 89^{th}) following the treatment phase, and moving to the healthy weight range

(BMI percentile: 80th) at the follow-up. As will be discussed in subsequent sections, this participant's progress did not seem to be strongly influenced by reductions in screen time, increases in physical activity, or treatment adherence. Therefore, this participant's results do not offer strong evidence of the effectiveness of the stimulus management treatment strategies and the importance of decreasing screen time.

There are factors that may have been more important to this participant's improvement in BMI percentile. First, this participant was a male who was near the upper limit of the age range (i.e., age 11 when the study began and age 12 by the time his participation ended) for this study. He was older than all but one of the participants and was one of only three male participants. It could be that the timing of the study coincided with natural pubertal changes and a related growth spurt. Indeed, data obtained offers limited support of this theory, as the participant grew one inch over the course of his 3 ½ months of participation. However, he also lost nine pounds over the course of the study, which would likely not be a result of a pubertal growth spurt.

Another factor gained through information provided by Participant 08's mother during the course of treatment is that he was making dietary changes during the course of the study. Specifically, anecdotal evidence suggested that Participant 08 was generally following a low carbohydrate, high protein diet. This diet was recommended to Participant 08's mother by her primary care physician because she was obese and experiencing weight-related health concerns. Participant 08's mother was responsible for shopping for food for the family and she prepared most family meals. Therefore, it was assumed that her dietary changes were carrying over to her children, including Participant

08. These dietary changes likely contributed to Participant 08's weight loss, which was an important determinant in decreasing his BMI percentile and moving into a healthy weight category.

Follow-up Data: BMI Percentile and Average

Posttreatment Daily Screen Time

To determine if changes in BMI percentile were related to decreases in average daily screen time, another objective of this study was to analyze this for children who experienced an improvement in BMI percentile. Participant 08 was the only participant to evidence a decrease in BMI percentile, eventually moving to the healthy weight category by the follow-up phase. Given this research objective could only be analyzed for one participant, conclusions regarding this study hypothesis should be viewed as tentative at best. Overall, data from Participant 08 indicated that he was already maintaining low levels of weekday screen time during the baseline phase, and this trend was maintained through the treatment and follow-up phases. As reported by Participant 08's mother during the pre-study screening questionnaire, it was estimated that he was engaging in an average of 120 minutes of screen time per weekday and 300 minutes of screen time per weekend day. Thus, he was already close to the study goal of < 120 minutes per day for average weekday screen time. Likely for this participant the act of monitoring and recording daily screen time resulted in the maintained decrease in weekday screen time across all phases of the study.

With regard to weekend screen time, Participant 08's daily weekend screen time increased slightly during the treatment phase and this was maintained through the follow-up phase. However, it should be noted that screen time values never approached the estimated pre-study weekend average screen time of 300 minutes per day, with the highest daily weekend screen time value being 225 minutes, which occurred during the treatment phase. This suggests that tracking of screen time may have been useful in reducing screen time during the baseline and this was generally maintained (with slight increase) across the treatment and follow-up phases; however, it is also difficult to ascertain the precision of the pre-study estimate of weekend screen time, as this was not confirmed prior to participation in the study.

Bivariate correlations conducted between average total screen time during the first week of the study and standardized baseline BMI scores, as well as correlations between pre-study, screening estimates of total average daily screen time and standardized baseline BMI scores were not statistically significant, though they were clinically meaningful . This finding does not support the findings of Marshall and colleagues' recent meta-analysis (2004), which suggested that screen time has only a small, non-clinically meaningful relationship with BMI. Given the overwhelming clinical belief, and other research which has supported (e.g., Arluk et al., 2003; Hancox et al., 2004) that screen time, and TV watching in particular, is related to weight in children and adolescents, more research is clearly needed to confirm or disconfirm the relationships between screen time and BMI found in the current study and the aforementioned meta-analysis.

Treatment Adherence

A final objective of this study was to prospectively examine treatment adherence to determine if better treatment adherence (as measured by parent rating) was related to greater reduction of screen time for participants who evidenced improvements in BMI percentile. Parent reported adherence ratings were designed to assess parents' subjective feelings of how successful they were at implementing strategies discussed in the treatment sessions. However, there was not a formal validity check to determine if parents were accurately responding to this question outside of having parents list strategies they implemented after choosing their rating of success for the week. Given Participant 08 was the only participant who evidenced an improvement in BMI percentile, this question was also examined tentatively. The hypothesis that greater treatment adherence would be present with reductions in screen time for participants who made improvements in BMI percentile, was somewhat supported in this study. Participant 08 showed overall low weekday screen time and weekend screen time that increased slightly during the treatment phase but was maintained through the remainder of the study. Participant 08's parent reported adherence, as assessed through a Likert scale, was slightly above the average for all participants.

Overall parent-reported adherence ratings fell closest to the "somewhat well" category, suggesting that most parents felt they were doing an average job of implementing treatment strategies. Following their adherence ratings parents were also asked to report on difficulties they had in implementing treatment strategies and overwhelmingly these difficulties typically centered around implementing treatment strategies during the weekend or other less structured/less controlled times (e.g., when children were sick; when children were visiting non-custodial parents).

Implications for Treatment of Children Who Are Overweight or At-Risk of Being Overweight

Overall, the implications for treatment are limited by the lack of consistent trends in findings for this sample of participants. One consistent finding was that most participants had an easier time limiting weekday screen time, which was maintained over the entire course of the study. Given the ease with which parents limited weekday screen time, and their positively rated satisfaction with the intervention, recommending that parents track and reduce weekday screen time to < 120 minutes per day may be an easy first step for families who want to make healthy lifestyle changes, such as decreasing screen time. Specifically, this recommendation could be implemented into well-child visits with pediatricians. Despite the lack of an association between decreasing screen time and decreasing BMI percentile, decreasing screen time can still have healthy benefits such as increasing opportunities to be physically active. Therefore, this recommendation, which would likely only take a few minutes to address during a well-child visit, could be given not only to children who are already overweight or at-risk of being overweight, but to children in a healthy weight category as a possible preventative strategy.

However, it appears that families may need more intensive supports in decreasing and maintaining changes to weekend screen time, particularly in geographical locations/

during seasons in which inclement weather often prevents children from being physically active outdoors. One possible solution to this problem might be to offer low or no-cost classes for families that span the winter months, during which families could learn and implement strategies to make and maintain healthy behavioral changes. These classes could provide access to indoor exercise equipment and could also include information on planning and preparing healthy meals. Ideally such classes would be advertised through various means (e.g., in doctors' offices; at churches; in schools) and would be offered at facilities such as community recreation centers so that all families would have equal access to them.

Limitations and Future Research

There were several limitations of the current study that warrant discussion. First, use of a multiple baseline, single subject design limits generalizability of findings due to the limited total number of study participants. Additionally, because participants were derived from the same geographic location in Northern Utah and were largely homogeneous with regard to ethnicity, generalizability is further compromised. However, this limitation is balanced by the advantages of using a multiple baseline, single-subject design in that internal validity in studies of this design is typically quite high. The multiple baseline, cohort approach allows for within-study replication of study results, which can provide more evidence of the effectiveness of treatment strategies in eliciting change in dependent variables.

Another limitation specific to this study is that only one participant evidenced a reduction in BMI percentile. Thus, drawing conclusions about many of the study hypotheses was difficult due to relying on information specific to one participant. Additionally, there were several factors specific to this participant, which were previously mentioned, that make drawing firm conclusions from his results difficult. It is unlikely his results can be generalized to other children who are at-risk of being overweight or who are overweight, which is supported by the fact that no other participants experienced similar improvements in BMI percentile values.

There were several factors related to treatment elements of the current study that also represent potential limitations. While the focus of the study was on simplifying the study design to focus primarily on only one treatment component, this was difficult to achieve. First, because direct observation of screen time behaviors or use of devices to track screen time was not possible in this study, gathering daily screen time data relied on parent tracking. There is significant support from previous research in other areas of behavioral health (e.g., smoking cessation) that self-monitoring or tracking of negative health behaviors (e.g., screen time behaviors in the case of the current study) significantly decreases these behaviors in the absence of any other treatment interventions. Therefore, for the current study, daily tracking of screen time can be viewed as a treatment intervention, and it was difficult to determine how this may have impacted the study results when trying to assess effectiveness of the intended treatment (i.e., the stimulus management interventions). To account for this the multiple baseline design was utilized, which helped to address this limitation by determining if participants evidenced a trend in decreased screen time during the baseline, tracking-only phase. As noted previously, some participants did evidence decreases in level of screen time during the baseline phase during which they were only monitoring/tracking screen time behaviors. This suggests that for some participants, monitoring the target behaviors may have been an intervention.

To address the aforementioned limitation future research could utilize alternate methods of tracking screen time behaviors. One possible include use of monitoring devices that could track use of televisions, computers, and video games, without requiring parents or children to monitor or document daily use of screen time. Such devices are currently available, primarily through specialty websites. Another option might be direct observation of the screen time behaviors through use of cameras to document when family members are watching television, playing video games, and using computers. However, this method could be obtrusive to family members, as well as costly.

Another issue related to components of the treatment was the difficulty in focusing only on stimulus management techniques to reduce screen time. Though this was clearly the primary focus throughout the treatment sessions, it should be noted that other elements could also be viewed as treatment strategies. These include the following: goal setting (both for daily screen time reduction and informally for daily physical activity), focusing on ways that parental behaviors may influence behaviors of children, and discussing ways to generalize and maintain positive behavior changes. Thus, although the study can still be viewed as primarily focused on stimulus management techniques, it can also be viewed as containing other potential treatment elements, which could have also influenced treatment outcomes.

Though it would likely be difficult to focus solely on one treatment component, future research could attempt to separate out the components of multicomponential treatment packages, while studying the effectiveness of each element in isolation of other elements. To do this, future research could employ a multiple baseline, single subject design in which each treatment element is tested; however, this research could also be tested through several research studies employing traditional treatment/control experimental designs so that treatment components could be tested against a control group not receiving the experimental treatment component.

While this study attempted to address limitations of previous research by focusing prospectively on measuring treatment adherence, another limitation was use of only parent-reported treatment adherence ratings. Given the subjectivity inherent in self-reported ratings, the validity of the treatment adherence ratings is unknown. Future research could benefit from implementing less subjective, prospective measures of treatment adherence, including completion of a checklist of implemented treatment strategies completed each week of the study by both parents and children.

A final issue related to treatment design is the role that parents had in the current intervention. Previous research (e.g., Golan et al., 1998; Golan & Crow, 2004) indicated that targeting parents as the agents of change had a positive impact on treatment outcomes. While the current study worked primarily with parents as agents of change in implementing the intervention strategies, parents' behaviors were not direct targets. Future research may be beneficial to explore the impact on children's treatment outcomes by directly targeting parents changing their own screen time and physical activity behaviors.

Future research needs to further address whether there is a significant association between screen time and BMI for children and adolescents. Given the results of the current study, as well as the results of a previous meta-analysis (Marshall et al., 2004), future research is needed to confirm or disconfirm whether a significant association even exists between screen time and BMI. Potentially, dietary, genetic, and other familial/ cultural factors could play larger roles in the epidemic percentages of children and adolescents who are overweight or at-risk of being overweight. These factors should also be more closely explored in future studies to create more effective intervention and prevention strategies.

Lastly, while not a limitation per se, it was noteworthy that in the current study there was significant difficulty in recruiting research participants. It is unknown if previous studies that employed a large sample size, also had difficulty recruiting families to participate, though it would be interesting to track this phenomenon in future research studies. Given there is ample evidence (e.g., Ogden et al., 2006) to support that there is a high base rate of children who are overweight or at-risk of being overweight, it was anticipated that recruitment for the current study would not be problematic; however, after efforts to recruit participants from a variety of methods largely failed, a change in study design was implemented to utilize a smaller sample size. Possibly, potential study participants may view weight as a difficult factor to change, given its likely multifaceted etiology, thus discouraging participants from signing up for a study in which weight-related behaviors would be targeted. It would be interesting for future research studies to track recruitment issues more closely to determine if this hypothesis is correct.

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APPENDICES

Appendix A:

Telephone Screening Questionnaire

Instructions for Student Researcher: Before calling parent, make sure you have a computer nearby & find the CDC BMI calculator for children online! Please introduce yourself to the parent and tell them that you have some brief questions to ask to determine if the parent and child qualify to participate in the study. You can tell parents that this should take about 10 - 15 min.

Section 1:

Go through this scripted section only if Julie has not spoken to the parents first.

Please tell parents the following: "First I'd like to give you some information about this study to determine if you're interested in it before we move on to the questions. This study is for children ages 6 through 12 who are overweight or at risk of being overweight. Parents who participate will be randomly assigned to one of two groups: a group that tracks their child's average daily screen time over the course of several weeks, or a group that tracks the same behaviors for several weeks but also attends five weekly parent groups that will provide parents with specific strategies to help decrease their child's average daily screen time. Screen time is defined as any of the following: watching TV and videos, playing video games, and playing on the computer. So if you participate in this study there is an equal chance that you could be in either group, but we have no way of guaranteeing which group you'll be in."

Ask parents: *"Based on the information you were given about the study are you still interested in possibly participating in this study and in going through these questions?"*

_________ Yes   _________ No

If **yes**, do the following: Tell parents that you are going to start asking them questions to determine if the parent and child qualify to participate in the study. Tell the parent that if at any time you realize they do not qualify you will tell them that and end the phone interview. Tell the parent that if they have questions about why they did not qualify, they can ask. Also tell parents that if at any time they do not want to answer questions or are no longer interested in possibly participating in the study, they should tell you & the phone interview will end. Now move on to SECTION 2.

If **no**, thank the parent for his / her time & end the call.

Note: If parents have questions about the purpose or design of the study, please tell parents that the study coordinator will contact them and inform the study coordinator of this ASAP.

Section 2: Please tell parents that initially you will ask them a few basic demographic questions and then you will ask them questions that are more specific to the study.

1. Child's full name: ____
2. Child's sex (circle one): Male Female
3. Child's current age: ______________
4. Child's current weight (to best of parent's knowledge): _________________
5. Child's current height (to best of parent's knowledge): _________________
6. Child's calculated BMI: ___________
7. How parent heard about study (circle all that apply): saw flier referred by doctor ad other

* Pause to check if child's height & weight is at the 85^{th} BMI percentile or above, using growth chart*

Is child's BMI percentile ≥ 85^{th} percentile: __________ Yes __________ N0

If **yes**, tell parent you are moving on to SECTION 3. If **no**, tell the parent that the child is not eligible to participate. Thank the parent and end the interview.

Section 3: Inform parents that you will now ask them a series of questions regarding whether their child often exhibits particular behaviors. Please tell parents that "often" means that their child exhibits the behavior more than they think is typical for a child at this age. Please tell parents that they need to answer either yes or no for each question. If parent endorses yes to questions, inquire if this is just w/ siblings & if it is more so than typical sibling rivalry.

Does your child:		*Circle each response*	
a.	Often lose his / her temper	Yes	No
b.	Often argue with adults	Yes	No
c.	Often actively defy or refuse to comply with adults' requests or rules	Yes	No
d.	Often deliberately annoy people	Yes	No
e.	Often blame others for his or her mistakes or misbehavior	Yes	No

Is your child: *Circle each response*

f.	Often touchy or easily annoyed by others	Yes	No
g.	Often angry or resentful	Yes	No
h.	Often spiteful or vindictive	Yes	No

TOTAL NUMBER OF ITEMS CIRCLED YES: _______ / 8 items

Is the total number of items circled yes ≥ 4: ________ Yes ________ No

If **no**, tell parent you are moving on to SECTION 4. If **yes**, tell the parent that the child is not eligible to participate. Thank the parent and end the interview.

Section 4: Inform parents that you will now ask them a few questions about their children's daily habits. Please tell parents that there are no right or wrong answers to these questions. Please tell them to simply think over each question and answer each question as accurately as possible.

a. On a typical schoolday / weekday (Monday – Friday), how many hours or minutes of television (*not* including videos) does your child watch?
____

b. On a typical weekday, how many hours or minutes of videos does your child watch? ________________________________

c. On a typical weekday, how many hours or minutes of video games (not on the computer) does your child play? ______________________________

d. On a typical weekday, how many hours or minutes does your child spend on the computer, doing activities NOT related to school or homework?
____

e. Pause to calculate: TOTAL MINUTES OF SCREEN TIME PER TYPICAL WEEKDAY:
ADD a through d above _______________

f. Now calculate TOTAL MINUTES OF SCREEN TIME PER TYPICAL WEEKDAY (part e above) MULTIPLIED BY 5: _______________

* Now inform the parents that you will ask the same questions but for a typical *weekend* day (Saturday & Sunday).

g. On a typical weekend day how many hours or minutes of television (not including videos) does your child watch? ______________________________

h. On a typical weekend day, how many hours or minutes of videos does your child watch? ______________________________

i. On a typical weekend day, how many hours or minutes of video games (not on the computer) does your child play? ____________________________

j. On a typical weekend day, how many hours or minutes does your child spend on the computer, doing activities NOT related to school or homework?

____

k. Pause to calculate: TOTAL MINUTES OF SCREEN TIME PER TYPICAL WEEKEND DAY: ADD g through j above ______________

l. Now calculate: TOTAL MINUTES OF SCREEN TIME PER TYPICAL WEEKEND DAY (part k from above) MULTIPLIED BY 2: ______________

m. Pause to calculate: Number from letter f above + Number from letter l above =

____

n. Pause to calculate Average daily screen time = Number from letter m DIVIDED BY 7 = ___________________

Is Average Daily Screen Time (value from letter n) ≥ *120 minutes?* _____ Yes _____ No

If **yes**, tell parent you are moving on to SECTION 5. If **no**, tell the parent that the child is not eligible to participate. Thank the parent and end the interview.

Section 5:

a. Is either parent currently undergoing structured treatment for being overweight, such as working regularly (weekly / monthly) with a doctor or nutritionist or going to Weight Watchers?

(circle one) Yes No

b. Is the child currently undergoing treatment for being overweight, such as working regularly (weekly / monthly) with a doctor or nutritionist?

(circle one) Yes No

Is the answer to either of these questions YES? _____ Yes _____ No

If **no**, tell parent you are moving on to SECTION 6. If **yes**, tell the parent that the child is not eligible to participate. Thank the parent and end the interview.

Section 6:

a. We can't guarantee that you would be assigned to the group that attends the weekly meetings, but if you are, is at least one parent able to consistently attend group sessions for five weeks in a row?

* Note: Both parents can attend, but at least one parent must be the same parent who consistently attends sessions each time.

(circle one) Yes No

b. Is at least one parent and the child willing to attend a baseline assessment period (a week or two before the treatment starts), an assessment after the treatment, and an assessment 3 months following completion of the treatment?

*Note: Assessments will include height and weight for parent and child. The initial assessment will also include one brief questionnaire.

(circle one) Yes No

c. Ask parent if someone would be able to consistently track the child's daily screen time for a total of seven weeks?

*Note: This can include either parent, a babysitter, nanny, relative, etc.

(circle one) Yes No

Did the parent answer NO to either a, b, or c above? ______ Yes (parent answered no to at least one of the above questions in this section) ______ No (parent answered yes to all questions in this section)

If **yes**, tell the parent that the child is not eligible to participate. Thank the parent and end the interview.

If **no**, tell parent you that the parent & child ARE ELIGIBLE to participate in the study. Please tell them that if they are still interested in participating, they will be contacted within the next week to schedule them for their first appointment to come in, read & sign the consent form to participate, and have their own height and weight measured, as well as their child's height and weight.

Student Researcher: Please complete the following information:

STUDY STATUS: (circle one) ELIGIBLE NOT ELIGIBLE
DATE OF PHONE INTERVIEW: ________________________ INITIALS OF INTERVIEWER: ___
IF ELIGIBLE, DATE BY WHICH BASELINE NEEDS TO BE SCHEDULED: _____________________ (Note: This should be exactly one week after the date of today's interview)

Appendix B:

Demographic Form

Part I: Parent Information

1. Mother's Name: ____

2. Mother's Age: ____________

3. Mother's Relationship to Child: (circle one)
   a. Biological parent b. Adoptive Parent c. Step-parent
   d. Legal Guardian e. Other: ________________________________

5. Mother's Marital Status: (circle one)
   a. Married b. Divorced c. Legally Separated
   d. Single, Never Married e. Widow

6. Mother's Highest Level of Education completed: (circle one)
   a. Graduate Degree b. Bachelor's Degree (BS / BA)
   c. Associate's Degree / Technical Degree d. Some college, no degree
   e. High School / GED f. Did not complete high school

7. Mother's Ethnicity: (circle one)
   a. Latina b. African American c. Caucasian
   d. Asian e. Native American f. Other: ______________________

8. Mother's Address: ____

____

____

9. Father's Name: ____

10. Father's Age: ____________

QUESTIONS CONTINUED ON NEXT PAGE

11. Father's Relationship to child: (circle one)
    a. Biological parent b. Adoptive Parent c. Step-parent
    d. Legal Guardian e. Other: ________________________________

12. Father's Marital Status: (circle one)
    a. Married b. Divorced c. Legally Separated
    d. Single, Never Married e. Widower

12. Father's Highest Level of Education completed: (circle one)
    a. Graduate Degree b. Bachelor's Degree (BS / BA)
    c. Associate's Degree / Technical Degree d. Some college, no degree
    e. High School / GED f. Some high school

13. Father's Ethnicity: (circle one)
    a. Latino b. African American c. Caucasian
    d. Asian e. Native American f. Other: __________________

14. Father's Address: ____

____

____

Part II: Child Information

1. Child's Name:

   ____

2. Child's Age: ____

3. Child's Current Grade in School: ______________

4. Child's Biological Sex: (circle one) Male Female

5. Child's Ethnicity: (circle one)
    a. Latina/o b. African American c. Caucasian
    d. Asian e. Native American d. Other: ______________________

Appendix C:

Daily Screen Time Log

Participant Number: ____

* Screen time =

Weekdays: hours / minutes spent before and after school watching television, watching videos, playing video games, and using the computer for non-school related purposes.

Weekends: hours / minutes spent all day doing the four activities.

Date	**Watching Television** (hours / minutes)	**Watching Videos** (hours / minutes)	**Playing Video Games** (hours / minutes)	**Using Computer for nonschool related purposes** (hours / minutes)

Appendix D:

Weekly Telephone Questionnaires

Weekly Telephone Questionnaire
(Treatment Phase)

Child's Name: ____

Parent's Name: ____

Date of Contact: _______________________________________

Student Researcher: _________________________________

<u>Part 1: Children's Behaviors</u>

1. Please ask parents: "Over the past 24 hours what is your estimate of the amount of time (in minutes or hours) your child spent in physical activities, which would include things such as walking, running, swimming, and participating in team or individual sports?"

   ____

2. a. Please ask parents, "Over the past 24 hours what is your estimate of how many times your child snacked between meals?"

   ____

   b. Then ask parents, "How many times did your child eat a snack in front of the television or while engaged in another screen time activity (e.g., playing video games; using the computer)?"

   ____

   c. Ask parents, "Of the total times your child snacked, how many of these times included high-fat or sugary snacks, which would include things such as cookies, pastries, chips, regular / non-diet soda, and high sugar fruit juice?"

   ____

QUESTIONS CONTINUED ON NEXT PAGE

Part 2: Treatment Adherence

1. Ask parents, "Please rate how well you were you able to successfully implement the treatment strategies discussed at the last group meeting?"

Circle One:

Extremely Well Very Well Somewhat Well A little Bit Not at all well

a. If yes, have parents list the strategies they implemented:

____
____
____
____
____
____
____

b. If no, please ask parents, "What made it difficult to implement the strategies?" Remind parents that these problems will be brought up and hopefully solved at the next group meeting.

____
____
____
____
____
____
____
____
____
____

2. Ask parents, "Since the last group meeting, on how many days were you able to meet the daily goal of limiting your child's screen time to 2 hours or less?"

_________ days met the goal / __________ possible days

(Be sure to fill in both numbers)

Weekly Telephone Questionnaire
(Baseline, Tracking-Only Phase)

Child's Name: ____

Parent's Name: ______________________________________

Date of Contact: _____________________________________

Student Researcher: ________________________________

Part 1: Children's Behaviors

1. Please ask parents: "Over the past 24 hours what is your estimate of the amount of time (in minutes or hours) your child spent in physical activities, which would include things such as walking, running, swimming, and participating in team or individual sports?"

   ____

2. a. Please ask parents, "Over the past 24 hours what is your estimate of how many times your child snacked between meals?"

   ____

   b. Then ask parents, "How many times did your child eat a snack in front of the television or while engaged in another screen time activity (e.g., playing video games; using the computer)?"

   ____

   c. Ask parents, "Of the total times your child snacked, how many of these times included high-fat or sugary snacks, which would include things such as cookies, pasteries, chips, regular / non-diet soda, and high sugar fruit juice?"

   ____

3. Please have parents provide the information from the Daily Screen Time Log:
   a. Date: ____________________
      i. Hours / Minutes of TV time:

____

ii. Hours / Minutes of video time:

____

iii. Hours / Minutes playing video games:

____

iv. Hours / Minutes using computer (non-school related): ____________

b. Date: ____________________

i. Hours / Minutes of TV time:

____

ii. Hours / Minutes of video time:

____

iii. Hours / Minutes playing video games:

____

iv. Hours / Minutes using computer (non-school related): ____________

c. Date: ____________________

i. Hours / Minutes of TV time:

____

ii. Hours / Minutes of video time:

____

iii. Hours / Minutes playing video games:

____

iv. Hours / Minutes using computer (non-school related): ____________

d. Date: ____________________

i. Hours / Minutes of TV time:

____

ii. Hours / Minutes of video time:

____

iii. Hours / Minutes playing video games:

____

iv. Hours / Minutes using computer (non-school related): ____________

e. Date: ____________________

i. Hours / Minutes of TV time:

____

ii. Hours / Minutes of video time:

____

iii. Hours / Minutes playing video games:

____

iv. Hours / Minutes using computer (non-school related): ____________

f. Date: ___________________

i. Hours / Minutes of TV time: ______________________________

ii. Hours / Minutes of video time: ____________________________

iii. Hours / Minutes playing video games: ______________________

iv. Hours / Minutes using computer (non-school related): ___________

g. Date: ___________________

i. Hours / Minutes of TV time: ______________________________

ii. Hours / Minutes of video time: ____________________________

iii. Hours / Minutes playing video games: ______________________

iv. Hours / Minutes using computer (non-school related): ___________

Appendix E:

Posttreatment Survey

Directions: Please circle the response for each question which best describes how you honestly feel.

1. Regarding techniques to help reduce my child's daily screen time, I believe I have learned:

nothing	very little	a few new techniques	several useful techniques	very many useful techniques

2. I believe that compared to before the intervention, my child's average daily screen time has:

increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

3. I believe that compared to before the intervention, my child's average daily participation in physical activity has:

decreased a lot	decreased somewhat	stayed the same	increased somewhat	increased a lot

4. I believe that compared to before the intervention, my child's snacking frequency has:

increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

5. I believe that compared to before the intervention, my child's consumption of high-fat snacks has:

increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

6. I believe that compared to before the intervention, my child's weight has:

increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

7. I believe that compared to before the intervention, my child's height has:

increased a lot	increased somewhat	stayed the same

8. With regard to your satisfaction with the intervention to reduce your child' daily screen time, please choose the response that best describes how satisfied you are:

not at all satisfied	a little satisfied	somewhat satisfied	very satisfied	completely satisfied

9. I believe that compared to before the intervention, *my* average daily screen time has:

increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

10. I believe that compared to before the intervention, *my* average daily participation in physical activity has:

decreased a lot	decreased somewhat	stayed the same	increased somewhat	increased a lot

11. I believe that compared to before the intervention, *my* snacking frequency has:

increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

12. I believe that compared to before the intervention, *my* consumption of high-fat snacks has:

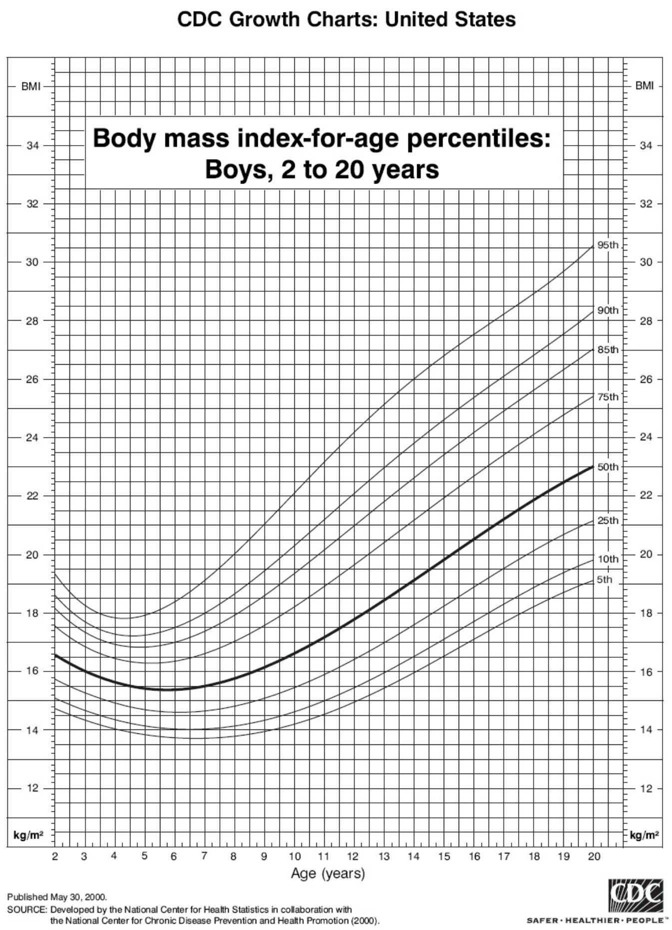
increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

13. I believe that compared to before the intervention, *my* weight has:

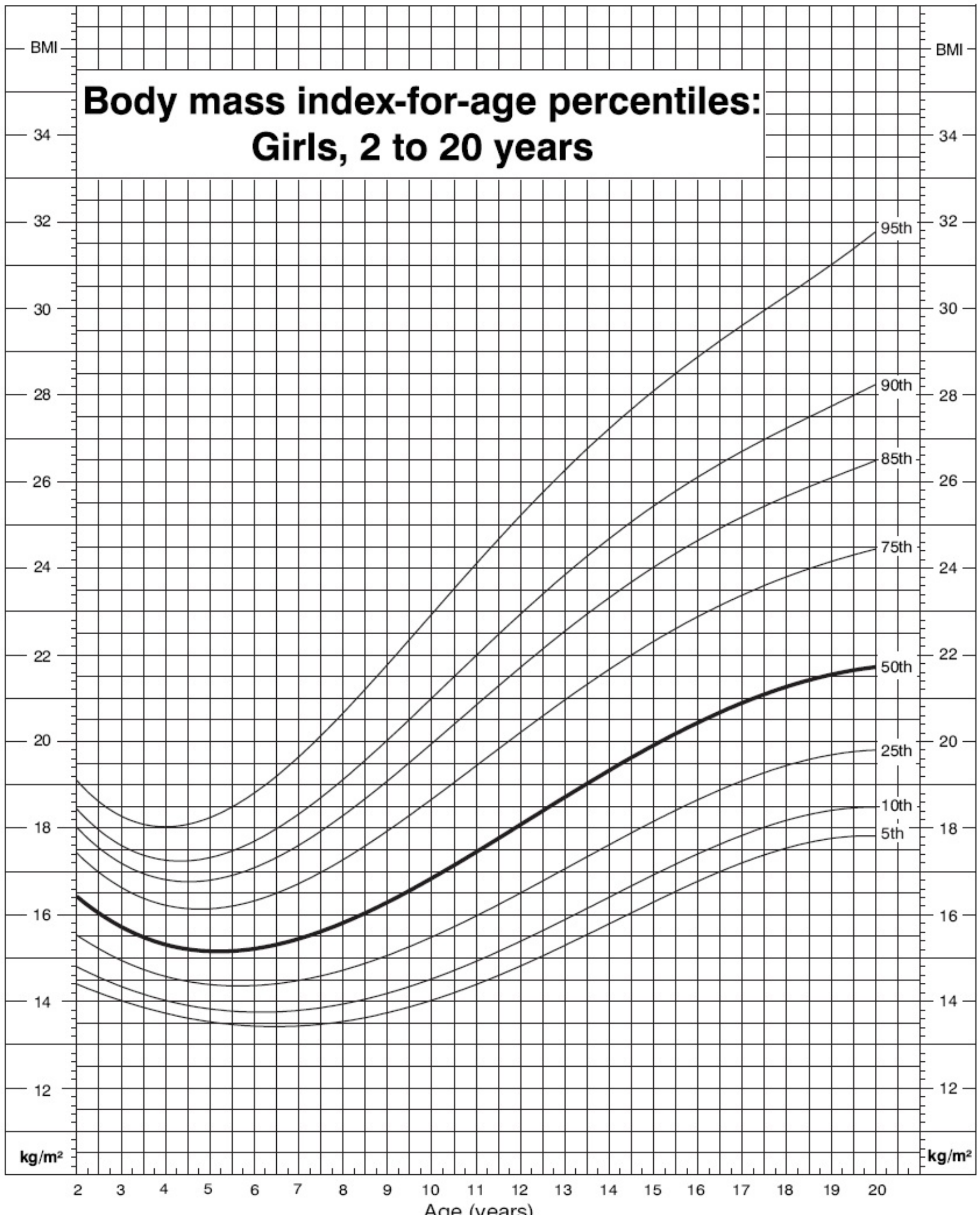
increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot

Appendix F:

CDC: Growth Charts: United States



CDC Growth Charts: United States



Published May 30, 2000.
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).

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Appendix G:

Informed Consent Form

Date Created: August 25, 2006. Page 160 of 177 Utah State University IRB Approved 08/25/2006 Approval terminates 08/25/2007 Protocol Number 1600 IRB Password Protected per True M. Rubal-Fox, IRB Administrat

Reducing Sedentary Behaviors in Children

Introduction: Dr. Gretchen Gimpel Peacock, a faculty member in the Department of Psychology at Utah State University (USU) and Julie Pelletier, a graduate student are conducting research on how to reduce sedentary behaviors in children. Sedentary behaviors include watching TV, playing video games, watching videos, and using a computer for non-school related activities. You are being asked to participate because your child is between the ages of 6 and 12 and is overweight or at risk of being overweight. Additionally, you have indicated your child engages in at least two hours of sedentary activities each day. Approximately 60 sets of parents and children will participate in this study.

Procedures: If you agree to participate, you will be randomly assigned to one of two groups: a treatment group or a tracking-only group. Parents in the treatment group will attend 5 weekly group-based sessions to learn how to reduce your child's sedentary behaviors. You will also be asked to track your child's sedentary behaviors for one week before the group sessions start, for each week of the group sessions, and for one week after the group sessions (7 weeks total). Parents in the tracking-only group will not participate in group sessions but will track their child's sedentary behaviors for 7 weeks.

Parents in both groups will receive weekly telephone calls from a trained undergraduate student to complete a 5 to 10 minute set of questions regarding their child's snacking and participation in physical activities. Parents in the tracking only group will also provide their tracking information on sedentary behaviors at this time.

Before the group sessions start, parents and children in both groups will be weighed and will have their height measured. Additionally, parents will complete a brief form with demographic information. At the last group session parents will complete a brief, anonymous survey regarding their perceptions of the treatment. One week after the end of the group sessions and 3 months after the completion of the group sessions, parents and children will again be weighed and measured. Additionally, 3 months after completion of the group sessions parents will be contacted by letter to have them complete one additional week of tracking sedentary behaviors.

Parents in both groups, who track their children's sedentary behaviors for at least six of the seven days of the week, will be entered into weekly drawings for a $25 gift card to Smith's Marketplace. There will be separate drawings for parents in the treatment and tracking-only groups. Parents in the treatment group who attend all group sessions, track their children's sedentary behaviors each week, and participate in the post-treatment assessment with their children will be entered into a drawing for a $50 gift card to a local sports store. Parents in the tracking-only group who track their children's sedentary behaviors each week and complete all post-treatment assessments will also be entered into a drawing for a $50 gift card to a local sports store. All parents who complete the three-month follow-up assessment will be entered into a drawing for a $50 gift card to a local sports store.

INFORMED CONSENT FORM

Reducing Sedentary Behaviors in Children

Benefits: If you are in the treatment group, you and your child may benefit from receiving free treatment for helping reduce your child's sedentary behaviors which may result in health benefits such as healthier height/weight ratio. If you are randomly assigned to the tracking-only group, you and your child may not receive direct benefits from this research; however, your participation may benefit others through improving information about treatments for children at-risk for weight problems.

Risks: There is minimal risk associated with participating in this study. If randomly assigned to participate in the parent sessions you might experience some slight discomfort in disclosing personal information in a group setting, but this risk is considered minimal.

Voluntary Nature of Participation and Right to Withdraw: Participation in this research study is entirely voluntary. You may refuse to participate or withdraw at any time without consequence.

Confidentiality: Information about you and your child will be kept confidential and be available only to the researchers. All information about you and your child will be assigned a code number that will be used when the data are stored in the computer. Code numbers and names will be listed on a master code list that will be kept separate in a locked file cabinet in Dr. Gimpel Peacock's research office at Utah State University. This list will be destroyed five years after the completion of the study. If you take part in the group sessions, all group members will be asked to verbally commit to maintain confidentiality of information shared in the sessions. Public presentations on study results will in no way identify you or your child.

Explanation and Offer to Answer Questions: Julie Pelletier, or a research assistant working with her, has explained this study to you and answered any questions you have at this time. If you have other questions, you may reach Julie Pelletier at (435) 797-3727 or Dr. Gretchen Gimpel Peacock at (435) 797-0721.

IRB Approval Statement: The Institutional Review Board (IRB) for the protection of human participants at Utah State University has reviewed and approved this research project. You may call the IRB at (435) 797-1821 with any questions regarding your rights as a research participant.

Copy of Consent: You have been given two copies of this Informed Consent Form.

Please sign both and retain one copy for your files.

Investigator Statement: "I certify that the research study has been explained to the above individual by me or my research staff, and that the individual understands the nature and purpose, the possible risks, and benefits associated with taking part in this research study. Any questions that have been raised have been answered."

Gretchen Gimpel Peacock, Ph.D. Principal Investigator (435) 797-0721	Date	Julie A. Pelletier, M.S. Student Investigator (435) 797-3727	Date

Signature of Parent Participant: I have read and understand this consent form and am willing to participate in this study.

Participant Signature	Printed Name	Date

Appendix H:

Informed Consent Form Addendum

INFORMED CONSENT FORM ADDENDUM

Reducing Sedentary Behaviors in Children

The purpose of this form is to provide you with information regarding changes in this study since you first consented to participate. On the original consent form you signed, you were informed that participants would be randomly assigned to a treatment or tracking-only group. At that time you were assigned to the tracking-only group. Due to a change in research design, you are now being offered the opportunity to participate in the treatment, beginning on 11/7/06. If you elect to participate in the treatment group you will attend 5 weekly group-based sessions to learn how to reduce your child's sedentary behaviors. You will also be asked to track your child's sedentary behaviors for each week of the group sessions, and for one week after the group sessions (6 weeks total).

One week after the end of the group sessions and 2 months after the completion of the group sessions, you and your child will again be weighed and measured. Additionally, 2 months after completion of the group sessions parents you will be contacted by letter to complete one additional week of tracking sedentary behaviors.

If you have any questions regarding this study or these changes, please feel free to contact one of us at the below phone numbers.

Investigator Statement: "I certify that the research study has been explained to the above individual by me or my research staff, and that the individual understands the nature and purpose, the possible risks, and benefits associated with taking part in this research study. Any questions that have been raised have been answered."

______________________________	__________	__________________	__________
Gretchen Gimpel Peacock, Ph.D. Principal Investigator (435) 797-0721	Date	Julie A. Pelletier, M.S. Student Investigator (435) 797-3727	Date

Signature of Parent Participant: I have read and understand this consent form and am

willing to participate in this study as described in the original consent form and as amended in this consent form.

______________________	______________________	______
Participant Signature	Printed Name	Date

Appendix I:

Revised Informed Consent Form

Date Created: December 20, 2006Revision 2 Approved 1/05/2007USU Original IRB Approval 08/25/2006Approval terminates 08/24/2007; Protocol Number 1600IRB Passwc or

INFORMED CONSENT FORM
Reducing Sedentary Behaviors in Children

Introduction: Dr. Gretchen Gimpel Peacock, a faculty member in the Department of Psychology at Utah State University (USU) and Julie Pelletier, a graduate student, are conducting research on how to reduce sedentary behaviors in children. Sedentary behaviors include watching TV, playing video games, watching videos, and using a computer for non-school related activities. You are being asked to participate because your child is between the ages of 6 and 12 and is overweight or at risk of being overweight. Additionally, you have indicated your child engages in at least two hours of sedentary activities each day. Approximately 10 - 15 sets of parents and children will participate in this study.

Procedures: If you agree to participate, you will be asked to track your child's sedentary behaviors for 6 weeks. You will then be asked to attend 5 weekly group-based treatment sessions to learn how to reduce your child's sedentary behaviors. You will also be asked to track your child's sedentary behaviors for each week of the group sessions, and for one week after the group sessions (6 additional weeks).

For the 6 weeks of tracking-only, the 5 weeks of treatment, and the week following the end of the treatment, all parents will receive weekly telephone calls from the study coordinator or a trained research assistant. During the phone calls parents will be asked to complete a 5 to 10 minute set of questions about their child's snacking and participation in physical activities. For the 6 weeks prior to the start of the group treatment sessions, parents will also provide their tracking information on sedentary behaviors during the weekly phone calls.

Before the group sessions start, parents and children will be weighed and will have their height measured. Additionally, parents will complete a brief form with demographic information. At the last group session parents will complete a brief, anonymous survey regarding their perceptions of the treatment. One week after the end of the group sessions and 2 months after the completion of the group sessions, parents and children will again be weighed and measured. Additionally, 2 months after completion of the group sessions parents will be contacted by letter to have them complete one additional week of tracking sedentary behaviors.

For all weeks of tracking, parents who track their children's sedentary behaviors for at least six of the seven days of the week, will be entered into weekly drawings for a $25 gift card to Smith's Marketplace. Parents who attend all group sessions, track their children's sedentary behaviors each week, and participate in the post-treatment assessment with their children will be entered into a drawing for a $50 gift card to a local sports store. All parents who complete the 2 month follow-up assessment will be entered into a drawing for a $50 gift card to a local sports store.

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Benefits: You and your child may benefit from receiving free treatment for helping reduce your child's sedentary behaviors. This may result in health benefits such as a healthier height/weight ratio. Also, your participation may benefit others through improving information about treatments for children who are overweight or at-risk of becoming overweight.

Risks: There is minimal risk associated with participating in this study. While participating in the treatment sessions you might experience some slight discomfort in disclosing personal information in a group setting, but this risk is considered minimal.

Voluntary Nature of Participation and Right to Withdraw: Participation in this research study is entirely voluntary. You may refuse to participate or withdraw at any time without consequence.

Confidentiality: Information about you and your child will be kept confidential and be available only to the researchers. All information about you and your child will be assigned a code number that will be used when the data are stored in the computer. Code numbers and names will be listed on a master code list that will be kept separate in a locked file cabinet in Dr. Gimpel Peacock's research office at Utah State University. This list will be destroyed five years after the completion of the study. For the treatment sessions, all group members will be asked to verbally commit to maintain confidentiality of information shared in the sessions. Public presentations on study results will in no way identify you or your child.

Explanation and Offer to Answer Questions: Julie Pelletier, or a research assistant working with her, has explained this study to you and answered any questions you have at this time. If you have other questions, you may reach Julie Pelletier at (435) 797-3727 or Dr. Gretchen Gimpel Peacock at (435) 797-0721.

IRB Approval Statement: The Institutional Review Board (IRB) for the protection of human participants at Utah State University has reviewed and approved this research project. You may call the IRB at (435) 797-1821 with any questions regarding your rights as a research participant.

Copy of Consent: You have been given two copies of this Informed Consent Form. Please sign both and retain one copy for your files.

Investigator Statement: "I certify that the research study has been explained to the above individual by me or my research staff, and that the individual understands the nature and purpose, the possible risks, and benefits associated with taking part in this research study. Any questions that have been raised have been answered."

______________________________	__________	__________________	__________
Gretchen Gimpel Peacock, Ph.D. Principal Investigator (435) 797-0721	Date	Julie A. Pelletier, M.S. Student Investigator (435) 797-3727	Date

Signature of Parent Participant: I have read and understand this consent form and am willing to participate in this study.

Participant Signature	Printed Name	Date

Appendix J:

Group Treatment Sessions

Group Treatment Session #1

Treatment Group: *circle one* 1 2 3

Date of Session: ______________________________

Session Facilitator: ____

Student Helper: ____

Group Members *not* Present:

____

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Session Agenda:
(check each item when completed)

1. ________ (5 minutes) Introduction:
   Introduce session facilitator & student helper.
   Welcome group members.
   Outline session agenda.

2. ________ (10 minutes) Group member introductions & brief ice breaker.

3. ________ (20 - 30 minutes) Education component:
   Discuss current epidemic of children and adults being overweight or at risk of being overweight.
   Provide current statistics.
   Indicate that there are multiple factors that contribute to children being overweight; have members work in teams to come up with different factors.
   Discuss sedentary behaviors & cite research that has made the link between sedentary behaviors & children being overweight; focus on TV
   Link between sedentary behaviors & decrease in physical activity / increase in food or snacks
   Define screen time & discuss AAP guidelines

Discuss that all children in the study currently engage in > 2 hours screen time per day

Introduce study goal: daily screen time ≤ 2 hours

Behavior can be hard to change so next week will start to focus on specific techniques to implement these changes

Reiterate that there are many different factors that contribute to kids being overweight, but in this study we are focusing on one of these areas to keep it as simple as possible for parents to implement; *These strategies should result in healthier lifestyle

4. ________ (10 minutes) Tracking of Screen Time

Discuss importance of daily tracking as an essential way to see if we are meeting the study goal

Brainstorm as a group ways to help parents remember to track & ask what helped them remember over previous week

- In two parent families, each parent reminds the other
- Visible reminders in appropriate places (e.g., refrigerator, daily planner, sticky notes, etc.)
- Check in each evening with child to discuss & track daily screen time
- Weekly reminder calls

5. ________ (5 minutes) Brief Overview of Next Session

Problem solve any problems had tracking

Begin discussing specific techniques to implement to meet study goal of ≤ 2 hours screen time / day

6. ________ (remaining time) Schedule times to call parents for weekly reminder / Assign Homework / Overview of next week

Homework: track daily screen time & have a discussion with child about study goal / why it is important (healthy lifestyle)

Group Treatment Session #2

Treatment Group: *circle one* 1 2 3

Date of Session: ______________________________

Session Facilitator: ______________________________

Student Helper: ______________________________

Group Members *not* Present:

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Session Agenda:
(check each item when completed)

1. ________ (10 minutes) Check In / Problem Solving

Discuss tracking of screen time & as a group solve problems parents encountered

Discuss homework to discuss study goal / tracking with children; See how this went with each group member

2. ________ (30 - 40 minutes) Discuss Stimulus Management Techniques

Introduce & define stimulus management: Sedentary behaviors like TV, videos, computer are stimuli or environmental cues for being inactive & for some children, for eating unhealthy foods. *Give example*: sit in front of TV & that is cue for eating a bag of chips, whether because you are bored or because you see a commercial for a bag of chips.

Stimulus management for this study means you will make changes to the environment to prevent your child from engaging in the target behaviors. This also includes making rules about use of screen time activities. *Give example:* Change in environment = unplug television; Rule = watch 1 hour of TV, but only after getting homework finished

Time for questions from parents

Have half parents work in teams to come up with environmental changes; other half = rules about screen time

As a group decide on two environmental changes & two rules that everyone agrees to implement over next week & create reminder sheets; Discuss where to post these reminder sheets!

Discuss concept of extinction with parents- explain that when you first start to limit child's screen time the child may resist. Get some examples of what children may do to resist. Explain that this resistance typically hits a peak & then over time the child will get used to the change. Give an example of what happens when you start to consistently ignore tantrums- tantrums initially get longer & worse but over time get shorter & less frequent. Explain that it is essential for parents to be consistent & stick with the plan to limit screen time.

Have parents work in same teams to brainstorm ideas on how they could deal with problems that arise from children resisting the changes they are making to screen time.

Encourage parents to choose the solution they think will work best in their family but do not mandate that each family chooses the same solution.

3. ________ (remaining time) Wrap up of session / Assign Homework / Schedule Reminder Calls / Overview of Next Week

Homework: a) track daily screen time
b) discuss environment changes & rules with children / post list of changes & rules / implement them!

Remind parents that during reminder call they will be asked about their tracking & whether they implemented intervention techniques; also, will be able to report problems they had so that these can be brought up & solved at next group meeting

Schedule reminder calls

Overview of next week- discuss physical activities that can be substituted for screen time

Group Treatment Session #3

Treatment Group: *circle one* 1 2 3

Date of Session: ______________________________

Session Facilitator: ____

Student Helper: ____

Group Members *not* Present:

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Session Agenda:
(check each item when completed)

1. ________ (15 – 20 minutes) Check In / Problem Solving
   Discuss tracking of screen time & as a group solve problems parents encountered
   Discuss homework to discuss / implement environmental changes & new rules with children- what went well, what didn't--- problem solve as a group how to improve parents' implementation of changes / rules

2. ________ (30 minutes) Discussion about Physical Activities that can Replace Sedentary Behaviors
   Remind parents that one possible way that sedentary behaviors contribute to children being overweight is that they take the place of times when children could be physically active
   Can be hard to reduce sedentary behaviors if kids aren't aware of what they could do to be active
   Parents play a role in this with their own actions- discuss modeling & what kids learn from examples of parents
   Brainstorm simple / feasible physical activities that could replace screen time- have parents work in teams; discuss having sports equipment (bikes, jump ropes, balls, etc.) available; note that it will probably be more successful if it is a family-wide focus (not just child singled out to be more active)

Problem solve any possible roadblocks in getting kids to be more active

Tell parents that we will not have a specific study goal about physical activity but it will be up to individual parents to determine strategies they want to use to get kids to be more active

3. ________ (5 minutes) Brief Overview of Next Session

Update group on where it is at in meeting goal of ≤ 2 hours screen time / day

Use it to really problem solve any remaining issues with implementing the environmental changes / rules

Discuss success in implementing changes in physical activity- what worked well / what didn't work

4. ________ (remaining time) Homework / Schedule times to call parents for weekly reminder

Homework: keep enforcing environmental changes / rules; focus on ways to increase physical activity in place of sedentary behaviors

Schedule weekly reminder call

Group Treatment Session #4

Treatment Group: *circle one* 1 2 3

Date of Session: ________________________________

Session Facilitator: ____

Student Helper: ____

Group Members *not* Present:

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Session Agenda:
(check each item when completed)

1. ________ (10 – 20 minutes) Update about Group Progress

   Discuss with group where they are at with meeting group goal of ≤ 2 hours screen time / day; show graph of weekly progress & compare this to other treatment groups

   If on target, provide group with positive reinforcement & discuss ways to keep the success going; discuss remaining roadblocks despite success

   If not on target, praise efforts & discuss roadblocks; problem solve & get parents to recommit to goal

2. ________ (20 minutes) Discussion about Physical Activities that can Replace Sedentary Behaviors

   Discuss experiences in getting children to be more active; Use a round robin approach so that all group members contribute & get feedback from each other

3. ________ (10 minutes) Discussion about Parents' Behaviors and How These Influence Children

   Not a requirement of the study, but parent changes in screen time & physical activity will make it more likely that children will change these things

   Find out where parents are at with this; use round robin approach again

4. ________ (5 minutes) Brief Overview of Next Session

Next session = final session
Will focus on how to take what we have learned & generalize it to different situations (e.g., different seasons of the year)

5. ________ (remaining time)

Homework / Schedule times to call parents for weekly reminders

Homework: keep enforcing environmental changes / rules; keep focusing on ways to increase physical activity in place of sedentary behaviors; think of changes parents are willing to make to model healthy behaviors

Schedule weekly reminder calls for each week

Group Treatment Session #5

Treatment Group: *circle one* 1 2 3

Date of Session: ______________________________

Session Facilitator: ____

Student Helper: ____

Group Members *not* Present:

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Session Agenda:
(check each item when completed)

1. ________ (5 – 10 minutes) Update about Group Progress
   - Discuss with group where they are at with meeting group goal of ≤ 2 hours screen time / day; show graph of weekly progress & compare this to other treatment groups
   - If on target, provide group with positive reinforcement & discuss ways to keep the success going; discuss remaining roadblocks despite success
   - If not on target, praise efforts & discuss roadblocks; problem solve & get parents to recommit to goal

2. ________ (5 minutes) Check In / Problem Solving
   - Discuss how things have gone with continued enforcement of environmental changes / rules
   - Discuss how things have gone with the continued emphasis on replacing sedentary behaviors with physical activities

3. ________ (20 - 25 minutes) Discussion about Generalizing Behavior Changes
   - Discuss that over the past five weeks we have worked on reducing screen time to no more than 2 hours / day & we have worked on replacing screen time w/ physical activity
   - Discuss that we want these changes to generalize to other contexts, such as during other seasons; moving from fall into winter so this could present challenges

for increasing physical activity

Brainstorm roadblocks for reducing screen time & increasing physical activity in winter; Then have parents work in teams to come up with possible solutions

Then brainstorm possible physical activities appropriate for spring / summer; discuss possible challenges of reducing screen time during summer when children are home from school; Have parents problem solve solutions to these problems

4. ________ (10 - 15 minutes) Discussion about Maintaining Behavior Changes

Discuss that over the past five weeks as a group we have worked on environmental changes / rules to help children reduce their daily screen time; could be challenging to continue to stick to this after treatment is over

Have group members work in pairs to come up with possible roadblocks to maintaining progress; have each pair share & as a group discuss strategies to help maintain changes

5. ________ (remaining time) Group Wrap-up

Discuss enjoyment of working with the group

Discuss that group members might want to exchange contact information if they formed friendships with other members

Have all members complete the Treatment Satisfaction Questionnaire

Remind parents that next week they will come in at the same time / day WITH THEIR CHILDREN to complete the post-treatment assessments (height & weight)