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I, Paul W Branscum, hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Health Education.

It is entitled:
Designing and evaluating an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children

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Designing and evaluating an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children

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Abstract

During the past three decades the prevalence of child and adolescent obesity has tripled and currently 31.7% of children and adolescents are either overweight or obese. This is of concern due to the reported metabolic, psychological and social consequences associated with excess weight gain. While obesity occurs as the result of a sustained energy imbalance, there are many reported factors associated with its etiology. Interventions that can favorably impact such factors such as a healthy diet and physical activity could help prevent its onset early in life and spare children from reported metabolic and psychological consequences. Schools are one place intervention strategies are needed, however many obesity prevention interventions that have been implemented in this setting have produced mixed or modest outcomes. The after-school time frame is another excellent opportunity for such strategies, however less work has been done in this area compared with school-based interventions and more studies are needed. The purpose of this study was to evaluate the efficacy of a social cognitive theory based childhood obesity intervention with children in the after-school environment.

This study employed a group randomized controlled design, whereby a convenience sample of twelve after-school programs were randomized into either an experimental (social cognitive theory based) or comparison (knowledge-based) intervention. A pretest, post-test and three month follow up test was conducted to evaluate the programs effects on BMI-percentile, key obesity prevention behaviors (fruit & vegetable consumption, sugar-sweetened beverage consumption, sugar-free drink & water consumption, the engagement of physical activities, and the engagement of sedentary activities), and three constructs of social cognitive theory (self-
efficacy, expectations (comprising of outcome expectations and outcome expectancies), and self-control) related to each behavior. Both interventions consisted of four-30 minute sessions that were implemented over a four-week period. Process evaluations were used during each session to evaluate program fidelity and dose.

A convenience sample of 71 children (37 in the experimental and 34 in the comparison) completed the interventions and were used for the final data analyses in this study. Results indicated that study variables and demographic variables were not different for children in the assigned groups at baseline. Process evaluations suggested that both programs were implemented as planned. It was found that BMI-percentile, all obesity related behaviors, and social cognitive theory constructs did not change between groups over the course of the intervention. There was however a significant main effect, indicating an improvement in both groups for fruit and vegetable consumption, the engagement in physical activity, the engagement in screen time, water and sugar free beverage consumption and self efficacy for fruit and vegetable consumption and physical activity. It can be concluded that the two interventions in this study may not have been very different from each other to discern changes. It is also likely that the experimental intervention may not have been of adequate length to truly produce the desired changes targeted in this study. More work is needed in this area to find appropriate, theory-based, health education programs that can complement larger health promotion efforts.
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CHAPTER 1

INTRODUCTION

Overweight and obesity rates in the United States and other countries are high. According to the most recent National Health and Nutrition Examination Survey (NHANES) 2007-2008, 68% of U.S. adults are either overweight or obese, and 33.8% are obese, with slight differences reported among gender; 32.2% of adult men and 35.5% of adult women were reported obese (Flegal, Carroll, Ogden, & Curtin, 2010). Prevalence rates also vary by states with Colorado having the lowest rate of 18.6% and Mississippi having the highest rate of 34.4%. This problem also affects the youth of our nation. During the past three decades the prevalence of child and adolescent obesity has also tripled. According to the latest NHANES 2007-2008, 16.9% of children (ages 2-19) were obese and 31.7% were overweight or obese. When stratified by age, it was found that 10.4% were obese between ages 2-5, 19.6% were obese between ages 6-11, and 18.1% were obese between 12-19 years of age. Hispanic (20.9%), Mexican American (20.8%) and Non-Hispanic Black (20%) were also more likely to be obese, compared to Non-Hispanic White children (15.3%) (Ogden, Carroll, Curin, Lamb, & Flegal, 2010).

This is of concern due to the reported risk factors associated with overweight and obesity. Overweight children have an increased risk for developing metabolic conditions in early and later life such as type 2-diabetes, coronary artery disease, cardiovascular disease, inflammation, musculo-skeletal injuries, early physical maturation, and metabolic syndrome (Ludwig, 2007; Mattsson, Nnemaa, Jounala, Villkari, & Raitakari, 2008). Psychological conditions such as depression, low reported self-esteem, social marginalization, and negative body image are also more prevalent among overweight children (Daniels, Jacobson, McCrindle, Eckel, & Sanner,
In past decades obesity related health care costs have also significantly increased and were estimated to be $75 million in 2003 (Finkelstein, Fiebelkorn, & Wang, 2004). If current obesity trend continue, total annual health care costs are projected to range from $860 to $956 billion by 2030 (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008).

Obesity occurs as the result of a sustained energy imbalance, whereby more calories are consumed than expended. Many factors are reportedly associated with this energy imbalance, and thus the etiology of obesity among children and adolescents is complex. These determinants are often described as either being modifiable, or factors that can be changed (i.e. diet or physical activity), and non-modifiable, or factors that cannot be changed (i.e. genetics or race).

In 2005 the American Medical Association (AMA), in collaboration with representatives from 15 national health care organizations, convened an expert committee to revise and develop updated recommendations for the evaluation and treatment of child and adolescent obesity. The purpose of the expert committee was to provide practical advice and guidance to clinicians and other health professionals in all areas of obesity prevention and treatment (Barlow, 2007). Key lifestyle behaviors the committee identified as being necessary for obesity prevention efforts included consuming no more than one sweetened beverage per day, consuming 5 servings of fruits and vegetables per day, engaging in at least 60 minutes of moderate to vigorous physical activity (MVPA) per day, and limiting screen time activities to no more than 2 hours per day (Roa, 2008).

Interventions for Prevention and Treatment of Childhood Obesity

Interventions that can favorably impact health behaviors associated with the prevention of obesity (such as a healthy diet), could help prevent the onset of obesity in childhood, and spare children from the associated metabolic and psychological consequences. Schools are one
place intervention strategies are needed. Schools provide a captive audience of children and adolescents, in which they typically spend 50% of their time, or 180 days per year. Schools also provide opportunities to engage in healthful behaviors, as with P.E. classes, and reinforce healthy behaviors through formal health classes, or by integrating health messages in core academic areas (U.S. Department of Education, 2001-2002). Many obesity prevention interventions have been implemented in the school setting, but results have been generally mixed or modest. Meta-analyses on school-based interventions conducted by Katz and colleagues (2008), Gonzalez-Suarez and colleagues (2009), Kanekar and Sharma (2008-2009), and Cook-Cottone, and colleagues (2009) all conclude that effectiveness of such interventions on BMI are generally small or statistically insignificant.

The after-school time frame is another excellent venue to implement child and adolescent obesity interventions. Currently, 7 million youth attend some type of after-school program (ASP) (Mahoney, Lord, & Carrly, 2005). Many ASP’s vary and attempt to provide alternative activities that are either not offered during the school day or can complement subject matter covered during the school day, including sports, arts and drama, cultural enrichment, science and health education (Mahoney, et al., 2005). Compared to school-based interventions less work has been done implementing and evaluating after-school based obesity prevention interventions. Pate and O’Neill (2009) reviewed after-school interventions aimed to increase physical activity among youth, and found that such programs were generally successful for this behavior, however they did not review other outcomes such as changes in diet, psychosocial measures, or weight status. More studies are needed in this area.

Finally, child and adolescent obesity prevention interventions should be based on theoretical underpinnings. Theories are beneficial for health-promotion for several reasons; for
example they discern measurable intervention objectives, and provide guidance for intervention strategies. However, not all obesity prevention interventions are theory-based, and even when they are, they may not operationalize the theoretical constructs adequately for evaluation purposes (Sharma, & Branscum, 2010). A commonly used theory in health promotion is social cognitive theory (SCT), which posits that human behavior can be explained by reciprocal determinism, or a continuous interaction between behavior, personal factors and the environment. In a recent meta-analysis spanning from 1985 to 2003 authors reviewed randomized controlled trials (RCT’s) designed to favorably impact nutrition and physical activity among children and interventions that were most successful were implicitly or explicitly based on social cognitive theory (Thomas, 2006).

Purpose & Relevance

The purpose of this study was to evaluate the efficacy of an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children. This study predicted that weight status (as measured by BMI-percentiles) will improve, obesity related behaviors will improve, and social cognitive theory constructs will improve at the end of the intervention and follow-up period. The results of this study will help the current state of research and issue of child and adolescent obesity by having effective and innovative obesity-prevention interventions for future children. A schematic depiction of this study is presented in Figure 1.1. The primary objectives of this study was to:

1. Examine the effects of a theory-based (experimental) and a traditional, non-theory based (knowledge-based) intervention from before to after to follow-up, on social cognitive theory (SCT) constructs namely: self-efficacy for (i) participation in no more than two hours of screen time per day; (ii) participation in 60 minutes of physical activity per day;
(iii) consumption of five servings of fruits and vegetables; (iv) consumption of water and sugar-free drinks; expectations for (i) participation in no more than two hours of screen time per day; (ii) participation in 60 minutes of physical activity per day; (iii) consumption of five servings of fruits and vegetables; (iv) consumption of water and sugar-free drinks; and self-control for (i) participation in no more than two hours of screen time per day; (ii) participation in 60 minutes of physical activity per day; (iii) consumption of five servings of fruits and vegetables; (iv) consumption of water and sugar-free drinks.

2. Examine the effects of a theory-based (experimental) and a traditional, non-theory-based (knowledge-based) intervention from before to after to follow-up on key obesity preventative behaviors, including (i) minutes engaged in screen time activities; (ii) minutes engaged in moderate to vigorous physical activity; (iii) number of servings of fruits and vegetables; (iv) number of glasses of sugar sweetened beverages; (v) number of glasses of water and sugar-free beverages.

3. Examine the effects of a theory-based (experimental) and a traditional, non-theory-based (knowledge-based) intervention from before follow-up on BMI-percentile.

Some of the methodological prerequisites for conducting this study were:

1. Assess the degree of fidelity of program implementation in both theory-based (experimental) and a traditional non-theory based (knowledge-based) interventions.

2. If the degree of fidelity is found significantly different, control for differences between the degree of fidelity of program implementation between both theory-based (experimental) and a traditional non-theory based (knowledge-based) interventions.
Significance of this Study to Health Promotion & Education

The prevalence of obesity has tripled in the past three decades, and efforts are needed to slow and reverse this trend. Interventions aimed at obesity prevention are one strategy that can help to prevent the onset of overweight in childhood, and spare children from the associated metabolic and psychological consequences. Schools are one place intervention strategies are needed, however many studies evaluating these interventions have reported mixed or modest outcomes. The after-school time frame is another place to implement child and adolescent obesity interventions, but compared with school-based interventions, less work has been done implementing and evaluating such programs.

Many complex factors are commonly reported as being associated with child and adolescent obesity, therefore health-promoting interventions need to identify and target the most vital behaviors related to obesity prevention. The American Medical Association’s expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity, identified four key lifestyle behaviors that are necessary for obesity prevention, including consuming no more than one sweetened beverage per day, consuming 5 servings of fruits and vegetables per day, engaging in at least 60 minutes of MVPA per day, and limiting screen time activities to no more than 2 hours per day (Roa, 2008).

The current study uses a mix of psychosocial, behavioral and physical factors to test the efficacy of a social cognitive theory based obesity prevention intervention. Specifically, we are measuring an indicator of weight-status (BMI-percentile), obesity prevention behaviors (fruit and vegetable consumption, sugar-sweetened beverage consumption, and water/sugar-free drink consumption, physical activities, sedentary activities), and psychosocial constructs of social cognitive theory (self-efficacy, self-control, expectations) about the four obesity prevention
behaviors. Very few studies evaluating obesity prevention interventions identify and operationalized a behavioral theory, and few include all of these measures. Furthermore, we are evaluating the effects of the intervention after a 3-month follow up period, which is not always done.
Figure 1.1 Study framework of a social cognitive theory comic book intervention among children for obesity prevention
Research Questions

1. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean self-efficacy for consuming five servings of fruit and vegetable per day from pre to post intervention that is sustained at a 3 month follow up?

2. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean self-control for consuming five servings of fruit and vegetable per day from pre to post intervention that is sustained at a 3 month follow up?

3. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean expectations (outcome expectations x outcome expectancies) for consuming five servings of fruit and vegetable per day from pre to post intervention that is sustained at a 3 month follow up?

4. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean self-efficacy for consuming more water and sugar-free drinks per day from pre to post intervention that is sustained at a 3 month follow up?

5. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean self-control for consuming more water and sugar-free drinks per day from pre to post intervention that is sustained at a 3 month follow up?

6. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean expectations (outcome expectations x outcome expectancies) for consuming more water and sugar-free drinks per day from pre to post intervention that is sustained at a 3 month follow up?

7. Is there a significant difference between experimental (theory based) and knowledge
based (non-theory) groups in mean self-efficacy for engaging in 60 minutes of moderate to vigorous physical activity per day from pre to post intervention that is sustained at a 3 month follow up?

8. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean self-control for consuming 60 minutes of moderate to vigorous physical activity per day from pre to post intervention that is sustained at a 3 month follow up?

9. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean expectations (outcome expectations x outcome expectancies) for consuming 60 minutes of moderate to vigorous physical activity per day from pre to post intervention that is sustained at a 3 month follow up?

10. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean self-efficacy for engaging in no more than 2 hours of screen time per day from pre to post intervention that is sustained at a 3 month follow up?

11. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean self-control for engaging in no more than 2 hours of screen time

12. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in mean expectations (outcome expectations x outcome expectancies) for engaging in no more than 2 hours of screen time per day from pre to post intervention that is sustained at a 3 month follow up?

13. Is there a significant difference between experimental (theory based) and knowledge
13. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in the mean number of servings of fruits and vegetables consumed per day from pre to post intervention that is sustained at a 3 month follow up?

14. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in the mean number of glasses of sugar sweetened beverage per day from pre to post intervention that is sustained at a 3 month follow up?

15. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in the mean number of glasses of water and sugar-free drinks per day from pre to post intervention that is sustained at a 3 month follow up?

16. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in the mean number of minutes of moderate to vigorous physical activity per day from pre to post intervention that is sustained at a 3 month follow up?

17. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in the mean number of minutes of screen time per day from pre to post intervention that is sustained at a 3 month follow up?

18. Is there a significant difference between experimental (theory based) and knowledge based (non-theory) groups in the mean BMI-percentile from pre to 3 month follow up?

19. What is the degree of fidelity in program implementation in both experimental (theory based) and knowledge based (non-theory) groups?
Hypotheses

Hypothesis #1: Children receiving a theory based intervention will decrease their BMI-percentile more than children receiving a knowledge based intervention.

Alternative Hypothesis #1: Children receiving a theory based intervention will increase their BMI-percentile than children receiving a knowledge based intervention.

Null Hypothesis#1: There will be no differences in BMI-percentile between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #2: Children receiving a theory based intervention will engage in less minutes of screen time per day than children receiving a knowledge based intervention.

Alternative Hypothesis #2: Children receiving a theory based intervention will engage in more minutes of screen time per day than children receiving a knowledge based intervention.

Null Hypothesis#2: There will be no differences in amount of minutes screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #3: Children receiving a theory based intervention will engage in more minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Alternative Hypothesis #3: Children receiving a theory based intervention will engage in less minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Null Hypothesis#3: There will be no differences in amount of minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children
Hypothesis #4: Children receiving a theory based intervention will consume more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Alternative Hypothesis #4: Children receiving a theory based intervention will consume more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Null Hypothesis #4: There will be no differences in amount of water and sugar-free drinks consumed per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #5: Children receiving a theory based intervention will consume less sugar sweetened beverages per day than children receiving a knowledge based intervention.

Alternative Hypothesis #5: Children receiving a theory based intervention will consume more sugar sweetened beverages per day than children receiving a knowledge based intervention.

Null Hypothesis #5: There will be no differences in amount of sugar-sweetened beverages consumed per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #6: Children receiving a theory based intervention will consume more servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Alternative Hypothesis #6: Children receiving a theory based intervention will consume less servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Null Hypothesis #6: There will be no differences in number of servings of fruits and vegetables consumed per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.
Hypothesis #7: Children receiving a theory based intervention will have higher mean self-efficacy scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Alternative Hypothesis #7: Children receiving a theory based intervention will have lower mean self-efficacy scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Null Hypothesis#7: There will be no differences in mean self-efficacy scores for consuming five servings of fruits and vegetables per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #8: Children receiving a theory based intervention will have higher mean self-control scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Alternative Hypothesis #8: Children receiving a theory based intervention will have lower mean self-control scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Null Hypothesis#8: There will be no differences in mean self-control scores for consuming five servings of fruits and vegetables per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #9: Children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Alternative Hypothesis #9: Children receiving a theory based intervention will have lower mean
expectations (outcome expectations x outcome expectancies) scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention.

Null Hypothesis#9: There will be no differences in mean expectations (outcome expectations x outcome expectancies) scores for consuming five servings of fruits and vegetables per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #10: Children receiving a theory based intervention will have higher mean self-efficacy scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Alternative Hypothesis #10: Children receiving a theory based intervention will have lower mean self-efficacy scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Null Hypothesis #10: There will be no differences in mean self-efficacy scores for consuming more water and sugar-free drinks per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #11: Children receiving a theory based intervention will have higher mean self-control scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Alternative Hypothesis #11: Children receiving a theory based intervention will have lower mean self-control scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Null Hypothesis#11: There will be no differences in mean self-control scores for consuming
more water and sugar-free drinks per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #12: Children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Alternative Hypothesis #12: Children receiving a theory based intervention will have lower mean expectations (outcome expectations x outcome expectancies) scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention.

Null Hypothesis#12: There will be no differences in mean expectations (outcome expectations x outcome expectancies) scores for consuming more water and sugar-free drinks per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #13: Children receiving a theory based intervention will have higher mean self-efficacy scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Alternative Hypothesis #13: Children receiving a theory based intervention will have lower mean self-efficacy scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Null Hypothesis#13: There will be no differences in mean self-efficacy scores for engaging in 60 minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #14: Children receiving a theory based intervention will have higher mean self-
control scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Alternative Hypothesis #14: Children receiving a theory based intervention will have lower mean self-control scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Null Hypothesis #14: There will be no differences in mean self-control scores for engaging in 60 minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #15: Children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Alternative Hypothesis #15: Children receiving a theory based intervention will have lower mean expectations (outcome expectations x outcome expectancies) scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention.

Null Hypothesis #15: There will be no differences in mean expectations (outcome expectations x outcome expectancies) scores for engaging in 60 minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #16: Children receiving a theory based intervention will have higher mean self-efficacy scores for engaging in no more than 2 hours of screen time per day than children
receiving a knowledge based intervention.

Alternative Hypothesis #16: Children receiving a theory based intervention will have lower mean self-efficacy scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention.

Null Hypothesis #16: There will be no differences in mean self-efficacy scores for engaging in no more than 2 hours of screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #17: Children receiving a theory based intervention will have higher mean self-control scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention.

Alternative Hypothesis #17: Children receiving a theory based intervention will have lower mean self-control scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention.

Null Hypothesis #17: There will be no differences in mean self-control scores for engaging in no more than 2 hours of screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #18: Children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention.

Alternative Hypothesis #18: Children receiving a theory based intervention will have lower mean expectations (outcome expectations x outcome expectancies) scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention.
Null Hypothesis #18: There will be no differences in mean expectations (outcome expectations x outcome expectancies) scores for engaging in no more than 2 hours of screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Hypothesis #19: The degree of program fidelity will be different between the theory-based intervention and knowledge based intervention.

Null Hypothesis #19: There will be no differences in the degree of program fidelity between the theory-based intervention and knowledge based intervention.

Delimitations

Delimitations for this study include the geographical location and use of a convenience sample. The participants consisted of elementary students enrolled in twelve YMCA after-school programs, in the Olentangy Local school district, Columbus, Ohio during the 2010-2011 school year. The results of this study may not be generalized to other locations and children. All data will also be collected during the winter months of 2011, and some of the study variables such as the engagement in physical activities and sedentary activities could be influenced by the weather and season. The study was confined to four behaviors influencing childhood obesity and other behaviors were not studied. In operationalizing the constructs of social cognitive theory only self-efficacy, self-control, and expectations (outcome expectations x outcome expectancies) were operationalized. Other constructs such as knowledge, environment, situational perception and emotional coping were not measured. This was done for a few reasons. First, not all of these constructs will be targeted during the course of the intervention. Second, there is some concern about the length of the evaluation tool being used in this study, in
relation to children’s attention spans’. There are 68 items on the current evaluation instrument and adding more constructs could increase the instrument to 90 or 100 items. Finally, we are attempting to use a parsimonious model, including only select constructs that have been found to be important with these four behaviors, as reported by Sharma, Wagner, & Wilkerson (2005-2006).

Limitations

This study had several limitations. First, this study was limited by the self-reporting accuracy of the children. Specifically participants provided information on demographics, the engagement of four obesity preventative behaviors, and constructs of social cognitive theory such as self-efficacy, self-control and expectations. Any inaccuracy in memory or distortions in these self-reports will impact the study results. Second, all self-reported behaviors will be based on a one-day recall, which may not be representative of a typical day. Third, participation in this study is volunteer and required parent permission and child assent. Given the topic area for this study (child obesity prevention), some parents may not wish to have their child(ren) participate for various reasons, such as believing their child does not need such an intervention. Children may also not elect to participate for various reasons, including embarrassment (i.e. not wanting to have their height or weight measured), or lack of interest. Fourth, the children enrolled in this study were not randomly selected for participation in this study, however ASP’s were randomly assigned to treatment condition.

Assumptions

The following assumptions will be made: (a) children will complete the instrument honestly and appropriately; (b) children attending the afterschool programs in this study will be
largely representative of children in Ohio; (c) the winter season will not affect any measure in
this study; (d) a one-day dietary recall is largely representative of children’s normal intake; (e) a
one-day activity recall is largely representative of children’s normal activity.

Operational Definitions

1. **Body Mass Index (BMI)** – Body Mass Index (BMI) is an indicator of body fatness used
   among adults. The body mass index is calculated by the following formula: weight (kg)/
   height² (m²).

2. **Body Mass Index Percentile (BMI-percentile)** – BMI-percentiles are the most commonly
   used clinical indicator to assess the size and growth patterns children in the United States.
   Percentiles rank the position of an individual by indicating what percent of the reference
   population the individual would equal or exceed (CDC, 2009).

3. **Child and adolescent obesity** – Child and adolescent obesity was defined as being at or
   above the 95th percentile according to the Centers for Disease Control and Prevention
   (CDC) age and gender-specific body mass index charts, and those considered overweight
   were at or above the 85th percentile (CDC, 2009).

4. **Serving** - A serving was defined as a unit of measurement to describe an amount of food
   consumed. A handout (See Appendix A) included examples of single servings of fruits
   and vegetables.

5. **Glasses** – A glass was defined as a unit of measurement equal to 8 oz of a fluid beverage.
   A handout (See Appendix A) included examples of glasses of sugar sweetened beverages,
   water and sugar-free drinks.

6. **Sugar Sweetened beverage** – A sugar sweetened beverages is defined as those which
contained sugar or other caloric sweeteners. Sugar-sweetened beverages included soft drinks, juice drinks containing < 100% fruit juice, fruit punch, lemonade, bottled tea, sports drinks, or drinks made from fruit-flavored powders.

7. **Sugar Free drinks** – A sugar-free drink is defined as those, which contain no sugar or caloric sweetener. Sugar-free drinks include sodas without calories, including diet sodas, sugar-free punches, sugar-free flavored water and sugar-free sports drinks.

8. **Moderate to Vigorous Physical activity** – Any amount of time an individual is engaged in either moderate or vigorous activity.
   
   a. **Moderate activity** - Any activity that burns 3.5 to 7 kcal/min or the equivalent of 3 to 6 metabolic equivalents (METs) and results in achieving 60 to 73 percent of peak heart rate. Examples of moderate physical activity include walking briskly, dancing, swimming, or bicycling on level terrain. A person should feel some exertion but should be able to carry on a conversation comfortably during the activity (USDHHS, 2005).

   b. **Vigorous Physical Activity**—Any activity that burns more than 7 kcal/min or the equivalent of 6 or more metabolic equivalents (METs) and results in achieving 74 to 88 percent of peak heart rate. Examples of vigorous physical activity include jogging, participating in high-impact aerobic dancing, swimming continuous laps, or bicycling uphill. Vigorous-intensity physical activity may be intense enough to represent a substantial challenge to an individual and results in a significant increase in heart and breathing rate (USDHHS, 2005).

9. **Sedentary activity** - Sedentary activities are often defined as those that provide little or no
physical activity during leisure time (USDHHS, 2005). In this study, sedentary activities include the amount of time spent watching television, playing video games, and on the computer.

10. Self-efficacy – Self-efficacy was defined for this study as the children’s perceived confidence to engage in key behaviors and overcome barriers to engage in key behaviors.

   a. Self-efficacy about consuming fruits and vegetables - In this study, the construct of self-efficacy about consuming fruits and vegetables has been defined as the children’s confidence to consume five or more servings of fruits and vegetables, consume five or more servings of fruits and vegetables everyday even they did not like them, and consume five or more servings of fruits and vegetables everyday even if others in their family did not like them. Self-efficacy was measured with three items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the three items were summed to achieve a possible range of 0-12.

   b. Self-efficacy about consuming water and sugar-free drinks - In this study, the construct of self-efficacy about consuming water and sugar-free drinks has been defined as the children’s confidence to drink more water and sugar-free drinks, drink water or sugar-free drinks everyday instead of sugar-sweetened drinks, and drink more water or sugar-free drinks even if they did not feel thirsty. Self-efficacy was measured with three items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the three items were summed to achieve a possible range of 0-12.
c. *Self-efficacy about engaging in 60 minutes of MVPA* - In this study, the construct of self-efficacy about engaging in 60 minutes of MVPA has been defined as the children’s confidence to exercise for 60 minutes at home everyday, exercise at home for 60 minutes even if they feel tired, and exercise at home for 60 minutes even if they are busy. Self-efficacy was measured with three items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the three items were summed to achieve a possible range of 0-12.

d. *Self-efficacy about engaging in no more than 2 hours of screen time* - In this study, the construct of self-efficacy about engaging in no more than 2 hours of screen time everyday has been defined as the children’s confidence to watch TV no more than 2 hours per day, reduce watching TV even if their favorite show is coming on, and reduce watching TV even if everyone else if your family is watching. Self-efficacy was measured with three items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the three items were summed to achieve a possible range of 0-12.

11. *Self-control* – Self-control was defined for this study as the children’s perceived ability to set goals for key behaviors and self-reward themselves upon adequate accomplishment of key behaviors.

   a. *Self-control about consuming fruits and vegetables* - In this study, the construct of self-control about consuming fruits and vegetables has been defined as the likelihood that children will set goals for consuming five servings of fruits and
vegetables per day and self-reward themselves for consuming five servings of fruit and vegetables per day. Self-control was measured with two items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the two items were summed to achieve a possible range of 0-8.

b. **Self-control about consuming water and sugar-free drinks** - In this study, the construct of self-control about consuming water and sugar-free drinks has been defined as the likelihood that children will set goals to drink more water and sugar-free drinks and self-reward themselves for drinking more water and sugar-free drinks. Self-control was measured with two items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the two items were summed to achieve a possible range of 0-8.

c. **Self-control about engaging in 60 minutes of MVPA** – In this study, the construct of self-control about engaging in 60 minutes of MVPA has been defined as the likelihood that children will set goals to engage in 60 minutes of MVPA everyday and self-reward themselves for engaging in 60 minutes of MVPA everyday. Self-control was measured with two items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the two items were summed to achieve a possible range of 0-8.

d. **Self-control about engaging in no more than 2 hours of screen time** - In this study, the construct of self-control about engaging in no more than 2 hours of screen time everyday has been defined as the likelihood that children will set goals to
engage in no more than 2 hours of screen time everyday and self-reward themselves for engaging in no more than 2 hours of screen time everyday. Self-control was measured with two items using a 5-item Likert-type self-reporting rating scale – not at all sure (0) to completely sure (4). The rating scores of the two items were summed to achieve a possible range of 0-8.

12. Expectations – Expectations comprise of a multiplicative score of outcome expectations and outcome expectancies which are then added up to get the summative score. There were four items for outcome expectations each on a scale of 0-16 & four items for outcome expectancies each on a scale of 0-16, yielding a possible range of 0-64 for each subscale.

13. Outcome expectations – Outcome expectations were defined for this study as the children’s perception for whether they believed certain outcomes would happen from engaging in a key obesity preventative behaviors.

a. Outcome expectations about consuming fruits and vegetables - In this study, the construct of outcome expectations about consuming fruits and vegetables has been defined as the perception that by consuming five servings of fruits and vegetables, children will have more energy, feel better, not get sick as often, and have better weight. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – never (0) to always (4).

b. Outcome expectations about consuming water and sugar-free drinks - In this study, the construct of outcome expectations about consuming water and sugar-free drinks has been defined as the perception that by consuming water and sugar
free drinks instead of sugar-sweetened beverages, children will be more relaxed, feel better, have more energy, and have better weight. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – never (0) to always (4).

c. *Outcome expectations about engaging in 60 minutes of MVPA* - In this study, the construct of outcome expectations about engaging in 60 minutes of MVPA everyday has been defined as the perception that by exercising 60 minutes everyday, children will not get sick as often, have more confidence, have more fun, and look better. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – never (0) to always (4).

d. *Outcome expectations about engaging in no more than 2 hours of screen time* – In this study, the construct of outcome expectations about engaging in no more than 2 hours of screen time everyday has been defined as the perception that by watching less than 2 hours of TV everyday, children will have more friends, have more free time, have more fun, and be more relaxed. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – never (0) to always (4).

14. *Outcome expectancies* – Outcome expectancies were defined for this study as the value children place on certain outcomes that would happen by engaging in a key obesity preventative behavior.

a. *Outcome expectancies about consuming fruits and vegetables* - In this study, the construct of outcome expectancies about consuming fruits and vegetables
everyday has been defined as the value that children place on having more energy, feeling better, not getting sick as often, and having a better weight. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – not at all important (0) to extremely important (4).

b. *Outcome expectancies about consuming water and sugar-free drinks* - In this study, the construct of outcome expectancies about consuming water and sugar-free drinks has been defined as the value that children place on being more relaxed, feeling better, having more energy, and having better weight. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – not at all important (0) to extremely important (4).

c. *Outcome expectancies about engaging in 60 minutes of MVPA* - In this study, the construct of outcome expectancies about engaging in 60 minutes of MVPA has been defined as the value that children place on not getting sick as often, having more confidence, having more fun, and looking better. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – not at all important (0) to extremely important (4).

d. *Outcome expectancies about engaging in no more than 2 hours of screen time* - In this study, the construct of outcome expectancies about engaging in no more than 2 hours of screen time has been defined as the value that children place having more friends, having more free time, having more fun, and being more relaxed. Outcome expectations were measured with four items using a 5-item Likert-type self-reporting rating scale – not at all important (0) to extremely important (4).
15. *Intervention failure* – Intervention failure refers to a situation when an intervention fails to produce the desired result. This can occur from an inadequate, insufficient or inappropriate intervention.

16. *Measurement failure* – Measurement failure refers to a scale on a survey or instrument that fails to measure the construct or behavior it intends to measure.

**Summary**

This chapter gave an introduction into the issue of child and adolescent obesity in the United States. Specifically, the prevalence of child and adolescent obesity was addressed, the concerns for this issue were addressed, and current health education strategies were addressed. This summary will be expanded upon in Chapter 2. The summary also led to purpose statement for this study. The remainder of the chapter established the relevant research questions and related hypotheses, delimitations, limitations, and assumptions which will be considered when data have been collected for this study. Operational definitions were written to allow the reader to have a better understanding of the terminology used throughout this dissertation. The significance of this study to health promotion and education was established to prepare readers for the upcoming background information addressed in Chapter 2. Specific methodology for this study can be found in Chapter 3. Finally, the results for this study will be presented in chapter 4 and an interpretation of the results will be discussed in the final chapter (Chapter 5).
CHAPTER 2

REVIEW OF LITERATURE

Obesity is a major public health issue in today’s society. This chapter will review this issue and is broken into different sections to discuss a) the current prevalence and incidence of obesity among adults, adolescents and children, b) the metabolic, psychological and economic consequences of obesity and c) the modifiable and non-modifiable determinants of obesity. After these have been established the final section will contain a review of school based and after school based primary obesity prevention interventions targeting children and adolescents.

Search Strategy

This review will cover many important areas related to child and adolescent obesity, a topic that has been widely studied and published in the current scientific literature. Relevant reviews of literature will be utilized in this review, and in order to collect the most recent materials a comprehensive search of Academic Search Complete, CINAHL, ERIC, PUBMED, and SPORTDiscus databases was conducted using the time period of 2008 to 2010. This time frame was used since there have been many literature reviews covering such determinants published within the last few years. Search terms and key words included “Child OR Adolescent AND Obesity AND Determinants”. This review will also include relevant materials from the Centers for Disease Control and Prevention and the World Health Organization.

The next area for review will focus on primary school-based prevention interventions, targeting child and adolescent obesity. In order to collect the most recent materials for this topic a comprehensive search of the same databases as listed above was performed for the time period
of 2008-2010. This time frame was chosen since there have been many literature reviews, systematic reviews, and meta-analyses published within the last few years, reviewing such interventions. Search terms of “Child OR Adolescent AND Obesity AND School AND Intervention” were included. Initially, a total of 240 articles were returned. Setting the search criteria, 70 articles remained. Upon reading the abstracts, the articles were narrowed even further. A total of 18 articles were review articles, 17 articles were school-based interventions, of which 7 targeted primary prevention.

The final area for review will focus on after-school based prevention interventions, targeting child and adolescent obesity. The same databases were used with the inclusion of peer-reviewed articles published between 2008-2010 in the English language. This time frame was chosen since Pate and O’Neill (2009) published a review of literature that reviewed such interventions up till 2008. Search terms of “Child OR Adolescent AND Obesity AND After-School” were included. Initially, a total of 161 articles were returned. Upon reading the abstracts, the articles were narrowed. One article was a review article, 8 articles were after-school based interventions, and all other remaining articles were excluded.

Prevalence of Childhood Overweight

Overweight and obesity rates in the United States and other countries are high. Among adults we determine weight status by calculating an individual's body mass index (BMI). The body mass index is calculated by the following formula: weight (kg)/ height² (m²). When an individual has a BMI ≥ 25, they are considered ‘overweight’ and when an individual has a BMI ≥ 30, they are considered ‘obese’. According to the latest National Health and Nutrition Examination Survey (NHANES) 2007-2008, 33.8% of U.S. adults are obese, with differences
reported among gender; 32.2% of adult men were reported obese, and 35.5% of adult women were reported obese (Flegal, Carroll, Ogden, & Curtin, 2010). There are also variations in obesity prevalence’s among states, with Colorado having the lowest prevalence rate of 18.6% and Mississippi having the highest prevalence rate of 34.4%. The Healthy People 2010 target for states was to achieve a 15% obesity prevalence rate, however by 2009 no state met target, and nine states (Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Missouri, Oklahoma, Tennessee, and West Virginia) reported prevalence rates at more than double (≥ 30%) this target (MMWR, 2010).

Among youth, overweight and obesity are defined using growth charts published by the Centers for Disease and Control and Prevention (CDC). Children (ages 2-20) with a BMI for age and sex ≥ 95th percentile are classified as obese, and overweight is defined as a BMI for age and sex ≥ 85th percentile (CDC, 2009). During the past three decades the prevalence of child and adolescent obesity has tripled and disparities are commonly noted among minority groups. According to the most recent NHANES 2007-2008, it was found that 16.9% of children (ages 2-19) were obese and 31.7% were overweight. When stratified by age, it was found that 10.4% were obese between ages 2-5, 19.6% were obese between ages 6-11, and 18.1% were obese between 12-19 years of age. Hispanic (20.9%), Mexican American (20.8%) and Non-Hispanic Black (20%) were also more likely to be obese, compared to Non-Hispanic White children (15.3%) (Ogden, Carroll, Curin, Lamb, & Flegal, 2010).

Physical Consequences of Child and Adolescent Obesity

According to the World Health Organization, overweight and obesity is the fifth leading cause of death in the world (WHO, 2009). In the U.S., obesity is the second leading cause of
death (Mokdad, Marks, Stroup, & Gerberding, 2000). Obesity in childhood and adolescents is a predominant risk factor for many serious medical conditions. In the Bogalusa Heart Study it was found that in a cohort of youth (ages 5-17) (n = 9167) over 60% of overweight children had at least 1 risk factor for cardiovascular disease (high triglycerides, high LDL cholesterol, low HDL cholesterol, high fasting insulin, or high blood pressure), and 11% had three or more risk factors (Freedman, Dietz, Srinivasan, & Berenson, 1999).

As the prevalence of obesity has increased among youth, so has the prevalence of type-2 diabetes. The prevalence of type-2 diabetes has increased 10 fold among adolescents in the past two decades (Ludwig, 2007). Type-2 diabetes is associated with an increased production of insulin, which over time can lead to insulin resistance, which in turn has been associated with cardiovascular disease risk factors, such as increased fatty plaque deposits on arterial walls, and increased VLDL production (Daniels, Arnett, Eckel, Gidding, Hayman, Kumanyika, et al., 2005). Preliminary data also suggests that early onset of type-2 diabetes places youth at an increased risk for limb amputations, kidney failure and premature death (Ludwig, 2007).

Metabolic syndrome is a complex disorder and is defined as the presence of obesity and associated conditions such as abdominal visceral fat deposition, hyperinsulinemia, hypertension, and hyperlipidemia. It is estimated that approximately 1 million adolescents currently meet the criteria for metabolic syndrome (Daniels, et al., 2005). Weiss and colleagues (2004) reported that up to 50% of severely obese youth had characteristics of metabolic syndrome, and for each half-unit increase in BMI among obese and overweight youth, the risk for having metabolic syndrome increases by approximately fifty percent. Recently, The Cardiovascular Risk in Young Finns Study, an on-going epidemiological study of cardiovascular disease risk factors and their
determinants from childhood to adulthood, found that after following a cohort of children and adolescents into adulthood (n=2195), youth obesity was the strongest predictor of having metabolic syndrome in adulthood. Other significant risk factors that predicted metabolic syndrome in adulthood included high triglycerides, high insulin, high C-reactive protein, and family history of hypertension and type 2-diabetes (Mattsson, Nnemaa, Jounala, Villkari, & Raitakari, 2008).

Obesity has the potential to affect many other systems of the body, including the neurological (i.e. pseudotumor cerebri), endocrine (i.e. premature puberty, polycystic ovaries (in girls) and hypogonadisms (in boys), cardiovascular (i.e. chronic inflammation), pulmonary (i.e. asthma), gastrointestinal (i.e. gallstones), renal (i.e. glomerulosclerosis), and musculoskeletal (i.e. back pain and blount’s disease) (Ludwig, 2007).

**Psychological Consequences of Child and Adolescent Obesity**

As reported in the recent *American Heart Association Childhood Obesity Research Summit Report* it has been consistently reported that overweight children and adolescents experience greater psychological distress such as high rates of depression, low reported self-esteem, social marginalization, and negative body image, compared to their normal weight peers (Daniels, Jacobson, McCrindle, Eckel, Sanner, 2009). Examples of misconceptions that are commonly placed on obese youth, that may reinforce a negative body image, include personal traits such as laziness, selfishness, and lower intelligence (Wilkinson, 2008). Adolescence is also a time when individuals have heightened sensitivity about their perceived body image. In a cross-sectional study using adolescents, while only 8.8% of the sample was measured as obese,
12.7% self-reported themselves as ‘fat’. Obesity rates were also higher among males, however females were more likely to consider themselves ‘fat.’ (De Souza, 2008).

In a study examining the relationship of depression and obesity among adolescents in grades 7-12, those with the highest BMI’s were found to have the highest rate of depression (Goodman, & Whitaker, 2002). After a 1-year follow-up, sustained elevated BMI’s were again positively associated with higher depression rates. In another cross-sectional study obese female adolescents (as compared with non-obese female adolescents (n=5201)) were: 1.63 times less likely to associate with friends, 1.79 times more likely to report hopelessness, 1.49 times more likely to report serious emotional problems, and 1.73 more times likely to report a suicide attempt, within the past week (Olds, 2009). Depressed adolescents are also commonly placed on antipsychotic medications such as risperidone, olanzapine or clozapine. A common side affect for such mediations is the inducement of insulin resistance, which may increase weight gain and risk for developing metabolic syndrome (Jasik, & Lustig, 2008).

It has also been reported that overweight adolescents tend to engage in harmful health behaviors to either lose weight or cope with stress. While the 2005 Youth Behavior Risk Survey (YRBS) reported that only 1% of adolescents engage in unhealthy dietary practices (i.e. food restricting, purging, using laxatives/diuretics), it is important to note that these behaviors increase with age and are more common with overweight adolescents than normal weight adolescents. Female adolescents may also be more vulnerable than males for such behaviors. In another study, researchers reported 18% of overweight females engaged in unhealthy dietary behaviors such as taking diet pills, laxatives/diuretics, and vomiting (Jasik, & Lustig, 2008).
Bullying is another issue that faces obese and overweight adolescents. Data from a report using longitudinal data suggested that weight status and bullying were generally predictive of one another. In other studies, it has been noted that weight-based teasing is negatively associated with outcomes such as usage of unhealthy weight control methods, decreased body satisfaction and self-concept, and depressive symptoms. In turn, higher body dissatisfaction has also been noted to be associated with higher depression and anxiety scores (Daniels, et al., 2009).

Societal Consequences of Child and Adolescent Obesity

Direct and indirect expenditures associated with obesity have also significantly increased in the past three decades. Direct medical costs include preventative, diagnostic, and treatment services. Finkelstein and colleagues (2003) reported that total medical expenses attributed to obesity account for 9.1 percent of total U.S. medical expenditures in 1998 and may have reached as high as $78.5 billion in the same year (Finkelstein, Fiebelkorn, and Wang, 2003). Annual hospital costs attributed to child and adolescent obesity increased from 1979–1981 to 1997-1999 from $12.6 million dollars to $110 million dollars (Wang, & Dietz, 2002). After adjusting for inflation in 2001, these medical expenses more than tripled from $35 million dollars to $127 million dollars. Individual states also bear some of these costs. A recent report estimated that states ranged from paying as low as $87 million (Wyoming) to as high as $7.7 billion (California) annually. Differences in expenditures are partly due to the different size and demographics of each state (Finkelstein, Fiebelkorn, and Wang, 2004).

Indirect costs can be classified into six categories: absenteeism, disability, premature mortality, presenteeism (or lack or production at work), workers’ compensation and total indirect costs not otherwise separated. It was reported that obese workers tend to miss more workdays
due to illness, injury or disability than non-obese workers, and it was estimated that indirect costs attributable to obesity are $65.67 billion annually, or $1627 per obese person (Trogdon, Finkelstein, Hylands, Dellea, & Kamal-Bahl, 2008).

*Determinants of Child and Adolescent Obesity*

Obesity occurs as the result of a sustained energy imbalance, whereby more calories are consumed than expended over a period of time. Many factors are reportedly associated with this energy imbalance, and thus the development of obesity in children and adolescents. These determinants are often described as either being modifiable, or factors that can be changed (i.e. diet or physical activity), and non-modifiable, or factors that cannot be changed (i.e. genetics or race). By understanding the etiology of obesity, health interventions can target and tailor messages to appropriate modifiable risk factors, to impact prevention efforts. These factors will be described below.

*Non-modifiable Determinants of Child and Adolescent Obesity*

As Sharma and Ickes reviewed (2008), non-modifiable determinants of child and adolescent obesity include genetic factors, parental BMI, sex, race, age and height. Genetic variations have been shown to predispose some individuals for developing obesity during their lifetime, however there is no consensus for how much genetics truly contribute. Specifically, the Human Obesity Gene Map consortium found more than 240 genes that were able to modulate body weight and adiposity, and three specific genes that were found to be directly related to obesity were glutamate decarboxylase 2 (GAD2), ectonucleotide pyrophosphatase/phosphodiesterase 1 (ENPP1) and solute carrier family 6 (amino acid transporter), member 14 (SLC6A14) (Walley, Asher, & Froguel, 2009).
Many studies also indicate genetically-related determinants. For example, it has been reported that when parents are overweight, their children are at greater risk for becoming overweight, and the effect is stronger when both parents are overweight. While this may support genetics as a causal factor, it is important to note that parents also construct the home environment in which children are raised. Foods made available in the household, eating habits, and physical activity habits learned from the parent or caregiver may allow these genetic predispositions to be more likely expressed. Gender and race may also be a genetically related factor. According to the most recent NHANES 2007-2008, overall there were no statistically significant differences in obesity rates among male and female children and adolescents. However, Mexican American boys were significantly more likely to be obese than Mexican American girls, Hispanic boys were more likely to be obese than non-Hispanic white boys, and non- Hispanic black girls were significantly more likely than non-Hispanic white girls to be obese (Ogden, et al., 2010).

Modifiable Determinants of Child and Adolescent Obesity

As Sharma and Ickes reviewed (2008), modifiable determinants of child and adolescent obesity include factors that occur in first year of life, maternal behaviors, elements of the home environment, dietary behaviors, physical activity levels, and environmental factors. Sleeping behaviors have also been noted as a determinant of obesity and will be described below.

Factors that Occur in First Year of Life

The ‘fetal programming’ hypothesis purports that the fetal environment is a predominant factor for predisposing children to obesity, with maternal over- or under-nutrition the underlying cause (Walley, et al., 2009). Gluckman and Hanson (2004) also indicated that the time during
fetal development is important, as the fetus will select an appropriate homeostasis in relation to the in utero environment. Children born with a low birth weight have also been noted to be at greater risk for developing obesity in their lifetime (Meyre, Boutin, Tounian, Deweirder, Aout, Jouret, et al., 2005). Kramer et al. (1985) found that of birth weight, sex, age at introduction of solids, and duration of breastfeeding were all predictors of weight and adiposity in the first year of life.

Maternal Behaviors

There are also important maternal behaviors that have been shown to impact the weight status of their children. As previously noted, women who are obese are likely to have children who are obese and parental obesity has been noted to more than doubles the risk of obesity for a child under the age of 10 years, but the amount of weight a woman gains during pregnancy is also an important determinant (Sinha, & Kling, 2009). The Institute of Medicine (IOM) recommends the following gestational weight gain by weight status: underweight women should gain 28-40 pounds, normal weight women should gain 25-35 pounds, overweight women should gain 15-25 pounds, and obese women should gain 11-20 pounds (IOM, 2009). Wrotniak and colleagues (2008) found in retrospective cohort study of 10,226 participants, the odds of obesity in offspring by the age of 7 years increased 3% for every 1 kg (2.2 pounds) of gestational weight gain, and when gestational weight gain was examined using the IOM’s guidelines, the odds of obesity were 48% greater for children of mothers who gained more than the recommended amount than for children of mothers who met the weight gain guidelines. Smoking and breastfeeding are also two important factors. As Ness (2004), reported women who smoke during pregnancy put their children at greater risk for obesity later in life. This has even been
shown to have a dose-dependent relationship, with the number of cigarettes smoked during pregnancy associated with the extent of overweight or obesity (Procter, 2007). Breastfeeding may also be associated with obesity among youth. Arenz and colleagues (2004) reported in a systematic review of nine studies, with more than 69,000 participants, breastfeeding lowered the risk of obesity in childhood, but the effect was small.

*Elements of the Home Environment*

Elements of the home environment can also influence children’s weight status. Children and Adolescents are more likely to eat foods they observe their parents consuming (Westenhoefer, 2002). The availability and accessibility of foods within the home have been noted to impact dietary intake and food preference among children and adolescents. Since parents keep foods in the home they typically prefer to eat, their children will have repeated exposures to these foods, which will likely influence and shape their preferences. This may lead to increase adiposity if children are constantly exposed to energy dense, nutrient poor foods (Patrick, & Nicklas, 2005). Further problems can ensue when parents teach their children to label foods as ‘good’ or ‘bad’. By limiting or withholding ‘bad’ foods as a punishment, children and adolescents are more likely to become fixated and over consume these foods when given the opportunity. It can also be confusing for them when foods are categorized as such, given the social context for which they are commonly placed. For instance positive life events, such as birthday parties and holiday celebrations, are often celebrated with ‘bad’ foods such as cake and ice-cream (Birch, & Fisher, 1998).

Parenting style related to feeding practices has also been shown to impact children’s dietary intake and food preference (Patrick, et al., 2005). Parents or caregivers who assume and
‘authoritarian’ style restrict highly palatable-energy dense/nutrient poor or ‘bad’ foods and force the consumption of ‘good’ foods such as fruits and vegetables. This feeding style has been associated with lower intake of fruits, vegetables and juice. The ‘permissive’ feeding style allows a child to freely choose what foods and portion sizes to eat without parental guidance. This feeding style has been associated with lower consumption of milk, and all nutrients except fat. Lastly, the ‘authoritative’ feeding style balances authoritarian and permissive styles, by encouraging the consumption of ‘healthy’ foods, while giving the child freedom over food choices. Children from families who practice this style of feeding appear to have higher fruit and vegetable intakes, and a lower intake of junk foods (Patrick, et al., 2005).

Dietary Behaviors

Average calorie intake has increased in past decades, accompanied by a decrease in diet quality among children. Wang and colleagues (2006) examined the weight changes of children in NHANES surveys taken from 1988-1994 and quantified the excess weight gain experienced by these children. After accounting for normal childhood growth, investigators reported children gained an additional .43 kg per year, and that behavioral changes resulting in a 110-165 daily caloric deficit could have counteracted this weight gain. Of interest, researchers suggested that changes in dietary intake may be easier to achieve compared with changes in physical activity (Wang, et al., 2006). Similarly, Harper, MG also noted that children’s caloric intake has increased on average by 80-230 Calories between 1989 – 1996, while physical activity decreased (Harper, 2006).
Fruit and Vegetable Consumption

Low consumption of fruits and vegetables have been associated with poor diet quality, and is considered one of the most common risk factors for the development of chronic diseases. Currently children do not consume the recommended amounts of fruit and vegetable. My Pyramid for Kids (www.mypyramid.gov) recommends children ages 6-12 (on a 1800 Calorie plan), consume 2.5 cup equivalents of vegetables, and 1.5 cup equivalents of fruits daily. According to data from NHANES 1999-2003, it was reported that children and adolescents consume approximately 1 cup equivalent of fruit each day and 1.0-1.25 cup equivalents of vegetables each day. This can be misleading if you take into account the significant contributors for which make up fruit and vegetable consumption. French fries were noted as the largest contributor to vegetable intake and 100% fruit juice was noted as the largest contributor to fruit intake (Lorson, Melgar-Quinonez, & Taylor, 2009).

Eating Away from Home

Eating away from home, especially at fast food restaurants, has also increased in recent years (O’Donnell, Hoerr, Mendoza, & Goh, 2008). Of concern, foods consumed away from home tend to be more calorically dense, contain more fat, saturated fat, cholesterol, sugars, and sodium and are served in larger portions than food consumed at home. From 1977 – 1994 total calories consumed from fast food restaurants increased among children from 2% to 10%. The frequency of eating away from home has also been positively associated with the intake of dietary fat, and negatively associated with the intake of fruit, vegetable and dairy groups (Patrick, et al., 2005). Compared to their normal weight peers, overweight and obese children and adolescents consume more foods away from home (O’Donnell, et al., 2008).
Snack Food Consumption

In a recent review, 21% of 8 and 9 year old children and 42% of 12 and 13 year old children indicated they skip breakfast throughout the week (Rampersaud, Pereira, Girard, Adams, & Metzl, 2005). While breakfast consumption has decreased among children and adolescents, snacking appears to have increased. Children consume approximately 25% of their total daily calorie intake in the form of snack foods (Jahns, Siega-Ria, & Popkin, 2001), and 91% report snacking at least 1 time per day (Savige, Macfarlane, Ball, Worsley, & Crawford, 2007). It appears that Calories from snack foods have displaced calories eaten at meals and at home. From 1977-1996 Calories eaten at home have decreased from 77% - 65%, and total Calories from meals have decreased from 89% to 81% (Nielson, & Popkin, 2003). Snack foods also tend to have greater energy density, and when consumed are less satiating making them easy to passively over consume (McCaffre, Rennie, Kerr, Wallace, Hannon-Fletcher, Coward, et al., 2008).

Snack foods are also relatively cheap, making them easier to attain among children and adolescents. In an observational study with 4th through 6th grade children, it was found that when children bought snacks from a corner store before and after school, their average expenditure was only $1.07. This bought them on average 2.1 food/beverage items, which also averaged 356.6 calories (Borradale, Sherman, Vander Veur, McCoy, Sandoval, Nachmani, et al., 2009).

Increased Portion Sizes

The consumption of large portion sizes has also been associated with obesity. Huang and colleagues (2004) reported that portion size was positively associated with BMI percentile in boys aged 6-11 years and in adolescents of both genders aged 12-19 years, but not in 3-5 year olds. It
has been found that in both the clinical and community settings children who are served larger portion sizes are more likely to consume more than if served smaller portion sizes. Younger children are also better at regulating their food intake. In a study with three and five year old children consuming different portion sized dishes of macaroni and cheese, the three years old children were better at regulating their food intake, via responding to physiologic cues for hunger and satiety, while among the five year old children, external cues such as portion size led children to consume more. It is suggested that early experiences shape the development of eating behaviors among children and they may learn to either rely on internal cues of hunger, or learn to rely on external cues such as portion size. A lack of a satiety response may also predisposed some children to overeat more so than others (Ello-Martin, Ledikwe, & Rolls, 2005).

Between 1977 – 1996 portion sizes and total calories have increased for many foods consumed both inside and outside of the home, especially among many common snack foods children often consume. The average salty snack (potato chips, popcorn) increased 60% from 1 oz to 1.6 oz, resulting in an increase consumption of 93 calories per serving. Desserts increased from 4.5 oz to 4.8 oz, resulting in an increase of 41 calories per serving. French fries increased from 3.1 oz to 3.6 oz, resulting in an increase or 68 calories per serving. (Nielson, et al., 2003).

Sugar Sweetened Beverage Intake

The consumption of added sugars has increased in recent decades among children and adolescents (Murphy, & Johnson, 2003). Added sugar includes sugar and syrups that do not naturally occur in foods, and are added during processing and preparation (www.MyPyramid.gov). The largest contributor to the intake of added sugars has been from
sugar-sweetened beverages (Harrington, 2008). The intake of sugar-sweetened beverages has increased 300% in the past two decades, and 56–85% of children consume at least one soft drink per day. According to data from CSF II and NHANES (99-01), from 1977 – 2001 soft drinks consumption increased from 2.8% - 7% of total daily Caloric intake. Parenthetically, energy intake from milk decreased during this time from 8% - 5%. This shift in beverage consumption has resulted in a daily net increase of 50 calories, with soft drinks accounting for an increase of 94 calories, and a milk accounting for a decrease of 44 calories. It is also important to note the decrease in calories from milk cannot be attributed to the consumption of lower fat milk, since total consumed ounces decreased during this time as well (Nielson, et al., 2003).

Overweight children tend to consume higher amounts of soft drinks than their leaner peers (Murphy, et al., 2003). In an 8-week observational study with children ages 6-13, children who reported drinking more than 12 oz of a soft drink daily experienced more weight gain than children who consumed less than 12 oz daily (Mrdjenovic, & Levitsky, 2003). In another study with 548 ethnically diverse school children the odds of becoming overweight or obese increased by 60% for every additional serving of soft drink a child consumed (Ludwig, Peterson, & Gortmaker, 2001). While not very well understood, it has also been suggested that liquid calories such as in soft drinks, are not as well regulated when compared with calories from solid foods (Murphy, et al., 2003). This suggests that children who consume large amounts of calories from sugar-sweetened beverages may be more likely to inadvertently consume more total calories throughout the day.
**Physical Activity Levels**

Currently, the Dietary Guidelines 2005 recommends children and adolescents should engage in at least 60 minutes of physical activity on most, if not all, days of the week. However, recently sedentary activities such as television viewing, and playing video games have replaced physical activities and many studies report children are not meeting this recommendation (Sharma, et al., 2008). Data from the most recent YRBSS report only about one-third of youth are meeting this recommendation (Stanford, 2007).

Overweight children also report spending less time engaged in physical activities compared with their leaner peers. In a cross-sectional study evaluating physical activity patterns among sixth graders, overweight children participated in significantly less moderate and vigorous physical activity (MVPA), and engaged in fewer continuous 5,10, and 20 minute bouts of MVPA (Trost, Kerr, Ward, & Pate, 2001). Overweight children have also been found to exhibit significantly less self-efficacy regarding their ability to overcome barriers to participate in physical activity, are less likely to ask parents to provide them with opportunities to engage in physical activity, and as a result are less likely to choose physical activity in place of sedentary activities (Trost, et al., 2001). Physical activity has also been shown to be an important factor for the prevention of childhood overweight and long-term term weight maintenance, as well as metabolic factors, such as an improved lipid and lipoprotein file, prevention of hypertension, prevention of diabetes indicators, and increases peak bone mass (Stanford, 2007).

**Screen Time**

The engagement in screen time in recent years has increased among all children, but has increased more among overweight children (Crespo, Smit, Troiano, Bartlett, Macera, & Aderson,
Currently, children spend an estimated 8.5 hours engage in screen time per day, with a large amount of that time accounting for television (Stanford, 2007). The effect of watching television on obesity can be viewed as a double-edged sword: watching television promotes more sedentary activities, while exposing children to more food advertisements. Of concern, the food industry is the largest buyer of television advertising and television is the largest single source of media messaging about food (Story, & French, 2004). Food companies that sell energy dense-nutrient poor foods and beverages, spend large amounts of money to aggressively advertise to children, in an attempt to build brand awareness, recognition, preference and loyalty for products they sell (Story, et al., 2004). In a study evaluating Saturday morning television advertisements aimed at children, 91% of food advertisements were those high in fat, added sugar, sodium, and nutrient poor (Batada, Seitz, Wootan, & Story, 2008). Of all foods advertised during this time ready to eat breakfast cereals was the most advertised (27%), followed by restaurant foods (19%) and snack foods (18%) (Batada, et al., 2008).

Sleeping Behaviors

Sleeping patterns have also been associated with the development of overweight among children. Cross sectional studies suggest that children who sleep less, go to sleep later in the night, and awake earlier in the morning are more likely to be overweight, compared to children receiving adequate sleep. Recent studies suggest this may be the result of a disruption of appetite and metabolism induced by a hormone imbalance. Less sleep has been shown to cause a reduction of leptin and an increase in ghrelin production, hormones associated with hunger and appetite (Snell, Adam, & Duncan, 2007). A recent meta-analysis reviewed 75 studies (31 using a sample of children and 44 using a sample of adults), found a consistent pattern of increased
odds of being obese and sleeping less than 5 hours per night. Among adults, it was found that a reduction in one hour of sleep per day was associated with a 0.35 unit of increase in BMI (Cappuccio, et al., 2008).

*Environmental Factors.*

Environmental factors within the community in which children live are also thought to contribute to the development of child and adolescent obesity (Story, & Orleans, 2006). As Sharma and Ickes reviewed (2008), environmental factors that can impact obesity include food commercialism, technology, and urban and socioeconomic development. The availability of fast food restaurants varies by community. Low-income and African American communities have been found to have more fast food restaurants and fewer full service restaurants compared with predominately Caucasian neighborhoods. However few studies have specifically evaluated the proximity of fast food restaurants with children’s weight status. Low-income and minority communities also tend to have fewer large supermarkets that carry fresh-high-quality foods such as fruits, vegetables, whole grains or low fat dairy products. Instead, residents in these areas buy food from small corner stores and bodegas, which tend to carry less healthful food selections. Prices of healthy foods in these locations are also higher compared with larger supermarkets. Unsafe neighborhoods, specifically in low-income areas, can also make it challenging for parents to allow their children to engage in unsupervised physical activities outdoors. This may inhibit families from encouraging their children to play outside, and encourage them to stay inside (Kumanyika, & Grier, 2006).
In 2005 the American Medical Association, in collaboration with representatives from 15 national health care organizations, including the Centers for Disease Control and Prevention (CDC) and the American Dietetic Association (ADA), convened an expert committee to revise and develop updated recommendations on the evaluation and treatment of child and youth obesity. The purpose of the expert committee was to provide practical advice and guidance to clinicians and other health professionals in all areas of obesity prevention and treatment (Barlow, 2007).

These recommendations have been divided into four distinct categories: lifestyle habits, family history, physical examination and laboratory testing. Key dietary behaviors the committee identified as contributors to obesity include the overconsumption of fast food and sweet beverages (including sugar-sweetened beverages such as soft drinks and naturally sweet beverages such as fruit juices), large portion sizes, skipping breakfast, choosing foods with high energy density, eating few fruits and vegetables, and having irregular meal frequency and snacking patterns. Key activity behaviors the committee identifies as contributors to obesity include inadequate physical activities and too many sedentary activities. The committee further graded these behaviors based on evidence as either a grade A (consistent, good quality evidence), B (inconsistent or limited quality evidence) and C (consensus, or expert opinion). The only behavior to receive a grade A evidence rating was the engagement of at least 60 minutes of moderate to vigorous activity on most days of the week. To advise children to consume no more than one-serving of sweetened beverage per day and limit television and other screen time activities to no more than 2 hours per day received an evidence grade of B, and encouraging families to eat meals together, and limiting fast food intake received an evidence grade of C. It is
unclear why the consumption of five servings of fruits and vegetables did not receive an evidence rating, but given the overwhelming evidence for the benefits of fruits and vegetable consumption and the placement of this behavior in these recommendations, it is likely this behavior should have received an evidence rating of A or B. In conclusion, from this review four recognized lifestyle behaviors that hold great potential for preventing childhood obesity include: consuming no more than one sweetened beverage per day and encouraging non-caloric beverages, consuming 5 servings of fruits and vegetables per day, engaging in at least 60 minutes of MVPA per day, and limiting screen time activities to no more than 2 hours per day (Roa, 2008).

*Review of school-based obesity prevention interventions*

Given the documented consequences of obesity, the prevention and treatment of child and adolescent obesity is a prominent public health issue of our time. In order to have the greatest impact, public health interventions need to target venues that service large and accessible segments of the at risk population. Schools are one such venue. Schools provide a captive audience of children and adolescent’s ages 5-18, of which typically spend 50% of their time, or 180 days per year (U.S. Department of Education, 2001-2002). Schools also have the potential to provide opportunities to engage in healthful behaviors, as with P.E. classes, and reinforce healthy behaviors through formal health classes, or by integrating health messages in core academic areas. Furthermore, schools are equipped with resources that can help to facilitate health behavior changes. For example, schools have gymnasiums and green spaces that provide a safe space to engage in physical activities, and they hire trained health professionals, such as physical education and health teachers, as well as school nurses.
As Cook-Cottone and colleagues (2009) reviewed, schools are also federally mandated to be major players in the movement against childhood obesity. Section 204 of the Child Nutrition and WIC Reauthorization Act of 2004 mandated that schools participating in the federal nutrition program must establish a wellness policy. Such policies must include the following components: goals for nutrition education, physical activity, promoting student wellness, nutrition guidelines for foods on school campus to reduce childhood obesity, a plan for measuring the local wellness policy’s implementation, and collaboration among parents, students, and representatives of the school in the policy’s development (Cook-Cottone, et al., 2009). What has not been established however, is a system that evaluates the effectiveness of school wellness policies.

There have been many obesity prevention interventions implemented in the school environment over the years. Concurrently, there have also been literature reviews, systematic reviews, and meta-analyses, all which review such interventions and give direction for future research. Shaya and colleagues (2008) reviewed school based interventions from 1986 to 2006. In all they found 51 obesity-related interventions, of which 15 evaluated an existing or modified physical education curriculum, 17 used one intervention strategy, such as a nutrition or physical activity behavior change curriculum, and 19 utilized a multi-components approach of physical activity, health/fitness programs and/or dietary/nutrition programs. Duration of interventions greatly varied from 4 weeks to 8 years; ten studies evaluated programs that were less than 12 weeks, eighteen studies evaluated programs that were 12 weeks to 1 year, and 20 studies evaluated programs lasting over 1 year. For all studies, there were overwhelmingly positive results for some quantitative measure: thirteen of the fifteen physical activity programs reported positive significant results, twelve of sixteen fitness, health and nutrition education and behavior
modification programs reported positive significant results, and fifteen of the twenty multi-component health programs reported positive significant results. It is important to note however, that these quantitative measures greatly varied, from psychosocial measures, dietary behavior, and physical activity behaviors. Also among the interventions reviewed, there was no consistency for reducing obesity. The authors also found that long-term interventions (lasting greater than six months) typically performed better than short-term interventions, especially for measures of weight status. However, it was also noted that long-term evidence for short-term interventions is an area needed for future study.

Katz and colleagues (2008) conducted a meta-analysis of primary, secondary and tertiary obesity prevention programs implemented in the school environment. This literature review spanned from 1966 to 2004, and included 19 studies for their systemic review and eight studies for their meta-analysis. Of the 19 studies, 14 were RCT’s, and 13 targeted primary prevention efforts. All studies included interventions that were multi-component, including two or more of the following strategies: parent/family participation, nutrition or physical activity education and behavior change strategies, incorporating health messages into core academic areas, skill building activities, dissemination of print materials, modifications of existing P.E. curricula’s, provision of new P.E. equipment, focus of active games and/or non-traditional physical activities. Results indicated that combination interventions, and single nutrition and TV reduction interventions were equally effective at reducing BMI, with a pooled effect size of -0.29, but single physical activity interventions were not effective at reducing BMI among participants. The authors did however warn of limitations that may have biased their results. There was a high degree of variability between studies for intervention methodologies and
outcome and impact measures, which can lead to misleading results. Also, results from studies targeting one behavior, including nutrition, physical activity or TV reduction, were only based on one study, therefore results should be interpreted with caution. Given the heterogeneity of interventions, this meta-analysis could not make any salient recommendations for which mix of program components are most or least effective. It is also important to note that this review included treatment-based interventions, with overweight and obese cohorts of children and adolescents. This may bias overall results, since overweight and obese youth have more excess weight to lose, or it may be more difficult to change overweight and obese youth’s behaviors. In conclusion this review supports the effectiveness that multi-component school-based obesity prevention interventions have on weight reduction.

A similar meta-analysis was performed by Gonzalez-Suarez and colleagues (2009), but authors claimed that compared to the meta-analysis performed by Katz and colleagues (2008), their meta-analysis was more comprehensive in terms of including more recent studies, including more studies in general, evaluating number of outcome and impact measures and coverage of both short and long term effects. This meta-analysis again included primary, secondary and tertiary obesity prevention studies, but only spanned from 1995 to 2007. In all, they found nineteen studies that met the inclusion criteria. They also concluded that the school environment was a favorable setting for obesity prevention programs, and that school-based interventions were generally effective at decreasing BMI, however they also found that these interventions were not effective at decreasing BMI compared with control or comparison interventions. Another difference from the Katz (2008) review was that authors found that interventions lasting greater than 1 year were typically more effective than those lasting less than 6 months.
Recommendations for future studies includes to have more than one measure of obesity, for studies to have more robust methodologies, and have larger sample sizes in studies to have greater power. Longer duration interventions, lasting two years or more, are also needed.

The next meta-analysis on school-based obesity interventions was performed by Kanekar and Sharma (2008-2009). Authors only evaluated primary prevention interventions in the U.S. and U.K from 2000 to 2007, and in total found 5 studies for inclusion. As with the other meta-analyses, they found that studies were quite heterogeneous; using the Cochran’s Q test of homogeneity, they found significance, which indicates studies were heterogeneous. This study reported that interventions were not generally effective at reducing BMI among children. Also, when dealing with primary prevention interventions, other measures such as physical activities, sedentary activities, and dietary intake are important, since they are more easily modified.

The final meta-analysis was performed by Cook-Cottone, and colleagues (2009). Among all previously reviewed meta-analyses, this was the only one that evaluated an extensive list of moderating factors, to help identify possible opportunities and threats to current school-based interventions. Moderators were categorized by two criteria. Participant features included age, sex, ethnicity, and risk-status, and Intervention features included program intensity, duration, family and community involvement, health education and nutritional change, physical activity, and delivery features. While overall effect sizes of interventions ranged from $r = -0.29$ to $+0.36$, an overall effect size of $r=0.05$ (95 CI = 0.04, 0.06) was small, yet significant (p<0.001). When analyzing studies by moderators, it was found that some characterizes were more important that others. Interventions that focused on primary prevention were significantly more effective ($r=0.07$; p<0.001) than those that target secondary and tertiary prevention. Interventions
targeting elementary children were more effective \((r=0.06;p<0.001)\) than those targeting middle and high school children. Interventions targeting primarily Asian and Caucasian children were more effective \((r=0.01;p<0.05)\) than those targeting Hispanic and African American children. The intensity of the intervention did not moderate effects on BMI as both low intensity (meeting 1-2 times per week) and higher intensity (meeting 3-5 times per week) were both positive and significantly effective \((r=0.05;p<0.001)\), however programs with short duration (lasting 0-12 weeks) showed a significant and negative effect \((r=-0.04;p<0.05)\) compared to low/moderate interventions (13-27 weeks), medium interventions (28-32 weeks) and long interventions (>32 weeks long), which were all positively and significantly related to reducing BMI. Including psycho-educational content, or when behavioral theories are used and operationalized, were also found to be more effective \((r=0.05;p<0.001)\) than those without such content. Finally, interventions that sought to encourage healthy eating were more effective \((r=0.13;p<0.001)\) than implementing environmental or system-wide changes, and those than targeted physical activity \((r=0.04;p<0.001)\) and sedentary activities \((r=0.15;p<0.001)\) were found to be more effective than those that did not.

From 2008 to August 2010 there have been five new studies (in seven articles) evaluating school-based interventions aimed at primary obesity prevention. A summary of these interventions can be found on Table 2.1. Overall, the quality of for these interventions greatly varied, as only one study was an RCT, two were quasi-experimental and two were pilot studies. Only three of the studies utilized interventions that were based on a behavioral theory; one used the theory of reasoned action (Abood, Black, & Coster, 2008) and two used social cognitive
theory (Canavera, Sharma & Murnan, 2009; Digate Muth, Chatterjee, Williams, Cross, & Flower, 2008).

As Table 2.2 shows, there were some noted limitations that were apparent in many studies. Only two studies reported an a priori sample size justification. As Eng (2003) reported, it is important for studies to have an adequate sample size, because it affects the statistical power of the study. Studies without enough power run the risk of reporting false-negative findings, which are also known as a type II errors. As Stevens (2009) noted, many literature reviews indicate that in social science research, small to medium effect sizes are very common.

Another finding from this review was that no study utilized process evaluations. Monitoring the implementation of health interventions enhances the interpretation of study findings and outcome and impact measures. This is especially true when multiple instructors implement interventions at multiple sites. By failing to monitor program activities, researchers run the risk of making what is known as a type III error, where weak or null results can be attributed to poorly executed or incorrectly implemented interventions. Most process evaluations focus on two dimensions; dose, or the amount of time research participants spend engaged in program activities, and fidelity, or to what extent an intervention was delivered according to the intended delivery. Therefore, future studies should conduct and report such information, such as average time spent implementing each lesson, and percentage of tasks completed by the instructor per lesson, per site (Basch, Sliepcevich, Gold, Duncan, & Kolbe, 1985; Townsend, Johns, Shilts, & Farfan-Ramirez, 2006).

Another limitation lies with the outcome and impact measures each study reported. Given the complexities that lie within health behavior change, a mix of psychosocial, behavioral
and physical outcome are needed to fully understand a program’s efficacy or effectiveness. With obesity prevention, a measure of weight status is ideal. Since children are naturally growing taller and heavier, a standardized measure of weight status is needed to discern between normal growth and excess growth. The best measures for weight status among children and adolescents are BMI-percentiles, which can be measured using CDC-growth charts, or BMI z-scores. Overall, BMI-percentile was measured for two interventions, published in 4 studies.

The next important sets of measures are behaviors that the program is attempting to modify. Common behaviors targeted in obesity prevention programs are often dietary behaviors and physical or sedentary activities. Both types of measures can be done by either subjective (or self-report) or objective (or independently measured) means, and within each behavior there are a diverse set of valid methods that can be utilized. For measuring dietary behaviors, asking the research participant to keep and maintain a food journal or performing a 24-hour diet recall are both valid means of measurement. Such data can be entered into software programs such as the Nutrition Data System for Research (NDSR) and outputs such as food groups, macro and micro nutrient consumption can be retrieved. These two methods are however, labor and time intensive and while working with large groups brief, yet valid measures are desirable, therefore food frequency lists and brief instruments are available, such as The School Physical Activity and Nutrition (SPAN) questionnaire (Thiagarajah, et al., 2008).

Measuring physical and sedentary activities are similar, as there are a wide range of valid measures. Accelerometry is one such measure, whereby physical activity can be measured from an individual while they wear a small device (accelerometer) over a set period of time. This method is expensive and labor intensive, therefore brief, validated self-report instruments such as
the Previous Day Physical Activity Recall (PDPAR) are desirable for the group or community settings (Trost, Ward, McGraw, & Pate, 1999). Overall, dietary behaviors and physical or sedentary activities were measured for three of the five studies in this review.

The final measurement that is important for child and adolescent obesity prevention interventions, are measures of psychosocial constructs, which are commonly derived from theories. When interventions are based on behavioral theories, it is important to operationalize theoretical constructs, to ensure those constructs were modified. For example, studies with interventions based on social cognitive theory should measure constructs such as self-efficacy, self-control, and expectations. Interventions based on the theory of planned behavior should measure constructs such as attitudes, perceived control, subjective norms and intentions. These constructs can only be measured by self-report. Three studies in this review contained interventions based on a theoretical foundation. In Abood and colleagues (2008), researchers noted the intervention used was based on the theory of reasoned action. Researchers did a good job of tailoring evaluation tools to evaluate constructs of TRA, and evaluated attitudes, subjective norms and intentions. In Digate Muth and colleagues (2008), researchers noted the intervention used was based on social cognitive theory, but only evaluated knowledge, and attitudes, leaving out self-efficacy, which has been noted as the most important construct of SCT. Finally, in Canavera and colleagues (2009), researchers noted the intervention used was based on social cognitive theory. For this study, researchers successfully operationalized three important constructs of SCT, including self-efficacy, self-control, and expectations.

The next limitation among these studies was that none evaluated any outcome or impact measures past the time of post intervention. Follow-up evaluations are greatly needed with
obesity prevention interventions, in order to show whether the effects of the intervention are sustained after some time. This is especially true for the measure of BMI-percentile, to show whether children in intervention groups are truly protected in the long-term.
<table>
<thead>
<tr>
<th>#</th>
<th>Study</th>
<th>Design &amp; sample*</th>
<th>Intervention/Theory &amp; Duration</th>
<th>Salient findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Abood, Black, &amp; Coster, 2008.</td>
<td>-RCT: Two group-delayed treatment design</td>
<td>-Present and Prevent® - Channing Bete Company - Theory of Reasoned Action - Two 30-minute presentations over 1-week at 14 high schools.</td>
<td>- Significant improvements observed for nutrition knowledge, and behavioral intentions to consume fewer fried foods, fewer sweets, look at food labels, and limit TV watching. - Teens reported the program was interesting and easy to follow.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Total: n = 880</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Tx: age = 14.5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Delayed Tx: n = 329</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Total n = 880</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Tx: n=551</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Delayed Tx: n = 329</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Present and Prevent® - Channing Bete Company - Theory of Reasoned Action - Two 30-minute presentations over 1-week at 14 high schools.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Digate Muth, Chatterjee, Williams, Cross, &amp; Flower, 2008.</td>
<td>-Pilot Study: Two group randomized design</td>
<td>-Improving Meals and Physical Activity in Children and Teen (IMPACT) - Social Cognitive Theory - Fourteen, 1-hour lessons delivered weekly.</td>
<td>- Significant improvements observed for fruit and vegetable consumption, and nutrition knowledge questions. - No differences between groups for dietary behaviors (i.e. calcium rich foods, grains), physical activity, sedentary activity, dietary attitudes, and BMI-percentile.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Total n = 75</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Tx: n=38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\bar{x}$ age = 9.96 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Cnt: n=37</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\bar{x}$ age = 9.83 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Canavera, Sharma &amp; Murnan, 2009.</td>
<td>-Pilot Test: One group design</td>
<td>-Promoting Healthy Lifestyles - Social Cognitive Theory - Twelve sessions (three sessions targeting four health behaviors)</td>
<td>- Sixteen comparisons were made from pre and posttests: four health behaviors and twelve SCT construct measures. - Significant improvements were reported for one behavior (consumption of glasses of water) and two SCT constructs (expectations for drinking water and watching television).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Total n = 122</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Prosper, Moczulski, Qureshi, Weiss, &amp; Bryars, 2009.</td>
<td>-Quasi-Experimental: One group design</td>
<td>-Healthy for Life Program - No theory cited - Physical education and nutrition education integrated into students PE class. - Additional two 1-hour long nutrition classes offered after school.</td>
<td>- Overall BMI significantly increased, but average BMI for overweight/obese students significantly decreased. - Significant improvements were reported for engaging in less screen time, consuming breakfast more often, consuming less junk food, consuming more low-fat dairy products, exercising more often, and students self-esteem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Total n = 1,496</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\bar{x}$ age = 11.7 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Prosper, Moczulski, Qureshi, Weiss, &amp; Bryars, 2009.</td>
<td>-Quasi-Experimental: One group design</td>
<td>-Healthy for Life Program - No theory cited - Physical education and nutrition education integrated into students PE class.</td>
<td>- Overall BMI significantly increased, but average BMI for overweight/obese students significantly decreased. - Significant improvements were reported for engaging in less screen time, consuming breakfast more often, consuming less junk food, consuming more low-fat dairy products, exercising more often, and students self-esteem.</td>
</tr>
</tbody>
</table>
|   | Hollar, Messiah, Lopez-Mitnik, Hollar, Almon, & Agatson, 2010. | -Quasi-Experimental: two group non-randomized design  
-Total n = 1197  
-\( \bar{x} \) age = 7.8 years  
-Tx: n = 974 (4 schools)  
-Cnt: n = 199 (1 school) | -Healthier Options for Public Schoolchildren  
-No theory cited  
-Intervention components were implemented over 2 school years. | -Significantly more students in the intervention group stayed within a normal BMI-percentile during study. No difference between groups for changes in overweight and obesity status.  
-Overall, students in the intervention schools performed significantly better for standardized math tests, but not for standardized reading tests. |
|---|---|---|---|
|   | Hollar, Lombardo, et al., 2010. | -Quasi-Experimental: two group non-randomized design  
-Same as previous study | -Same. | -Students in the intervention schools experienced a significantly greater decrease in BMI-percentile by year 2 of the study.  
-Overall DBP significantly increased for both groups during the summer, and SBP significantly increased for males in both groups, but only for females in the control group. |
|   | Hollar, Messiah, et al., 2010 | -Quasi-Experimental: two group non-randomized design  
-Total n = 2494  
-\( \bar{x} \) age = 8 years  
-Tx: n = 2029 (4 schools)  
-Cnt: n = 465 (1 school) | -Same | -Female students experienced a significantly greater decrease in BMI z-score in treatment schools, but this was not significant for male students.  
-DBP significantly decreased for female students by the end of year two, but SBP was only significantly lower at the end of year one, but neither was significantly impacted for male students during the study. |

* Tx=Treatment group; Cnt=Control or comparison groupWH=white; BL=Black; HS=Hispanic; AS=Asian/Pacific Islander; DBP=Diastolic Blood Pressure; SBP=Systolic Blood Pressure
Table 2.2 Important details for school-based obesity prevention interventions

<table>
<thead>
<tr>
<th>#</th>
<th>Study</th>
<th>Outcome Measures</th>
<th>Sample Size Justification</th>
<th>Process Evaluation</th>
<th>Number of Measurements</th>
<th>Validated tools?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Abood, Black, &amp; Coster, 2008.</td>
<td>-Nutrition knowledge, attitudes, social influences and intentions.</td>
<td>Yes</td>
<td>No</td>
<td>Two Pre and Post Intervention</td>
<td>Yes Used previously validated instrument</td>
</tr>
<tr>
<td>3.</td>
<td>Canavera, Sharma &amp; Murnan, 2009.</td>
<td>-Four dietary and physical activity related behaviors. -Constructs of SCT related to four behaviors.</td>
<td>Yes</td>
<td>No</td>
<td>Two Pre and Post Intervention</td>
<td>Yes Used previously validated instrument</td>
</tr>
<tr>
<td>4.</td>
<td>Prosper, Moczulski, Qureshi, Weiss, &amp; Bryars, 2009.</td>
<td>-BMI-percentile -Blood pressure -Dietary and physical activity related behaviors -Self-esteem</td>
<td>No</td>
<td>No</td>
<td>Three Pre intervention, mid year, and post intervention</td>
<td>Yes Used previously validated instrument</td>
</tr>
<tr>
<td></td>
<td>Study</td>
<td>Variables</td>
<td>Time Points</td>
<td>Other Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------</td>
<td>----------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hollar, Messiah, Lopez-Mitnik, et al., 2010</td>
<td>-BMI-percentile</td>
<td>Four time points over two years: at the beginning and end of each school year</td>
<td>-N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-FCAT math and reading scores</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hollar, Lombardo, et al., 2010</td>
<td>-BMI-percentile</td>
<td>Four time points over two years: at the beginning and end of each school year</td>
<td>-N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Blood Pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-FCAT math and reading scores</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hollar, Messiah, et al., 2010</td>
<td>-BMI-percentile</td>
<td>Four time points over two years: at the beginning and end of each school year</td>
<td>-N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Blood Pressure</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>-FCAT math and reading scores</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The final limitation of all studies in this review is that none reported effect sizes. When outcome and impact measures are reported as statistically significant, this does not always equate to practical or clinical relevance. To evaluate a posteriori effect size for the primary outcomes of each intervention, Cohen’s $f$ was calculated using G*Power version 3.1.2. Cohen’s $f$ values will be interpreted using the following criteria: 0.1 to 0.24 represents a small effect size, 0.25 to 0.39 will represent a medium effect size, and greater than 0.4 will represent a large effect size. Where possible, a posteriori power calculation was done using SAS Proc POWER, to evaluate the achieved power for each measure. Where this was not possible, it was assumed the study achieved adequate (1-\(\beta=0.80\)) power.

Table 2.3 reports the effect sizes, which overall ranged from small to medium. Four of the seven studies reported a measure of BMI, and all four studies showed significant effects with an average small effect size of $f=0.027$. Three studies evaluated fruit and vegetable consumption, but only 1 study was significant and had a small/medium effect size of 0.16. Three studies evaluated physical activities and sedentary activities, but only 1 study was significant for both outcomes, and both had a small/medium effect size of 0.10. Finally, two studies evaluated sugar-sweetened beverage consumption, but only 1 study was significant and had a medium effect size of 0.20.
**Table 2.3 Computed effect size for school-based obesity prevention interventions**

<table>
<thead>
<tr>
<th>#</th>
<th>Study</th>
<th>Dependent Variable</th>
<th>Type of Statistical Test</th>
<th>Type I Error $\alpha$</th>
<th>Power 1-$\beta$</th>
<th>Effect Size (Cohen’s $f$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Present and Prevent</em>®</td>
<td>BMI-percentile</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=880</td>
<td>F/V</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td><em>IMPACT</em></td>
<td>BMI-percentile</td>
<td>Paired t-test</td>
<td>0.05</td>
<td>0.80$^b$</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>n=75</td>
<td>F/V</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSB</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td><em>Promoting Healthy Lifestyles</em></td>
<td>BMI-percentile</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=122</td>
<td>F/V</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSB</td>
<td>Paired t-test</td>
<td>0.022</td>
<td>0.59$^c$</td>
<td>0.20</td>
</tr>
<tr>
<td>4.</td>
<td><em>Healthy for Life</em></td>
<td>BMI-percentile</td>
<td>Paired t-test</td>
<td>0.003</td>
<td>0.004$^c$</td>
<td>0.002</td>
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<tr>
<td></td>
<td>n=1496</td>
<td>Fruit/vegetable Consumption</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>McNemar’s Test$^d$</td>
<td>0.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Time</td>
<td>McNemar’s Test$^{d'}$</td>
<td>0.001</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td></td>
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<tr>
<td>5a.</td>
<td><em>HOPS</em></td>
<td>BMI-percentile</td>
<td>Repeated Measures ANOVA</td>
<td>0.02</td>
<td>0.95$^c$</td>
<td>0.057</td>
</tr>
<tr>
<td></td>
<td>n=1197</td>
<td>F/V</td>
<td>Did not measure</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5b.</td>
<td>HOPS</td>
<td>BMI-percentile</td>
<td>Repeated Measures ANOVA</td>
<td>0.007</td>
<td>0.72&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.029</td>
</tr>
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<tr>
<td></td>
<td></td>
<td>F/V</td>
<td>Did not measure</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Did not measure</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td>--</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=3200</td>
<td>HOPS</td>
<td>BMI Z-score&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Repeated Measures ANOVA</td>
<td>0.0031</td>
<td>0.081&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F/V</td>
<td>Did not measure</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Did not measure</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=1247</td>
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<td></td>
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</tr>
</tbody>
</table>

NS=Not significant; F/V = Fruit and Vegetables; SSB=Sugar-Sweetened Beverages
‘a’ indicates measure was only significant for girls
‘b’ assumed 0.80 power
‘c’ power calculated using SAS Proc POWER
‘d’ cannot measure Cohen’s $f$ for non-parametric tests
Review of after-school based obesity prevention interventions

While the school environment may be an ideal place for health promotion and education the feasibility of offering such programming and services during school hours is becoming problematic. With the No Child Left Behind legislation, schools and school districts are under increased pressure to focus their efforts on academic areas that are tested through standardized examinations, which excludes health and physical education. While it is reasonable to expect that programming focused on health and obesity prevention will improve learning outcomes many schools have decided that they can no longer devote time to these areas, and some are greatly reducing or all together eliminating health and physical education from their curriculums (Gottfredson, Cross, Wilson, Rorie, & Connell, 2010).

Another potential venue for obesity prevention efforts is after-school programs (ASP’s) or clubs. From 1985 to 1998 the percentage of children (6-17) with both parents (or all) in the work force increased from 63% to 71%, making a larger demand for before and after school programming (Sarampote, Bassett, & Winsler, 2004). ASP’s aim to provide a safe and structured environment for children during the hours immediately following the end of the school day. Currently, 7 million youth attend some type of ASP (Mahoney, Lord, & Carrly, 2005). Many ASP’s vary and try to provide alternative activities that either are not offered during the school day or can complement subject matter covered during the school day, including sports, arts and drama, cultural enrichment, science and health education. Positive outcomes that have been associated with attending these programs include: academic achievement, lowered behavioral problems and increased social competence (Mahoney, et al., 2005).
The after school time frame presents an excellent opportunity to aid in prevention efforts targeting child and adolescent obesity. Children who are left at home unsupervised have the opportunity to engage in as much snacking as they prefer, while children in ASP’s commonly have designated snack times, which limit what they have access to in terms of types of snacks and portion sizes. Physical activities are also commonplace in ASP’s, which is ideal, since children often need to unwind after a long school day (Mahoney, et al., 2005).

Compared to school-based interventions, less work has been done implementing and evaluating after-school based obesity prevention interventions. Pate and O’Neill (2009) reviewed after-school interventions which aimed to increase physical activity among youth. This literature review included interventions from 2003 to 2008, and included 12 studies. Authors organized the studies based on the method used for measuring physical activity, of which nine used objective measures, such as accelerometry, or direct observations (such as SOFIT), and three used self-report measures, such as 7-day recalls and the validated instrument PDPAR. Results indicated that overall finding were mixed with regards to their effectiveness in increasing physical activity. The quality of studies greatly varied in this review, as not all had a control or comparison group and sample size of some studies did not appear to be adequate. In all, six studies used RCT’s, and of these four showed significant improvements for the engagement of physical activities. Of the three studies using quasi-experimental designs, two were effective in increasing children’s after-school physical activity. In general the authors noted that the programs were well received by participants and attendance rates were good, but varied across study, which is a limitation. Another limitation to these studies was that few did follow-up evaluations after the intervention ended. Finally, it is important to note that some of the interventions reviewed in this article also targeted dietary behaviors, however the authors did not
mention any of these outcomes. Authors also did not comment on measures of weight status evaluated by these interventions.

From 2008 to August 2010 there have been eight new studies evaluating after-school based interventions aimed at primary obesity prevention. A summary of these interventions can be found on Table 2.4. Overall, the quality of for these interventions greatly varied, as only two were RCT’s, two were quasi-experimental and four were pilot studies. Many studies utilized interventions that were based on a behavioral theory however and the only theory used was social cognitive theory, which was used in six interventions.

As Table 2.5 shows, there were some noted limitations that were apparent in many studies. Only three studies reported an a priori sample size justification. As previously noted, studies without an adequate sample size are at risk for committing a type II error. Compared to the school-based interventions however, more after-school based interventions report using process evaluations to evaluate programmatic dose and integrity. As with the school-based interventions no study in this review evaluated any outcome or impact measure past the time of post intervention, which are vital for showing whether interventions have sustained effects over time. The final limitation of all studies in this review is that very few (only 2 studies) reported effect sizes. This is important for discerning outcomes that are statistically significant, but not clinically or practically significant. The only effect size measure that was reported was Cohen’s $d$. To evaluate a posteriori effect size for the primary outcomes of each intervention, Cohen’s $f$ was calculated using G*Power version 3.1.2. Cohen’s $f$ values will be interpreted using the following criteria: 0.1 to 0.24 represents a small effect size, 0.25 to 0.39 will represent a medium effect size, and greater than 0.4 will represent a large effect size. Where possible, a posteriori power calculation was done using SAS Proc POWER, to evaluate the achieved power
for each outcome measure. Where this was not possible, it was assumed the study achieved adequate (0.80) power.

Table 2.6 reports the effect sizes, which overall ranged from small to large. Six of the eight studies reported a measure of BMI, but only half (three studies) showed significant effects with an average small effect size of $f=0.11$. Four studies evaluated fruit and vegetable consumption, but only 1 study was significant and had a medium/large effect size of 0.39. Five studies evaluated physical activities, and three studies were significant with an average medium/large effect size of 0.36. One study evaluated sedentary activities, and three studies evaluated sugar-sweetened beverage consumption, but no studies reported significant results for either behavior.
<table>
<thead>
<tr>
<th>#</th>
<th>Study</th>
<th>Design &amp; sample*</th>
<th>Intervention/Theory &amp; Duration</th>
<th>Salient findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Annesi, Faigenbaum, Westcott, &amp; Smith, 2008.</td>
<td>-Quasi-Experimental: Two group-delayed treatment design</td>
<td>-<em>Youth Fit for Life</em>&lt;br&gt;-Social Cognitive Theory&lt;br&gt;-Three 45-minute sessions delivered over 12 weeks.</td>
<td>- Significant improvements observed for positive self-appraisal, reduced tension, improved mood and engagement in PA in treatment group but not control group.</td>
</tr>
<tr>
<td></td>
<td>-Total: n = 269&lt;br&gt;- Tx: n = 146&lt;br&gt;- Delayed Tx: n = 123&lt;br&gt;- age = 10.6 yrs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Huberty, Balluff, Beighle, Berg, and Sun, 2009</td>
<td>-Quasi-Experimental: One group design&lt;br&gt;-Total n = 670&lt;br&gt;- Ages 5 to 11</td>
<td>-<em>Club POSSIBLE</em>&lt;br&gt;-Social Cognitive Theory&lt;br&gt;- Implemented differently across thirteen separate sites.</td>
<td>- On average, sites implemented 75 minutes of PA per week.&lt;br&gt;- BMI-percentile significantly decreased among children.&lt;br&gt;- There were no changes in PA self-efficacy, or social support among children ages 7-9 or 10-12, and only 7-9 age group significantly increased PA enjoyment.</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td>3.</td>
<td>Madsen, Thompson, Wlakiuk, Queliza, Schmidt, &amp; Newman, 2009.</td>
<td>-Pilot Test: One group design&lt;br&gt;-Total n = 178&lt;br&gt;- age = 9.7 yrs</td>
<td>-<em>SCORES</em>&lt;br&gt;-No theory cited&lt;br&gt;-Eight weeks in the fall and ten weeks in the spring, with three-1 hour sessions per week.</td>
<td>- Overall physical fitness scores significantly increased.&lt;br&gt;- No significant change was reported for overall BMI-percentile, except there was a significant decrease among Asian children.</td>
</tr>
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<td></td>
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</tr>
<tr>
<td>4.</td>
<td>Neumark-Sztainer, et al., 2009.</td>
<td>-Pilot Study: Two group design&lt;br&gt;-Total n = 96&lt;br&gt;- age = 10.3 yrs&lt;br&gt;- Tx: n = 51&lt;br&gt;-Cnt: n = 45</td>
<td>-<em>Ready. Set. ACTION</em>&lt;br&gt;-Social Cognitive Theory&lt;br&gt;-Both were fourteen, 2 hour sessions, over 7 weeks.</td>
<td>- There were no significant differences in changes for BMI-percentile, child diet and physical activity levels, family/home environment or SCT constructs, except for self-efficacy for PA.&lt;br&gt;- Authors acknowledge that this study is not powered for formal statistics.</td>
</tr>
<tr>
<td></td>
<td>Author(s)</td>
<td>Design</td>
<td>Sample</td>
<td>Theory</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>5.</td>
<td>Branscum, &amp; Kaye, 2009</td>
<td>Pilot Test: One group design</td>
<td>Total n = 58</td>
<td>Food Fit</td>
</tr>
<tr>
<td>6.</td>
<td>Annesi, Tennant, Westcott, &amp; Faigenbaum, 2009</td>
<td>Pilot Test: One group design</td>
<td>Total n = 43</td>
<td>Youth Fit for Life</td>
</tr>
<tr>
<td>7.</td>
<td>Rosenkranz, Behrens, &amp; Dzewaltoski, 2010</td>
<td>RCT</td>
<td>Total n = 76</td>
<td>SNAP (Scouting Nutrition &amp; Activity Program)</td>
</tr>
<tr>
<td>8.</td>
<td>Aguilar, et al., 2010</td>
<td>RCT</td>
<td>Total n = 1119</td>
<td>MOVI</td>
</tr>
</tbody>
</table>

* TX=treatment group; RCT=Randomized Controlled Trial; FV=fruit and vegetable; SSB= Sugar sweetened beverage
Table 2.5 Important details for after-school based obesity prevention interventions

<table>
<thead>
<tr>
<th>#</th>
<th>Study</th>
<th>Outcome Measures</th>
<th>Sample Size Justification</th>
<th>Process Evaluation</th>
<th>Number of Measurements</th>
<th>Validated tools?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>Huberty, Balluff, Beighle, Berg, and Sun, 2009</td>
<td>-BMI-Percentile -Constructs of SCT related to PA</td>
<td>No</td>
<td>Yes</td>
<td>Two Pre and Post Intervention</td>
<td>Yes Used previously validated instrument</td>
</tr>
<tr>
<td>3.</td>
<td>Madsen, Thompson, Wlakiuk, Queliza, Schmidt, &amp; Newman, 2009.</td>
<td>-BMI-percentile -Physical fitness.</td>
<td>No</td>
<td>No</td>
<td>Two Pre and Post Intervention</td>
<td>N/A</td>
</tr>
<tr>
<td>4.</td>
<td>Neumark-Sztainer, et al., 2009.</td>
<td>-BMI-percentile -Diet and physical activity behaviors -SCT constructs -Family/home environment</td>
<td>No</td>
<td>Yes</td>
<td>Three Pre intervention, mid year, and post intervention</td>
<td>Yes Used previously validated instrument</td>
</tr>
<tr>
<td>5.</td>
<td>Branscum, &amp; Kaye, 2009.</td>
<td>-Overall dietary behaviors. -SCT constructs</td>
<td>No</td>
<td>Yes (reported elsewhere)</td>
<td>Two Pre and Post Intervention</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Study Authors, Year</td>
<td>Measures</td>
<td>Validated?</td>
<td>Pre/Post Intervention</td>
<td>Used Previously Validated Instrument?</td>
<td></td>
</tr>
<tr>
<td>---</td>
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<td>-----------------------------------</td>
<td>------------</td>
<td>------------------------</td>
<td>---------------------------------------</td>
<td></td>
</tr>
</tbody>
</table>
| 6 | Annesi, Tennant, Westcott, & Faigenbaum, 2009 | -BMI  
- Fitness Measures (i.e. strength, endurance, flexibility)  
- Voluntary PA  
- Fruit and vegetable consumption  
- Constructs of SCT | No | No | Two Pre and Post Intervention |
| 7 | Rosenkranz, Behrens, & Dzewaltoski, 2010 | Yes | Yes | Yes | Used previously validated instrument |
| 8 | Aguilar, et al., 2010 | Yes | No | Three Pre intervention, and the end of years 1 and 2. | N/A |
Table 2.6 Computed effect size for after-school based obesity prevention interventions

<table>
<thead>
<tr>
<th>#</th>
<th>Study</th>
<th>Dependent Variable (Primary Outcome)</th>
<th>Type of Statistical Test</th>
<th>Type I Error $\alpha$</th>
<th>Power 1-$\beta$</th>
<th>Effect Size (Cohen’s $f$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Youth Fit for Life</em></td>
<td>BMI-percentile</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F/V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Paired t-test</td>
<td>$0.001$</td>
<td>$0.97^c$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td><em>Club POSSIBLE</em></td>
<td>BMI-percentile</td>
<td>Repeated Measures ANOVA</td>
<td>$0.0001^c$</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F/V</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td><em>SCORES</em></td>
<td>BMI-percentile</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F/V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Paired t-test</td>
<td>$0.001$</td>
<td>$0.80^b$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td><em>Ready. Set. ACTION</em></td>
<td>BMI-percentile</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F/V</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SSB</td>
<td>Paired t-test</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td><em>Food Fit</em></td>
<td>BMI-percentile</td>
<td>Did not measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F/V</td>
<td></td>
<td></td>
<td>McNemar’s Test$^a$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Physical Activity</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SSB</td>
<td>McNemar’s Test$^c$</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Youth Fit for Life</td>
<td>BMI</td>
<td>Paired t-test</td>
<td>0.03</td>
<td>0.21(^c)</td>
<td>0.17</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td>n=43</td>
<td>F/V</td>
<td>Paired t-test</td>
<td>0.02(^a)</td>
<td></td>
<td>0.67(^c)</td>
<td>0.39</td>
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<tr>
<td></td>
<td>Physical Activity</td>
<td>Paired t-test</td>
<td>0.01</td>
<td></td>
<td>0.67(^c)</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td>0.01</td>
<td></td>
<td>0.67(^c)</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td>0.01</td>
<td></td>
<td>0.67(^c)</td>
<td>0.44</td>
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<td></td>
<td>SNAP</td>
<td>BMI Z-score</td>
<td>SAS Proc Mixed</td>
<td>NS</td>
<td></td>
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</tr>
<tr>
<td>n=76</td>
<td>F/V</td>
<td>SAS Proc Mixed</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical Activity</td>
<td>SAS Proc Mixed</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td>0.01</td>
<td></td>
<td>0.67(^c)</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td>SSB</td>
<td>SAS Proc Mixed</td>
<td>NS</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>MOVI</td>
<td>BMI</td>
<td>SAS Proc Mixed</td>
<td>0.001</td>
<td>0.80(^b)</td>
<td>0.06</td>
</tr>
<tr>
<td>n=1119</td>
<td>F/V</td>
<td>Did not measure</td>
<td>0.001</td>
<td></td>
<td>0.80(^b)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Physical Activity</td>
<td>Did not measure</td>
<td>0.001</td>
<td></td>
<td>0.80(^b)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Screen Time</td>
<td>Did not measure</td>
<td>0.001</td>
<td></td>
<td>0.80(^b)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>SSB</td>
<td>Did not measure</td>
<td>0.001</td>
<td></td>
<td>0.80(^b)</td>
<td>0.06</td>
</tr>
</tbody>
</table>

NS=Not significant; F/V = Fruit and Vegetables; SSB=Sugar-Sweetened Beverages
\(^a\) indicates measure was only for vegetable consumption
\(^b\) assumed 0.80 power
\(^c\) power calculated using SAS Proc POWER
\(^d\) can not measure Cohen’s \(f\) for non-parametric tests
\(^e\) mean BMI-percentiles not reported
Social Cognitive theory and child and adolescent obesity

Effective child and adolescent obesity prevention interventions are greatly needed, and such interventions should be based on theoretical underpinnings. Theories are beneficial for health-promoting interventions, since theories discern measurable intervention objectives, provides guidance for intervention strategies, identifies the timing for interventions, enhances communication between professionals, improves replication, and theory based health-promoting interventions are generally more effective than those not using theory (Painter, Borba, Hynes, Mays, & Glanz, 2008; Sharma, & Romas, 2008). A commonly used theory in health education is social cognitive theory, which posits that human behavior can be explained by reciprocal determinism, or a continuous interaction between behavior, personal factors and the environment. ‘Behavior’ refers to the health behavior, which is being targeted or modified. ‘Personal factors’ refers to cognitions, affect and biological events. ‘Environment’ refers to the social and physical environments (Sharma, & Romas, 2008).

Social Cognitive Theory has been applied for primary prevention to a wide array of health topics including HIV prevention programs in adolescents, nutrition education program, smoking cessation programs and problem solving skills. It has also been used in secondary and tertiary prevention for diabetes education program, promotion of female condom use in a sexually transmitted disease clinic and dietary approaches to reducing hypertension (Sharma, et al., 2008).

Social cognitive theory has been successfully used for obesity prevention as well. In a recent meta-analysis spanning from 1985 to 2003 authors reviewed RCT’s designed to favorably impact nutrition and physical activity among children. Fifty-seven RCT’s met the author’s inclusion criteria, which included: students enrolled in the study were in elementary or secondary
school, interventions included a school component, studies had a control-comparison group, and a variety of outcomes were measured. Among the fifty-seven RCT’s, nineteen were exclusively related to improving nutrition. Of these studies, six showed no differences between treatment and control groups, twelve showed modest or mixed outcomes, and one showed significant improvements. Only three other studies from this analysis showed significant outcomes in the areas of: increasing physical activity, decreasing physical inactivity, and improving nutrition and increasing physical activity. The interventions from the four studies with significant outcomes were either implicitly or explicitly based on social cognitive theory (Thomas, 2006).

Social cognitive theory is comprised into several constructs for behavior change. As seen on Table 2.7, which has adapted from the book ‘Theoretical Foundations of Health Education and Health Promotion (Sharma, et al., 2008), in all SCT has nine constructs. Some of these constructs have been used to predict behaviors associated with obesity prevention among children. For example, Sharma and colleagues (2005-2006) reported that among fifth grade school children, self efficacy is an important predictor for exercising daily and eating the correct number of fruits and vegetables, self-control is an import predictor for watching less television daily, and expectations were an important predictor for drinking 8 glasses of water. Using a sample of 3rd grade children, Resnicow and colleagues (1997) reported expectations as a positive predictor for fruit and vegetable consumption.
### Table 2.7 Constructs of social cognitive theory

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Learning facts and gaining insights related to an action, idea, object, person, or situation</td>
</tr>
<tr>
<td>Outcome expectations</td>
<td>Anticipation of the probable outcomes that would ensue as a result of engaging in the behavior under discussion</td>
</tr>
<tr>
<td>Outcome expectancies</td>
<td>Value a person places on the probable outcomes that result from performing a behavior</td>
</tr>
<tr>
<td>Situational perception</td>
<td>How one perceives and interprets the environment around oneself</td>
</tr>
<tr>
<td>Environment</td>
<td>Physical or social circumstances or conditions that surround a person</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>Confidence in one’s ability to pursue a behavior</td>
</tr>
<tr>
<td>Self-efficacy in overcoming impediments</td>
<td>Confidence that a person has in overcoming barriers while performing a given behavior</td>
</tr>
<tr>
<td>Self-control or Goal setting</td>
<td>Setting goals and developing plans to accomplish chosen behaviors</td>
</tr>
<tr>
<td>Emotional coping</td>
<td>Techniques employed by the person to control the emotional and physiological states associated with acquisition of a new behavior</td>
</tr>
</tbody>
</table>
Conclusion and Summary

This literature review covered in detail the current scope of the problem of child and adolescent obesity in today’s society. With the prevalence of obesity among youth at 16.9%, the need for effective intervention strategies are critical. Interventions that can favorably impact health behaviors associated with the prevention of overweight (such as a healthy diet), can help to prevent the onset of overweight in childhood, and spare children from the associated metabolic and psychological consequences. Schools are one place intervention strategies are needed, however many obesity prevention interventions implemented in the school setting have produced mixed or modest outcomes. The after-school time frame is another place to implement child and adolescent obesity interventions, but compared with school-based interventions, less work has been done implementing and evaluating such programs.

Many complex factors are commonly reportedly as being associated with child and adolescent obesity, therefore health-promoting interventions need to identify and target the most vital behaviors related to obesity prevention. The AMA’s expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity, identified four key lifestyle behaviors that are necessary for obesity prevention, including consuming no more than one sweetened beverage per day, consuming 5 servings of fruits and vegetables per day, engaging in at least 60 minutes of MVPA per day, and limiting screen time activities to no more than 2 hours per day (Roa, 2008).

Finally, there is great need for interventions to correctly operationalize, utilize, and evaluate health behavior theories, since theory based health-promoting interventions are generally more effective than those not using theory. A commonly used and successful theory in health education and obesity prevention is social cognitive theory. The purpose of this study was
to evaluate the efficacy of an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children. The next chapter discusses the methods that were utilized for this study.
CHAPTER 3

Methods

The purpose of this study was to evaluate the efficacy of an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children. Specifically, a comparison of the effects of a theory-based (experimental) intervention to a knowledge-only (comparison) based intervention was conducted. Important study dependent variables included: (1) a measure of weight status (BMI-percentile), (2) obesity prevention behaviors (fruit & vegetable consumption, sugar-sweetened beverage consumption, sugar-free drink & water consumption, the engagement of physical activities, and the engagement of sedentary activities), and (3) constructs of social cognitive theory (self-efficacy, expectations, and self-control).

This chapter begins with a description of this study in five parts: 1) the first part of the chapter describes the research design and the population for this study, 2) the second part provides a description of the three levels of dependent variables, and the way in which these variables were measured, 3) the third part will describe the sampling procedure used for this study, and participant recruitment procedure, 4) the fourth part gives an explanation of both interventions that was implemented for this study, and finally 5) in the fifth part the processes of data collection and data analyses will be discussed.

Study design and rationale

The first set of dependent variables for the primary purpose of this study is (1) weight-status (as measured BMI-percentile), (2) obesity prevention behaviors (fruit and vegetable consumption, engagement of physical activities, engagement of sedentary activities, water/sugar-
free drink consumption, and sugar-sweetened beverage consumption), and (3) subscale scores on constructs of social cognitive theory [expectations for each behavior (summation of multiplicative score of frequency * magnitude of behavior), self-efficacy for each behavior, and self-control for each behavior].

The primary independent variable for this study was the intervention (group). This was a fixed, categorical variable with two levels: (1) social cognitive theory based group (experimental) and (2) knowledge based group (comparison). The second independent variable was ASP (sites) which is nested within levels of group variable (the nestee), hence, one group of sites received the theory-based intervention, while the second group received the knowledge-based intervention. This was a random quantitative variable with twelve levels (six sites were randomly assigned to receive the experimental intervention and six sites were randomly assigned to receive the comparison intervention). The third independent variable was a within-group variable of time, with three levels of measurement at pre-test, post-test and three month follow-up test. Therefore, the design used for testing the experimental and comparison intervention was a hierarchical one between and one within repeated measures design. The between variable will be the grouping variable and contains two levels, (experimental group and comparison group) while the within variable is the number of measurements, which contained three levels.

*Population*

The target population for this study consisted of third, fourth and fifth grade students enrolled in twelve YMCA after school programs in Columbus, OH. Each after-school program was hosted in public elementary schools, which are contained within the Olentangy Local School District, in Delaware County, OH. A listing of these ASP’s can be found in Appendix C. Delaware county is a predominantly suburban county and in 2009 had a total population of
There are 40 schools in this county, all of which are contained in four school districts. In 2009 the total enrollment of students in the county was 24,144, of which 14,256 attended schools in the Olentangy Local school district. The Olentangy Local school district contains one preschool, fourteen elementary schools, four middle schools, and three high schools. During the 2007-2008 school year in the United States, there were a total of 48,515,020 students enrolled in K through 12th grade, and in Ohio during the same school year there were a total of 1,827,184 students enrolled K through 12th grade (Noel & Sable, 2009). Table 3.1 compared the demographics between students in the Olentangy Local school district, the state of Ohio, and the student population of the United States. While gender was comparable across all groups, the demographics of race/ethnicity and students on free or reduced lunch varies. Olentangy Local schools has a slightly higher percentage of Caucasian students (84%) compared to Ohio (79%), and was markedly different than in the U.S. (56%). Olentangy schools also had much fewer students on free or reduced lunch (6%), compared to Ohio (34%) and the U.S. (42%). The after-school programs chosen for this study were done primarily due to convenience, since programs have access to children and the existing infrastructure of the programs make them the most efficient setting for obesity prevention interventions. However, given these sites were chosen for convenience, and the Olentangy schools represented a primarily white, middle class, suburb in the Midwest, the external validity (or generalizability) of this study may be limited.
Table 3.1 Student distributions of the Olentangy Local school district, the State of Ohio and the United States

<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>Sub Group</th>
<th>Olentangy Local School District¹</th>
<th>Ohio Public School Population</th>
<th>United States Student Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>% (N)</td>
<td>49,292,507 % (N)</td>
</tr>
<tr>
<td>Total Population</td>
<td></td>
<td>7,840</td>
<td>1,827,184</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>% (N)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>3832</td>
<td>5,511,580²</td>
<td>24,744,838³ 50%</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3706</td>
<td>5,841,560²</td>
<td>24,251,913³ 50%</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>Caucasian</td>
<td>6563</td>
<td>1,387,417</td>
<td>27,062,600 56%</td>
</tr>
<tr>
<td></td>
<td>African American</td>
<td>285</td>
<td>301,118</td>
<td>8,267,000 17%</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>144</td>
<td>47,701</td>
<td>10,249,902 21%</td>
</tr>
<tr>
<td></td>
<td>Asian/Pacific Islander</td>
<td>536</td>
<td>27,077</td>
<td>2,348,472 5%</td>
</tr>
<tr>
<td></td>
<td>American Indian/Alaskan Native</td>
<td>10</td>
<td>2,580</td>
<td>587,046 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>484</td>
<td>616,031²</td>
<td>20,516,584² 42%</td>
</tr>
</tbody>
</table>

Data source Noel & Sable, 2009 unless noted otherwise
4. Data source: National Center for Educational Statistics: Percentage distribution of students, by sex, race/ethnicity, school type, and selected school characteristics: 2007-08
5. Gender does not add to 100% due to missing data for 302 students
Weight Status

To evaluate weight status, a BMI-percentile will be derived for each child. Children’s height and weight was measured without shoes and with minimal clothing (e.g., without shoes, sweaters, or sweatshirts) to facilitate correct positioning of the body. Height was measured with a Seca 214 portable stadiometer to the nearest 0.1 cm and body weight was measured on an electronic digital scale (Tanita HD 317) to the nearest 0.1 kg. The electronic scale was zeroed periodically throughout the study. BMI-percentile was then derived by using the BMI Calculator for Child and Teen available from the Centers for Disease Control and Prevention (CDC) at http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx. Necessary inputs for this calculator included: birth date, date of measurement, gender, height, and weight. Children with a BMI percentile less than the 5th were considered ‘underweight’, those between the 5th and 85th were considered ‘normal weight’, between 85 and 95 were considered ‘overweight’ and children with a BMI percentile greater than the 95th were considered ‘obese’.

Diet and Activity Behaviors

To evaluate key obesity prevention behaviors, a previously validated scale (SPAN) has been revised into a new scale containing five subscales (Thiagarajah, et al., 2008). The first subscale evaluated fruit and vegetable consumption and consists of nine items. Each item evaluated a type of fruit or vegetable, as stipulated by the MyPyramid food classification system, including melons, berries, mixed fruit, and other fruits for ‘fruit consumption’ and dark green vegetables, orange vegetables, dried beans or peas, starchy vegetables, and other vegetables for ‘vegetable consumption’. The scale used a rating score of 0 serving to 6 servings per item, with a possible subscale range of 0 to 54 servings. The next subscale measured the engagement of physical activities and consisted of two items. One item evaluated the amount of time children
are engaged in moderate activity and the other item evaluated the amount of time children are engaged in vigorous activity. This scale used a rating of 30 minute blocks, from 0 minutes to 240 minutes, with a possible subscale range of 0 to 480 minutes. The next subscale measured the engagement of sedentary activities and consisted of three items. One item evaluated the amount of time children spend watching TV or movies, one item evaluated the amount of time children spend on the computer and the final item evaluated the amount of time children spend playing video games. This scale uses a rating of 30 minute blocks, from 0 minutes to 240 minutes, with a possible subscale range of 0 to 720 minutes. The next subscale evaluated water and sugar-free drink consumption and consisted of two items. One item evaluated the amount of water children consumed and the other item evaluated the amount of sugar-free drinks children consumed. The scale uses a rating of 0 glasses to 10 glasses, with a possible subscale range of 0 to 20 glasses. The final subscale evaluated sugar-sweetened beverage consumption and consisted of one item. The scale used a rating of 0 glasses to 10 glasses.

A panel of six experts in a two-round review process established content validity, face validity and readability of the items in each scale. The panel consisted of five university professors with expertise in instrument development, subject matter, and working with children. The other expert had expertise with working with children in the population targeted in this study (See Appendix B).

Social Cognitive Theory Constructs

The Promoting Healthy Lifestyles survey (Sharma, Wagner, & Wilkerson, 2005-2006) was used to evaluate four constructs of social cognitive theory. This survey has been previously evaluated for internal consistency reliability using Cronbach’s alpha, and test-retest reliability using the appropriate correlation coefficient, and in both cases were found to be over 0.70, which
indicates acceptable reliability. Furthermore, construct validity using confirmatory factor analysis was performed for each subscale, and each subscale contained only one-factor solutions, thus confirming the scale’s construct validity. Cronbach’s alpha and construct validity using confirmatory factor analysis was repeated in study to confirm the reliability and validity of this instrument, by combining the results from the pretest for both groups; the experimental and comparison groups. An *a priori* critical limit of 0.70 was considered adequate for Cronbach’s alpha measures. Confirmatory factor analysis using maximum likelihood estimation was used to determine construct validity. Scree plots and Eigenvalues were used to identify whether subscales contained a one-factor solution. An *a priori* critical limit of 0.32 was set for each item’s factor loading for the items given subscale (Tabachnik, et al., 2007).

The survey consisted of 45 items measuring four constructs of social cognitive theory. The first sixteen items were about outcome expectations of exercising for 60 minutes everyday, spending less than 2 hours with screen time everyday, drinking water and sugar-free drinks instead of sugar-sweetened beverages, and consuming five servings of fruit and vegetables. This scale used a rating of never (0), hardly ever (1), sometimes (2), almost always (3), and always (4). The outcome expectations for exercising included not getting sick as often, having more confidence, having more fun, and looking better. The outcome expectations for spending less than 2 hours with screen time everyday included having more friends, having more free time, having more fun, and being more relaxed. The outcome expectations for drinking water and sugar-free drinks included being more relaxed, feeling better, having more energy, and having a better weight. The outcome expectations for eating five or more servings of fruits and vegetables each day included having more energy, feeling better, not getting sick as often, and having better weight. The next ten questions measured outcome expectancies or how children valued each
behavior. This scale used the following rankings: not at all important (0), slightly important (1), moderately important (2), very important (3), and extremely important (4). The next twenty items measured the children’s self-efficacy or belief that they could complete the task successfully, and self-control, or belief they could set goals and reward themselves for accomplishing their goal. Both scales used the following rankings: not at all sure (0), slightly sure (1), moderately sure (2), very sure (3), and completely sure (4). The self-efficacy questions focused on the four primary key obesity prevention behaviors previously discussed. In each of the sets the first item measured self-efficacy for performing a specific behavior. The second and third items measured self-efficacy for overcoming barriers related to each behavior. The self-control questions focused on the same behaviors, and in each set included an item measuring their perception they can set goals for each behavior, and another item measuring their perception they can reward themselves for accomplishing their goals.

For each behavior, the expectations subscale score could range from 0-64, which was calculated by multiplying each outcome expectation with its corresponding outcome expectancy, and summing each item within the subscale. Each self-efficacy subscale has a range of 0-12 for each behavior and each self-control subscale has a range of 0-8 for each behavior.

Sampling

For the purpose of this study a convenience sample of twelve YMCA sponsored after-school programs were selected from the Olentangy Local school district. Permission for the study was obtained by Nancy Brody, the Metropolitan School-Age Quality Resource Director of the YMCA. Since this was an efficacy study random assignment of program sites to experimental and comparison conditions was done to increase the internal validity. Of the twelve program sites (the number of children in each site ranging from 15-20) six sites were
randomly assigned to the experimental intervention and six sites were randomly assigned to the comparison condition. In calculating the required sample size of children for this study, G*Power was used with the following criteria: an alpha level of significance ($\alpha=0.05$), statistical power ($\beta=0.80$), an estimated medium effect size ($f=0.30$), number of groups ($n=2$), number of measurements ($n=3$), and an attrition rate of 20% (Lipsey & Wilson, 1993). Efforts were made to reduce the attrition rate to as low as possible. For example, informal make-up sessions were provided as needed, and parents were informed for which day and time the given program was implemented, to assure their child attended each lesson. Based on the previously mentioned criteria, a sample size of 34 was needed for each group.

*Randomization and Intervention*

Each intervention was implemented during normal after-school hours. For each intervention there were four sessions, and each session lasted 30-minutes in length. The experimental intervention sessions were based on the constructs of behavioral capabilities, self-efficacy, expectations and self-control. Pedagogical techniques that were employed to promote healthy eating behaviors and physical activities included: (a) hands on activities to teach abstract concepts, (b) discrete skills development through instructor modeling and practice (c) use of positive role models, (d) role playing to practice learned skills and behaviors and to overcome barriers, (e) use of positive and vicarious reinforcement to encourage children to demonstrate targeted behaviors, and (f) planning activities to practice self-regulatory behaviors. The comparison intervention sessions were based on knowledge about healthy eating and physical activities. All lessons were implemented by the same researcher at each site.
**Intervention: Experimental (social cognitive theory based)**

A detailed description for the experimental intervention can be found in Appendix D. Each experimental-based lesson consisted of 4 modules: Introduction & Purpose of lesson, Benefits, and Goal Setting. During the ‘Introduction & Purpose of lesson’ the instructor introduced and reviewed the lesson’s key objectives and covered necessary knowledge and skills in order to perform the behavior the lesson targeted. In the ‘Benefits’ module, children learned positive benefits associated with the health behavior being promoted and sketched a comic-panel showing such a benefit. Next, children participated in ‘Role-Playing’ with the instructor to practice skills learned in the lesson in two separate real-world examples: one with a parent or guardian, and one with a peer. Finally, during ‘Goal Setting’, the instructor reviewed the key objectives of the lesson, children have the opportunity to ask questions about the lesson, and children sketched comic-book panels of themselves setting goals, monitoring and self-rewarding themselves for engaging the behavior the lesson targeted. The behavioral objectives for each lesson of the experimental intervention was to enable children to:

*Session 1: Engaging in no more than 2 hours of screen time per day*

1. Define screen time
2. List various activities that constitute screen time.
3. Identify the appropriate amount of screen time children should engage in everyday (no more than 2 hours).
4. Explain benefits of limiting screen time to only 2 hours per day.
5. Explain to parents and friends how much screen time they should have and alternative activities to screen time.
6. Demonstrate self-control for limiting screen time to 2 hours per day.
Session 2: Consuming water/sugar-free drinks instead of sugar-sweetened beverages

1. Define sugar-sweetened drinks
2. List various examples of them.
3. Define sugar-free drinks
4. List various examples of them.
5. Identify the food label on various drink containers
6. Identify ‘Sugars’ on given food labels.
7. Explain benefits of choosing sugar-free drinks and water instead of sugar-sweetened beverages.
8. Explain to parents and friends why having sugar-free drinks and water instead of sugar-sweetened beverages is better.

Session 3: Engaging in at least 60 minutes of physical activity per day

1. Define physical activity
2. List various examples of physical activities.
3. Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes).
4. Explain benefits of being physically active for at least 60 minutes per day.
5. Explain to parents and friends why having at least 60 minutes of physical activity everyday is important.
6. Demonstrate self-control for being physically active for at least 60 minutes per day.
Session 4: Consuming 5 servings of Fruits and Vegetables per day

1. Identify four basic types of fruits.
2. Identify five basic types of vegetables.
3. Identify the amount of fruits and vegetables children should eat each day.
4. Explain benefits of eating 5 servings of fruits and vegetables per day.
5. Explain to parents and friends why eating 5 servings of fruits and vegetables per day is important.
6. Demonstrate self-control for eating 5 servings of fruits and vegetables.

Intervention: Comparison (Knowledge based)

A detailed description for the comparison intervention can be found in Appendix E. Each comparison lesson consists of 4 modules: Introduction & Purpose of lesson, Comic-Book activity #1, Comic-Book activity #2 and Wrap-up. During the ‘Introduction & Purpose of lesson’ the instructor introduced and covered the lesson’s key objectives and taught necessary knowledge and skills in order to perform the behavior the lesson targeted. In the ‘Comic-Book activity #1’ and ‘Comic-Book activity #2’ modules, children learned an aspect of comic-book creation and sequential art. Finally, during ‘Wrap-up’, the instructor reviewed the key objectives of the lesson, and children had the opportunity to ask questions about the lesson. The behavioral objectives for each lesson of the comparison intervention was to enable children to:

Session 1: Engaging in no more than 2 hours of screen time per day

1. Define screen time
2. List various activities that constitute screen time.
3. Identify the appropriate amount of screen time children should engage in everyday (no more than 2 hours).
4. Identify the importance of emotions for comic-book creation.
5. Identify the importance of shapes for comic-book creation.
6. Identify the importance of balloons for comic-book creation.

**Session 2: Consuming water/sugar-free drinks instead of sugar-sweetened beverages**

1. Define sugar-sweetened drinks
2. List various examples of them.
3. Define sugar-free drinks
4. List various examples of them.
5. Identify the food label on various drink containers
6. Identify ‘Sugars’ on given food labels.
7. Identify the importance of panels for comic book creation
8. Identify that comic stories can be told in varying number of panels.
9. Demonstrate the ability to create a comic story using a three-panel sequence.

**Session 3: Engaging in at least 60 minutes of physical activity per day**

1. Define physical activity
2. List various examples of physical activities.
3. Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes).
4. Demonstrate the ability to develop a beginning for an original comic book story.
5. Demonstrate the ability to develop a middle for an original comic book story.
6. Demonstrate the ability to develop an ending for an original comic book story.

**Session 4: Consuming 5 servings of Fruits and Vegetables per day**

1. Identify four basic types of fruits.
2. **Identify** five basic types of vegetables.

3. **Identify** the amount of fruits and vegetables children should eat each day.

4. **Explain** how to create an original comic-book story.

5. **Explain** how to create original comic-book characters.

6. **Demonstrate** the ability to create a story using sequential art.

*Process Evaluations*

In order to evaluate the dose and fidelity between the planned intervention and the actual implementation of the intervention for each of the eight sessions (4 experimental and 4 comparison) process evaluations were created. Face and content validity, and readability for these evaluation sheets were established by simultaneously comparing the sessions with the process evaluation sheets by a panel of six experts (five university professors and one director from the YMCA) in a two-round review process. See Appendix G for a listing of Panel members and letters of notification sent to each panel member. See Appendix H for the process evaluation sheets used in this study. An analysis of variance (ANOVA) was conducted to evaluate whether time of implementation (dependent variable) is equivalent among intervention sites, intervention conditions (experimental and comparison) and an interaction between the two.

The after-school program personnel were not notified for which type of intervention their site received in order to improve external validity. Additionally, efforts were made to make both interventions as equivalent as possible. Specifically, interventions were (1) delivered by the same researcher, (2) both interventions had four sessions, (3) following each session, children were be given identical take-home assignments, and (4) each lesson was delivered in the same week.
Data collection & analysis

Implementation of this study and data collection was done during the period of January to April 2011. Pretest survey questionnaires were given to all children at all sites the week before the intervention began. At the end of both four-lesson interventions, children completed the posttest which consisted of all testing done during the pretest, with the exception of BMI-percentile. Similarly a three-month follow-up test was completed, consisting of all testing done during the pretest. Each item on the instrument was read to the children to increase the response rate of completion. Children who were absent on data-collection days were asked to complete the instrument with an after-school staff member, in a similar manner in which the investigator implemented. Children who failed to complete more than 80% of the instrument (54 items) were eliminated from this study.

Data were analyzed using Predictive Analytical Software (PASW) version 18 for descriptive statistics, such as frequencies, mean, median, and range of responses for the participants studied. Using pretest data, sites which were randomly assigned to the experimental intervention were compared with sites in the comparison group to assure equivalency among groups. Separate repeated measures ANOVA’s using the nested and un-nested design were carried out using both the PASW (version 18) software and the Statistical Analysis Software (SAS) version 9.1. Power for such tests were analyzed using both: PASW (version 18) for the un-nested design, and proc GLMPOWER with SAS (version 9.1) for the nested design. To evaluate effect size Cohen’s $f$ was calculated as described in Kirk (1995), and interpreted as small ($f=0.10$), medium ($f=0.25$), and large ($f=0.40$). The following assumptions for the single-group univariate repeated measures analysis were evaluated using such criteria (a) normality
using the Kolmogorov-Smirnov test (K-S test), histograms and Q-Q plots, (b) homogeneity of variance using the Levene Test, and (c) sphericity using the Mauchly’s Sphericity test.

Conclusion

This chapter discussed the methodology that was utilized for the study. A background into the study design and rationale, population, psychosocial, behavioral and physical measures, instrumentation, sampling procedure, randomization, interventions, data collection and data analysis were given. Results from the study will follow in Chapter 4 with a discussion and interpretation of those results presented in Chapter 5.
CHAPTER 4

RESULTS

The purpose of this study was to evaluate the efficacy of an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children. Specifically, a comparison between an experimental group (receiving a social cognitive theory based intervention) and a comparison group (receiving a knowledge only based intervention) was done using three types of measures: a measure of weight status (as measured by BMI-percentiles), obesity prevention behaviors (fruit and vegetable consumption, sugar-free drink consumption, sugar sweetened beverage consumption, engagement in moderate to vigorous physical activity, and engagement in screen time) and social cognitive theory constructs for each behavior (self-efficacy, self-control, and expectations). This chapter begins with a description of the recruitment and data screening process that was used to determine the final sample used for this study. In the next section pretest data will be compared between the experimental and comparison groups to assure the randomization of after school sites yielded two comparable groups. Next, results from the evaluation of the construct validity and internal consistency reliability of the portion of the instrument evaluating constructs of social cognitive theory are presented. In the next section the degree of program fidelity and dose of program implementation will be reported to show that the program was implemented correctly at all of the after school sites, across both groups. Next, the assumptions of normality, homogeneity of variance, and sphericity are tested and presented. Finally, the results of the pretest, posttest and follow-up test data for impact and outcome measures are presented.
Data Screening and Participant Dropout

Before data analysis began all data were screened for accuracy, missing values, and outliers. A total of 183 children at twelve YMCA after school programs were recruited for this study. Of these twelve sites, six were randomly assigned to an experimental group (n=94) and the remaining six to a comparison group (n=89). Of the 183 children enrolled n=19 dropped out of the study at the time of posttest and n=3 dropped out at the time of the follow-up test. All children completed at least 80% of the items on the Promoting Health Lifestyles survey, therefore no children were removed from this study for this reason. Two methods were used to detect outliers and omit children with improbable responses. First the means and standard deviations for each variable were individually analyzed and children with responses greater than three standard deviations from the mean were deleted on a case-by-case basis (Stevens, 2009). Second, individuals were omitted based upon criteria set by a previously peer-reviewed study using a similar sample of children (Sharma, et al., 2006) including: Number of minutes exercised at home in the past 24 hours (240 minutes), number of hours watched TV at home in past 24 hours (10 hours), number of glasses of water consumed in past 24 hours (15 glasses), number of servings of fruits consumed in past 24 hours (6 servings), and number of servings of vegetables consumed in past 24 hours (6 servings). Using these two criteria n=66 were omitted at the time of posttest, n=23 were omitted at the time of the follow-up test and n=1 was omitted from the final analysis. This is depicted in Figure 4.1.
Figure 4.1 Study recruitment and data screening process to arrive at final sample

Total participants enrolled at Pretest in the experimental group
n=94

Dropout at Pretest (n=12)
Participants omitted due to overestimation (n=30)

Total participants enrolled at posttest in the experimental group
n=52

Dropout after posttest (n=2)
Participants omitted due to overestimation (n=13)

Total participants enrolled at follow-up evaluation in the experimental group
n=37

Participants omitted due to overestimation (n=0)

Total participants use in final data analyses in the experimental group
n=37

Total participants enrolled at Pretest in the comparison group
n=89

Dropout at Pretest (n=7)
Participants omitted due to overestimation (n=36)

Total participants enrolled at posttest in the comparison group
n=46

Dropout after posttest (n=1)
Participants omitted due to overestimation (n=10)

Total participants enrolled at follow-up evaluation in the comparison group
n=35

Participants omitted due to overestimation (n=1)

Total participants use in final data analyses in the comparison group
n=34
Results from pretest data on demographic and study variables

A total of 71 children were included in the final analyses for this study, with n=37 assigned to the experimental group and n=34 assigned to the knowledge-based group. A comparison of demographic characteristics and study variable between both groups at the time of pretest are presented in Tables 4.1, 4.2, 4.3, and 4.4. Table 4.1 shows the results of an omnibus MANOVA, using all study and demographic variables as dependent variables (excluding three categorical variables), and group (experimental and comparison) as the independent variable. From this omnibus test there appeared to be no difference between groups for any variable, however it is important to note that this test yielded a low amount of power making the results difficult to interpret. Table 4.2 shows univariate pair wise comparisons for mean age, number of times taught in school about healthy eating, number of times taught in school about physical activity, BMI-percentile and key obesity related behaviors. Again, from these comparisons it appeared no variables were significantly different between groups. Table 4.3 shows univariate comparisons for all social cognitive theory constructs including self-efficacy, self-control and expectations for all four obesity related behaviors. Again, from these comparisons it appeared no variables were significantly different between groups. Finally, Table 4.4 showed the difference between three categorical variables: race, gender, and weight classification. Weight classification categorized children based upon BMI-percentile with 0%-5% classified as ‘Underweight,’ 5%-85% classified as ‘Normal weight,’ 85%-95% classified as ‘Overweight’ and 95%-99.99% classified as ‘Obese’. From these comparisons it appeared these variables were not significantly different between groups. In summary, at the time of pretest no demographic or study variable appeared to be different between the experimental and knowledge based groups, therefore there does not appear to be a need to control for any variables in subsequent analyses.
Table 4.1 A comparison of demographic and study variables between children in the experimental (n=37) and comparison (n=34) interventions at pretest using an omnibus multivariate test.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Estimate</th>
<th>Value</th>
<th>F-statistic</th>
<th>degrees of freedom</th>
<th>p-value</th>
<th>power (1-β)</th>
<th>effect size (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Pillai’s Trace</td>
<td>0.321</td>
<td>0.722</td>
<td>21</td>
<td>0.781</td>
<td>0.395</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Wilks’ Lambda</td>
<td>0.679</td>
<td>0.722</td>
<td>21</td>
<td>0.781</td>
<td>0.395</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Hotelling’s Trace</td>
<td>0.474</td>
<td>0.722</td>
<td>21</td>
<td>0.781</td>
<td>0.395</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Roy’s Largest Root</td>
<td>0.474</td>
<td>0.722</td>
<td>21</td>
<td>0.781</td>
<td>0.395</td>
<td>--</td>
</tr>
</tbody>
</table>
Table 4.2 A comparison of demographic and study variables between children in the experimental (n=37) and comparison (n=34) interventions at pretest using separate univariate tests.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Possible Range</th>
<th>Observed Range</th>
<th>Experimental Group m(SD)</th>
<th>Comparison Group m(SD)</th>
<th>F</th>
<th>p-value (1-β)</th>
<th>power</th>
<th>effect size (η)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>8-11</td>
<td>8-11</td>
<td>8.86 (0.86)</td>
<td>9.12 (1.01)</td>
<td>1.305</td>
<td>0.257</td>
<td>0.203</td>
<td>--</td>
</tr>
<tr>
<td>Number of times taught in school about healthy eating</td>
<td>0-3</td>
<td>0-3</td>
<td>1.89 (1.28)</td>
<td>2.43 (0.97)</td>
<td>4.423</td>
<td>0.060</td>
<td>0.472</td>
<td>--</td>
</tr>
<tr>
<td>Number of times taught in school about physical activity</td>
<td>0-3</td>
<td>0-3</td>
<td>2.17 (1.08)</td>
<td>2.35 (1.05)</td>
<td>0.364</td>
<td>0.548</td>
<td>0.091</td>
<td>--</td>
</tr>
<tr>
<td>BMI-Percentile</td>
<td>0-99</td>
<td>2.1 – 99.2</td>
<td>60.15 (26.39)</td>
<td>55.52 (27.96)</td>
<td>0.508</td>
<td>0.479</td>
<td>0.108</td>
<td>--</td>
</tr>
<tr>
<td>Fruit and Vegetable Consumption (in servings)</td>
<td>0-12</td>
<td>0 – 12</td>
<td>3.41 (2.68)</td>
<td>3.35 (3.17)</td>
<td>0.006</td>
<td>0.940</td>
<td>0.051</td>
<td>--</td>
</tr>
<tr>
<td>Sugar Free Beverage Consumption (in glasses)</td>
<td>0-12</td>
<td>0 – 12</td>
<td>3.35 (2.58)</td>
<td>4.03 (2.76)</td>
<td>1.144</td>
<td>0.289</td>
<td>0.184</td>
<td>--</td>
</tr>
<tr>
<td>Sugar Sweetened Beverage Consumption (in glasses)</td>
<td>0-10</td>
<td>0 – 10</td>
<td>1.36 (2.00)</td>
<td>0.94 (1.17)</td>
<td>1.114</td>
<td>0.295</td>
<td>0.180</td>
<td>--</td>
</tr>
<tr>
<td>Moderate to Vigorous Physical Activity (in minutes)</td>
<td>0-240</td>
<td>0 – 240</td>
<td>69.73 (63.66)</td>
<td>65.29 (55.01)</td>
<td>0.098</td>
<td>0.755</td>
<td>0.061</td>
<td>--</td>
</tr>
<tr>
<td>Screen Time (in minutes)</td>
<td>0-240</td>
<td>0 – 240</td>
<td>113.33 (68.83)</td>
<td>83.82 (67.20)</td>
<td>4.013</td>
<td>0.074</td>
<td>0.432</td>
<td>--</td>
</tr>
</tbody>
</table>

Abbreviations: BMI (body mass index)
Table 4.3: A comparison of social cognitive theory construct scores between children in the experimental (n=37) and comparison (n=34) interventions at pretest using separate univariate tests.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Possible Range</th>
<th>Observed Range</th>
<th>Experimental Group m(SD)</th>
<th>Comparison Group m(SD)</th>
<th>F</th>
<th>p-value (1-β)</th>
<th>power</th>
<th>effect size (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Activity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>0 – 12</td>
<td>0 – 12</td>
<td>4.97 (3.56)</td>
<td>4.50 (3.57)</td>
<td>0.312</td>
<td>0.578</td>
<td>0.085</td>
<td>--</td>
</tr>
<tr>
<td>Self-Control</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>4.59 (2.34)</td>
<td>3.85 (2.41)</td>
<td>1.728</td>
<td>0.193</td>
<td>0.254</td>
<td>--</td>
</tr>
<tr>
<td>Expectations</td>
<td>0 – 64</td>
<td>0 – 60</td>
<td>27.33 (16.93)</td>
<td>27.42 (14.43)</td>
<td>0.001</td>
<td>0.981</td>
<td>0.050</td>
<td>--</td>
</tr>
<tr>
<td><strong>Screen Time</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>0 – 12</td>
<td>0 – 12</td>
<td>5.32 (3.57)</td>
<td>5.17 (4.10)</td>
<td>0.026</td>
<td>0.871</td>
<td>0.053</td>
<td>--</td>
</tr>
<tr>
<td>Self-Control</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>4.57 (2.62)</td>
<td>3.79 (2.76)</td>
<td>1.470</td>
<td>0.230</td>
<td>0.223</td>
<td>--</td>
</tr>
<tr>
<td>Expectations</td>
<td>0 – 64</td>
<td>0 – 64</td>
<td>25.29 (19.94)</td>
<td>30.18 (16.91)</td>
<td>1.186</td>
<td>0.280</td>
<td>0.189</td>
<td>--</td>
</tr>
<tr>
<td><strong>Sugar-Sweetened Beverage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>0 – 12</td>
<td>0 – 12</td>
<td>7.46 (3.51)</td>
<td>7.91 (3.97)</td>
<td>0.253</td>
<td>0.617</td>
<td>0.079</td>
<td>--</td>
</tr>
<tr>
<td>Self-Control</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>4.83 (2.42)</td>
<td>4.42 (2.77)</td>
<td>0.428</td>
<td>0.515</td>
<td>0.099</td>
<td>--</td>
</tr>
<tr>
<td>Expectations</td>
<td>0 – 64</td>
<td>0 – 64</td>
<td>28.65 (18.19)</td>
<td>31.53 (16.81)</td>
<td>0.461</td>
<td>0.500</td>
<td>0.103</td>
<td>--</td>
</tr>
<tr>
<td><strong>Fruit and Vegetable</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>0 – 12</td>
<td>0 – 12</td>
<td>5.89 (3.42)</td>
<td>5.42 (3.46)</td>
<td>0.323</td>
<td>0.572</td>
<td>0.087</td>
<td>--</td>
</tr>
<tr>
<td>Self-Control</td>
<td>0 – 8</td>
<td>0 – 8</td>
<td>4.70 (2.61)</td>
<td>4.00 (2.98)</td>
<td>1.106</td>
<td>0.297</td>
<td>0.179</td>
<td>--</td>
</tr>
<tr>
<td>Expectations</td>
<td>0 – 64</td>
<td>0 – 64</td>
<td>32.72 (21.37)</td>
<td>31.33 (18.39)</td>
<td>0.083</td>
<td>0.774</td>
<td>0.059</td>
<td>--</td>
</tr>
</tbody>
</table>
Table 4.4: A comparison of categorical study variables between children in the experimental (n=37) and comparison (n=34) interventions at pretest using separate chi-square tests.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental Group (n=37)</th>
<th>Comparison Group (n=34)</th>
<th>Chi-square statistic ($\chi^2$)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>16 (47%)</td>
<td>21 (57%)</td>
<td>0.668</td>
<td>0.414</td>
</tr>
<tr>
<td>Female</td>
<td>18 (53%)</td>
<td>16 (43%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>5 (14%)</td>
<td>2 (6%)</td>
<td>4.825</td>
<td>0.303</td>
</tr>
<tr>
<td>Caucasian</td>
<td>27 (73%)</td>
<td>28 (82%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>2 (5%)</td>
<td>4 (12%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1 (3%)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed Race</td>
<td>2 (5%)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight Status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>0</td>
<td>2 (6%)</td>
<td>4.238</td>
<td>0.237</td>
</tr>
<tr>
<td>Normal weight</td>
<td>26 (72%)</td>
<td>27 (79%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>8 (22%)</td>
<td>3 (9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>2 (6%)</td>
<td>2 (6%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evaluation of construct validity and internal consistency reliability for instrument measuring constructs of social cognitive theory

An evaluation of the construct validity for the subscales measuring constructs of social cognitive theory for the four key obesity related behaviors are presented in Tables 4.5, 4.6, 4.7 and 4.8. To evaluate construct validity, confirmatory factor analysis using the maximum likelihood estimation method was used and Eigenvalue’s > 1.0 were used to confirm the presence of factor solutions. These analyses were performed on the all pretest data. It should be noted that the sample of 71 used in this study could be viewed as relatively small for conducting confirmatory factor analysis. Although there is no exact method for determining how many subjects are adequate for such an analysis, Tabachnick and Fidell (2007) suggest that 300 cases are necessary whereas Grimm and Yarnold (1995) and Hatcher (1994) both have suggested having at least 5 cases per item is adequate. The social cognitive theory construct subscales for these analyses ranged from 2-items to 4-items, yielding a subjects-to-variable ratio range of 35.5:1 to 17.75:1. Therefore, while the earlier recommendation for sample size would have been less than needed, the sample size was adequate for the latter recommendation. Another issue is interpreting the factor loadings for each factor solution. Stevens (2009) suggests factor loadings should be interpreted based on sample size, indicating for this analysis that loadings (2 x 0.286) or 0.572 are needed. However, Tabachnik and Fidell (2007) propose a rule of thumb that factor loadings of 0.32 or higher can be used to identify variables that load on each factor. As shown on Tables 4.4, 4.5, 4.6 and 4.7, all subscales yielded a 1-factor solution, with all factor loadings above 0.32, except the outcome expectations subscale for moderate to vigorous physical activity which yielded two factors with Eigenvalues greater than 1 (1.54 and 1.01) and factor loadings less than 0.32. It is important to note that this instrument has been previously validated with school children, but not specifically with after-school children (Sharma, Wagner, & Wilkerson,
2005-2006). There may be underlying factors inherently different between children who attend and do not attend after-school programming, therefore further investigation into this matter is warranted.

For determining the internal consistency reliability for each subscale Cronbach’s alphas were calculated from the same sample of 71 children, and results are presented on Table 4.9. As mentioned earlier an acceptable level for Cronbach’s alphas for each scale was set a priori at 0.70 (Polit and Hungler, 1999). Most subscales met this criteria, however subscales that did not include: outcome expectations for moderate to vigorous physical activity (α=0.47); self-control for moderate to vigorous physical activity (α=0.58); self-control for screen time (α=0.53); and self-control for sugar sweetened beverages (α=0.65). It was unknown why the outcome expectations for moderate to vigorous physical activity subscale was low. As previously noted this scale was originally validated with school children, and there may be underlying factors inherently different between children who attend and do not attend after-school programming, therefore further investigation into this matter is warranted. In the other three cases where the alpha did not meet the criteria, it can be noted that the subscales were all for ‘self-control’, which were measured using a two-item scale. As noted by Pallant (2001), Cronbach’s alpha can be sensitive to scales with fewer items. Future researchers should consider lengthening this scale to at least three or four items, as with the self-efficacy and outcome expectations and expectancies scales.
Table 4.5 Summary of factor analysis for social cognitive theory constructs for moderate to vigorous physical activity (n=71)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Eigenvalue</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Expectations</strong></td>
<td>1.54/1.01*</td>
<td></td>
</tr>
<tr>
<td>If I exercise 60 min. daily at home I will . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…not get sick as often?</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>…have more confidence?</td>
<td>0.905</td>
<td></td>
</tr>
<tr>
<td>…have more fun?</td>
<td>0.323</td>
<td></td>
</tr>
<tr>
<td>…look better?</td>
<td>0.354</td>
<td></td>
</tr>
<tr>
<td><strong>Outcome Expectancies</strong></td>
<td>2.24</td>
<td></td>
</tr>
<tr>
<td>How important is it to you that you . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…not get sick as often?</td>
<td>0.632</td>
<td></td>
</tr>
<tr>
<td>…have more confidence?</td>
<td>0.778</td>
<td></td>
</tr>
<tr>
<td>…have more fun?</td>
<td>0.638</td>
<td></td>
</tr>
<tr>
<td>…look better?</td>
<td>0.505</td>
<td></td>
</tr>
<tr>
<td><strong>Self Efficacy</strong></td>
<td>2.34</td>
<td></td>
</tr>
<tr>
<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…exercise every day for 60 minutes at home?</td>
<td>0.771</td>
<td></td>
</tr>
<tr>
<td>…exercise for 60 minutes at home even if you are tired?</td>
<td>0.947</td>
<td></td>
</tr>
<tr>
<td>…exercise for 60 minutes at home even if you are busy?</td>
<td>0.742</td>
<td></td>
</tr>
<tr>
<td><strong>Self-Control</strong></td>
<td>1.36</td>
<td></td>
</tr>
<tr>
<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…set goals to exercise every day for 60 minutes at home?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…reward yourself with something you like for exercising?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Maximum likelihood estimation used for all subscales
* Indicates the possibility of two factor solutions for this construct.
Table 4.6 Summary of factor analysis for social cognitive theory constructs for screen time (n=71)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Eigenvalue</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Expectations</strong></td>
<td>2.09</td>
<td></td>
</tr>
<tr>
<td>If I spend less than 2 hours/day with screen time I will . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...have more friends?</td>
<td>0.455</td>
<td></td>
</tr>
<tr>
<td>...have more free time?</td>
<td>0.582</td>
<td></td>
</tr>
<tr>
<td>...have more fun?</td>
<td>0.709</td>
<td></td>
</tr>
<tr>
<td>...be more relaxed?</td>
<td>0.653</td>
<td></td>
</tr>
<tr>
<td><strong>Outcome Expectancies</strong></td>
<td>2.73</td>
<td></td>
</tr>
<tr>
<td>How important is it to you that you . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...have more friends?</td>
<td>0.775</td>
<td></td>
</tr>
<tr>
<td>...have more free time?</td>
<td>0.918</td>
<td></td>
</tr>
<tr>
<td>...have more fun?</td>
<td>0.726</td>
<td></td>
</tr>
<tr>
<td>...be more relaxed?</td>
<td>0.619</td>
<td></td>
</tr>
<tr>
<td><strong>Self Efficacy</strong></td>
<td>1.97</td>
<td></td>
</tr>
<tr>
<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...spend no more than 2 hours per day with screen time?</td>
<td>0.544</td>
<td></td>
</tr>
<tr>
<td>...reduce screen time even if your favorite shows are coming on?</td>
<td>0.999</td>
<td></td>
</tr>
<tr>
<td>...reduce screen time even if everyone else in the family is watching?</td>
<td>0.657</td>
<td></td>
</tr>
<tr>
<td><strong>Self-Control</strong></td>
<td>1.43</td>
<td></td>
</tr>
<tr>
<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...set goals to spend no more than 2 hours per day with screen time?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...reward yourself with something you like for reducing screen time?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Maximum likelihood estimation used for all subscales
Table 4.7 Summary of factor analysis for social cognitive theory constructs for sugar sweetened beverages (n=71)

<table>
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<tr>
<th>Variable</th>
<th>Eigenvalue</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Expectations</strong></td>
<td>2.10</td>
<td></td>
</tr>
<tr>
<td>If I drink water or sugar-free drinks instead of sugar-sweetened beverages I will . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...be more relaxed?</td>
<td></td>
<td>0.547</td>
</tr>
<tr>
<td>...feel better?</td>
<td></td>
<td>0.897</td>
</tr>
<tr>
<td>...have more energy?</td>
<td></td>
<td>0.530</td>
</tr>
<tr>
<td>...have better weight?</td>
<td></td>
<td>0.445</td>
</tr>
<tr>
<td><strong>Outcome Expectancies</strong></td>
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<td></td>
</tr>
<tr>
<td>How important is it to you that you . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...be more relaxed?</td>
<td></td>
<td>0.504</td>
</tr>
<tr>
<td>...feel better?</td>
<td></td>
<td>0.964</td>
</tr>
<tr>
<td>...have more energy?</td>
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<td>0.810</td>
</tr>
<tr>
<td>...have better weight?</td>
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<td>0.512</td>
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<td><strong>Self Efficacy</strong></td>
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<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...drink more water or sugar-free drinks?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.656</td>
</tr>
<tr>
<td>...drink water or sugar-free drinks everyday instead of sugar-sweetened drinks?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.847</td>
</tr>
<tr>
<td>...drink more water or sugar-free drinks even if you do not feel thirsty?</td>
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<td></td>
<td></td>
<td>0.632</td>
</tr>
<tr>
<td><strong>Self Control</strong></td>
<td>1.49</td>
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</tr>
<tr>
<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...set goals to replace sugar-sweetened drinks with water every day?</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...reward yourself with something you like for drinking water or sugar-free drinks instead of sugar-sweetened drinks?</td>
<td></td>
<td></td>
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<td>Note: Maximum likelihood estimation used for all subscales</td>
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Table 4.8 Summary of factor analysis for social cognitive theory constructs for fruit and vegetable (n=71)

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</thead>
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<td><strong>Outcome Expectations</strong></td>
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<tr>
<td>If I eat 5 or more servings of fruits and vegetables I will . . .</td>
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<td></td>
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<tr>
<td>... have more energy?</td>
<td>0.628</td>
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</tr>
<tr>
<td>...feel better?</td>
<td>0.892</td>
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<tr>
<td>...not get sick as often?</td>
<td>0.460</td>
<td></td>
</tr>
<tr>
<td>...have better weight?</td>
<td>0.603</td>
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<td><strong>Outcome Expectancies</strong></td>
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<td>How important is it to you that you . . .</td>
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<td></td>
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<tr>
<td>... have more energy?</td>
<td>0.907</td>
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<tr>
<td>...feel better?</td>
<td>0.841</td>
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</tr>
<tr>
<td>...not get sick as often?</td>
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<td>...have better weight?</td>
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<tr>
<td><strong>Self-Efficacy</strong></td>
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<tr>
<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...eat 5 or more servings of fruits and vegetables everyday?</td>
<td>0.724</td>
<td></td>
</tr>
<tr>
<td>...eat 5 or more servings of fruits and vegetables everyday even if you do not like them?</td>
<td>0.603</td>
<td></td>
</tr>
<tr>
<td>...eat 5 or more servings of fruits and vegetables everyday even if others in your family do not like them?</td>
<td>0.846</td>
<td></td>
</tr>
<tr>
<td><strong>Self Control</strong></td>
<td>1.67</td>
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</tr>
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<td>How sure are you that you can . . .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...set goals to eat 5 or more servings of fruits and vegetables?</td>
<td></td>
<td></td>
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<tr>
<td>...reward yourself with something you like for eating 5 or more servings of fruits and vegetables everyday?</td>
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Note: Maximum likelihood estimation used for all subscales
Table 4.9: Summary of Cronbach’s alpha for all social cognitive theory construct scales (n=71)

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<th>Social Cognitive Theory Construct with Behavior</th>
<th>Cronbach’s Alpha</th>
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<td><strong>Engaging in at least 60 minutes of physical activity per day</strong></td>
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<td>Outcome Expectations</td>
<td>0.47</td>
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<td>Outcome Expectancies</td>
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<td>Self-Efficacy</td>
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<td>Self-Control</td>
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<tr>
<td><strong>Limiting screen time to no more than 2 hours per day</strong></td>
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</tr>
<tr>
<td>Outcome Expectations</td>
<td>0.69</td>
</tr>
<tr>
<td>Outcome Expectancies</td>
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<tr>
<td>Self-Efficacy</td>
<td>0.73</td>
</tr>
<tr>
<td>Self-Control</td>
<td>0.58</td>
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<tr>
<td><strong>Consuming sugar free drinks instead of sugar sweetened drinks</strong></td>
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</tr>
<tr>
<td>Outcome Expectations</td>
<td>0.69</td>
</tr>
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<td>Self-Control</td>
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<td><strong>Consuming 5 servings of fruits and vegetables per day</strong></td>
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<td>Self-Efficacy</td>
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Results of assessment of degree of program fidelity

Hypothesis #19 stated ‘the degree of program fidelity will be different between the theory-based intervention and knowledge based intervention’. To evaluate program fidelity process evaluation forms consisting of structured tally sheets were created and validated for each program. During the implementation of each lesson an after school worker observed the program and recorded the amount of tasks completed for that lesson on the corresponding tally sheet. Concurrently, after each lesson the individual implementing the program also recorded the amount of tasks completed on a separate tally sheet. The results of the percentage of tally check marks for each lesson, at each site are presented in Table 4.10 for the experimental group and 4.11 for the comparison group.

It is evident from these two Tables that the program was implemented near perfect at each site, for each lesson. There were four instances however when the program was not recorded as being perfectly implemented by both evaluators. In the experimental group, at one site the program implementer was not able to fully implement the program on two occasions. The program was implemented close to 90%, indicating only three or four tasks were missed. In the control group at one site the after-school worker did not record the implementation of tasks in two lessons, however the individual implementing the program did record the completion of these tasks. It is likely that something came up during the program that distracted the after-school worker and she was unwilling to record the completion of certain tasks. It is unlikely these tasks could impact the focus of the lesson therefore there does not appear to be a need to adjust for this in subsequent analyses.

Upon further investigation, repeated measures ANOVA’s were conducted to compare groups with less than perfect process evaluations with other groups in the same treatment
condition to confirm there to be no difference between groups. For the experimental condition, site 6 was less than perfect for lessons 3 and 4; therefore this site was compared with experimental sites 1 through 5 for the following variables; fruit and vegetable consumption, self-efficacy for fruit and vegetable consumption, self-control for fruit and vegetable consumption, expectations for fruit and vegetable consumption, moderate to vigorous physical activity, self-efficacy for moderate to vigorous physical activity, self-control for moderate to vigorous physical activity, and expectations for moderate to vigorous physical activity. In no case was the less than perfect site significantly different from the perfectly implemented sites, suggesting that this did not appear to have a strong effect thus this site will remain for subsequent analyses. However, it is also important to note that the sample sizes in each group was rather low for these analyses, which likely resulted in a low amount of power for each test.

Upon further investigation for the comparison group, site 6 was less than perfect for lessons 1 and 2, therefore this site was compared with comparison sites 1 through 5 for the following variables; screen time, self-efficacy for screen time, self-control for screen time, expectations for screen time, the consumption of sugar sweetened beverages, the consumption of water and sugar free drinks, self-efficacy for the consumption of water and sugar free drinks, self-control for the consumption of water and sugar free drinks, and expectations for the consumption of water and sugar free drinks. In no case was the less than perfect site significantly different from the perfectly implemented sites, suggesting that this did not appear to have a strong effect, thus this site will remain for subsequent analyses. However, it is also important to note that the sample sizes in each group was rather low for these analyses, which likely resulted in a low amount of power for each test.
Table 4.10 Summary of assessment of the degree of program fidelity for after school programs in the experimental (theory-based) intervention

<table>
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<th>Group</th>
<th>ASP</th>
<th>Session #</th>
<th>Max Possible Checkmarks</th>
<th>Checked marks by rater #1</th>
<th>Percentage of checked marks by rater #1</th>
<th>Checked marks by implementer</th>
<th>Percentage of checked marks by implementer</th>
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</table>

Abbreviations: ASP (after-school program)
Table 4.11 Summary of assessment of the degree of program fidelity for after school programs in the comparison (knowledge-based) intervention

<table>
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<th>ASP</th>
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<th>Max Possible Checkmarks</th>
<th>Checked marks by rater #1</th>
<th>Percentage of checked marks by rater #1</th>
<th>Checked marks by implementer</th>
<th>Percentage of checked marks by implementer</th>
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</table>

Abbreviations: ASP (after-school program)
Attendance and the amount of time the implementer used to implement each lesson was also tracked and is presented on Tables 4.12 and 4.13. The record for attendance is presented in Table 4.12. It is important to note that this Table represents a record of children who attended the lesson upon the initial day it was implemented. Informal make-up sessions were completed after these lessons to assure all children received the program in its entirety therefore all children were included in the final analyses. It is evident from this Table that a majority of children in both groups attended the entirety of the program on the initial day, and there did not appear to be a difference between groups in terms of the amount of lessons attended. The amount of time taken to implement each lesson and a comparison between group (experimental and control), session (sessions 1 through 4) and the interaction between the two are presented on Tables 4.13 and 4.14. It is evident from these Tables that the actual time of completion was very close to the planned 30 minutes for each lesson, and there was no apparent difference between groups and sessions. From Tables 4.10, 4.11, 4.12, 4.13 and 4.14 it appeared the implementation of each lesson was similar and consistent between both intervention groups.
Table 4.12 Attendance of children for both intervention groups

<table>
<thead>
<tr>
<th>Number of lessons attended</th>
<th>Experimental Group n (%)</th>
<th>Comparison Group n (%)</th>
<th>Overall n (%)</th>
<th>Chi-Square $\chi^2$ (df)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>27 (73.0%)</td>
<td>23 (67.7%)</td>
<td>50 (70.4%)</td>
<td>0.305, 2</td>
<td>0.859</td>
</tr>
<tr>
<td>3</td>
<td>6 (16.2%)</td>
<td>6 (17.6%)</td>
<td>12 (16.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4 (10.8%)</td>
<td>5 (14.7%)</td>
<td>9 (12.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37 (100%)</td>
<td>34 (100%)</td>
<td>71 (100%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.13 Summary of assessment of the degree of program fidelity for each the session during both the experimental (theory-based) and comparison (knowledge-based) intervention groups.

<table>
<thead>
<tr>
<th>Variable Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-B)</th>
<th>Effect size (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>7</td>
<td>13.313</td>
<td>1.902</td>
<td>0.961</td>
<td>0.472</td>
<td>0.358</td>
<td>--</td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>1.021</td>
<td>1.021</td>
<td>0.516</td>
<td>0.477</td>
<td>0.108</td>
<td>--</td>
</tr>
<tr>
<td>Session</td>
<td>3</td>
<td>5.062</td>
<td>1.687</td>
<td>0.853</td>
<td>0.473</td>
<td>0.218</td>
<td>--</td>
</tr>
<tr>
<td>Group * Session</td>
<td>3</td>
<td>7.229</td>
<td>2.410</td>
<td>1.218</td>
<td>0.316</td>
<td>0.301</td>
<td>--</td>
</tr>
<tr>
<td>Error</td>
<td>40</td>
<td>79.167</td>
<td>1.979</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Table 4.14 A summary of total time taken for implementing each lesson for both interventions

<table>
<thead>
<tr>
<th>Group</th>
<th>ASP</th>
<th>Session #</th>
<th>Time Taken (in minutes)</th>
<th>Session mean (Std. dev)</th>
<th>Group mean (Std. dev)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental</strong></td>
<td>1</td>
<td>1</td>
<td>31</td>
<td></td>
<td>30.92 (1.47)</td>
</tr>
<tr>
<td>(knowledge based)</td>
<td></td>
<td>2</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>32</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>32</td>
<td>31.0 (1.41)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
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<td>31</td>
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<td>32</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>4</td>
<td>30</td>
<td>31.25 (0.95)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>30</td>
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<td>33</td>
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<td>29</td>
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<tr>
<td></td>
<td></td>
<td>4</td>
<td>33</td>
<td>31.25 (2.06)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>4</td>
<td>32</td>
<td>30.75 (0.96)</td>
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</tr>
<tr>
<td></td>
<td>5</td>
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<td>30</td>
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<td></td>
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<td>28</td>
<td></td>
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<td></td>
<td></td>
<td>4</td>
<td>29</td>
<td>30.0 (1.83)</td>
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<tr>
<td><strong>Comparison</strong></td>
<td>1</td>
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<td>28</td>
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<td>30.63 (1.35)</td>
</tr>
<tr>
<td>(knowledge based)</td>
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<tr>
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<td>30.25 (2.06)</td>
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<td>4</td>
<td>30</td>
<td>30.25 (0.96)</td>
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</tr>
</tbody>
</table>
Assumption testing on residuals of BMI-percentile, key obesity related behaviors and SCT constructs

The assumptions tested for this study on the model residuals of all study variables were independence of observations, normality, homogeneity of variance, and sphericity. Observations were independent between children. Normality was tested using the Kolmogorov-Smirnov (K-S) test. As presented on Table 4.15 it was found that this assumption appears to have been violated a number of times, however Stevens (2009) notes that skewness and kurtosis have only a slight impact on significance or power of statistical tests, and that variances are robust against slight deviations from normality. Kirk (1995), also states (page 99) “…the F-statistic is quite robust with respect to violation of the normality assumption.” Therefore, upon visually inspecting the histograms and Q-Q plots when this assumption was violated, it was deemed that the variable sugar sweetened beverage consumption at the time of pretest, posttest and follow-up test deviated more than slight from normality. It was further attempted to transform these variables based upon their departures from normality as shown in Figure 4.2. After data were transformed they were inspected again for normality using the K-S test, however in no case did the transformation remedy this problem. Kirk also states that transforming such data to remedy the problem of normality is ‘rarely advantageous’. Therefore it was decided to keep all study variables untransformed in subsequent analyses. This process is depicted in Figure 4.2.

Homogeneity of variance (or homoscedasticity) was tested using the Levine Test of Equality of Error Variances. As presented on Table 4.16 it was found that this assumption appears to have been violated in three instances: for the engagement of moderate to vigorous physical activity at the time of posttest, the consumption of water and sugar free drinks at the time of the follow-up test and the mean self-efficacy score for screen time at the time of posttest. Tabachnick and Fidell (2007) suggest that violations of this assumption can be remedied in two
ways: transformation of the variable or by using a more stringent alpha for untransformed data (page 86). Tabachnick and Fidell (2007) also note that the interpretation of transformed data can be limited, therefore in the noted cases where this assumption has been violated an alpha of 0.01 will be used.

Finally, the assumption of sphericity was tested using Mauchly’s sphericity test. As presented on Table 4.17 it was found that this assumption appears to have been violated in four cases: the mean self-efficacy scores for drinking water and sugar-free drinks and having less screen time, and the expectations scores for the engagement in moderate to vigorous physical activity and having less screen time. Tabachnick and Fidell (2007) suggest that violations of this assumption can be remedied by using the Greenhouse & Geisser estimate, therefore this estimate will be used throughout the subsequent analyses.
Figure 4.2 Flow chart for variables with deviations and slight deviations from normality

Variables with apparent deviations from normality n=30

Variables with greater than slight deviations from normality after visual inspection of histograms and Q-Q plots n=3

Variables with slight deviations of normality after visual inspection of histograms and Q-Q plots n=27

Sugar Sweetened Beverage Consumption (pre-test) - Positively skewed
At attempted transformation (natural log) - Result (KS-test: 0.271 (p<0.001))
At attempted transformation (log10) - Result (KS-test: 0.291 (p<0.001))
Final Decision – Use untransformed data

Sugar Sweetened Beverage Consumption (post-test) - Positively skewed
At attempted transformation (natural log) - Result (KS-test: 0.336 (p<0.001))
At attempted transformation (log10) - Result (KS-test: 0.271 (p<0.001))
Final Decision – Use untransformed data

Sugar Sweetened Beverage Consumption (follow-up test) - Positively skewed
At attempted transformation (natural log) - Result (KS-test: 0.291 (p<0.001))
At attempted transformation (log10) - Result (KS-test: 0.336 (p<0.001))
Final Decision – Use untransformed data
Table 4.15 A summary of evaluating the assumption of normality using the Kolmogrov-Smirnov (K-S) test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test</th>
<th>Pretest (p-value) Statistic</th>
<th>Posttest (p-value) Statistic</th>
<th>Follow-up test (p-value) Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI-Percentile</td>
<td>Kolmogorov-Smirnov</td>
<td>0.106 (0.062)</td>
<td>N/A</td>
<td>0.104 (0.073)</td>
</tr>
<tr>
<td>Screen time</td>
<td>Kolmogorov-Smirnov</td>
<td>0.192 (&lt;0.001)*</td>
<td>0.134 (0.003)*</td>
<td>0.131 (0.004)*</td>
</tr>
<tr>
<td>MVPA</td>
<td>Kolmogorov-Smirnov</td>
<td>0.169 (&lt;0.001)*</td>
<td>0.111 (0.030)*</td>
<td>0.171 (&lt;0.001)*</td>
</tr>
<tr>
<td>Water &amp; Sugar-free drinks</td>
<td>Kolmogorov-Smirnov</td>
<td>0.158 (&lt;0.001)*</td>
<td>0.123 (0.009)*</td>
<td>0.127 (0.006)*</td>
</tr>
<tr>
<td>Sugar Sweetened Beverages</td>
<td>Kolmogorov-Smirnov</td>
<td>0.268 (&lt;0.001)*</td>
<td>0.291 (&lt;0.001)*</td>
<td>0.253 (&lt;0.001)*</td>
</tr>
<tr>
<td>Fruit &amp; Vegetables</td>
<td>Kolmogorov-Smirnov</td>
<td>0.154 (&lt;0.001)*</td>
<td>0.143 (0.001)*</td>
<td>0.108 (0.039)*</td>
</tr>
<tr>
<td>SE for Fruit &amp; Vegetables</td>
<td>Kolmogorov-Smirnov</td>
<td>0.076 (0.200)</td>
<td>0.106 (0.051)</td>
<td>0.107 (0.045)*</td>
</tr>
<tr>
<td>SC for Fruit &amp; Vegetables</td>
<td>Kolmogorov-Smirnov</td>
<td>0.118 (0.018)*</td>
<td>0.105 (0.052)</td>
<td>0.114 (0.025)*</td>
</tr>
<tr>
<td>EX for Fruit &amp; Vegetables</td>
<td>Kolmogorov-Smirnov</td>
<td>0.082 (0.200)</td>
<td>0.117 (0.019)*</td>
<td>0.103 (0.067)</td>
</tr>
<tr>
<td>SE for Water &amp; Sugar-free drinks</td>
<td>Kolmogorov-Smirnov</td>
<td>0.141 (0.002)*</td>
<td>0.111 (0.033)*</td>
<td>0.175 (&lt;0.001)*</td>
</tr>
<tr>
<td>SC for Water &amp; Sugar-free drinks</td>
<td>Kolmogorov-Smirnov</td>
<td>0.110 (0.042)*</td>
<td>0.117 (0.023)*</td>
<td>0.127 (0.008)*</td>
</tr>
<tr>
<td>EX for Water &amp; Sugar-free drinks</td>
<td>Kolmogorov-Smirnov</td>
<td>0.068 (0.200)</td>
<td>0.084 (0.200)</td>
<td>0.094 (0.200)</td>
</tr>
<tr>
<td>SE for MVPA</td>
<td>Kolmogorov-Smirnov</td>
<td>0.155 (0.020)</td>
<td>0.082 (0.200)</td>
<td>0.091 (0.200)</td>
</tr>
<tr>
<td>SC for MVPA</td>
<td>Kolmogorov-Smirnov</td>
<td>0.090 (0.200)</td>
<td>0.151 (&lt;0.001)*</td>
<td>0.110 (0.032)*</td>
</tr>
<tr>
<td>EX for MVPA</td>
<td>Kolmogorov-Smirnov</td>
<td>0.098 (0.100)</td>
<td>0.085 (0.200)</td>
<td>0.078 (0.200)</td>
</tr>
<tr>
<td>SE for Screen Time</td>
<td>Kolmogorov-Smirnov</td>
<td>0.117 (0.017)*</td>
<td>0.127 (0.006)*</td>
<td>0.084 (0.200)</td>
</tr>
<tr>
<td>SC for Screen Time</td>
<td>Kolmogorov-Smirnov</td>
<td>0.082 (0.200)</td>
<td>0.095 (0.194)</td>
<td>0.124 (0.010)*</td>
</tr>
<tr>
<td>EX for Screen Time</td>
<td>Kolmogorov-Smirnov</td>
<td>0.104 (0.072)</td>
<td>0.101 (0.084)</td>
<td>0.096 (0.200)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI (body mass index); MVPA (moderate to vigorous physical activity); SE (self-efficacy); SC (self-control); EX (expectations)
Table 4.16 A summary of evaluating the assumption of homoscedasticity using the Levine test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test</th>
<th>Pretest (p-value) Statistic</th>
<th>Posttest (p-value) Statistic</th>
<th>Follow-up test (p-value) Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI-Percentile</td>
<td>Levine Test</td>
<td>0.53 (0.818)</td>
<td>N/A</td>
<td>0.26 (0.871)</td>
</tr>
<tr>
<td>Screen time</td>
<td>Levine Test</td>
<td>0.440 (0.509)</td>
<td>0.434 (0.512)</td>
<td>1.363 (0.247)</td>
</tr>
<tr>
<td>MVPA</td>
<td>Levine Test</td>
<td>0.304 (0.583)</td>
<td>6.756 (0.011)*</td>
<td>1.087 (0.301)</td>
</tr>
<tr>
<td>Water &amp; Sugar-free drinks</td>
<td>Levine Test</td>
<td>0.555 (0.459)</td>
<td>0.036 (0.850)</td>
<td>8.508 (0.005)*</td>
</tr>
<tr>
<td>Sugar Sweetened Beverages</td>
<td>Levine Test</td>
<td>3.426 (0.069)</td>
<td>1.457 (0.232)</td>
<td>1.744 (0.191)</td>
</tr>
<tr>
<td>Fruit &amp; Vegetables</td>
<td>Levine Test</td>
<td>1.069 (0.305)</td>
<td>0.624 (0.432)</td>
<td>0.149 (0.701)</td>
</tr>
<tr>
<td>SE for Fruit &amp; Vegetables</td>
<td>Levine Test</td>
<td>0.014 (0.906)</td>
<td>0.515 (0.476)</td>
<td>0.837 (0.363)</td>
</tr>
<tr>
<td>SC for Fruit &amp; Vegetables</td>
<td>Levine Test</td>
<td>1.234 (0.271)</td>
<td>0.308 (0.581)</td>
<td>0.016 (0.899)</td>
</tr>
<tr>
<td>EX for Fruit &amp; Vegetables</td>
<td>Levine Test</td>
<td>2.741 (0.102)</td>
<td>0.027 (0.869)</td>
<td>0.091 (0.763)</td>
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<tr>
<td>SE for Water &amp; Sugar-free drinks</td>
<td>Levine Test</td>
<td>0.580 (0.449)</td>
<td>1.504 (0.224)</td>
<td>2.220 (0.141)</td>
</tr>
<tr>
<td>SC for Water &amp; Sugar-free drinks</td>
<td>Levine Test</td>
<td>1.757 (0.190)</td>
<td>0.801 (0.371)</td>
<td>0.946 (0.334)</td>
</tr>
<tr>
<td>EX for Water &amp; Sugar-free drinks</td>
<td>Levine Test</td>
<td>0.399 (0.530)</td>
<td>0.042 (0.837)</td>
<td>0.278 (0.600)</td>
</tr>
<tr>
<td>SE for MVPA</td>
<td>Levine Test</td>
<td>0.264 (0.609)</td>
<td>0.909 (0.344)</td>
<td>1.863 (0.177)</td>
</tr>
<tr>
<td>SC for MVPA</td>
<td>Levine Test</td>
<td>0.015 (0.902)</td>
<td>0.631 (0.430)</td>
<td>0.337 (0.564)</td>
</tr>
<tr>
<td>EX for MVPA</td>
<td>Levine Test</td>
<td>1.557 (0.216)</td>
<td>0.231 (0.633)</td>
<td>0.409 (0.525)</td>
</tr>
<tr>
<td>SE for Screen Time</td>
<td>Levine Test</td>
<td>1.324 (0.254)</td>
<td>10.703 (0.002)*</td>
<td>1.540 (0.219)</td>
</tr>
<tr>
<td>SC for Screen Time</td>
<td>Levine Test</td>
<td>0.057 (0.813)</td>
<td>0.991 (0.323)</td>
<td>0.013 (0.908)</td>
</tr>
<tr>
<td>EX for Screen Time</td>
<td>Levine Test</td>
<td>1.852 (0.178)</td>
<td>0.008 (0.928)</td>
<td>0.187 (0.667)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI (body mass index); MVPA (moderate to vigorous physical activity); SE (self-efficacy); SC (self-control); EX (expectations)
Table 4.17 A summary of evaluating the assumption of sphericity using the Mauchly’s sphericity test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Test</th>
<th>Mauchly’s W</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Screen time</td>
<td>Mauchly’s sphericity test</td>
<td>0.946</td>
<td>0.157</td>
</tr>
<tr>
<td>MVPA</td>
<td>Mauchly’s sphericity test</td>
<td>0.958</td>
<td>0.233</td>
</tr>
<tr>
<td>Water &amp; Sugar-free drinks</td>
<td>Mauchly’s sphericity test</td>
<td>0.989</td>
<td>0.682</td>
</tr>
<tr>
<td>Sugar Sweetened Beverages</td>
<td>Mauchly’s sphericity test</td>
<td>0.985</td>
<td>0.602</td>
</tr>
<tr>
<td>Fruit &amp; Vegetables</td>
<td>Mauchly’s sphericity test</td>
<td>0.941</td>
<td>0.129</td>
</tr>
<tr>
<td>SE for Fruit &amp; Vegetables</td>
<td>Mauchly’s sphericity test</td>
<td>0.940</td>
<td>0.127</td>
</tr>
<tr>
<td>SC for Fruit &amp; Vegetables</td>
<td>Mauchly’s sphericity test</td>
<td>0.920</td>
<td>0.062</td>
</tr>
<tr>
<td>EX for Fruit &amp; Vegetables</td>
<td>Mauchly’s sphericity test</td>
<td>0.984</td>
<td>0.579</td>
</tr>
<tr>
<td>SE for Water &amp; Sugar-free drinks</td>
<td>Mauchly’s sphericity test</td>
<td>0.858</td>
<td>0.006*</td>
</tr>
<tr>
<td>SC for Water &amp; Sugar-free drinks</td>
<td>Mauchly’s sphericity test</td>
<td>0.998</td>
<td>0.936</td>
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<tr>
<td>EX for Water &amp; Sugar-free drinks</td>
<td>Mauchly’s sphericity test</td>
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<td>0.305</td>
</tr>
<tr>
<td>EX for MVPA</td>
<td>Mauchly’s sphericity test</td>
<td>0.882</td>
<td>0.016*</td>
</tr>
<tr>
<td>SE for Screen Time</td>
<td>Mauchly’s sphericity test</td>
<td>0.851</td>
<td>0.004*</td>
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<td>SC for Screen Time</td>
<td>Mauchly’s sphericity test</td>
<td>0.948</td>
<td>0.167</td>
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<td>EX for Screen Time</td>
<td>Mauchly’s sphericity test</td>
<td>0.908</td>
<td>0.045*</td>
</tr>
</tbody>
</table>

Abbreviations: BMI (body mass index); MVPA (moderate to vigorous physical activity); SE (self-efficacy); SC (self-control); EX (expectations)
Results for changes on weight status, key obesity related behaviors, and social cognitive theory construct subscales from pretest, to posttest, to follow-up

**BMI-Percentile.**

Hypothesis #1 stated ‘children receiving a theory based intervention will decrease their BMI-percentile more than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) of BMI-percentile by group (theory-based vs knowledge-based) and time is provided in Table 4.18. For the theory-based group the mean BMI-percentile decreased from 60.15 units at pretest to 59.23 units at the three-month follow-up and for the knowledge-based group it increased from 55.52 units at pretest to 57.26 units at the three month follow-up. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.995; time x group p=0.083); un-nested (group p=0.610; time x group p=0.135)], indicating there was no differences in the change in BMI-percentile between groups.
Table 4.18 Summary of the final model of analysis of variance (ANOVA) for BMI-percentile by group (theory-based vs. knowledge-based) and time (pretest vs. follow-up test)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nested Design</strong></td>
<td>BMI-Percentile</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
<td></td>
<td>167.193</td>
<td>167.193</td>
<td>0.006&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.812</td>
<td>0.56</td>
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</tr>
<tr>
<td>Sites/Group</td>
<td>10</td>
<td></td>
<td>27962.57</td>
<td>2796.26</td>
<td>2.13&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.037</td>
<td>0.90</td>
<td>--</td>
</tr>
<tr>
<td>Within Sites</td>
<td>Children/Sites/Group</td>
<td>58</td>
<td>76268.06</td>
<td>1314.967</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
<td>Time</td>
<td>1</td>
<td>6.343</td>
<td>6.343</td>
<td>0.35&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.567</td>
<td>0.050</td>
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<tr>
<td></td>
<td>Time*Group</td>
<td>1</td>
<td>56.945</td>
<td>56.945</td>
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<td>0.106</td>
<td>0.114</td>
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<tr>
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<td>Sites*Time/Group</td>
<td>10</td>
<td>180.717</td>
<td>18.0717</td>
<td>0.63&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.782</td>
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<tr>
<td></td>
<td>Sub. Time/Site/Group</td>
<td>58</td>
<td>1664.64</td>
<td>28.701</td>
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<tr>
<td><strong>Un-nested Design</strong></td>
<td>BMI-Percentile</td>
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</tr>
<tr>
<td></td>
<td>Between Subjects</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
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<td>379.972</td>
<td>379.972</td>
<td>0.263</td>
<td>0.610</td>
<td>0.080</td>
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<tr>
<td>Error</td>
<td>68</td>
<td></td>
<td>98132.822</td>
<td>1443.130</td>
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<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
<td>Time</td>
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<td>5.743</td>
<td>5.743</td>
<td>0.211</td>
<td>0.647</td>
<td>0.074</td>
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<td>Time*Group</td>
<td>1</td>
<td>62.141</td>
<td>62.141</td>
<td>2.284</td>
<td>0.135</td>
<td>0.319</td>
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<td>Error</td>
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<td>1850.196</td>
<td>27.209</td>
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</tr>
</tbody>
</table>

Abbreviations: BMI (body mass index)
a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Screen Time

Hypothesis #2 stated ‘children receiving a theory based intervention will engage in less minutes of screen time per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) of screen time by group (theory-based vs knowledge-based) and time is provided in Table 4.19. For the theory-based group the mean screen time decreased from 113.33 minutes at pretest to 79.17 minutes at posttest, and then increased at the follow-up test to 84.17 minutes. For the knowledge based group screen time decreased from 83.82 minutes at pretest to 70.59 minutes at posttest and then increased at the follow-up test to 77.64. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.342; time x group p=0.102); un-nested (group p=0.217; time x group p=0.297)]. The main effect of time was significant in the un-nested design (p=0.013) however, which suggests improvement in screen time overtime for both groups. This difference also produced a small to medium effect size ($f=0.159$). A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) presented on Table 4.20 indicates screen time significantly decreased from pretest to posttest.
Table 4.19 Summary of the final model of analysis of variance (ANOVA) for screen time by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nested Design</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen Time</td>
<td>Between Subjects Group</td>
<td>1</td>
<td>14363.91</td>
<td>14363.91</td>
<td>0.97</td>
<td>0.349</td>
<td>0.186</td>
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<td>148748.03</td>
<td>14874.80</td>
<td>2.36</td>
<td>0.020</td>
<td>0.467</td>
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<td>Within Sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Children/Sites/Group</td>
<td>59</td>
<td>371516.31</td>
<td>6296.887</td>
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<td>--</td>
<td>--</td>
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<tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within Subjects Time</td>
<td>2</td>
<td>14821.74</td>
<td>7410.87</td>
<td>2.39</td>
<td>0.1173</td>
<td>0.147</td>
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<tr>
<td></td>
<td>Time*Group</td>
<td>2</td>
<td>2643.412</td>
<td>1321.706</td>
<td>0.43c</td>
<td>0.659</td>
<td>0.061</td>
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</tr>
<tr>
<td></td>
<td>Sites*Time/Group</td>
<td>20</td>
<td>62007.56</td>
<td>3100.278</td>
<td>1.20d</td>
<td>0.263</td>
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<td>Sub. Time/Site/Group</td>
<td>117</td>
<td>301057.957</td>
<td>2573.145</td>
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<tr>
<td><strong>Un-nested Design</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Screen Time</td>
<td>Between Subjects Group</td>
<td>1</td>
<td>11598.039</td>
<td>11598.039</td>
<td>1.555</td>
<td>0.217</td>
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<td>Error</td>
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<td>507251.961</td>
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<td>--</td>
<td>--</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within Subjects Time</td>
<td>1.898</td>
<td>21224.734</td>
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<td>4.580</td>
<td>0.013*</td>
<td>0.753</td>
<td>0.159</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>1.898</td>
<td>5659.020</td>
<td>2981.412</td>
<td>1.221</td>
<td>0.297</td>
<td>0.256</td>
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<td>Error</td>
<td>129.07</td>
<td>315100.980</td>
<td>4633.838</td>
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<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Table 4.20 A summary of pair wise comparisons for screen time from pretest to posttest to follow-up test using the Bonferroni adjustment

<table>
<thead>
<tr>
<th>Screen Time (i)</th>
<th>Screen Time (j)</th>
<th>Mean Difference (i-j)</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Posttest</td>
<td>23.701</td>
<td>8.554</td>
<td>0.022*</td>
</tr>
<tr>
<td></td>
<td>Follow-up</td>
<td>17.672</td>
<td>8.640</td>
<td>0.134</td>
</tr>
<tr>
<td>Posttest</td>
<td>Follow-up</td>
<td>-6.029</td>
<td>7.136</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Figure 4.3 Overall time effect for screen time
Moderate to Vigorous Physical Activity

Hypothesis #3 stated ‘children receiving a theory based intervention will engage in more minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) of MVPA by group (theory-based vs knowledge-based) and time is provided in Table 4.21. For the theory-based group the MVPA increased from 69.73 minutes at pretest to 88.38 minutes at posttest, and then increased at the follow-up test to 106.22 minutes. For the knowledge based group MVPA increased from 65.29 minutes at pretest to 69.71 minutes at posttest and then increased at the follow-up test to 100.59 minutes. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.526; time x group p=0.705); un-nested (group p=0.416; time x group p=0.614)]. The main effect of time was significant in both the nested (p=0.004) and un-nested (p<0.001) designs however, which suggests improvement in MVPA overtime for both groups. These differences also produced medium effect size (nested ($f=0.216$); un-nested ($f=0.255$)). A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) presented on Table 4.22, indicates MVPA significantly improved from pretest to follow-up and posttest to follow up.
Table 4.21 Summary of the final model of analysis of variance (ANOVA) for moderate to vigorous physical activity by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

<table>
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<th>Source</th>
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<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (f)</th>
</tr>
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<td>MVPA</td>
<td>Between Subjects</td>
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</tr>
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<td>4877.04</td>
<td>0.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.526</td>
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<tr>
<td>Sites/Group</td>
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<td>0.324</td>
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<tr>
<td><strong>Within Sites</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Children/Sites/Group</td>
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<td>388548.052</td>
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<tr>
<td><strong>Within Subjects</strong></td>
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<td></td>
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<td>Time</td>
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<td>7.63&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.004*</td>
<td>0.560</td>
<td>0.216</td>
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<tr>
<td>MVPA</td>
<td>Between Subjects</td>
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</tr>
<tr>
<td>Group</td>
<td>1</td>
<td>4877.040</td>
<td>4877.040</td>
<td>0.671</td>
<td>0.416</td>
<td>0.127</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>66</td>
<td>501582.114</td>
<td>7269.306</td>
<td>--</td>
<td>--</td>
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<td></td>
</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>2</td>
<td>47590.759</td>
<td>23795.379</td>
<td>10.248</td>
<td>&lt;0.001*</td>
<td>0.983</td>
<td>0.255</td>
<td></td>
</tr>
<tr>
<td>Time*Group</td>
<td>2</td>
<td>2210.477</td>
<td>1151.603</td>
<td>0.476</td>
<td>0.614</td>
<td>0.125</td>
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</tr>
<tr>
<td>Error</td>
<td>132.44</td>
<td>320420.509</td>
<td>2419.290</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: MVPA (moderate to vigorous physical activity)

- a (used Classes/Group as error)
- b (used Children/Sites/Group as error)
- c (used Sites*Time/Group as error)
- d (used Sub. Time/Site/Group as error)
Table 4.22 A summary of pair wise comparisons for moderate to vigorous physical activity from pretest to posttest to follow-up test using the Bonferroni adjustment

<table>
<thead>
<tr>
<th>MVPA (i)</th>
<th>MVPA (j)</th>
<th>Mean Difference (i-j)</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Posttest</td>
<td>-11.530</td>
<td>7.991</td>
<td>0.461</td>
</tr>
<tr>
<td></td>
<td>Follow-up</td>
<td>-35.890</td>
<td>8.825</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Posttest</td>
<td>Follow-up</td>
<td>-24.360</td>
<td>7.404</td>
<td>0.005*</td>
</tr>
</tbody>
</table>

Abbreviations: MVPA (moderate to vigorous physical activity)

Figure 4.4 Overall time effect for moderate to vigorous physical activity
Water and Sugar Free Drink Consumption

Hypothesis #4 stated ‘children receiving a theory based intervention will consume more water and sugar-free drinks per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) of water and sugar-free drinks by group (theory-based vs knowledge-based) and time is provided in Table 4.23. For the theory-based group the water and sugar-free drinks increased from 3.3514 glasses at pretest to 4.6216 glasses at posttest, and then decreased at the follow-up test to 4.2162. For the knowledge based group water and sugar-free drinks increased from 4.0294 glasses at pretest to 5.2353 glasses at posttest and then increased at the follow-up test to 6.0588 glasses. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.173; time x group p=0.082); un-nested (group p=0.085; time x group p=0.142)]. The main effect of time was significant in both the nested (p<0.001) and un-nested (p<0.001) designs however, which suggests improvement in water and sugar-free drinks overtime for both groups. These differences also produced medium effect size (nested (f=0.305); un-nested (f=0.254)). A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) presented on Table 4.24, indicates water and sugar-free drinks significantly improved from pretest to posttest and pretest to follow up.
Table 4.23 Summary of the final model of analysis of variance (ANOVA) for water and sugar free drinks by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nested Design</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water &amp; Sugar Free Drinks</td>
<td>Between Subjects</td>
<td>1</td>
<td>58.022</td>
<td>58.022</td>
<td>2.16a</td>
<td>0.173</td>
<td>0.249</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Sites/Group</td>
<td>10</td>
<td>269.001</td>
<td>26.901</td>
<td>1.52b</td>
<td>0.155</td>
<td>0.390</td>
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</tr>
<tr>
<td>Within Sites</td>
<td>Children/Sites/Group</td>
<td>59</td>
<td>1044.04</td>
<td>17.695</td>
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<td>--</td>
<td>--</td>
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</tr>
<tr>
<td><strong>Within Subjects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td>2</td>
<td>85.0423</td>
<td>42.521</td>
<td>14.25c</td>
<td>0.001*</td>
<td>0.473</td>
<td>0.305</td>
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<tr>
<td>Time*Group</td>
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<td>2</td>
<td>16.954</td>
<td>8.477</td>
<td>2.84c</td>
<td>0.082</td>
<td>0.132</td>
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</tr>
<tr>
<td>Sites*Time/Group</td>
<td></td>
<td>20</td>
<td>59.668</td>
<td>2.983</td>
<td>0.66d</td>
<td>0.853</td>
<td>0.116</td>
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</tr>
<tr>
<td>Sub. Time/Site/Group</td>
<td></td>
<td>118</td>
<td>529.669</td>
<td>4.489</td>
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</tr>
<tr>
<td><strong>Un-nested Design</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water &amp; Sugar Free Drinks</td>
<td>Between Subjects</td>
<td>1</td>
<td>58.022</td>
<td>58.022</td>
<td>3.049</td>
<td>0.085</td>
<td>0.406</td>
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<tr>
<td></td>
<td>Error</td>
<td>69</td>
<td>1313.039</td>
<td>19.030</td>
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<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td>1.978</td>
<td>86.719</td>
<td>43.360</td>
<td>10.153</td>
<td>&lt;0.001*</td>
<td>0.984</td>
<td>0.254</td>
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<tr>
<td>Time*Group</td>
<td></td>
<td>1.978</td>
<td>16.954</td>
<td>8.572</td>
<td>1.985</td>
<td>0.142</td>
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<tr>
<td>Error</td>
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<td>136.470</td>
<td>589.337</td>
<td>4.318</td>
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</tr>
</tbody>
</table>

a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Table 4.24 A summary of pair wise comparisons for water and sugar free drinks from pretest to posttest to follow-up test using the Bonferroni adjustment

<table>
<thead>
<tr>
<th>Water &amp; SFD (i)</th>
<th>Water &amp; SFD (j)</th>
<th>Mean Difference (i-j)</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Posttest</td>
<td>-1.238</td>
<td>0.353</td>
<td>0.002*</td>
</tr>
<tr>
<td></td>
<td>Follow-up</td>
<td>-1.447</td>
<td>0.359</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Posttest</td>
<td>Follow-up</td>
<td>-0.209</td>
<td>0.329</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Abbreviations: SFD (sugar-free drinks)

Figure 4.5 Overall time effect for water and sugar free drinks
Sugar Sweetened Beverage Consumption

Hypothesis #5 stated ‘children receiving a theory based intervention will consume less sugar sweetened beverages per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) of sugar sweetened beverages consumption by group (theory-based vs knowledge-based) and time is provided in Table 4.25. For the theory-based group the sugar sweetened beverage consumption decreased from 1.3611 glasses at pretest to 0.8889 glasses at posttest, and then stayed the same at the follow-up test. For the knowledge based group sugar sweetened beverage consumption increased from 0.9394 glasses at pretest to 1.00 glasses at posttest and then increased at the follow-up test to 1.0909 glasses. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.819; time x group p=0.118); un-nested (group p=0.905; time x group p=0.137)].
Table 4.25 Summary of the final model of analysis of variance (ANOVA) for sugar sweetened beverages by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

<table>
<thead>
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<th>Variable</th>
<th>Source</th>
<th>df</th>
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<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (f)</th>
</tr>
</thead>
<tbody>
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<td><strong>Nested Design</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweetened Group</td>
<td>1</td>
<td>0.156</td>
<td>0.156</td>
<td>0.03^a</td>
<td>0.872</td>
<td>0.050</td>
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</tr>
<tr>
<td>Beverages Sites/Group</td>
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<td>57.688</td>
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<td>1.31^b</td>
<td>0.247</td>
<td>0.712</td>
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<tr>
<td>Within Sites</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Children/Sites/Group</td>
<td>59</td>
<td>260.151</td>
<td>4.409</td>
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<td>--</td>
<td>--</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>2</td>
<td>1.822</td>
<td>0.911</td>
<td>1.08^c</td>
<td>0.358</td>
<td>0.073</td>
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<td>Time*Group</td>
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<td>2.514</td>
<td>1.257</td>
<td>1.49^d</td>
<td>0.249</td>
<td>0.084</td>
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</tr>
<tr>
<td>Sites*Time/Group</td>
<td>20</td>
<td>16.837</td>
<td>0.842</td>
<td>0.84^d</td>
<td>0.665</td>
<td>0.133</td>
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<tr>
<td>Sub. Time/Site/Group</td>
<td>116</td>
<td>116.659</td>
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</tr>
<tr>
<td><strong>Un-nested Design</strong></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td>Between Subjects</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sweetened Group</td>
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<td>0.068</td>
<td>0.068</td>
<td>0.014</td>
<td>0.905</td>
<td>0.052</td>
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</tr>
<tr>
<td>Beverages Error</td>
<td>67</td>
<td>316.425</td>
<td>4.723</td>
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<td>--</td>
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</tr>
<tr>
<td>Within Subjects</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1.970</td>
<td>1.610</td>
<td>0.817</td>
<td>0.832</td>
<td>0.436</td>
<td>0.189</td>
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</tr>
<tr>
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<td>1.970</td>
<td>3.910</td>
<td>1.985</td>
<td>2.021</td>
<td>0.137</td>
<td>0.411</td>
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</tr>
<tr>
<td>Error</td>
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<td>129.598</td>
<td>0.982</td>
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<td>--</td>
<td>--</td>
<td></td>
<td>--</td>
</tr>
</tbody>
</table>

a (used Classes/Group as error)  
b (used Children/Sites/Group as error)  
c (used Sites*Time/Group as error)  
d (used Sub. Time/Site/Group as error)
Hypothesis #6 stated ‘children receiving a theory based intervention will consume more servings of fruits and vegetables per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) of fruit and vegetable consumption by group (theory-based vs knowledge-based) and time is provided in Table 4.26. For the theory-based group the fruit and vegetable consumption increased from 3.4054 servings at pretest to 4.6757 servings at posttest, and then decreased at the follow-up test to 4.6216 servings. For the knowledge based group fruit and vegetable consumption increased from 3.3529 servings at pretest to 4.1471 servings at posttest and then increased at the follow-up test to 4.9118 servings. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.876; time x group p=0.581); un-nested (group p=0.872; time x group p=0.511)]. The main effect of time was significant in both the nested (p=0.005) and un-nested (p<0.001) designs however, which suggests improvement in fruit and vegetable consumption overtime for both groups. These differences also produced medium effect size (nested (f=0.203); un-nested (f=0.223)). A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) presented on Table 4.27, indicates fruit and vegetable consumption significantly improved from pretest to posttest and pretest to follow up.
Table 4.26 Summary of the final model of analysis of variance (ANOVA) for fruit and vegetables by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

<table>
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<tr>
<th>Variable</th>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (ƒ)</th>
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<td><strong>Nested Design</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit &amp; Vegetables</td>
<td>Between Subjects</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Group</td>
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<td>0.499</td>
<td>0.499</td>
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<td>0.876</td>
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<td>Sites/Group</td>
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<td>194.568</td>
<td>19.457</td>
<td>1.01ₐ</td>
<td>0.4424</td>
<td>0.406</td>
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</tr>
<tr>
<td>Within Sites</td>
<td>Children/Sites/Group</td>
<td>59</td>
<td>1131.421</td>
<td>19.177</td>
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<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Time</td>
<td>2</td>
<td>73.502</td>
<td>36.751</td>
<td>6.86ₐ</td>
<td>0.005*</td>
<td>0.367</td>
<td>0.203</td>
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</tr>
<tr>
<td>Time*Group</td>
<td>2</td>
<td>5.992</td>
<td>2.996</td>
<td>0.56ₐ</td>
<td>0.581</td>
<td>0.111</td>
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</tr>
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<td>Sites*Time/Group</td>
<td>20</td>
<td>107.199</td>
<td>5.3599</td>
<td>1.21ₐ</td>
<td>0.256</td>
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<tr>
<td>Sub. Time/Site/Group</td>
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<td><strong>Un-nested Design</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fruit &amp; Vegetables</td>
<td>Between Subjects</td>
<td>1</td>
<td>0.500</td>
<td>0.500</td>
<td>0.026</td>
<td>0.872</td>
<td>0.053</td>
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<tr>
<td>Error</td>
<td>69</td>
<td>1313.039</td>
<td>19.022</td>
<td>--</td>
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<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
<td>Time</td>
<td>1.889</td>
<td>73.635</td>
<td>38.972</td>
<td>8.084</td>
<td>0.001*</td>
<td>0.946</td>
<td>0.223</td>
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<tr>
<td>Time*Group</td>
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<td>5.992</td>
<td>3.171</td>
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<td>0.511</td>
<td>0.155</td>
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<td>130.370</td>
<td>628.506</td>
<td>4.821</td>
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</tr>
</tbody>
</table>

ₐ (used Classes/Group as error)  
ₐ (used Children/Sites/Group as error)  
ₐ (used Sites*Time/Group as error)  
ₐ (used Sub. Time/Site/Group as error)
Table 4.27 A summary of pair wise comparisons for fruit and vegetables from pretest to posttest to follow-up test using the Bonferroni adjustment

<table>
<thead>
<tr>
<th>Fruit &amp; Vegetables (i)</th>
<th>Fruit &amp; Vegetables(j)</th>
<th>Mean Difference (i-j)</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>Posttest</td>
<td>-1.032</td>
<td>0.313</td>
<td>0.005*</td>
</tr>
<tr>
<td></td>
<td>Follow-up</td>
<td>-1.388</td>
<td>0.385</td>
<td>0.002*</td>
</tr>
<tr>
<td>Posttest</td>
<td>Follow-up</td>
<td>-0.355</td>
<td>0.373</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Figure 4.6 Overall time effect for fruit and vegetable consumption
Self Efficacy for Fruit and Vegetable Consumption

Hypothesis #7 stated ‘children receiving a theory based intervention will have higher mean self-efficacy scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-efficacy for fruit and vegetable consumption by group (theory-based vs knowledge-based) and time is provided in Table 4.28. For the theory-based group the self-efficacy for fruit and vegetable consumption increased from 5.8919 units at pretest to 7.4865 units at posttest, and then decreased at the follow-up test to 6.8378 units. For the knowledge based group self-efficacy for fruit and vegetable consumption increased from 5.4242 units at pretest to 6.4848 units at posttest and then decreased at the follow-up test to 5.6970 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis (nested (group p=0.139; time x group p=0.680); un-nested (group p=0.196; time x group p=0.736)). The main effect of time was significant in both the nested (p=0.022) and un-nested (p<0.020) designs however, which suggests improvement in self-efficacy for fruit and vegetable consumption overtime for both groups. These differences also produced small to medium effect size [nested (f=0.160); un-nested (f=0.147)]. A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) presented on Table 4.29, indicates self-efficacy for fruit and vegetable consumption significantly improved from pretest to posttest.
Table 4.28 Summary of the final model of analysis of variance (ANOVA) for self-efficacy for fruits and vegetables by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>Effect size (f)</th>
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Abbreviations: SE (self-efficacy)
- a (used Classes/Group as error)
- b (used Children/Sites/Group as error)
- c (used Sites*Time/Group as error)
- d (used Sub. Time/Site/Group as error)
Table 4.29 A summary of pairwise comparisons for self-efficacy for fruits and vegetables from pretest to posttest to follow-up test using the Bonferroni adjustment

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<th>Mean Difference (i-j)</th>
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</table>

Abbreviations: SE (self-efficacy)

Figure 4.7 Overall time effect for self-efficacy for fruit and vegetable consumption
Self-Control for Fruit and Vegetable Consumption

Hypothesis #8 stated ‘children receiving a theory based intervention will have higher mean self-control scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-control for fruit and vegetable consumption by group (theory-based vs knowledge-based) and time is provided in Table 4.30. For the theory-based group the self-control for fruit and vegetable consumption increased from 4.7027 units at pretest to 4.8919 units at posttest, and then decreased at the follow-up test to 4.5405 units. For the knowledge based group self-control for fruit and vegetable consumption increased from 4.00 units at pretest to 4.1515 units at posttest and then decreased at the follow-up test to 3.9091 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (p=0.146; time x group p=0.964); un-nested group (p=0.198; time x group p=0.982)].
Table 4.30 Summary of the final model of analysis of variance (ANOVA) for self-control for fruits and vegetables by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>F</th>
<th>p-value</th>
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</table>

Abbreviations: SC (self-control)
a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Expectations for Fruit and Vegetable Consumption

Hypothesis #9 stated ‘children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for consuming five servings of fruits and vegetables per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for expectations for fruit and vegetable consumption by group (theory-based vs knowledge-based) and time is provided in Table 4.31. For the theory-based group the expectations for fruit and vegetable consumption increased from 32.7222 units at pretest to 38.8056 units at posttest, and then decreased at the follow-up test to 37.6944 units. For the knowledge based group expectations for fruit and vegetable consumption increased from 31.3333 units at pretest to 35.7273 units at posttest and then decreased at the follow-up test to 31.4545 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.498; time x group p=0.595); un-nested (group p=0.384; time x group p=0.519)].
Table 4.31 Summary of the final model of analysis of variance (ANOVA) for expectations for fruits and vegetables by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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Abbreviations: EX (expectations)
a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Hypothesis #10 stated ‘Children receiving a theory based intervention will have higher mean self-efficacy scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-efficacy for consuming water and sugar free drinks by group (theory-based vs knowledge-based) and time is provided in Table 4.32. For the theory-based group the mean self-efficacy for consuming water and sugar free drinks increased from 7.4595 units at pretest to 8.3784 units at posttest, and then decreased at the follow-up test to 8.1351 units. For the knowledge based group self-efficacy for consuming water and sugar free drinks decreased from 7.9091 units at pretest to 6.5455 units at posttest and then increased at the follow-up test to 7.3636 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.338; time x group p=0.109); un-nested (group p=0.263; time x group p=0.073)].
Table 4.32 Summary of the final model of analysis of variance (ANOVA) for self-efficacy for water and sugar free drinks by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>p-value</th>
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Abbreviations: SE (self-efficacy)
a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Self-Control for Consuming Water & Sugar Free Drinks

Hypothesis #11 stated ‘children receiving a theory based intervention will have higher mean self-control scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-control for consuming water and sugar free drinks by group (theory-based vs knowledge-based) and time is provided in Table 4.33. For the theory-based group the mean self-control for consuming water and sugar free drinks increased from 4.8333 units at pretest to 5.4167 units at posttest, and then decreased at the follow-up test to 4.8333 units. For the knowledge based group self-control for consuming water and sugar free drinks decreased from 4.3750 units at pretest to 3.7500 units at posttest and then increased at the follow-up test to 3.8125 units. The null hypothesis was tested by the group and time x group interaction in the table. For the nested design we failed to reject the null hypothesis in both cases (group p=0.059; time x group p=0.402). In the un-nested design there appeared to be significant difference for the group variable (p=0.025), while there appeared to be no difference for the time x group interaction (p=0.262). This difference produced small to medium effect size ($f=0.158$). A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) was performed to find pairwise differences between pretest, posttest and follow-up test, however no comparison was found significant.
Table 4.33 Summary of the final model of analysis of variance (ANOVA) for self-control for water and sugar free drinks by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
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<td>594.48</td>
<td>10.076</td>
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<td>--</td>
<td></td>
<td>--</td>
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<tr>
<td>Within Subjects</td>
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Abbreviations: SC (self-control)
\(a\) (used Classes/Group as error)
\(b\) (used Children/Sites/Group as error)
\(c\) (used Sites*Time/Group as error)
\(d\) (used Sub. Time/Site/Group as error)
Expectations for Consuming Water & Sugar Free Drinks

Hypothesis #12 stated ‘children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for consuming more water and sugar-free drinks per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for expectations for consuming water and sugar free drinks by group (theory-based vs knowledge-based) and time is provided in Table 4.34. For the theory-based group the expectations for consuming water and sugar free drinks increased from 28.6471 units at pretest to 32.6765 units at posttest, and increase at the follow-up test to 34.1471 units. For the knowledge based group expectations for consuming water and sugar free drinks decreased from 31.5294 units at pretest to 29.6765 units at posttest and then increased at the follow-up test to 30.7647 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.895; time x group p=0.225); un-nested (group p=0.761; time x group p=0.286)].
Table 4.34 Summary of the final model of analysis of variance (ANOVA) for expectations for water and sugar free drinks by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (f)</th>
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Abbreviations: EX (expectations)  
\(a\) (used Classes/Group as error)  
\(b\) (used Children/Sites/Group as error)  
\(c\) (used Sites*Time/Group as error)  
\(d\) (used Sub. Time/Site/Group as error)
Self Efficacy for Moderate to Vigorous Physical Activity

Hypothesis #13 stated ‘children receiving a theory based intervention will have higher mean self-efficacy scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-efficacy for moderate to vigorous physical activity by group (theory-based vs knowledge-based) and time is provided in Table 4.35. For the theory-based group the self-efficacy for moderate to vigorous physical activity increased from 4.9730 units at pretest to 6.6757 units at posttest, and increased at the follow-up test to 6.8919 units. For the knowledge based group self-efficacy for moderate to vigorous physical activity increased from 4.5000 units at pretest to 5.2647 units at posttest and increased at the follow-up test to 5.7941 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.196; time x group p=0.631); un-nested (group p=0.125; time x group p=0.493)]. The main effect of time was significant in both the nested (p=0.009) and un-nested (p=0.004) designs however, which suggests improvement in self-efficacy for moderate to vigorous physical activity overtime for both groups. These differences also produced small to medium effect size (nested (f=0.187); un-nested (f=0.186)). A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) presented on Table 4.29, indicates self-efficacy for moderate to vigorous physical activity significantly improved from pretest to follow-up.
Table 4.35 Summary of the final model of analysis of variance (ANOVA) for self-efficacy for moderate to vigorous physical activity by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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</table>

Abbreviations: SE (self-efficacy); MVPA (moderate to vigorous physical activity)

a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Table 4.36 A summary of pair wise comparisons for self-efficacy for moderate to vigorous physical activity from pretest to posttest to follow-up test using the Bonferroni adjustment

<table>
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<th>SE for MVPA (i)</th>
<th>SE for MVPA (j)</th>
<th>Mean Difference (i-j)</th>
<th>Standard Error</th>
<th>p-value</th>
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<td>Follow-up</td>
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<td>0.005*</td>
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<tr>
<td>Posttest</td>
<td>Follow-up</td>
<td>-0.373</td>
<td>0.423</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Abbreviations: SE (self-efficacy); MVPA (moderate to vigorous physical activity)

Figure 4.8 Overall time effect for self efficacy for moderate to vigorous physical activity
Self-Control for Moderate to Vigorous Physical Activity

Hypothesis #14 stated ‘children receiving a theory based intervention will have higher mean self-control scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-control for moderate to vigorous physical activity by group (theory-based vs knowledge-based) and time is provided in Table 4.37. For the theory-based group the self-control for moderate to vigorous physical activity increased from 4.5946 units at pretest to 5.2703 units at posttest, and then decreased at the follow-up test to 4.8649 units. For the knowledge based group self-control for moderate to vigorous physical activity increased from 3.8529 units at pretest to 4.2353 units at posttest and then decreased at the follow-up test to 3.7647 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.085; time x group p=0.757); un-nested (group p=0.052; time x group p=0.148)].
Table 4.37 Summary of the final model of analysis of variance (ANOVA) for self-control for moderate to vigorous physical activity by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>p-value</th>
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<th>Effect size (ƒ)</th>
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<td>SC for MVPA</td>
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<tr>
<td>Group</td>
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<td>48.878</td>
<td>3.66&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.085</td>
<td>0.157</td>
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<td>Within Subjects</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>2</td>
<td>11.521</td>
<td>5.761</td>
<td>2.52&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.106</td>
<td>0.107</td>
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<tr>
<td>Time*Group</td>
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<td>1.292</td>
<td>0.646</td>
<td>0.28&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.757</td>
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<td>SC for MVPA</td>
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</table>

Abbreviations: SC (self-control); MVPA (moderate to vigorous physical activity)

<sup>a</sup> (used Classes/Group as error)
<sup>b</sup> (used Children/Sites/Group as error)
<sup>c</sup> (used Sites*Time/Group as error)
<sup>d</sup> (used Sub. Time/Site/Group as error)
Expectations for Moderate to Vigorous Physical Activity

Hypothesis #15 stated ‘children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for engaging in 60 minutes of moderate to vigorous physical activity per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for expectations for moderate to vigorous physical activity by group (theory-based vs knowledge-based) and time is provided in Table 4.38. For the theory-based group the mean expectations for moderate to vigorous physical activity increased from 27.3333 units at pretest to 30.3333 units at posttest, and decreased at the follow-up test to 30.0556 units. For the knowledge based group mean expectations for moderate to vigorous physical activity increased from 27.4242 units at pretest to 28.4242 units at posttest and then decreased at the follow-up test to 26.5152 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.658; time x group p=0.638); un-nested (group p=0.597; time x group p=0.643)].
Table 4.38 Summary of the final model of analysis of variance (ANOVA) for expectations for moderate to vigorous physical activity by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

<table>
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<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
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<td>Between Subjects</td>
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<td>0.597</td>
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</table>

Abbreviations: EX (expectations); MVPA (moderate to vigorous physical activity)

a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Self-efficacy for Screen Time

Hypothesis #16 stated ‘children receiving a theory based intervention will have higher mean self-efficacy scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-efficacy for screen time by group (theory-based vs knowledge-based) and time is provided in Table 4.39. For the theory-based group the mean self-efficacy for screen time increased from 5.3243 units at pretest to 6.6757 units at posttest, and decreased at the follow-up test to 6.5135 units. For the knowledge based group self-efficacy for screen time increased from 5.1765 units at pretest to 5.6176 units at posttest and then increased at the follow-up test to 5.6765 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.446; time x group p=0.606); un-nested (group p=0.597; time x group p=0.542)].
Table 4.39 Summary of the final model of analysis of variance (ANOVA) for self-efficacy for screen time by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>Source</th>
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<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
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</table>

Abbreviations: SE (self-efficacy)
a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Self-Control for Screen Time

Hypothesis #17 stated ‘children receiving a theory based intervention will have higher mean self-control scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for self-control for screen time by group (theory-based vs knowledge-based) and time is provided in Table 4.40. For the theory-based group the mean self-control for screen time increased from 4.5676 units at pretest to 5.2432 units at posttest, and then decreased at the follow-up test to 5.1351 units. For the knowledge based group the mean self-control for screen time decreased from 3.7879 units at pretest to 3.6667 units at posttest and then increased at the follow-up test to 3.7879 units. The null hypothesis was tested by the group and time x group interaction in the table. In both the nested and un-nested designs the group variable appeared to be significant [nested (0.024); un-nested (p=0.015)], while the time x group interaction did not (nested (0.427); un-nested (p=0.473)]. A post hoc analysis (using the Bonferonni adjustment for multiple comparisons) was performed to find pair wise differences between pretest, posttest and follow-up test, however no comparison was found significant.
Table 4.40 Summary of the final model of analysis of variance (ANOVA) for self-control for screen time by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

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<th>p-value</th>
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<td>82.536</td>
<td>6.87&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.026*</td>
<td>0.432</td>
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</tr>
<tr>
<td>Sites/Group</td>
<td>10</td>
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<td>12.012</td>
<td>0.93&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.515</td>
<td>0.349</td>
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<td></td>
</tr>
<tr>
<td>Within Sites</td>
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<td></td>
<td></td>
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<tr>
<td>Children/Sites/Group</td>
<td>59</td>
<td>764.294</td>
<td>12.954</td>
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<td>--</td>
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</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>2</td>
<td>4.233</td>
<td>2.116</td>
<td>0.75&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.486</td>
<td>0.074</td>
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</tr>
<tr>
<td>Time*Group</td>
<td>2</td>
<td>5.678</td>
<td>2.839</td>
<td>1.00&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.384</td>
<td>0.074</td>
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<td></td>
</tr>
<tr>
<td>Sites*Time/Group</td>
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<td>2.824</td>
<td>0.69&lt;sup&gt;d&lt;/sup&gt;</td>
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<tr>
<td>Sub. Time/Site/Group</td>
<td>117</td>
<td>478.924</td>
<td>4.0933</td>
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</tr>
<tr>
<td><strong>Un-nested Design</strong></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SC for Screen time</td>
<td>Between Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Group</td>
<td>1</td>
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<td>79.749</td>
<td>6.181</td>
<td>0.015*</td>
<td>0.688</td>
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</tr>
<tr>
<td>Error</td>
<td>68</td>
<td>877.317</td>
<td>12.902</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Within Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1.901</td>
<td>3.661</td>
<td>1.926</td>
<td>0.462</td>
<td>0.621</td>
<td>0.122</td>
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<td></td>
</tr>
<tr>
<td>Time*Group</td>
<td>1.901</td>
<td>5.871</td>
<td>3.088</td>
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<td>0.473</td>
<td>0.170</td>
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</tr>
<tr>
<td>Error</td>
<td>129.27</td>
<td>539.262</td>
<td>4.171</td>
<td>--</td>
<td>--</td>
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<td>--</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: SC (self-control)
a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Expectations for Screen Time

Hypothesis #18 stated ‘children receiving a theory based intervention will have higher mean expectations (outcome expectations x outcome expectancies) scores for engaging in no more than 2 hours of screen time per day than children receiving a knowledge based intervention’. A summary of the ANOVA (both nested and un-nested design) for expectations for screen time by group (theory-based vs knowledge-based) and time is provided in Table 4.41. For the theory-based group the mean expectations for screen time increased from 25.8824 units at pretest to 30.4118 units at posttest, and increase at the follow-up test to 33.2353 units. For the knowledge based group mean expectations for screen time decreased from 30.181 units at pretest to 29.5152 units at posttest and further decreased at the follow-up test to 26.6061 units. The null hypothesis was tested by the group and time x group interaction in the table. In both cases we failed to reject the null hypothesis [nested (group p=0.937; time x group p=0.101); un-nested (group p=0.779; time x group p=0.058)].
Table 4.41 Summary of the final model of analysis of variance (ANOVA) for expectancies for screen time by group (theory-based vs. knowledge-based) and time (pretest vs. posttest vs. follow-up test)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
<th>Power (1-β)</th>
<th>Effect size (f)</th>
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<tr>
<td>EX for Screen Time</td>
<td>Between Subjects Group</td>
<td>1</td>
<td>20.968</td>
<td>20.968</td>
<td>1.35a</td>
<td>0.282</td>
<td>0.076</td>
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<tr>
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<td>Sites/Group</td>
<td>10</td>
<td>7857.951</td>
<td>785.795</td>
<td>1.15b</td>
<td>0.3445</td>
<td>0.313</td>
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<tr>
<td>Within Sites</td>
<td>Children/Sites/Group</td>
<td>59</td>
<td>40421.922</td>
<td>685.117</td>
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<td>--</td>
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<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
<td>Time</td>
<td>2</td>
<td>609.059</td>
<td>304.523</td>
<td>1.35c</td>
<td>0.282</td>
<td>0.111</td>
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</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>2</td>
<td>731.683</td>
<td>365.819</td>
<td>1.62c</td>
<td>0.222</td>
<td>0.151</td>
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<tr>
<td></td>
<td>Sites*Time/Group</td>
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<td>4517.743</td>
<td>225.887</td>
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<td>0.263</td>
<td>0.199</td>
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<tr>
<td></td>
<td>Sub. Time/Site/Group</td>
<td>114</td>
<td>21364.726</td>
<td>187.409</td>
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</tr>
<tr>
<td><strong>Un-nested Design</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EX for Screen Time</td>
<td>Between Subjects Group</td>
<td>1</td>
<td>58.107</td>
<td>58.107</td>
<td>0.079</td>
<td>0.779</td>
<td>0.059</td>
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</tr>
<tr>
<td></td>
<td>Error</td>
<td>65</td>
<td>47713.813</td>
<td>734.059</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Within Subjects</td>
<td>Time</td>
<td>1.831</td>
<td>162.970</td>
<td>89.004</td>
<td>0.490</td>
<td>0.598</td>
<td>0.129</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>1.831</td>
<td>1000.861</td>
<td>546.603</td>
<td>3.007</td>
<td>0.058</td>
<td>0.549</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Error</td>
<td>119.02</td>
<td>21637.099</td>
<td>181.796</td>
<td>--</td>
<td>--</td>
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<td>--</td>
</tr>
</tbody>
</table>

Abbreviations: EX (expectations)
a (used Classes/Group as error)
b (used Children/Sites/Group as error)
c (used Sites*Time/Group as error)
d (used Sub. Time/Site/Group as error)
Summary

While this chapter presents many findings, the following summarizes them into salient bullet points. A greater discussion and interpretation of these results are presented in the following chapter, where implications for both health promotion practitioners and health promotion researchers are also presented.

1.) For this study an adequate amount of children were recruited and retained with regards to the a priori sample size calculation.

2.) The randomization of sites into groups (experimental and comparison) appeared to have been effective, as no demographic or study variables were significantly different between groups at the time of pretest.

3.) With the exception of a few sub-scales, the social cognitive theory subscales appeared to have adequate construct validity and internal consistency reliability for this group of children.

4.) Both interventions (experimental and comparison) appear to have been implemented fully across all sites, and there did not appear to be any differences for program dose or fidelity between intervention groups.

5.) The assumptions tested for this study on the model residuals of all study variables included independence of observations, normality, homogeneity of variance, and sphericity.

   (a) Observations were independent between children.

   (b) Normality was tested using the Kolmogorov-Smirnov (K-S) test, and even though this assumption was violated in a few cases, Stevens (2009) and Kirk (1995) note that skewness and kurtosis have only a slight impact on significance or power of statistical tests, and that variances are robust against slight deviations from normality.

   (c) Homogeneity of variance (or homoscedasticity) was tested using the Levine Test of
Equality of Error Variances, and in cases where this assumption was violated a more stringent alpha was used.

(d) Sphericity was tested using Mauchly’s sphericity test, and since this assumption was violated in a few cases the Greenhouse & Geisser estimate was used.

6.) A summary of the study variables at each testing point (pre/post/follow-up) is presented on Tables 4.40 and 4.41.

(a) Results suggested that there was no significant difference between groups over time for BMI-percentile.

(b) Results suggested that there were no significant differences between groups over time for any of the obesity related behaviors, however four of the five behaviors did significantly increase for both groups.

(c) Results suggested that there were no significant differences between groups over time for any social cognitive theory construct, however in two cases (self-efficacy for fruit and vegetable consumption and self-efficacy for moderate to vigorous physical activity) constructs significantly increased for both groups.

7). In cases where the main effect was significant, there appeared to be adequate power.

8.) In cases where the main effect was significant, effect sizes ranged from small to medium.
Table 4.42 Comparisons of BMI-percentile and key obesity related behaviors between the experimental and comparison group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention</th>
<th>n</th>
<th>Possible Range</th>
<th>Observed Range</th>
<th>Pretest m(SD)</th>
<th>Posttest m(SD)</th>
<th>Follow-up m(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI-percentile</td>
<td>Experimental</td>
<td>36</td>
<td>0-99.99</td>
<td>9.2 - 98.8</td>
<td>60.15 (26.39)</td>
<td>--</td>
<td>59.23 (26.31)</td>
</tr>
<tr>
<td></td>
<td>Comparison</td>
<td>34</td>
<td>0-99.99</td>
<td>2.4 - 97.3</td>
<td>55.52 (27.96)</td>
<td>--</td>
<td>57.26 (27.84)</td>
</tr>
<tr>
<td>Fruit and Vegetable* Consumption (in servings)</td>
<td>Experimental</td>
<td>37</td>
<td>0-12</td>
<td>0-12</td>
<td>3.41 (2.68)\textsuperscript{1,2}</td>
<td>4.68 (3.08)\textsuperscript{1}</td>
<td>4.62 (3.33)\textsuperscript{2}</td>
</tr>
<tr>
<td></td>
<td>Comparison</td>
<td>34</td>
<td>0-12</td>
<td>0-12</td>
<td>3.35 (3.17)\textsuperscript{1,2}</td>
<td>4.15 (2.97)\textsuperscript{1}</td>
<td>4.91 (3.18)\textsuperscript{2}</td>
</tr>
<tr>
<td>Sugar Free Beverage Consumption (in glasses)</td>
<td>Experimental</td>
<td>37</td>
<td>0-15</td>
<td>0-12</td>
<td>3.35 (2.58)\textsuperscript{1,2}</td>
<td>4.62 (3.17)\textsuperscript{1}</td>
<td>4.21 (2.62)\textsuperscript{2}</td>
</tr>
<tr>
<td></td>
<td>Comparison</td>
<td>34</td>
<td>0-15</td>
<td>0-12</td>
<td>4.03 (2.76)\textsuperscript{1,2}</td>
<td>5.24 (3.25)\textsuperscript{1}</td>
<td>6.06 (3.71)\textsuperscript{2}</td>
</tr>
<tr>
<td>Sugar Sweetened Beverage Consumption (in glasses)</td>
<td>Experimental</td>
<td>36</td>
<td>0-10</td>
<td>0-10</td>
<td>1.36 (2.00)</td>
<td>0.89 (0.98)</td>
<td>0.89 (0.95)</td>
</tr>
<tr>
<td></td>
<td>Comparison</td>
<td>33</td>
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<td>0-10</td>
<td>0.94 (1.17)</td>
<td>1.00 (1.54)</td>
<td>1.09 (1.94)</td>
</tr>
<tr>
<td>Moderate to Vigorous* Physical Activity (in minutes)</td>
<td>Experimental</td>
<td>37</td>
<td>0-240</td>
<td>0-240</td>
<td>69.73 (63.66)\textsuperscript{1}</td>
<td>88.38 (68.90)\textsuperscript{1,2}</td>
<td>106.21 (64.65)\textsuperscript{2}</td>
</tr>
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<td>0-240</td>
<td>65.29 (55.01)\textsuperscript{1}</td>
<td>69.71 (45.36)\textsuperscript{1,2}</td>
<td>100.58 (75.27)\textsuperscript{2}</td>
</tr>
<tr>
<td>Screen Time* (in minutes)</td>
<td>Experimental</td>
<td>37</td>
<td>0-240</td>
<td>0-240</td>
<td>116.76 (70.99)\textsuperscript{1}</td>
<td>83.51 (70.76)</td>
<td>88.38 (70.69)\textsuperscript{2}</td>
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<td>0-240</td>
<td>83.82 (67.20)\textsuperscript{1}</td>
<td>70.59 (57.63)</td>
<td>77.64 (51.23)\textsuperscript{2}</td>
</tr>
</tbody>
</table>

Abbreviations: BMI (body mass index)
* p-value > 0.05 for main effect
Numbers (i.e. 1 and 2) represent significant pair wise comparisons
Table 4.43 Comparisons of all social cognitive theory constructs for each obesity related behavior between the experimental and comparison group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention</th>
<th>n</th>
<th>Possible Range</th>
<th>Observed Range</th>
<th>Pretest m(SD)</th>
<th>Posttest m(SD)</th>
<th>Follow-up m(SD)</th>
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</thead>
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<tr>
<td><strong>Moderate to Vigorous Physical Activity</strong></td>
<td></td>
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<td></td>
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</tr>
<tr>
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<td>Experimental</td>
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<td>0-12</td>
<td>4.97 (3.56)</td>
<td>6.68 (3.45)</td>
<td>6.89 (3.23)</td>
</tr>
<tr>
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<td>0-12</td>
<td>0-12</td>
<td>4.50 (3.57)</td>
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<td>Experimental</td>
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<td>3.85 (2.41)</td>
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<td>27.33 (16.93)</td>
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<td>0-64</td>
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<td>28.42 (17.90)</td>
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<td>0-12</td>
<td>0-12</td>
<td>5.32 (3.57)</td>
<td>6.68 (2.91)</td>
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<td>0-64</td>
<td>30.18 (16.91)</td>
<td>29.52 (18.54)</td>
<td>26.61 (19.57)</td>
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<td>Experimental</td>
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<td>7.46 (3.51)</td>
<td>8.38 (2.73)</td>
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<td>4.38 (2.80)</td>
<td>3.75 (2.54)</td>
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<td>Experimental</td>
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<td>0-64</td>
<td>0-64</td>
<td>28.65 (18.19)</td>
<td>32.68 (20.25)</td>
<td>34.14 (17.66)</td>
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<td>Comparison</td>
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<td>0-64</td>
<td>0-64</td>
<td>31.53 (16.81)</td>
<td>29.68 (20.39)</td>
<td>30.76 (20.00)</td>
</tr>
<tr>
<td><strong>Fruit and Vegetables</strong></td>
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<td>7.49 (3.19)</td>
<td>6.84 (3.59)</td>
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<td>6.48 (3.82)</td>
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<td>31.33 (18.39)</td>
<td>35.71 (19.52)</td>
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* p-value >0.05 for main effect
Numbers (i.e. 1 and 2) represent significant pair wise comparisons
CHAPTER 5

Discussion and Conclusions

The purpose of this study was to evaluate the efficacy of an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children. Notably, this study used three types of measures to evaluate both interventions, including a measure of weight status (as measured by BMI-percentiles), obesity related behaviors (fruit and vegetable consumption, the engagement in moderate to vigorous physical activity, the engagement in screen time, sugar-free drinks & water consumption, and sugar sweetened beverage consumption), and social cognitive theory constructs (self-efficacy, self-control and expectations) related to each obesity related behavior. This chapter discusses the interpretation of the results of this study, considers the limitations of these results, presents the main conclusions by discussing each hypothesis, addresses the implications for future health practitioners and makes recommendations for future researchers.

Recruitment, data screening and dropout

As noted in chapter 4, one hundred eighty-three children were initially enrolled in this study, however only seventy-one were used for the final data analysis, or almost 40% of the original recruitment. This indicates that we experienced approximately 60% attrition, which included twenty-two children who dropped out of the program (accounting for 12% total attrition) and ninety (accounting for 49% total attrition) who were omitted due to overestimations made on their questionnaire during the pretest, posttest, or follow-up test. The 12% attrition accounted for dropout is in point expected, given the nature of after-school programming. However the 49% attrition due to overestimation of behaviors appears to be high, but in fact,
could also be expected given the nature in which the data were collected. McPherson and colleagues (2000) note that among dietary assessment methodologies (i.e. 24-hour recalls, food diary’s and records, food frequency questionnaires (FFQ)) FFQ’s, such as the one used in this study are advantageous as they are relatively easy to administer, have a low response burden, are inexpensive compared with other methods, and are easily adaptable for target population. However, they further note that among diet assessment methodologies they tend to overestimate energy intake and consumption among both adults and children. Therefore, it appears that more work is needed in the area of diet evaluation among children to find methods that have the advantages of FFQ’s, but more accurately measure dietary intake. Such methods might consider using an indicator scale instead of a scale based on servings or portion size, to help simplify the questions for children who have a hard time recalling and estimating the exact portion sizes of their meals and snacks. It is also important to note that attrition due to dropout and overestimation was relatively equal among the experimental and comparison group. Therefore, if this introduced any bias it is likely shared equally among both groups.

Instrument validation and reliability

The instrument used in this study evaluated both obesity related behaviors and constructs of social cognitive theory related to each behavior. As previously mentioned such behaviors can be measured by either subjective (or self-report) or objective (or independently measured) means, and within each behavior there are various valid methods that can be utilized. Five behaviors were measured in this study: fruit and vegetable consumption, sugar sweetened beverage consumption, water and sugar free drink consumption, the engagement in moderate to vigorous activity, and the engagement in screen time, which included television, video games and the computer. Prior to this study face validity, content validity and the readability of this
scale were established. Future work can be done to further improve this instrument, and attempt to establish criterion validity by comparing it to ‘gold standard’ methods such as using an accelerometer to evaluate the activity scales and 24-hour recalls or food logs to evaluate the dietary scales.

For evaluating the constructs of social cognitive theory we used a previously validated instrument the *Promoting Healthy Lifestyles* survey, which has established face validity, content validity, construct validity, internal consistency reliability, and test-retest reliability (Sharma, et al., 2005-2006). To measure the construct validity and internal consistency reliability of the instrument for use in this study confirmatory factor analysis and Cronbach’s alphas were evaluated respectively. With regards to construct validity it appeared all subscales were adequate but one (outcome expectations for moderate to vigorous physical activity). This likely occurred due to one item with an obviously low loading, however it is unclear why this item had a low loading. The original scale was validated with school children (including those who did and did not attend after school programming) and it may be that after school children are slightly different from their counterparts who do not attend such programming. It was decided to keep this item given the theoretical underpinnings for which the entire survey was constructed; however readers should use caution when interpreting the results from the scale as they may be biased. With regards for reliability, Cronbach’s alpha scores were notably low for four subscales. Three scales evaluating self control for moderate to vigorous physical activity, screen time and sugar sweetened beverages, were likely low due to having only two items on each scale. Readers should again use caution when interpreting the results from these scales, as they may too be biased (Pallant, 2007). Future health professionals and researches should consider lengthening these scales to 3 or 4 items, to follow suit with the other subscales on this instrument.
that were found to be valid.

*The use of nested and un-nested designs in this study*

Given the complexities of designing childhood obesity prevention studies such as the one presented in this dissertation, the investigators recognize that designing a ‘perfect’ obesity prevention trial is almost impossible. We did however choose a group-randomized controlled trial, which is considered one of the strongest design for such studies (Stevens, Taber, Murray, & Ward, 2007). However, we also recognize that there are limitations that we could not control. As Stevens and colleagues (2007) explain, group randomized trials carry the unique challenge of having correlations within assigned groups. For example, children within each site of this study were likely similar to one another, given that they attended the same school and after-school program. The magnitude of this association is known as the *intraclass correlation (ICC)*. While it is important to be aware that ICC can impact findings, it is not always properly used or recognized in the literature. In a recent review of 59 grouped randomized controlled trials authors concluded that only 54% used ‘appropriate analyses’ accounting for ICC, while 25% used a mixture of ‘appropriate and inappropriate analyses’, and 20% used ‘all inappropriate analyses’ not accounting for ICC (Varnell, Murray, Janega, & Blitstein, 2004). The magnitude of this correlation has the potential to impact study results which could lead to misleading or erroneous conclusions. Therefore, we show both the nested and un-nested results in this study. As presented in Chapter 4, by introducing the nested design the power was severely diminished in many cases, given the small overall sample size (n=71) compared to the number of sites used in this study (n=12). In some cases there were only four children in a site. Study variables that were found to have significant differences however were only impacted in two cases: Screen time significantly decreased for both groups in the un-nested design, where there was no effect in
the nested design, and self-control for consuming sugar-sweetened beverages was found to be significantly different between groups in the un-nested design, where there was no effect in the nested design. Therefore, it is advised that readers use caution when interpreting these results.

**Testing Research Hypotheses**

Null Hypothesis#19: There will be no differences in the degree of program fidelity between the theory-based intervention and knowledge based intervention.

In the line of childhood obesity prevention research, researchers are challenged by the constraint that programs are often evaluated at multiple sites, by multiple implementers, each of which could contribute bias to overall study results. Therefore, it is critical for investigators to employ standardized process evaluation methods to capture this variability. As Windsor and colleagues (2004) note, important aspects of process evaluations include the *what*, *who*, *when*, *how much* and the *setting* of such programs. With regards to the ‘*what*’, both interventions were highly standardized and detailed as presented in Appendices D and E. Children in both intervention groups received identical worksheets, take-home worksheets, and booster session worksheets according to their condition. With regards to the ‘*who*’, the same individual implemented each lesson of each program. Therefore, it is highly likely that children in both groups received almost identical experiences during the program, given there was no difference in teaching styles and personalities, and there was no preexisting relationship between the children and program facilitator. With regards to the ‘*when*’, all lessons were implemented during the same after school hours. With regards to the ‘*how much*’ each lesson was timed using a stop-watch to assure the lesson was implemented for approximately 30 minutes. This information is presented on Table 4.14, and it is evident that this was consistently accomplished for both groups across all lessons. Finally, with regards to the ‘*setting*’ all of the sites used in this study were YMCA sponsored after school programs, in the same school district. This setting
is ideal for this line of research as the differences between sites are likely to be marginal, compared with selecting schools from different school districts in different setting (i.e. suburban, rural, and inter-city).

There was some discrepancy in fidelity between both the experimental and comparison groups. At one site for two lessons in the experimental group approximately 90% of the program was implemented as recorded by both the independent observer and the program implementer, and at one site for two lessons in the comparison group there was a discrepancy between the full implementation of two lessons at one site. While this may raise some concern, it is important to note that since the discrepancy happened for two lessons in the experimental group and two lessons in the comparison group, any bias this could create is likely equal between groups. Furthermore, comparisons between the less than perfect sites and perfectly implemented sites found no significant differences in study variables, which suggest this discrepancy likely had little to no effect. However, readers should note that the chances of finding a discrepancy in this situation were rather small due to small sample sizes in both groups. In conclusion from this comprehensive analysis for program fidelity, it appears the program was implemented the way in which was intended, which helps to limit possible bias that could impact the results found in this study.

*BMI-Percentile*

**Null Hypothesis#1: There was no difference in BMI-percentile between children receiving a theory-based intervention and children receiving a knowledge based intervention.**

In this study BMI-percentile was measured using gender appropriate growth charts published by the CDC. There did not appear to be any differences in BMI-percentile between children receiving the experimental and comparison interventions. Investigating further, it should be noted that while mean BMI-percentiles did not change in this study, the means for
both groups were considered *normal weight* (Table 4.42). This sample of children also had lower levels of overweight and obesity as compared with national trends: nationally, 16% of children are obese and 31.7% are either overweight or obese; in this study only 6% were obese and 21% were either overweight or obese at baseline. This may have made it more difficult to find changes in this variable. For example, in a sample of highly overweight children the potential for BMI-percentile to decrease is higher since children have a greater amount of *excess* weight to lose. In a sample with more normal weight children, the potential to lose *excess* weight is lower.

There are also other possible explanations for why this occurred. It is possible that the intervention failed to produce the desired result, also known as *intervention failure* (Green, & Lewis, 1986). To truly impact an individuals weight status and lose weight, a caloric deficit is needed. Given important environmental cues and the fact that parents are the gatekeepers for providing most of what their children consume and provide opportunities to engage in physical activities, it is likely this intervention was inadequate and insufficient to overcome these barriers and impact weight. Future interventions should consider intervening with both children and parents, if the desired outcome is changing weight status or body composition. It should also be noted that this study was meant to be a primary prevention study. Therefore, these results may in fact be positive if this group continues on the same trajectory. The time between measures in this study can be considered a relatively small amount of time, with regards to the prevention of childhood obesity. For a better understanding of whether either group benefitted from either program, it would be ideal to monitor their BMI over an extended period of time.
Social Cognitive Theory Antecedents of Screen Time and Engagement in Screen Time

Null Hypothesis#2: There was no difference in amount of minutes of screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study minutes of screen time were measured using a three item scale, asking children to recall the amount of minutes they engaged in screen time activities over the past 24-hours. The three types of screen time evaluated included time watching TV, time playing video games, and time on the computer. There did not appear to be any differences for the engagement of screen time between children receiving the experimental and comparison interventions during this intervention period. There was however a significant main effect for this behavior, indicating that both groups significantly decreased their screen time over the course of the intervention. This effect was also small to medium, as indicated by a Cohen’s $f$ of 0.159. Investigating further, it should be noted that the 2005 AMA recommendation for preventing childhood obesity and the goal of this intervention was to have children limit screen time activities to no more than 2 hours per day. On average many children were meeting this recommendation at baseline: overall 73% (65% in the experimental and 82% in the comparison groups) were meeting this recommendation. Improvements were seen however during the study, but for both groups: overall at posttest 83% (78% in the experimental and 88% in the comparison groups) were meeting this recommendation, and at the follow up test 87% (81% in the experimental and 94% in the comparison groups) were meeting this recommendation.

While it is possible that both interventions were robust enough to mediate this behavior, it is unclear why both groups increased. First, both interventions were similar in that they targeted the same behavior for reducing screen time. Second, both interventions used a comic-book approach to target screen time, which appears to be a well-received teaching method to
frame health messages to children. Third, competing programs such as *Jump rope for heart* and *Y-Kids are fit* were implemented at the same time this program was implemented, which may cause concern for contamination. These two programs are fully discussed later in the chapter.

Fourth, this finding may have occurred due to a *Hawthorne effect*, whereby children decreased their screen time as a result of being studied, and not as a result of participating in the program (Windsor, et al., 2004). Fifth, there may have been contamination by after school staff members at some of the sites, especially among the comparison sites. This is elaborated on later in this discussion in the *limitations* section. Sixth, children may have changed because of their parents. Anecdotally during the lesson, which targeted screen time many children reported to the implementer that their parents had strict rules with regards to screen time activities during the school week, and they were not allowed to participate in heavy amounts during certain times. It is unknown however, whether these rules are enforced during the weekends or summer break, which may be an area for future investigation. Finally as reported at baseline, children in both groups participated in at least two programs targeting healthy eating, and two programs targeting physical activity before this study. By participating in this intervention it could have reinforced previously learned messages, to in turn decrease screen time for both groups.

*Null Hypothesis*#16: *There was no difference in mean self-efficacy scores for engaging in no more than 2 hours of screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.*

In this study the construct of self-efficacy was measured using a three-item scale. There did not appear to be any differences for self-efficacy for screen time between children receiving the experimental and comparison interventions during the course of the intervention. The baseline scores for this construct was consistently towards the mid-range of the scale indicating that children had a moderate amount of self-efficacy for screen time and improvements were
possible. In order to mediate a change in self-efficacy in the experimental group, four basic strategies were utilized for this lesson. First, children were asked to brainstorm and report how many minutes of screen time they engaged in each day, and encouraged to take small steps if they were not attaining the two-hour per day recommendation. Next, the implementer attempted to serve as a positive role model, and consistently told the children that he rarely engaged in screen time and instead participated in physical activities. Next, the implementer verbally encouraged the children to engage in no more than two hours of screen time per day. Finally, it was attempted to reduce the stress children might have from barriers to reducing their screen time by participating in role plays with the program implementer acting as a friend or family member.

Given these strategies however overall self-efficacy for screen time did not change for the experimental group. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for this specific behavior. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly, thus resulting in intervention failure (Green, & Lewis, 1986). Third, as noted above many children were already adequately meeting the recommendations for screen time. After participating in the intervention and learning that children their age should not engage in more than two hours of screen time per day, children who were already meeting this recommendations may in turn been complacent with their level of self-efficacy, and saw no reason to change.

Null Hypothesis#17: There was no difference in mean self-control scores for engaging in no more than 2 hours of screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.
In this study the construct of self-control was measured using a two-item scale. There did not appear to be any differences for this construct for screen time between children receiving the experimental and comparison interventions during the course of the intervention. There was however a significant overall between group difference for screen time. Given that there was no main effect for self-control however, it can only be concluded that at some point during this study both groups were significantly different from one another, however there was no improvement for either group. It is also important to note that the groups were not significantly different at baseline, suggesting the difference occurred after the start of the program. The power for this analysis was also low (0.688) therefore readers should use caution when interpreting this finding.

The baseline score for this construct for both groups was towards the mid-range of this scale, indicating that children had a moderate amount of self-control and improvements were possible. In order to mediate a change in self-control in the experimental group children participated in a comic-book related activity. During the activity children were asked to create a small comic book story showing themselves going through the process of goal setting for having no more than two hours of screen time per day. For example children were given three sequential comic book panels and in the first panel they were asked to show themselves setting a goal to have no more than two hours of screen time per day. In the second panel they were asked to show themselves creating a plan to make sure they only have two hours of screen time per day. Finally, in the third panel they were asked to show themselves self-rewarding for accomplishing the goal of having no more than two hours of screen time per day. Anecdotally, the implementer observed some children having a difficult time with this activity, as they found it hard to create a story based on the idea of self-control. Some children were also confused by
the idea of *self-rewarding* themselves. For example, many children would use unhealthy behaviors (i.e. I will reward myself by having a bowl of ice cream) for self-rewarding this behavior. Therefore, while children understood this basic concept, they did not use all of the elements of the program to determine appropriate ways to self-reward. Self-control was also targeted during the role-plays implemented during the lesson. It is likely that these activities alone were not powerful enough to mediate changes in self-control.

Given these strategies however self-control for did not appear to change for screen time. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for these specific behaviors. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Third, as noted above many children were already adequately meeting the recommendations for this behavior. After participating in the intervention and learning that children their age should not engage in more than two hours of screen time per day, children who were meeting this recommendations may in turn been complacent with their level of self-control, and saw no reason to change. Finally, the instrument used in this study may not have been adequately operationalized for this construct, resulting in measurement failure. To measure self-control children were asked to report their ability to set goals for reducing their screen time, and to reward themselves for successfully reducing their screen time. While these two components are essential for self-control, developing a concrete plan to accomplish the goal is another important component that appears to be missing from this subscale. This subscale could potentially be improved by adding an additional question to evaluate this component (i.e. ‘How sure are you that you could make a plan to help you reduce screen time everyday?’). This
subscale also only contains two questions and the reliability was lower than adequate (α=0.58), which could create a measurement bias, thus leading to misleading results.

Null Hypothesis #18: There was no difference in mean expectations (outcome expectations x outcome expectancies) scores for engaging in no more than 2 hours of screen time per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of expectations was measured using the sum of multiplicative scores of four items from an outcome expectations subscale with four corresponding items on an outcome expectancies scale. There did not appear to be any differences for expectations for screen time between children receiving the experimental and comparison interventions during the course of the intervention.

At baseline this construct was towards the mid-range of the scale for both groups indicating that children had a moderate amount of expectations and improvements were possible. In order to mediate a change in expectations in the experimental group children participated in a comic-book related activity. During the activity children were asked to brainstorm possible benefits for having less than two hours of screen time per day. For example, during this lesson children indicated benefits such as having a better weight, keeping your brain more alert and ready, and keeping your heart healthy. Next, children were asked to choose a benefit that was most important to them and with a comic book panel was asked to sketch what that benefit would look like to them, or what that benefit meant to them. After the activity some children were asked to share their comic book panel with the group. It is likely that this activity alone was not powerful enough to mediate changes in expectations. Anecdotally, the implementer also observed some children having a difficult time with this activity, as they found it hard to show the benefit with only one comic book panel and wanted more panels to be able to tell a small story. It was also difficult to keep children on task during this activity, as some would finish in
one or two minutes, and others wanted 5 or even 10 minutes to complete their panel. If this program is replicated in the future, it may be beneficial to give children more panels in order to tell a small story.

Given this strategy however expectations did not appear to change. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for screen time. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Third, as noted above many children were already adequately meeting the recommendations for screen time. After participating in the intervention and learning that children their age should not engage in more than two hours of screen time per day, children who were meeting this recommendations may in turn been complacent with their level of expectations, and saw no reason to change.

Social Cognitive Theory Antecedents of Moderate to Vigorous Physical Activity and Engagement in Moderate to Vigorous Physical Activity

Null Hypothesis#3: There was no difference in amount of minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children receiving a knowledge based intervention

In this study minutes of moderate to vigorous physical activity (MVPA) was measured using a two item scale, asking children to recall the amount of minutes they engaged in vigorous activities (i.e. jogging or playing basketball), and minutes they engaged in moderate activities (i.e. walking or doing house chores) in the past 24-hours. There did not appear to be any differences for the engagement of MVPA between children receiving the experimental and comparison interventions. There was however a significant main effect for this behavior, indicating that both groups significantly increased their MVPA over the course of the
intervention. This effect was also medium, as indicated by a Cohen’s $f$ of 0.255. Investigating further, it should be noted that the 2005 AMA recommendation for preventing childhood obesity and the goal of this intervention was to have children engage in at least 60 minutes of moderate to vigorous physical activity per day. At baseline a little more than half of the children met recommendation: overall 56% (54% in the experimental and 59% in the comparison) met the recommendation. This also improved during the study for both groups: overall at posttest 71% (70% in the experimental and 74% in the comparison) were meeting the recommendation, and at the follow up test 80% (89% in the experimental and 76% in the comparison) were meeting the recommendation.

While it is possible that both interventions were robust enough to mediate this behavior, it is unclear why both groups increased. First, the both interventions were similar in that they targeted the same behavior for increasing MVPA. Second, both interventions used a comic-book approach to target MVPA, which appears to be a well-received teaching method to frame health messages. Third, competing programs with similar goals were implemented at the same time of this intervention. For example half way through the intervention period the implementer found out that the program Jump Rope for Heart, a fundraising program sponsored by both the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) and American Heart Association (AHA), which encourages children to be physically active by jumping rope, was being implemented in all of Olentangy elementary schools. This program was implemented school-wide, and was likely reinforced by their principal, and teachers. Parents were also informed of the program and asked to help their children raise money. Another competing program was the YMCA created curriculum Y-Kids Are Fit. This program is not a standard program containing a series of lessons however. Instead, Y-Kids Are Fit consists
of a various games and activities that after school staff are encouraged to use, in order to increase the amount of MVPA children engage in while in the program. This program is also not mandated by the YMCA, hence the program was implemented differently at each after school site. Therefore it would have been extremely difficult to evaluate how much and to what extent each site implemented this program. Another reason this finding may have occurred is due to a Hawthorne effect, whereby children improved their physical activities as a result of being studied, and not as a result of participating in the program (Windsor, et al., 2004). Another reason is that there may have been contamination by after school program staff members at some of the sites, especially among the comparison sites. This is elaborated on later in this discussion. Finally as reported at baseline, children in both groups participated in at least two programs targeting healthy eating, and two programs targeting physical activity before this study. By participating in this intervention it could have reinforced previously learned messages, to in turn increased moderate to vigorous physical activities for both groups.

Null Hypothesis#13: There was no difference in mean self-efficacy scores for engaging in 60 minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of self-efficacy was measured using a three-item scale. There did not appear to be any differences for self-efficacy for MVPA between children receiving the experimental and comparison interventions during the course of the intervention. There was however a significant main effect for this construct, indicating that both groups significantly increased their self-efficacy for MVPA over the course of the intervention. This effect was also small to medium, as indicated by a Cohen’s $f$ of 0.186.

At baseline the subscale scores for this construct were towards the mid-range for both groups, indicating that children had a moderate amount of self-efficacy and improvements were
possible. In order to mediate a change in self-efficacy in the experimental group, four basic strategies were utilized. First, children were asked to brainstorm and report the amount of minutes of MVPA they engage in each day, and encouraged to take small steps to if they were currently not meeting the 60 minute per day recommendation. Next, the implementer attempted to serve as a positive role model, and consistently told the children that he participated in at least 60 minutes of MVPA on most days of the week. Next, the implementer verbally encouraged the children to engage in 60 minutes of MVPA per day. Finally, it was attempted to reduce the stress children might have from barriers to increase their MVPA by participating in role plays with the program implementer acting as a friend or family member.

While it is possible that both interventions were robust enough to mediate changes in this construct, it is unclear why children in both groups increased their self-efficacy. First, both interventions were similar in that they targeted the same behavior for increasing MVPA. Therefore, children in the comparison group may have overestimated their self-efficacy, as the result of learning the behavior (Windsor, et al., 2004). Second, both interventions used a comic-book approach to target screen time, which appears to be a well-received teaching method to frame health messages. Third, competing programs with similar goals were implemented at the same time of this intervention, as previously discussed. Fourth, this may have occurred due to a Hawthorne effect, whereby children improved their self-efficacy for physical activities as a result of being studied, and not as a result of participating in the program (Windsor, et al., 2004). Another reason is that there may have been contamination at some of the sites by after school staff members, especially among the comparison sites. This is elaborated on later in this discussion. Finally as reported at baseline, children in both groups participated in at least two programs targeting healthy eating, and two programs targeting physical activity before this study.
By participating in this intervention it could have reinforced previously learned messages, to in turn increase self-efficacy for both groups.

*Null Hypothesis*#14: There was no difference in mean self-control scores for engaging in 60 minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of self-control for MVPA was measured using a two-item scale. There did not appear to be any differences for this construct between children receiving the experimental and comparison interventions during the course of the intervention. Furthermore, there was no significant main effect for this construct, unlike self-efficacy, indicating that both groups did not change their self-control. There was however a significant overall between group difference for MVPA. Given that there was no main effect for self-control however, it can only be concluded that at some point during this study both groups were significantly different than one another, however there was no improvement for either group. It is also important to note that the groups were not significantly different at baseline, suggesting the difference occurred after the start of the program. The power for this analysis was also low (0.617) therefore readers should use caution when interpreting this finding.

The baseline score for this construct for both groups was towards the mid-range of this scale, indicating that children had a moderate amount of self-control and improvements were possible. In order to mediate a change in self-control in the experimental group children participated in a comic-book related activity. During the activity children were asked to create a small comic book story showing themselves going through the process of goal setting for having at least 60 minutes of MVPA per day. For example children were given three sequential comic book panels and in the first panel they were asked to show themselves setting a goal to have at least 60 minutes of MVPA per day. In the second panel they were asked to show themselves
creating a plan to make sure they have at least 60 minutes of MVPA per day. Finally, in the third panel they were asked to show themselves self-rewarding for accomplishing the goal of having at least 60 minutes of MVPA per day. Anecdotally, the implementer also observed some children having a difficult time with this activity, as they found it hard to create a story based on the idea of self-control. Some children were also confused by the idea of self-rewarding themselves. For example, many children would use unhealthy behaviors (i.e. I will reward myself by watching my favorite TV shows) to self-reward for this behavior. Therefore, while children understood this basic concept, they did not use all of the elements of the program to determine appropriate ways to self-reward. Self-control was also targeted during the role-plays implemented during the lesson. It is likely that these activities alone were not powerful enough to mediate changes in self-control.

Given these strategies however self-control in the experimental group did not appear to change for MVPA. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for these specific behaviors. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Third, as noted above slightly more than half of the children in this study were already adequately meeting the recommendations for these behaviors. After participating in the intervention and learning that children their age should have at least 60 minutes of MVPA per day, children who were meeting this recommendations may in turn been complacent with their level of self-control, and saw no reason to change. Finally, the instrument used in this study may not have been adequately operationalized for this construct, resulting in measurement failure. To measure self-control for MVPA children were asked to
report their ability to set goals for increasing their MVPA, and to reward themselves for successfully increasing their MVPA. While these two components are essential for self-control, developing a concrete plan to accomplish the goal is another important component that appears to be missing from this subscale. This subscale could potentially be improved by adding an additional question to evaluate this component (i.e. ‘How sure are you that you could make a plan to help you increase physical activities everyday?’). This subscale also only contains two questions and the reliability was lower than adequate ($\alpha=0.53$), which could create a measurement bias, thus leading to misleading results.

Null Hypothesis #15: There was no difference in mean expectations (outcome expectations x outcome expectancies) scores for engaging in 60 minutes of moderate to vigorous physical activity per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of expectations was measured using the sum of multiplicative scores of four items from an outcome expectations subscale with four corresponding item on an outcome expectancies scale. There did not appear to be any differences for expectations for moderate to vigorous physical activity between children receiving the experimental and comparison interventions during the course of the intervention.

At baseline the subscale score for this construct for both groups was towards the mid-range, indicating that children had a moderate amount of expectations and improvements were possible. In order to mediate a change in expectations in the experimental group children participated in a comic-book related activity. During the activity children were asked to brainstorm possible benefits for having least 60 minutes of MVPA per day. For example, during this lesson children indicated benefits such as having a better weight, and keeping your heart healthy, having stronger bones, and performing better at various sports. Next, children were asked to choose a benefit that was most important to them and with a comic book panel were
asked to sketch what that benefit would look like to them, or what that benefit meant to them. After the activity some children were asked to share their comic book panel with the group. It is likely that this activity alone was not powerful enough to mediate changes in expectations. Anecdotally, the implementer also observed some children having a difficult time with this activity, as they found it hard to show the benefit with only one comic book panel and wanted more to be able to tell a story. It was also difficult to keep children on task during this activity, as some would finish in one or two minutes, and others wanted 5 or even 10 minutes to complete their panel. If this program is replicated in the future, it may be beneficial to give children more panels in order to tell a small story.

Given this strategy however expectations did not appear to change. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for screen time. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Third, as noted above many children were already adequately meeting the recommendations for MVPA. After participating in the intervention and learning that children their age should not engage in at least 60 minutes of MVPA per day, children who were meeting this recommendations may in turn been complacent with their level of expectations, and saw no reason to change.
Social Cognitive Theory Antecedents of Sugar Sweetened Beverages and Consumption of Sugar-sweetened Beverages and Sugar-free Drinks & Water

Null Hypothesis #4: There was be no difference in amount of water and sugar-free drinks consumed per day between children receiving a theory-based intervention and children receiving a knowledge based intervention. & Null Hypothesis #5: There will be no differences in amount of sugar-sweetened beverages consumed per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

Since these two behaviors are inter-related, they will be discussed together in this section.

In this study the number of glasses of sugar-sweetened beverages was measured using one item, and the number of glasses of water and sugar free drinks was measured using a two item scale. There did not appear to be any differences for either behavior between children receiving the experimental and comparison interventions during the course of this study. There was however a significant main effect for water and sugar free drink consumption, indicating that both groups significantly increased the number of glasses of water and sugar free drinks they consumed. This effect was also medium, as indicated by a Cohen’s $f$ of 0.254. Investigating further it should be noted that the 2005 AMA recommendations for childhood obesity and goal in the intervention program was to have children replace sugar-sweetened beverages with water and sugar free drinks, and more specifically to *consume no more than one sweetened drink per day*. At baseline many children were already meeting this recommendation: overall 76% (70% in the experimental and 82% in the comparison) were meeting the recommendation.

It is uncertain why water and sugar free drink consumption increased while there was no change in sugar-sweetened beverage consumption. One explanation is that since many children were already meeting this recommendation and sugar-sweetened beverage consumption was low at baseline [experimental (1.36 glasses per day (+/-2.00 )); comparison (0.94 glasses per day (+/-1.17))], children saw no need to change their behavior. Second, parents may have been influencing the children to change. Anecdotally, during this lesson many children reported that
their parents controlled the amount of sugar-sweetened beverages they are allowed to consume, and many reported that their parents did not allow them to consume any type of carbonated beverage. A reason that sugar free drink consumption increased for both group may be due to a Hawthorne effect, whereby children decreased their consumption as a result of being studied, and not as a result of participating in the program (Windsor, et al., 2004). Finally as previously reported, children in both groups participated in at least two programs targeting healthy eating, and two programs targeting physical activity before this study. By participating in this intervention it could have reinforced previously learned messages to in turn improve this behavior.

Null Hypothesis #10: There was no difference in mean self-efficacy scores for consuming more water and sugar-free drinks per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of self-efficacy was measured using a three-item scale. There did not appear to be any differences for self-efficacy for sugar sweetened beverages between children receiving the experimental and comparison interventions during the course of the intervention. At baseline the scores for this construct were also towards the mid-range of the scale both groups, indicating that children had a moderate amount of self-efficacy for sugar sweetened beverage consumption and improvements were possible. In order to mediate a change in self-efficacy in the experimental group, four basic strategies were utilized. First, children were asked to brainstorm and report the number of sugar sweetened beverages they consume each day, and encouraged to take small steps to reduce the number of sugar sweetened beverages they consumed if it was a high amount. Children were also taught step-by-step how to use a food label to identify what drinks contained added sugar. Next, the implementer attempted to serve as a positive role model, and consistently told the children that he rarely consumed sugar
sweetened beverages. Next, the implementer verbally encouraged the children to consume less sugar sweetened beverages and more water and sugar-free drinks. Finally, it was attempted to reduce the stress children might have from barriers to reduce their sugar sweetened beverage consumption by participating in role plays with the program implementer acting as a friend or family member.

Given these strategies however overall self-efficacy for sugar sweetened beverages did not change for the experimental group. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify self efficacy for this specific behavior. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure (Green, & Lewis, 1986). Third, as noted above many children were already adequately meeting the recommendations for sugar sweetened beverages. After participating in the intervention and learning that children their age should not consume sugar-sweetened beverages, children who were meeting this recommendations may in turn been complacent with their level of self-efficacy, and saw no reason to change.

Null Hypothesis#11: There was no difference in mean self-control scores for consuming more water and sugar-free drinks per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of self-control was measured using a two-item scale. There did not appear to be any differences for this construct for sugar sweetened beverages between children receiving the experimental and comparison interventions during the course of the intervention. At baseline the subscale score for this construct for both groups was towards the mid-range of the scale, indicating that children had a moderate amount of self-control and improvements were possible. In order to mediate a change in self-control in the experimental
group children participated in a comic-book related activity. During the activity children were asked to create a small comic book story showing themselves going through the process of goal setting for assuring they attained the goal of having water or sugar free drinks instead of sugar sweetened beverages. For example children were given three sequential comic book panels and in the first panel they were asked to show themselves setting a goal to have water or sugar free drinks instead of sugar sweetened beverages. In the second panel they were asked to show themselves creating a plan to make sure they consumed water or sugar free drinks instead of sugar sweetened beverages. Finally, in the third panel they were asked to show themselves self-rewarding for accomplishing the goal of consuming water or sugar free drinks instead of sugar sweetened beverages. Anecdotally, the implementer also observed some children having a difficult time with this activity, as they found it hard to create a story based on the idea of self-control. Some children were also confused by the idea of self-rewarding themselves. For example, many children would use unhealthy behaviors (i.e. I will reward myself by playing video games) to self-reward. Therefore, while children understood this basic concept, they did not use all of the elements of the program to determine appropriate ways to self-reward. Self-control was also targeted during the role-plays implemented during the lesson. It is likely that these activities alone were not powerful enough to mediate changes in self-control.

Given these strategies however self-control for did not appear to change for sugar sweetened beverages. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for these specific behaviors. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Third, as noted above many children were
already adequately meeting the recommendations for these behaviors. After participating in the intervention and learning that children their age should not consume sugar sweetened beverages, children who were meeting this recommendations may in turn been complacent with their level of self-control, and saw no reason to change. Finally, the instrument used in this study may not have adequately operationalized this construct, resulting in measurement failure. For the self-control subscale children were asked to report their ability to set goals for reducing their screen time, and to reward themselves for successfully reducing their screen time. While these two components are essential for self-control, developing a concrete plan to accomplish the goal is another important component that appears to be missing from this subscale. This subscale could potentially be improved by adding an additional question to evaluate this component (i.e. ‘How sure are you that you could make a plan that could help you replace sugar sweetened beverages with water or sugar free drinks?’). This subscale also only contains two questions and the reliability was slightly lower than adequate ($\alpha=0.65$), which could also create a measurement bias thus leading to misleading results.

**Null Hypothesis#12:** There was no difference in mean expectations (outcome expectations x outcome expectancies) scores for consuming more water and sugar-free drinks per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of expectations was measured using the sum of multiplicative scores of items from an outcome expectations scale with a corresponding item on an outcome expectancies scale. There did not appear to be any differences for this construct between children receiving the experimental and comparison interventions during the course of the intervention. At baseline the subscale score for this construct for both groups was towards the mid-range of this scale, indicating that children had a moderate amount of expectations and improvements were possible. In order to mediate a change in expectations in the experimental
group children participated in a comic-book related activity. During the activity children were asked to brainstorm possible benefits for replacing sugar sweetened beverages with water or sugar-free drinks. For example, during this lesson children indicated benefits such as having a better weight, keeping you hydrated, doing better at sports and not having a sugar-crash later in the day. Next, children were asked to choose a benefit that was most important to them and with a comic book panel were asked to sketch what that benefit would look like to them, or what that benefit meant to them. After the activity some children were asked to share their comic book panel with the group. It is likely that this activity alone was not powerful enough to mediate changes in expectations. Anecdotally, the implementer also observed some children having a difficult time with this activity, as they found it hard to show the benefit with only one comic book panel and wanted more to be able to tell a story. It was also difficult to keep children on task during this activity, as some would finish in one or two minutes, and others wanted 5 or even 10 minutes to complete their panel. If this program is replicated in the future, it may be beneficial to give children more panels in order to tell a small story.

Given this strategy however expectations did not appear to change. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for screen time. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Third, as noted above many children were already adequately meeting the recommendations for sugar-sweetened beverages. After participating in the intervention and learning that children their age should not consume sugar sweetened beverages, children who were meeting this recommendations may in turn been complacent with their level of expectations, and saw no
reason to change.

Social Cognitive Theory Antecedents of Fruit and Vegetable Consumption and Consumption of Fruits and Vegetables

Null Hypothesis #6: There was no difference in number of servings of fruits and vegetables consumed per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the consumption of fruits and vegetables was measured using a nine-item scale: five items measured vegetable consumption and four items measured fruit consumption. There did not appear to be any differences in this behavior between children receiving the experimental and comparison interventions during the course of this intervention. There was however a significant main effect, indicating that both groups significantly increased their fruit and vegetable consumption. This effect was also medium, as indicated by a Cohen’s $f$ of 0.223. Investigating further, it should be noted that the 2005 AMA recommendation for the prevention of childhood obesity and goal in the intervention was to have children consume 5 servings of fruits and vegetables per day. Unlike the other behaviors measured in this study, many children were not meeting this recommendation at baseline: 27% (24% in the experimental and 29% in the comparison) were meeting this recommendation. Therefore this behavior appeared to have the most promise for change, and indeed improved during the study: overall at posttest 51% (54% in the experimental and 47% in the comparison) were meeting the recommendation, and at the follow up test 55% (54% in the experimental and 56% in the comparison) were meeting the recommendation.

While it is possible that both interventions were robust enough to mediate this behavior, it is unclear why both groups increased. First, the both interventions were similar in that they targeted the same behavior for increasing fruit and vegetable consumption. Second, both interventions used a comic-book approach to target this behavior, which appears to be a well-
received teaching method to frame health messages. Third, competing programs with similar
goals may have been implemented at the same time of this intervention. As previously reported
Jump Rope for Heart, and Y-Kids Are Fit were implemented at the time of this intervention.
These programs largely target physical activity and not diet. However, it is possible that other
program were implemented at the same time as this one, without the researchers knowledge.
Another reason this finding may have occurred is due to a Hawthorne effect, whereby children
increased their fruit and vegetable consumption as a result of being studied, and not as a result of
participating in the program (Windsor, et al., 2004). Another reason is that there may have been
contamination by after school staff member at some of the sites, especially among the
comparison sites. This is elaborated on later in this discussion. Finally as reported at baseline,
children in both groups participated in at least two programs targeting healthy eating, and two
programs targeting physical activity before this study. By participating in this intervention it
could have reinforced previously learned messages, to in turn increased fruit and vegetable
consumption for both groups.

Null Hypothesis#7: There was no difference in mean self-efficacy scores for consuming five
servings of fruits and vegetables per day between children receiving a theory-based intervention
and children receiving a knowledge based intervention.

In this study the construct of self-efficacy was measured using a three-item scale. There
did not appear to be any differences for self-efficacy for fruit and vegetable consumption
between children receiving the experimental and comparison interventions during the course of
the intervention. There was however a significant main effect for this construct, indicating that
both groups significantly increased their self-efficacy for fruit and vegetable consumption over
the course of the intervention. This effect was also small to medium, as indicated by a Cohen’s f
of 0.147.
The baseline scores for this construct was consistently towards the mid-range of the scale, indicating that children had a moderate amount of self-efficacy and improvements were possible. In order to mediate a change in self-efficacy in the experimental group, four basic strategies were utilized. First, children were asked to brainstorm and report the number of fruits and vegetables they consumed during the day, and encouraged to take small steps to eating more if they were not attaining the goal of consuming five servings per day. Next, the implementer attempted to serve as a positive role model, and consistently told the children that he consumed at least five servings of fruits and vegetables each day. Next, the implementer verbally encouraged the children to consume five servings of fruits and vegetables per day. Finally, it was attempted to reduce the stress children might have from barriers to increase fruit and vegetable consumption by participating in role plays with the program implementer acting as a friend or family member.

While it is possible that both interventions were robust enough to mediate changes in this construct, it is unclear why children in both groups increased their self-efficacy. First, both interventions were similar in that they targeted the same behavior for increasing fruit and vegetable consumption. Therefore, children in the comparison group may have overestimated their self-efficacy, as the result of learning the behavior (Windsor, et al., 2004). Second, both interventions used a comic-book approach to target fruit and vegetable consumption, which appears to be a well-received teaching method to frame health messages. Third, competing programs with similar goals may have been implemented at the same time of this intervention, as previously discussed. Fourth, this may have occurred due to a Hawthorne effect, whereby children improved their self-efficacy for this behavior as a result of being studied, and not as a result of participating in the program (Windsor, et al., 2004). Another reason is that there may have been contamination by after school staff members at some of the sites, especially among the
comparison sites. This is elaborated on later in this discussion. Finally as reported at baseline, children in both groups participated in at least two programs targeting healthy eating, and two programs targeting physical activity before this study. By participating in this intervention it could have reinforced previously learned messages, to in turn increased self-efficacy for both groups.

*Null Hypothesis*#8: *There was no difference in mean self-control scores for consuming five servings of fruits and vegetables per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.*

In this study the construct of self-control was measured using a two-item scale. There did not appear to be any differences for this construct for fruit and vegetable consumption between children receiving the experimental and comparison interventions during the course of the intervention. At baseline the subscale score for this construct for both groups was towards the mid-range of this scale, indicating that children had a moderate amount of self-control and improvements were possible. In order to mediate a change in self-control in the experimental group children participated in a comic-book related activity. During the activity children were asked to create a small comic book story showing themselves going through the process of goal setting for assuring they attained the goal of having at least five servings of fruits and vegetables per day. For example children were given three sequential comic book panels and in the first panel they were asked to show themselves setting a goal for eating more fruits and vegetables. In the second panel they were asked to show themselves creating a plan to make sure they consumed five servings of fruits and vegetables that day. Finally, in the third panel they were asked to show themselves self-rewarding for accomplishing the goal consuming five servings of fruits and vegetables per day. Anecdotally, the implementer also observed some children having a difficult time with this activity, as they found it hard to create a story based on the idea of self-
control. Some children were also confused by the idea of self-rewarding themselves. For example, many children would use unhealthy behaviors (i.e. I will reward myself by having an extra desert) to self-reward for this behavior. Therefore, while children understood this basic concept, they did not use all of the elements of the program to determine appropriate ways to self-reward. Self-control was also targeted during the role-plays implemented during the lesson. It is likely that these activities alone were not powerful enough to mediate changes in self-control.

Given these strategies however self-control did not appear to change for fruit and vegetable consumption. This may have occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes for these specific behaviors. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Finally, the instrument used in this study may not have adequately operationalized this construct, resulting in measurement failure. For the self-control subscale children were asked to report their ability to set goals for consuming five servings of fruits and vegetables per day, and to reward themselves for successfully consuming five servings of fruits and vegetables per day. While these two components are essential for self-control, developing a concrete plan to accomplish the goal is another important component that appears to be missing from this subscale. This subscale could potentially be improved by adding an additional question to evaluate this component (i.e. ‘How sure are you that you could make a plan that could help you consume at least five servings of fruits and vegetables everyday?’).
Null Hypothesis: There was no difference in mean expectations (outcome expectations x outcome expectancies) scores for consuming five servings of fruits and vegetables per day between children receiving a theory-based intervention and children receiving a knowledge based intervention.

In this study the construct of expectations was measured using the sum of multiplicative scores of items from an outcome expectations scale with a corresponding item on an outcome expectancies scale. There did not appear to be any differences for this construct between children receiving the experimental and comparison interventions during the course of the intervention. At baseline the subscale score for this construct for both groups was towards the mid-range of this scale, indicating that children had a moderate amount of expectations and improvements were possible. In order to mediate a change in expectations in the experimental group children participated in a comic-book related activity. During the activity children were asked to brainstorm possible benefits for consuming fruits and vegetables. For example, during this lesson children indicated benefits such as having a better weight, keeping your skin and hair healthy, and improving your vision. Next, children were asked to choose a benefit that was most important to them and with a comic book panel was asked to sketch what that benefit would look like to them, or what that benefit meant to them. After the activity some children were asked to share their comic book panel with the group. It is likely that this activity alone was not powerful enough to mediate changes in expectations. Anecdotally, the implementer also observed some children having a difficult time with this activity, as they found it hard to show the benefit with only one comic book panel and wanted more to be able to tell a story. It was also difficult to keep children on task during this activity, as some would finish in one or two minutes, and others wanted 5 or even 10 minutes to complete their panel. If this program is replicated in the future, it may be beneficial to give children more panels in order to tell a small story.

Given this strategy however expectations did not appear to change. This may have
occurred for several reasons. First, the dose of the intervention may not have been sufficient to adequately modify changes in expectations. This is further elaborated upon later in this chapter. Second, this theoretical construct may not have been operationalized correctly in this intervention, thus resulting in intervention failure, as previously noted (Green, & Lewis, 1986). Additional limitations that may have impacted this finding are presented later in this chapter.

*Dose of the program*

The current study tested the effects of an after-school social cognitive theory based comic book intervention for the prevention of childhood obesity among elementary aged school children. As earlier reported, social cognitive theory has been applied for primary prevention to a wide array of health topics and has been an overall successful theory used for obesity prevention. In the meta-analysis previously mentioned by Thomas (2006), four interventions based on social cognitive theory were identified as being successful for favorably impacting nutrition and physical activity behaviors among children, which in turn impacted childhood obesity. The intervention periods for these four studies ranged from 2 to 3 years however, which is notably longer than the intervention period used in this study. This intervention consisted of four lessons implemented over a four week period, with each lesson lasting 30 minutes in length, resulting in a total intervention time of two hours. Additional take-home activities and booster session activities were given to children in an attempt to prolong this intervention period, however it is uncertain how much additional impact they truly had.

Before this study began it was believed that a brief intervention period may be adequate to mediate some changes in social cognitive theory constructs, as brief interventions have been successful in other health promotion efforts. For example, in a review of interventions using motivational interviewing to reduce drinking problems among college students it was noted that
brief interventions were consistently effective. All intervention periods ranged from 30 minutes to two hours, with an average intervention period of approximately one hour (Branscum, & Sharma, 2010). However, it is important to note that this review was with a different population (college students) targeting a different behavior (drinking problems/binge drinking) therefore it likely the case that brief interventions are either not suitable for children or for targeting the key obesity related behaviors that were targeted in this study.

Currently, there appears to be conflicting evidence pertaining to the efficacy of brief and longer interventions for obesity prevention. In the meta-analyses by Cook-Cottone and colleagues (2009), it was reported that interventions with a short duration (0–12 weeks) were associated with very small, significant, negative effect on BMI, while low to moderate (13–27 weeks), moderate (28–32 weeks), and long (>32 weeks) interventions were associated with small, significant, positive effect on BMI. However, in another meta-analysis by Stice and colleagues (2006) shorter duration intervention (<16 weeks) exhibited a small yet significant positive effect size for BMI, while longer duration interventions (>16 weeks) exhibited no significant effect on BMI. Theoretically it makes sense that longer interventions allow children a better chance to fully comprehend material being presented and incorporate behavior changes into their lives, however brief interventions are also advantageous since they can be conducted in a reasonable time-frame, which was found to be appealing to the after school staff members present during this study. There were no significant differences between the two intervention groups for the mean scores of any social cognitive theory construct for any behavior targeted in this study, which is likely attributed to the small does this intervention provided. It is likely that the short duration of this intervention was inadequate to fully mediate changes in constructs of social cognitive theory, however this intervention may by helpful as an ancillary program to a
larger health promotion interventions, given that it was well received by the children in this study and is an innovative approach at teaching these health-related behaviors. Nonetheless, if this approach is used in the future as an ancillary program, a longer intervention period will be needed.

Limitations

Besides the limitation discussed in preceding sections, this study has some additional limitations. The main purpose of this study was to find differences for BMI-percentile, key obesity related behaviors, and social cognitive theory antecedents of each behavior between the experimental and comparison groups. While there were no differences over time between groups, we did find four behavioral variables (fruit and vegetable consumption, water and sugar-free drink consumption, moderate the vigorous physical activity and screen time) and two social cognitive theory construct subscales (self efficacy for moderate to vigorous physical activity and fruit and vegetable consumption) that significantly improved over time for both groups. While it appears this increase may have occurred as a result of the program, we can not definitively come to this conclusion as these changes may have occurred from a number of other sources such as the physical environment (i.e. seasons changing in between evaluations which may impact children’s ability to engage in physical activity outdoors), or social environment (i.e. competing programs that target similar behaviors as this intervention). Another limitation in this study was that almost all study variables were measured by self-report. Specifically participants provided information on demographics, the engagement in five obesity preventative behaviors, and constructs of social cognitive theory such as self-efficacy, self-control and expectations. Any inaccuracy in memory or distortions in these self-reports could have impacted the results for this study. The instrument used for this self-report was also rather lengthy for a child’s attention
span. Anecdotally, some children complained that the instrument was too long, which could introduce bias if they hurried through the instrument instead of answering the questions genuinely.

There may have also been contamination from after school staff member at some sites, most notably from the sites in the comparison condition. Since the comparison intervention was a knowledge-based program, and the after-school program staff members were unaware of which program children were receiving, the staff may have perceived the intervention as weak and attempted to reinforced the health messages given for each lesson thinking the intervention did an inadequate job of fully explaining the importance of the behavior. This was observed once during the study by the program implementer at a comparison site during the lesson targeting sugar-sweetened beverages. It is unknown how much and to what extent reinforcement was given at each site, hence future studies should consider controlling for this by either evaluating the amount of reinforcement or asking the after-school staff from refraining from reinforcing the messages.

All behaviors in this study were also based on a one-day recall, which may not be representative of a typical day. Given the amount of children enrolled in this study and the resources that were available to the investigators, it was decided to use a questionnaire type instrument to evaluate these behaviors. Such instruments can be based on a one-day recall, or more extensive such as a 7-day recall. To keep the instrument simple, clear and easy to understand and given children’s lack of memory over a period longer than 24-hours, it was decided to use this method. It can however be said, that a drawback to using such methods are that they tend to overestimate consumption and activity levels (McPherson, et al., 2000; Kjonniksen, Torsheim, & Wold, 2008).
Participation in this study was also voluntary and required parent permission and child assent. This may have limited the participation to some children, who were unwilling to participate for various reasons. Anecdotally, the program facilitator observed some children declining to participate because they did not want to have their height and weight measured in public. Children enrolled in this study were also not randomly selected for participation in this study, however ASP’s were randomly assigned to a treatment condition. It can be said that most children in this study were Caucasian, and from middle to upper class families, given the low enrollment children in free and reduced priced federally subsidized lunches as reported by the school district. This limits the generalizability of these findings, and this study can only be generalized to schools that have similar demographics.

As previously mentioned, during this intervention period the authors of this study found two competing programs were being implemented simultaneously that targeted similar behaviors to this study. Additional programs could have been implemented in all or a select number of sites for which the authors were unaware. It occurred to the authors after all data collection was complete that evaluating children’s involvement in such programs would have been helpful. If it was found that some sites were participating in other health programs that other sites were not, it would have allowed us to introduce this variable into the analyses as a covariate, which could have helped explain why some study variables increased for both the experimental and comparison conditions.

Another limitation was that one of the two raters for establishing program fidelity was the program facilitator himself. This could have introduced bias as the program implementer was familiar with the program and process evaluation tally sheets, whereas the other rater was not. This was done however out of necessity as resources were not available to hire another rater to
attend each lesson per week. The use of two independent raters could have strengthened the assessment of program fidelity in this study.

Another limitation to this study is that the theory used to design the experimental intervention in this study (social cognitive theory) may not have been operationalized adequately to make changes in the key obesity related behaviors targeted in this study, thus resulting in theory failure. As previously stated, social cognitive theory is a commonly used theory in health education which posits that human behavior can be explained by reciprocal determinism, or a continuous interaction between behavior, personal factors and the environment. While social cognitive theory is a useful framework for health promoting interventions, a limitation from using this theory is that it can be difficult to operationalize and use all nine constructs, which make up this theory. It was decided to intervene on self-efficacy, self-control and expectations in order to have a more parsimonious model for evaluation. Knowledge was targeted in this intervention, since knowledge is a necessary factor for behavior change but it was not evaluated since it was targeted in both the experimental and comparison interventions, and assumed all children had a general knowledge of these health behaviors as evident by the amount of health programs they reported participating in the past. Another construct that is greatly needed for behavior change was environment, however this can be a difficult construct to modify since children do not generally control their own environments, and it can be difficult to intervene with parents.

Finally, there were multiple significant tests (univariate ANOVA’s) performed in this study, which could potentially inflate the type I error for these tests. Some researchers suggest using a more stringent alpha when faced with this situation, however it should also be noted that doing so can increase the chances of making a type II error (Perneger, 1998). Upon using a more
stringent alpha, such as 0.01, the results would not dramatically change in this study, however using an alpha as stringent as 0.001 would make all but one finding in this study statistically significant.

Implications for Practice

Obesity continues to be a major issue among children and adolescents, and one of the largest public health concerns for this generation. While obesity is the result of a sustained energy imbalance, whereby more calories are consumed than expended, identifying the underlying causes of this imbalance is challenging and even more challenging is finding health promotion and education strategies to mediate changes in such underlying causes. Many factors are reportedly associated with childhood obesity, and in 2005 the American Medical Association (AMA) convened an expert committee to provide practical advice and guidance for obesity prevention efforts. Key lifestyle behaviors that were identified included: consuming no more than one sweetened beverage per day, consuming 5 servings of fruits and vegetables per day, engaging in at least 60 minutes of moderate to vigorous physical activity (MVPA) per day, and limiting screen time activities to no more than 2 hours per day (Roa, 2008).

The findings from this study are important for health education practice for different reasons. First, this study was designed to be an efficacy study, in that we were able to attain trends regarding the impact this approach had on weight status (as measured by BMI-percentile), key obesity related behaviors, and constructs of social cognitive theory. Overall, this approach did not appear to have an impact on weight status in the short term. However, this approach did appear to have an impact on four of the five key obesity related behaviors targeted in this study. For the various constructs of social cognitive theory, only self-efficacy was enhanced in two occasions for both groups, but all other constructs did not appear to change for either group.
This may have happened due to a majority of children already engaging in most of the recommended behaviors promoted during the intervention. It was however unexpected that while most children were engaging in the recommended behaviors, the social cognitive theory construct subscale scores were consistently towards the mid-range. This finding may have more than one explanation. Children may have either over-reported their engagement in the targeted behaviors, or underreported their self-efficacy, self-control and expectations. Another explanation however is that outside forces, such as their parents, provided an environment such that made it easy to engage in these behaviors, and in some cases parents urged their children to engage in these behaviors. If this was the case then it is possible that the interpersonal factors measured in this study could be moderate, while having children engage in these behaviors. Future health educators should be aware of such a finding and decide if resources are best spent on populations that may not need intervention.

This study also gives us important preliminary findings regarding the feasibility and acceptability of this approach to inform future larger trials. The comic-book approach does appear to be an acceptable intervention medium through which messages can be framed and transmitted. Children in this study generally enjoyed making their comic books, and wanted more time to fully develop their ideas into stories. Future health professionals should consider using a similar comic book approach when targeting this age group.

The dose of this intervention was considered brief, and future health professions should consider lengthening this intervention. For example more than one lesson should target each behavior, to give children a better chance to develop targeted psychosocial constructs. If future health professionals spent one lesson mediating changes in self-efficacy, one lesson on self-control and one lesson on expectations, the intervention would be lengthened to twelve sessions,
which would also give children a longer period to learn different comic book techniques and create longer comic book stories. Health educators can operationalize self-efficacy better by taking more time with the intervention methods already used and include other strategies such as taste-testing various fruits and vegetables to reduce barriers such as food neo-phobias, participate in active games where children can have fun being physically active, and even have parents participate on occasion to give verbal persuasion to assure the child feels confident in their abilities. Health educators can operationalize self-control better by taking more time with the intervention methods already used and include other strategies such as helping children set short term goals, have follow-up discussions with them to talk about their successes and hardships with goals and discuss contingency plans they can take when they are not meeting their goals. Health educators can operationalize expectations better by taking more time with the intervention methods already used and include other strategies such as taste-testing (as previously mentioned), include small group activities that helps clarify what children perceive as truly important, and even have parents participate on occasion to share with their children what they perceive to be important.

This study assessed the program fidelity by using a variety of methods, which is a recommendation for future health educators. While process evaluations are starting to be used more in obesity intervention research, it still is not considered a widely utilized practice. Program fidelity was evaluated by using a structured tally sheets, by timing each intervention to assure the length of the lesson did not vary by site or intervention condition, and by taking attendance to assure the children in this study were exposed to the intervention in its entirety. Although this study used two raters, one of these raters was the program implementer himself, and future studies done by health promotion practitioners should include two independent raters,
which would further strengthen the study.

**Recommendations for future researchers**

This study demonstrated that a brief social cognitive theory comic book childhood obesity prevention intervention had no significant difference compared to a brief knowledge based comic book childhood obesity prevention intervention for modifying social cognitive theory constructs, key obesity related behaviors and BMI-percentile. There are many recommendations for future researchers as a result of this study. First, the intervention should be expanded upon to increase dose and tested under similar conditions as this study. This will help researchers to identify what effects a longer intervention period might have. If results are promising, the intervention should be implemented under more normal, real-world conditions, where after school site personnel are trained to implement and evaluate the program under typical conditions. Second, this intervention was implemented with a primarily white, middle to upper class group of children in a suburb of a Midwestern city. Most of these children were also already engaging in the recommended behaviors this study targeted, as evident by their pretests. Future researchers should consider implementing this program in other settings, with racially diverse children and those who are not meeting the behavioral recommendations to further our current knowledge base.

The instrument in this study can also be further improved if it used in future studies in the after school setting. It was apparent that from using a previously validated instrument for the SCT subscales, it was mostly valid and reliable with this group as well. To further improve this instrument one or two questions could be added to the self-control subscale, and validity and reliability should be further evaluated. The validity and reliability of the outcome expectations for moderate to vigorous physical activity subscale was also found to be low in this study. If this
scale is used in future research using similar children and found to have the same validity and reliability as with this study, researchers should consider changing items on this scale based from advise from an expert panel or from focus groups with children in the after school setting. Also, this study was limited to using only three constructs of social cognitive theory. By utilizing additional constructs, it may improve the predictive power and efficacy of the intervention. However it should also be noted that the length of the instrument is already long, therefore it is unclear how many more questions is feasible for children to be able to answer.

This study evaluated a theory-based intervention to a knowledge-only based intervention, but found increases in some behaviors and self-efficacy subscales for both. In the future it may be more beneficial to use a staggered design, whereby one group of children receive the theory-based program, and is compared to a group of children who are waitlisted to receiving the program. This could help researchers understand whether the effects found in the study are from the intervention or from competing, outside programs. It may also be beneficial to compare this theory-based approach to another theory-based approach, such as one based on the theory of planned behavior or the transtheoretical model. This will allow future researchers the ability to compare different theories in order to determine which methods have the most predictive power and efficacy for certain behaviors.

Future researchers may want to also consider including additional health promotion efforts with this program. It is well understood that efforts directed towards an individual are usually not sufficient to mediate behavior change, and changes in the environment and policies can act to help support obesity prevention efforts. Such intervention strategies might include providing fruits and vegetables for snacks during the after school hours in place of pre-packaged snacks, providing opportunities to engage in physical activities, and only allowing healthier
options to be served in lunch lines and vending machines in the school setting.

Finally, this study only utilized evaluations at three time points: before the intervention, immediately after the intervention, and three months after the completion of the intervention. While this design has strengths and evaluates children after some time has passed from the intervention, three months may be seen as a relatively short amount of time. Given the constraints of the academic school year however, a three month follow up was the longest amount of time that was feasible for this study. Future researcher may want to plan for longer evaluation periods by implementing health programs towards the beginning of the school year. In cases where this is not feasible, researchers can attempt to follow children into the following school year.

Summary

In summary this study demonstrates the need for further research targeted toward childhood obesity prevention, especially efforts that are theory-based. It appeared from this study that while the brevity of the program might not have been sufficient to make changes in targeted study variables, using a comic book approach with children does appear to have some clout. It can also be said that studies such as this one are difficult to conduct, given the large number of extraneous variables that may intervene and impact study results. Nevertheless, more intermediate and efficacy trials are needed in this area to help future researchers decide what practices and methods are best suited for larger, longer, and more comprehensive group randomized controlled trials, that include both health promotion and education strategies. This should keep us all busy for years to come.
References


Appendix A. What is a serving size? What is a glass?

**What is a Serving Size?**

- 1/2 cup mixed fruit
- 1 Small piece of fruit
- 1/2 cup berries
- 1 wedge of melon
- 1/2 cup raw, cooked, or frozen vegetables
- 1 cup leafy, green lettuce

**What is a Glass?**

- 8 ounce of water
- 8 ounce of diet-pop, or other sugar-free drinks
- 8 ounces of Kool aid, soda, pop, or other fruit drinks
Appendix B. Panel of experts for *Diet and Activity Behaviors* scale & letter to panel

List of panel of experts

1. Nancy Brody, Med
   Metropolitan School-Age Quality Education Resource Director
   YMCA OF CENTRAL OHIO
   40 West Long Street, Columbus, Ohio 43215
   Phone: 614 224 1137 ext 166
   nbrody@ymcaglobal.org
   Expertise: Target Population

2. Judy Murnan, PhD
   Assistant Professor Health Promotion & Education
   University of Cincinnati, Cincinnati, OH 45221
   Phone: (513)556-3855
   judy.murnan@uc.edu
   Expertise: Target Population, and Childhood Obesity

3. Brad Wilson, PhD
   Professor Health Promotion & Education
   University of Cincinnati, Cincinnati, OH 45221
   Phone: (513)556-3862
   bradley.wilson@uc.edu
   Expertise: Childhood Obesity

4. Amar Kanekar, M.B.; B.S., MPH, PhD
   Assistant Professor of Health Studies
   East Stroudsburg University, East Stroudsburg, PA 18301
   Phone: (570) 422-3211
   akanekar@po-box.esu.edu
   Expertise: Childhood Obesity, and Instrumentation

5. Manoj Sharma, M.B.; B.S., MCHES, Ph.D
   Professor Health Promotion & Education
   University of Cincinnati Cincinnati, OH 45221
   Phone:513-556-3878
   Expertise: Target Population, Childhood Obesity, and Instrumentation

6. Lihshing Leigh Wang, PhD
   Associate Profession Educational Studies
   University of Cincinnati, Cincinnati, OH 45221
   Phone: 513-556-3628
   lihshing.wang@uc.edu
   Expertise: Instrumentation
Dear: Dr. Manoj Sharma,  
Dr. Lihshing Wang,  
Dr. Amar Kanekar,  
Dr. Judy Murnan,  
Dr. Brad Wilson,  
Nancy Brody  

As you know, I am working a study for my dissertation entitled *Designing and evaluating a social cognitive theory comic-book based intervention for the prevention of childhood obesity among elementary aged school children*. For this study I am developing a brief instrument to measure five key obesity related behaviors, and based on your expertise in the subject matter of childhood obesity, instrument development, or working with elementary school children, you have been identified as a potential expert to help me establish content and face validity of my instrument. This process will include a two-round review process, with the first draft being sent out immediately. A timeframe of one week would be given for you to respond with comments and feedback. After making changes based on your input, a second draft of the instrument would be sent out for your review. An additional week would then be given for your final comments and suggestions.

If you have the time and would be willing to participate I would be greatly appreciated. I am very thankful for your time and hope to work with you in the near future. If you have any questions, please feel free to contact me by email bransepw@mail.uc.edu or phone (513) 324-9783.

Sincerely,  

Paul Branscum, PhD (c), MS, RD, LD  
Graduate Assistant  
Health Promotion and Education  
The University of Cincinnati
Appendix C. Listing of YMCA after-school program sites

1. Scioto Ridge Y-Club
   8715 Big Bear Avenue
   Powell, Ohio 43065

2. Tyler Run Y-Club
   580 Salisbury Drive
   Powell, Ohio 43065

3. Indian Springs Y-Club
   3828 Home Road
   Powell Road, Ohio 43065

4. Liberty Tree Y-Club
   6877 Sawmill Pkwy
   Powell, Ohio 43065

5. Freedom Trail Y-Club
   6743 Bale Kenyon Drive
   Lewis Center, Ohio 43035

6. Walnut Creek Y-Club
   5600 Grand Oak Blvd.
   Galena, Oh 43021

7. Glen Oak
   7300 Blue Holly Dr
   Lewis Center, OH 43035

8. Oak Creek
   1256 Westwood Dr
   Lewis Center, OH 43035

9. Olentangy Meadows Y-Club
   8950 Emerald Drive
   Lewis Center, OH 43035

10. Alum Creek Y-Club
    2515 Parklawn Drive
    Lewis Center, OH 43035

11. Jonnycake Corners Y-Club
    6783 Falling Meadows Drive
    Galena, OH 43021

12. Cheshire Y-Club
    2681 Gregory Road
    Delaware, OH 43015
Appendix D. Learning healthy behaviors with comics (experimental version)

Experimental Intervention

Learning Healthy Behaviors With Comics

After completing this four-session intervention children will be able to:

Session 1: Engaging in no more than 2 hours of screen time per day
1. Define screen time
2. List various activities that constitute screen time.
3. Identify the appropriate amount of screen time children should engage in everyday (no more than 2 hours).
4. Explain benefits of limiting screen time to only 2 hours per day.
5. Explain to parents and friends how much screen time they should have and alternative activities to screen time.
6. Demonstrate self-control for limiting screen time to 2 hours per day.

Session 2: Consuming water/sugar-free drinks instead of sugar-sweetened beverages

1. Define sugar-sweetened drinks
2. List various examples of them.
3. Define sugar-free drinks
4. List various examples of them.
5. Identify the food label on various drink containers
6. Identify 'Sugars' on given food labels.
7. Explain benefits of choosing sugar-free drinks and water instead of sugar-sweetened beverages.
8. Explain to parents and friends why having sugar-free drinks and water instead of sugar-sweetened beverages is better.
Session 3: Engaging in at least 60 minutes of physical activity per day

1. Define physical activity
2. List various examples of physical activities.
3. Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes).
4. Explain benefits of being physically active for at least 60 minutes per day.
5. Explain to parents and friends why having at least 60 minutes of physical activity everyday is important.
6. Demonstrate self-control for being physically active for at least 60 minutes per day.

Session 4: Consuming 5 servings of Fruits and Vegetables per day

1. Identify four basic types of fruits.
2. Identify five basic types of vegetables.
3. Identify the amount of fruits and vegetables children should eat each day.
4. Explain benefits of eating 5 servings of fruits and vegetables per day.
5. Explain to parents and friends why eating 5 servings of fruits and vegetables per day is important.
6. Demonstrate self-control for eating 5 servings of fruits and vegetables.
Session 1: Engaging in no more than 2 hours of screen time per day

1. Define screen time
2. List various activities that constitute screen time.
3. Identify the appropriate amount of screen time children should engage in everyday (no more than 2 hours).
4. Explain benefits of limiting screen time to only 2 hours per day.
5. Explain to parents and friends how much screen time they should have and alternative activities to screen time.
6. Demonstrate self-control for limiting screen time to 2 hours per day.
Session 1: Limiting screen time to no more than 2 hours per day

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<th>Learning Process</th>
<th>Required Materials</th>
<th>Required Time</th>
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| Introduction & Purpose of Lesson | 1. Define screen time  
2. List various activities that constitute screen time.  
3. Identify the appropriate amount of screen time they should engage in everyday (no more than 2 hours). | - Introduce yourself  
- Explain to children the goal of the lesson.  
- Say: “Today we will be talking about screen time. Specifically, what it is, and how much we should have everyday. During the course of this program we are also going to talk about comic books. Specifically, what they are and how to create our own comic  
- Ask children ‘So first I have a question for you. What do you think is meant by the word screen time?’  
- Get responses from the word ‘screen time.’ (prompt as needed)  
- Say: Screen time refers to activity that provides little or no activity. Examples of screen time include: TV watching, videos, movies, computer time and playing non-active video games.  
- Show and distribute worksheet 1.  
- Ask children ‘How long do you spend with screen time everyday? Let us do this fun activity to find out!’  
- Read directions and implement activity 1.1 on worksheet 1.  
- After children are done have them share with the group the amount of time spent in screen time.  
- Next, take guesses for how long they should spend with screen time.  
- Explain to children they should spend no more than 2 hours per day with screen time.  
- Explain that during this lesson they will talk about ways to achieve this goal. | WK SH 1             | 3-5 minutes    |
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| Benefits | 4. Explain benefits of limiting screen time to only 2 hours per day.                   | - Explain that during the course of this program children will learn about comic books. Specifically, how to create their own comic book.  
- Ask children: So, what do you know about comic books? Have you ever read them yourselves? What are your favorite kinds of comic books?  
- Get responses from children.  
- Explain that comic books are a way to tell a story by using both pictures and words.  
- Show worksheet 1, activity 1.2 and explain that when making comic books it is important to know what the characters are feeling like, or their emotions. Ask children what are examples of different emotions. (happy, sad, excited, disappointed, confused, etc).  
- Say: Read directions for activity 1.2 on worksheet 1 and implement activity.  
- After children are done, have some show the group their pictures.  
- Ask children: Going back to talking about screen time, remember I said we should only spend about 2 hours doing those activities. Can anyone think of reasons why we would want to do this?  
- Wait and take responses from children.  
- Be sure to cover benefits: Helps you stay healthy, relieves stress, gain more energy, improve your mood, sleep better, make more friends, build stronger bones and muscles, increase your flexibility, and have more time to spend with friends.  
- Now show them activity WK 1.3 on worksheet 1. Read the directions for activity 1.3 and implement activity.  
- When children are done, have them show the other children.                                                                                               | WK SH 1            | 10 minutes    |
| Role-play| 5. Explain to parents and friends how much screen time they should have and alternative activities to screen time. | - Say: Now let us practice talking with our parents and our friends about this, because they might not know about screen time, or why it is important to only have 2 hours everyday. Let’s practice using our knowledge by doing something called ‘role plays.’  
- Ask: Who can tell me what a ‘role play’ is?  
- Provides/acknowledges correct response                                                                                                                   | Role-play activity sheet 1 | 10 minutes     |
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|            | 6. Demonstrate self-control for limiting screen time to 2 hours per day.                  | - Says: A 'role-play' is an activity that allows you to practice doing something in a 'pretend' setting. It helps you build your 'skill muscles.'  
- Asks: Who would like to play themselves for the first Role-Play??  
Don't worry if you don't get to do it the first time or even today, because there will be plenty of opportunity to do it in the future.  
- Says: Thanks (says child's name) for agreeing to be a volunteer.  
- Explain scenario # 1 as listed on role-play activity sheet 1.  
- Implement role-play 1.1 on role-play activity sheet 1.  
- Processes role play 1.1 as listed on activity sheet 1.  
- Explain scenario # 2 as listed on role-play activity sheet 1.  
- Implement role-play 1.2 on role-play activity sheet 1.  
- Processes role play 1.2 as listed on activity sheet 1.  |                    |               |
|            |                                                                                         | - Says: That was a great job everyone! Now we are going to talk about one more thing. When we have a goal, like the limiting screen time to only 2 hours per day, it is important that we set the goal, work in small steps to get there and then reward ourselves when we achieve our goal.  
- Says: Look at activity 1.4 on worksheet 1. Read instructions for activity and implement activity.  
- Ask if one or two children want to share their activity.  
- Wrap up  
- Say: Alright kids, that is all we are going to do today. Thank you so much for paying attention. Does anyone have any questions?  
- Say: Next time we are going to talk more about comic books and get you ready for making your own comic book. So what I want you to do is think about CHARACTERS that you want in your story. The story will be about you, but what will you be? A superhero? A pirate? An explorer? Something else?  
- Say: Also, what other characters will be in your story? You can have a mix of real-life characters (like your friends, teachers, or parents), and pretend characters (like Superman, Batman, | WK SH 1 Character Creation Sheet | 5-7 minutes    |
<p>| | | | | |
|            |                                                                                         |                                                                                                                                                                                                                                                                                                                                                   |                    |               |</p>
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<td>Spiderman, etc.)</td>
<td>-Say: Take this Character Creation Sheet home with you and fill it out, and bring it back to me the next time we meet. -Make sure children know next day/time they will meet.</td>
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Session 2: Consuming water/sugar-free drinks instead of sugar-sweetened beverages

1. Define sugar-sweetened drinks
2. List various examples of them.
3. Define sugar-free drinks
4. List various examples of them.
5. Identify the food label on various drink containers
6. Identify 'Sugars' on given food labels.
7. Explain benefits of choosing sugar-free drinks and water instead of sugar-sweetened beverages.
8. Explain to parents and friends why having sugar-free drinks and water instead of sugar-sweetened beverages is better.
## Introduction & Purpose of Lesson

1. Define sugar-sweetened drinks
2. List various examples of them.
3. Define sugar-free drinks
4. List various examples of them.
5. Identify the food label on various drink containers
6. Identify 'Sugars' on given food labels.

### Learning Process

- Re-introduce yourself
- Explain to children the goal of the lesson.
- Say: Today, we will be talking about drinks. Specifically, drinks with added sugars and drinks without added sugars.
- Ask children 'What do you think is meant by the word "sugar-sweetened drinks"?'
- Get responses from the word 'sugar-sweetened drinks.' (prompt as needed)
- Say: Sugar-sweetened drinks refers to any drinks that have extra or added sugars in them. Examples of sugar-sweetened drinks include: kool-aid, pops, and fruit punches.
- Ask children 'But how do we know if a drink is made with added sugars or has added sugars in it?'
- Provide worksheet 2 and direct their attention to activity 2.1.
- Read the direction for activity 2.1 and implement activity 2.1
- During activity 2.1 be sure to Say: For example, in this activity Carlo wants to choose the better drink out of these two drinks. The drink on the left is soda-pop and the drink on the right is a bottle of water. What Carlo needs to do to figure out which drinks have added sugar, is look at the food label. Has anyone ever looked at the food label on the foods they eat before? Well the food label is a GREAT tool for helping us to know what is in our food and drinks. Just like added sugars. Does everyone see the food labels for the drinks on the worksheet? Can everyone point to it? Great! And on the food label it will list 'Sugars' which tells us how much sugar is in the drink.
- Show children where 'sugars' is on food label and assure they all point to it.
- Says: Great job! Well next to the word 'sugar' there is usually a number. That number is the amount of sugar in the drink. So how much sugar does the soda have?
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<td>- Get responses from children.</td>
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<td>- Says: Yes, that is right! 39 grams. What about the water? How much sugar does water have?</td>
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<td>- Get responses from children.</td>
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<td>- Says: Yes, that is right! Water has 0 grams of sugar! So which would be the better choice? The soda or the water?</td>
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<td>- Get responses from children.</td>
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<td>Says: Yes, that is right! The water would be a better choice, because the water has 0 sugars. When drinks like water have no sugars, we call them 'sugar-free drinks.' Can you think of any other 'sugar-free drinks?'</td>
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<td>- Get responses from children.</td>
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<td>Says: That's great! Diet pops, crystal light, sugar-free kool-aid. In fact a lot the drinks that we have today usually have a version with sugar and without sugar. So it's really important to read the food label every time we can choose a drink. And when it is available, WATER is the best choice, because it will never have any sugars. Does everyone understand?</td>
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<td>Benefits</td>
<td>7. Explain benefits of choosing sugar-free drinks and water instead of sugar-sweetened beverages.</td>
<td>- Explain that during the course of this program children will learn about comic books. Specifically, how to create their own comic book.</td>
<td>WK SH 2</td>
<td>7-10 minutes</td>
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<td>- Says: Remember, we are learning about comic books during this program, and last time we talked about emotions. Today we are going to move on to shapes. Remember in comic books, we rely on the pictures to tell us what is going on in the story. What are the basic building blocks of pictures?</td>
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<td>- Say: That's right! Shapes!</td>
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<td>- Read the directions for activity 2.2 and implement activity 2.2.</td>
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<td>- Have a few children show off what objects they created with their shapes.</td>
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<td>- Ask the children if they had any problem with this activity.</td>
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<td>- Ask children: Going back to talking about drinks with added sugars, remember I said we should choose sugar-free drinks like water</td>
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<td>instead of sugar-sweetened drinks like pop and soda. Can anyone think of reasons why we would want to do this? -Wait for responses. -Be sure to cover benefits: Helps you stay healthy, gain more energy, cleans out your body, have a healthy weight, helps you have healthy skin and hair, reduces stress and improves your mood -Now read the directions for activity 2.3 on worksheet 2 and implement activity 2.3. -When children are done, have them show the other students.</td>
<td>None</td>
<td>10 minutes</td>
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<tr>
<td>Role-play</td>
<td>8. Explain to parents and friends why having sugar-free drinks and water instead of sugar-sweetened beverages is better.</td>
<td>-Say: Now let us practice talking with our parents and our friends about this, because they might not know about sugar-free or sugar-sweetened drinks, or why it is important to only have sugar-free drinks instead of sugar-sweetened drinks. -Let's practice using our knowledge by doing something called 'role play', remember from last week? -Explain what role-play is as needed. Says: A 'role-play' is an activity that allows you to practice doing something in 'pretend' setting. It helps you build your 'skill muscles.' Asks: Who would like to play themselves for the first Role-Play?? Don't worry if you don't get to do it the first time or even today, because there will be plenty of opportunity to do it in the future. -Explain scenario # 1 as listed on role-play activity sheet 2. -Implement role-play 2.1 on role-play activity sheet 2. -Processes role play 2.1 as listed on activity sheet 2. -Explain scenario # 2 as listed on role-play activity sheet 2. -Implement role-play 2.2 on role-play activity sheet 2. -Processes role play 2.2 as listed on activity sheet 2.</td>
<td>None</td>
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<td>Module</td>
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</table>
| Goal Setting | 9. **Demonstrate self-control** for choosing sugar-free drinks and water instead of sugar-sweetened beverages. | - Says: That was a great job everyone! Now we are going to talk about one more thing. When we have a goal, like choosing sugar-free drinks over sugar-sweetened drinks, it is important that we set the goal, work in small steps to get there and then reward ourselves when we achieve our goal.  
- Show children activity 2.4 on worksheet 2. Read the directions for activity 2.4 and implement the activity  
- Give them adequate time to create their small comic strip.  
- Ask if one or two children want to share their activity.  
- **Wrap up**  
  - Say: Alright kids, that is all we are going to do today. Thank you so much for paying attention. Does anyone have any questions?  
  - Next time we are going to talk more about comic books and get you ready for making your own comic book. Remember last time you took home a Character Creation Sheet. Did everyone get that? Does anyone want to share the characters they created?  
  - Ask children to share (as time permits).  
  - Distribute more sheets if children need extra.  
  - Well now that you have characters, you need to think about a plot or a story that your characters will go on. For next time, I want you to think about a really neat story and try to write out some key point on this 'Story Creation Worksheet.' Take this worksheet home with you and fill it out, and bring it back to me the next time we meet.  
  - Make sure children know next day/time they will meet. | WK SH 2 Story Creation Worksheet | 5-7 minutes |
Session 3: Engaging in at least 60 minutes of physical activity per day

1. **Define** physical activity
2. **List** various examples of physical activities.
3. **Identify** the appropriate amount of physical activity children should engage in everyday (at least 60 minutes).
4. **Explain** benefits of being physically active for at least 60 minutes per day.
5. **Explain to parents and friends** why having at least 60 minutes of physical activity everyday is important.
6. **Demonstrate self-control** for being physically active for at least 60 minutes per day.
### Session 3: Engaging in at least 60 minutes of physical activity per day

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<th>Module</th>
<th>Key Learning Objectives</th>
<th>Learning Process</th>
<th>Required Materials</th>
<th>Required Time</th>
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| Introduction & Purpose of Lesson | 1. Define physical activity  
2. List various examples of physical activities.  
3. Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes). | 1. Re-introduce yourself as needed.  
2. Explain to children the goal of the lesson.  
3. Say: Today, we will be talking about physical activity and exercise. Specifically, what it is, and how much we should have everyday. We are also going to continue to talk about comic books.  
4. Ask children 'What do you think is meant by physical activity or exercise?'  
5. - Get responses from the word 'physical activity or exercise' (prompt as needed)  
6. - Say: Physical activity refers to activity that includes any form of movement that increases their heart rate.  
7. - Ask: What are some examples of physical activities that you all do?  
8. - Get responses from children.  
9. - Bring up the fact that there are many different types of physical activities.  
Say: Those are great examples! So to review, physical activities include any type of activity that gets your heart rate up and gets you moving. It can include team sports like (use children's examples; i.e. basketball, soccer, football), or individual activities (use children's examples; i.e. ballet, gymnastics, tennis, karate) or it can be something simple like getting up and cleaning your room, walking your dog or doing yard work with your family.  
10. Ask children 'How long do you spend doing physical activities each day?'  
11. - Provide worksheet 3 and direct attention towards activity 3.1.  
12. - Read the directions for activity 3.1 and implement activity.  
13. - When children are done, have them share with the group the amount of time spent with physical activities.  
14. - Ask children: But how much physical activity do you think we should have each day?  
15. - Take guesses for how long they should spend with physical | WK SH 3               | 5 minutes        |
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|        | 4. Explain benefits of being physically active for at least 60 minutes per day. | - Explain that during the course of this program children will learn about comic books. Specifically, how to create their own comic book.  
-Say: So last time we at the end of the lesson, you took home a 'Story Creation Sheet.' Did you all have fun filling that out? Did anyone have any problems with this?  
-Give feedback as necessary.  
-Ask children: so what were some of the stories that you guys created?  
-Have a few children talk about their comic-book stories and ask them about the characters in the story.  
-Ask children: Going back to talking about physical activity, remember I said we should spend at least 60 minutes doing physical activities each day. Can anyone think of reasons why we would want to do this?  
-Wait for responses.  
-Be sure to cover benefits: helps you stay healthy, relieves stress, gain more energy, improve your mood, sleep better, make more friends, build stronger bones and muscles, increase your flexibility, and have more time to spend with friends  
-Now show activity 3.2 on worksheet 3. Read the directions for activity 3.2 and implement activity.  
-When children are done, have them show their comic panel to other students. | WK SH 3 | 10 minutes |
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| Role-play | **5. Explain to parents and friends why having at least 60 minutes of physical activity everyday is important.** | - Say: Now let us practice talking with our parents and our friends about this, because they might not know about being active, or why it is important to be active for at least 60 minutes per day. Let’s practice using our knowledge by doing something called ‘role plays.’
- Ask: Who remembers what a ‘role play’ is?
- Provides/acknowledges correct response
- (repeat as necessary) Says: A ‘role-play’ is an activity that allows you to practice doing something in ‘pretend’ setting. It helps you build your ‘skill muscles.’
- Asks: Who would like to play themselves for the first Role-Play??
Don’t worry if you don’t get to do it the first time or even today, because there will be plenty of opportunity to do it in the future.
- Explain scenario # 1 as listed on role-play activity sheet 3.
- Implement role-play 3.1 on role-play activity sheet 3.
- Processes role play 3.1 as listed on activity sheet 3.
- Explain scenario # 2 as listed on role-play activity sheet 3.
- Implement role-play 3.2 on role-play activity sheet 3.
- Processes role play 3.2 as listed on activity sheet 3. | None                        | 10 minutes         |
| Goal Setting | **6. Demonstrate self-control for being physically active for at least 60 minutes per day.** | - Says: That was a great job everyone! Now we are going to talk about one more thing. When we have a goal, like being active for at least 60 minutes per day, it is important that we set the goal, work in small steps to get there and then reward ourselves when we achieve our goal.
- Show children activity 3.3 on worksheet 3. Read instructions for activity 3.3 and implement activity.
- Give them adequate time to create their small comic strip.
- When children are done, ask one or two if they want to share their comic panels.
- Wrap up
- Say: Alright kids, that is all we are going to do today. Thank you so much for paying attention. Does anyone have any questions?
- So far we have talked about your personal comic book and we talked | WK SH 3 Comic-book Template Worksheet | 5-7 minutes          |
about characters, and how it is important to have interesting characters, and we talked about how to make a good story. Remember a good story has a beginning, middle and end. Now that you have all right pieces, I am going to give you a ‘Comic-book Template’ worksheet! This is for you to take home and make your first very own comic-book story. Next time when we meet, some of you can share your stories with everyone. What would be really neat, is if someone could make their story about all the things we have learned so far. Let us review real quick some of things you have learned while I have been here.

-Review Lesson objectives.
  -Lesson 1: Limiting screen time to no more than 2 hours per day
  -Lesson 2: Choosing sugar-free drinks and water instead of sugar-sweetened beverages.
  -Lesson 3: Being physically active for 60 minutes per day.
Says: Thanks kids! I’ll see you next time!
-Make sure children know next day/time they will meet.
Session 4: Consuming 5 servings of Fruits and Vegetables per day

1. Identify four basic types of fruits.
2. Identify five basic types of vegetables.
3. Identify the amount of fruits and vegetables children should eat each day.
4. Explain benefits of eating 5 servings of fruits and vegetables per day.
5. Explain to parents and friends why eating 5 servings of fruits and vegetables per day is important.
6. Demonstrate self-control for eating 5 servings of fruits and vegetables.
Session 4: Consuming 5 servings of Fruits and Vegetables per day

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| **Introduction & Purpose of Lesson** | 1. Identify four basic types of fruits.  
2. Identify five basic types of fruits.  
3. Identify the amount of fruits and vegetables children should eat each day. | -Re-Introduce yourself as necessary.  
-Explain to children the goal of the lesson.  
-Say: Today, we will be talking about fruits and vegetables. Specifically, what they are and how much we should eat each day!  
-Ask children 'What do you think is meant by the word "fruits"? I'm sure you all eat fruits, but how can you tell if something is a fruit?  
-Get responses from the word 'fruit.' (prompt as needed)  
-Fruits refers to foods that come from trees and plants, that are usually sweet.  
-Ask: But what about foods like Starbursts candy? It's candy, but the flavors are orange, cherry, lemon, and strawberry. Does that mean that this should count as fruit? Or that there is fruit in these types of foods?  
-Get responses from children.  
-Says: Actually these types of foods are what we call 'Fruit-Flavored Foods.' They have flavors of fruits, but are not actually fruits and do not count as a fruit. There are actually four different types of fruits. Can you think of what one type might be?  
-Get responses and Explain that the types include: Melons (give example), berries (give example), mixed fruit (give example), and all other fruits.  
-Ask children 'So now that we know what fruits are, what about vegetables? I'm sure you all eat vegetables, but how can you tell if something is a vegetable?  
-Get responses from the word 'vegetable.' (prompt as needed)  
-Vegetables are just like fruits as they refer to plants that are planted and harvested for us to eat.  
-Ask: But what about foods like French fries? French fries come from potatoes, which are a vegetables. Does that mean that this should count as a vegetable?  
-Get responses from children. | WK SH 4 | 5 minutes |
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<td>-Says: Actually French fries are not considered a vegetable anymore. It's true that they come from potatoes, BUT to make the French fry they have to cook it in a lot of oil, grease and fat, and after doing all of this, it makes them become unhealthy. There are actually five different types of vegetables. Can you think of what one type might be? -Get responses and Explain that the types include: Green leafy (give examples), orange (give examples), beans (give examples), starchy (give examples), and then other (give examples). -Provide worksheet 4 and show activity 4.1. -Read the directions for activity 4.1 and implement activity 4.1. -After activity Says: Great job! Now that we have a better understanding of what fruit and vegetables are, let me ask you another question. How many do you think we should eat each day? -Get responses from children. -Says: We should make sure we have 5 servings of fruits and vegetables everyday! Does everyone understand? -Ask children if they feel comfortable with this material.</td>
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<td>WK SH 4</td>
<td>7-10 minutes</td>
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<td>Benefits</td>
<td>4. Explain benefits of eating 5 servings of fruits and vegetables per day.</td>
<td>-Say: So last time at the end of the lesson, you took home a comic book template. Did you all have fun making your own stories? Did anyone have any problems with this? -Give feedback as necessary. -Ask: So who wants to share their story briefly? Who made their story about all the healthy behaviors we have learned about during this program? -Have a few children share their stories and praise those who included health themes. -Ask children: Going back to talking about fruits and vegetables, remember I said we should eat 5 servings everyday. Can anyone think of reasons why we would want to do this? -Wait for responses. -Be sure to cover benefits: helps you stay healthy, gain more energy,</td>
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<td>cleans out your body, have a healthy weight, helps you have healthy skin and hair, helps your eyes stay healthy, reduces stress and improves your mood:&lt;br&gt;-Now show them the activity 4.2 on worksheet 4.&lt;br&gt;-Read the directions to 4.2 and implement activity 4.2.&lt;br&gt;-When children are done, have them show the other students.</td>
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<td>Role-play</td>
<td>5. Explain to parents and friends why eating 5 servings of fruits and vegetables per day is important.</td>
<td>-Say: Now let us practice talking with our parents and our friends about this, because they might not know about fruits and vegetables, or why it is important to have 5 servings of fruits and vegetables per day.&lt;br&gt;-Let's practice using our knowledge by doing something called 'role plays, remember from last week?&lt;br&gt;-Explain what role-play is as needed.&lt;br&gt;Says: A 'role-play' is an activity that allows you to practice doing something in 'pretend' setting. It helps you build your 'skill muscles.'&lt;br&gt;Asks: Who would like to play themselves for the first Role-Play??&lt;br&gt;Let's let someone try who has not done this yet, since today is our last day together.&lt;br&gt;-Explain scenario # 1 as listed on role-play activity sheet 3.&lt;br&gt;-Implement role-play 3.1 on role-play activity sheet 3.&lt;br&gt;-Processes role play 3.1 as listed on activity sheet 3.&lt;br&gt;-Explain scenario # 2 as listed on role-play activity sheet 3.&lt;br&gt;-Implement role-play 3.2 on role-play activity sheet 3.&lt;br&gt;-Processes role play 3.2 as listed on activity sheet 3.</td>
<td>None</td>
<td>10 minutes</td>
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<td>Module</td>
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| Goal Setting | 6. Demonstrate self-control for eating 5 servings of fruits and vegetables per day.     | - Says: That was a great job everyone! Now we are going to talk about one more thing. When we have a goal, like eating 5 servings of fruits and vegetables each day, it is important that we set the goal, work in small steps to get there and then reward ourselves when we achieve our goal.  
- Show children activity 4.3 on worksheet 4. Read the directions for activity 4.3 and implement activity 4.3.  
- Give children adequate time to create their small comic strip.  
- Ask if one or two children want to share their activity.  
- Wrap up  
- Say: Alright kids, well today was the last day for our fun comic book program. I hope you have learned some really neat things about being healthy and how to make your own comic books.  
- As time permits have more children share their comic book stories.  
- Says: I am going to leave you with more blank comic template for you to use to keep making comic books. Before we end let us review the 4 behaviors we learned about during this program.  
- Review lesson key objectives:  
  Lesson 1 - Limit screen time to no more than 2 hours per day.  
  Lesson 2 - Choose sugar-free drink or water instead of sugar-sweetened drinks.  
  Lesson 3 - Be physically active for at least 60 minutes per day.  
  Lesson 4 - Eat 5 servings of fruits and vegetables each day.  
- Say: Thanks everyone! You all have been great fun! | WK SH 2.4 | 5-7 minutes |
Appendix E. Learning healthy behaviors with comics (comparison version)

Comparison Intervention

Learning Healthy Behaviors With Comics

After completing this four-session intervention children will be able to:

Session 1: Engaging in no more than 2 hours of screen time per day
1. Define screen time
2. List various activities that constitute screen time.
3. Identify the appropriate amount of screen time children should engage in everyday (no more than 2 hours).
4. 
5. Identify the importance of emotions for comic-book creation.
6. Identify the importance of shapes for comic-book creation.
7. Identify the importance of balloons for comic-book creation.

Session 2: Consuming water/sugar-free drinks instead of sugar-sweetened beverages

1. Define sugar-sweetened drinks
2. List various examples of them.
3. Define sugar-free drinks
4. List various examples of them.
5. Identify the food label on various drink containers
6. Identify 'Sugars' on given food labels.
7. Identify the importance of panels for comic book creation
8. Identify that comic stories can be told in varying number of panels.
9. Demonstrate the ability to create a comic story using a three-panel sequence.
Session 3: Engaging in at least 60 minutes of physical activity per day

1. Define physical activity
2. List various examples of physical activities.
3. Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes).
4. Demonstrate the ability to develop a beginning for an original comic book story.
5. Demonstrate the ability to develop a middle for an original comic book story.
6. Demonstrate the ability to develop an ending for an original comic book story.

Session 4: Consuming 5 servings of Fruits and Vegetables per day

1. Identify four basic types of fruits.
2. Identify five basic types of vegetables.
3. Identify the amount of fruits and vegetables children should eat each day.
4. Explain how to create an original comic-book story.
5. Explain how to create original comic-book characters.
6. Demonstrate the ability to create a story using sequential art.
Session 1: Engaging in no more than 2 hours of screen time per day (need 6)

1. Define screen time
2. List various activities that constitute screen time.
3. Identify the appropriate amount of screen time children should engage in everyday (no more than 2 hours).
4. Identify the importance of emotions for comic-book creation.
5. Identify the importance of shapes for comic-book creation.
6. Identify the importance of balloons for comic-book creation.
### Session 1: Limiting screen time to no more than 2 hours per day

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</table>
| **Introduction & Purpose of Lesson** | 1. Define screen time  
2. List various activities that constitute screen time.  
3. Identify the appropriate amount of screen time they should engage in everyday (no more than 2 hours). | - Introduce yourself  
- Explain to children the goal of the lesson.  
- Say: “Today we will be talking about screen time. Specifically, what it is, and how much we should have everyday. During the course of this program we are also going to talk about comic books. Specifically, what they are and how to create our own comic  
- Ask children ‘So first I have a question for you. What do you think is meant by the word screen time?’  
- Get responses from the word ‘screen time.’ (prompt as needed)  
- Say: Screen time refers to activity that provides little or no activity. Examples of screen time include: TV watching, videos, movies, computer time and playing non-active video games.  
- Show and distribute worksheet 1.  
- Ask children ‘How long do you spend with screen time everyday? Let us do this fun activity to find out!’  
- Read directions and implement activity 1.1 on worksheet 1.  
- After children are done have them share with the group the amount of time spent in screen time.  
- Next, take guesses for how long they should spend with screen time.  
- Explain to children they should spend no more than 2 hours per day with screen time.  
- Explain that during this lesson they will talk about ways to achieve this goal. | WK SH 1 | 3-5 minutes |
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<tr>
<td><strong>Comic Book Activity #1</strong></td>
<td>4. Identify the importance of emotions for comic-book creation.</td>
<td>- Explain that during the course of this program children will learn about comic books. Specifically, how to create their own comic book. - Ask children: So, what do you know about comic books? - Explain that comic books are a way to tell a story using both pictures and words. - Show worksheet 1, activity 1.2 and explain that when making comic books it is important to know what the characters are feeling like, or their emotions - Read the directions for activity 1.2 and implement activity 1.2. - When children are done, have them list emotions and show the group their pictures. - Ask the children if they had any problem with this activity.</td>
<td>WK SH 1</td>
<td>5-10 minutes</td>
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<td><strong>Comic Book Activity #2</strong></td>
<td>5. Identify the importance of shapes for comic-book creation.</td>
<td>- Say: That was a great job! Now let us move on to shapes. Remember in comic books, we rely on the pictures to tell us what is going on in the story. What are the basic building blocks of pictures? - Say: That’s right! Shapes! - Go read the directions for activity 1.3 of worksheet 1 to children and implement activity 1.3. - Have children show off what objects they created with their shapes. - Ask the children if they had any problem with this activity.</td>
<td>WK SH 1</td>
<td>5-10 minutes</td>
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<td><strong>Comic Book Activity #3</strong></td>
<td>6. Identify the importance of balloons for comic book creation.</td>
<td>- Says: That was a great job everyone! Now we are going to talk about one more thing. - Says: In comics we rely know what people are saying through something called a ‘Word Balloon.’ We also can know what people are thinking. Does anyone know what kind of balloon this is called? - Says: That’s right! A ‘Thought Balloon.’ Let us practice making our own word and thought balloons. - Read the directions for activity 1.4 of worksheet 1 and implement activity 1.4.</td>
<td>WK SH 1 Character Creation Sheet</td>
<td>5-10 minutes</td>
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<td>- Have children show off what they had their characters say.</td>
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<td>- Ask the children if they had any problem with this activity.</td>
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<td><strong>Wrap-up</strong></td>
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<td>- Say: Alright kids, that is all we are going to do today. Thank you so much for paying attention. Does anyone have any questions?</td>
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<td>- Say: Next time we are going to talk more about comic books and get you ready for making your own comic book. So what I want you to do is think about CHARACTERS that you want in your story. The story will be about you, but what will you be? A superhero? A ninja? An explorer? Something else?</td>
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<td>- Say: Also, what other characters will be in your story? You can have a mix of real-life characters (like your friends, teachers, or parents), and pretend characters (like Superman, Batman, Spiderman, etc.)</td>
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<td>- Say: Take this Character Creation Sheet home with you and fill it out, and bring it back to me the next time we meet.</td>
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<td></td>
<td>- Make sure children know next day/time they will meet</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Session 2: Consuming water/sugar-free drinks instead of sugar-sweetened beverages

1. Define sugar-sweetened drinks
2. List various examples of them.
3. Define sugar-free drinks
4. List various examples of them.
5. Identify the food label on various drink containers
6. Identify ‘Sugars’ on given food labels.
7. Identify the importance of panels for comic book creation
8. Identify that comic stories can be told in varying number of panels.
9. Demonstrate the ability to create a comic story using a three-panel sequence.
# Session 2: Consuming water/sugar-free drinks instead of sugar-sweetened beverages

<table>
<thead>
<tr>
<th>Module</th>
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<th>Learning Process</th>
<th>Required Materials</th>
<th>Required Time</th>
</tr>
</thead>
</table>
| **Introduction & Purpose of Lesson** | 1. Define sugar-sweetened drinks  
2. List various examples of them.  
3. Define sugar-free drinks  
4. List various examples of them.  
5. Identify the food label on various drink containers  
6. Identify 'Sugars' on given food labels. | - Re-introduce yourself  
- Explain to children the goal of the lesson.  
- Say: Today, we will be talking about drinks. Specifically, drinks with added sugars and drinks without added sugars.  
- Ask children 'What do you think is meant by the word "sugar-sweetened drinks"?'  
- Get responses from the word 'sugar-sweetened drinks.' (prompt as needed)  
- Say: Sugar-sweetened drinks refers to any drinks that have extra or added sugars in them. Examples of sugar-sweetened drinks include: kool-aid, pops, and fruit punches.  
- Ask children 'But how do we know if a drink is made with added sugars or has added sugars in it?'  
- Provide worksheet 2 and direct their attention to activity 2.1.  
- Implement activity 2.1  
- During activity 2.1 be sure to Say: For example, in this activity Carlo wants to choose the better drink out of these two drinks. The drink on the left is soda-pop and the drink on the right is a bottle of water. What Carlo needs to do to figure out which drinks have added sugar, is look at the food label. Has anyone ever looked at the food label on the foods they eat before? Well the food label is a GREAT tool for helping us to know what is in our food and drinks. Just like added sugars. Does everyone see the food labels for the drinks on the worksheet? Can everyone point to it? Great! And on the food label it will list 'Sugars' which tells us how much sugar is in the drink.  
- Show children where 'sugars' is on food label and assure they all point to it.  
- Says: Great job! Well next to the word 'sugar' there is usually a number. That number is the amount of sugar in the drink. So how much sugar does the soda have? | WK SH 2 | 3-5 minutes |
<table>
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<th>Required Time</th>
</tr>
</thead>
</table>
| Comic Book Activity #1 | 7. Identify the importance of panels for comic book creation. | -Explain that during the course of this program children will learn about comic books. Specifically, how to create their own comic book.  
-Says: Remember I had you take home the 'Character Creation Worksheet' last time? Did anyone remember to fill this out and bring it back?  
-Ask a few children to stand up and share the characters they created.  
-Says: That was a great job. Now, moving on remember, does anyone remember what we talked about during the last lesson?  
-Have children recall the comic-book related activities. Specifically, the activity on the importance of showing emotions, the importance of shapes and how all objects are made out of shapes, and word and thought balloons.  
-Says: Today we are going to move on to practicing how to plan for | WK SH 2 | 10 minutes |
<table>
<thead>
<tr>
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</thead>
</table>
| Comic Book Activity #2 | 8 Identify that comic stories can be told in varying number of panels. 9 Demonstrate the ability to create a comic story using a three-panel sequence. | - Says: Now let us move on to a more difficult task. Last time there were 2 panels and now there are three panels. Also, you can pick the story you make. Let’s all look at activity 2.3.  
- Read the directions for activity 2.3 and implement activity 2.3.  
- When children are done, have them show off the stories they made.  
- Ask the children if they had any problem with this activity. | WK SH 2 | 10-15 minutes |
| Wrap-Up |  | - Say: Alright kids, that is all we are going to do today. Thank you so much for paying attention. Does anyone have any questions?  
- Say: Next time we are going to talk more about comic books and get you one step closer to making your own comic book.  
- Say: Remember, now that you have characters, you need to think about a plot or a story that your characters will go on. For next time, I want you to think about a really neat story and try to write out some key point on this ‘Story Creation Worksheet.’ Take this worksheet home with you and fill it out, and bring it back to me the next time we meet.  
- Make sure children know next day/time they will meet. | Story creation worksheet | 1-3 minutes |
Session 3: Engaging in at least 60 minutes of physical activity per day

1. Define physical activity
2. List various examples of physical activities.
3. Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes).
4. Demonstrate the ability to develop a beginning for an original comic book story.
5. Demonstrate the ability to develop a middle for an original comic book story.
6. Demonstrate the ability to develop an ending for an original comic book story.
### Session 3: Engaging in at least 60 minutes of physical activity per day

<table>
<thead>
<tr>
<th>Module</th>
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<th>Learning Process</th>
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<th>Required Time</th>
</tr>
</thead>
</table>
| **Introduction & Purpose of Lesson**| 1. Define physical activity  
2. List various examples of physical activities.  
3. Identify the appropriate amount of physical activity children should engage in everyday (at least 60 minutes). | - Re-introduce yourself as needed.  
- Explain to children the goal of the lesson.  
- Say: Today, we will be talking about physical activity and exercise. Specifically, what it is, and how much we should have everyday. We are also going to continue to talk about comic books.  
- Ask children 'What do you think is meant by physical activity or exercise?'  
- Get responses from the word 'physical activity or exercise.' (prompt as needed)  
- Say: Physical activity refers to activity that includes any form of movement that increases their heart rate.  
- Ask: What are some examples of physical activities that you all do?  
- Get responses from children.  
- Bring up the fact that there are many different types of physical activities.  
Say: Those are great examples! So to review, physical activities include any type of activity that gets your heart rate up and gets you moving. It can include team sports like (use children's examples; i.e. basketball, soccer, football), or individual activities (use children's examples; i.e. ballet, gymnastics, tennis, karate) or it can be something simple like getting up and cleaning your room, walking your dog or doing yard work with your family.  
- Ask children 'How long do you spend doing physical activities each day?'  
- Provide worksheet 3 and direct attention towards activity 3.1.  
- Read the directions for activity 3.1 and implement activity.  
- When children are done, have them share with the group the amount of time spent with physical activities.  
- Ask children: But how much physical activity do you think we should have each day?  
- Take guesses for how long they should spend with physical | WK SH 3 | 5 minutes     |
<table>
<thead>
<tr>
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<th>Required Time</th>
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<tbody>
<tr>
<td></td>
<td>- Explain to children they should spend at least 60 minutes doing physical activities each day and it includes all these types of activities. So it does not mean you must do 60 minutes all at once, just as long as all these activities add up to 60 minutes. - Explain that 60 minutes is also just the minimum. The more the better! - Explain that during this lesson they will talk about ways to achieve this goal.</td>
<td></td>
<td>None</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Comic Book</td>
<td>Activity #1 - Explain that during the course of this program children will learn about comic books. Specifically, how to create their own comic book. - Say: So last time what did we talk about? - Review with children that during the last lesson they talked about comic book panels and made stories using a two-panel layout and a three-panel layout. - They also took home the 'Story Creation Worksheet'. - Say: For those who completed the 'Story Creation Worksheet' who would like to share with the group your story? - Briefly allow 1 or 2 children to talk about their story. - Thank children for sharing.</td>
<td></td>
<td>None</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Comic Book</td>
<td>Activity #2 4. <strong>Demonstrate</strong> the ability to develop a beginning for an original comic book story. 5. <strong>Demonstrate</strong> the ability to develop a middle for an original comic book story. 6. <strong>Demonstrate</strong> the ability to develop an ending for an original comic book story. - Say: Now we are going to do something really fun. When you make comic books, it is fun because we all picture things differently in our minds. What we are going to do now is, as a group, come up with a story and everyone will create the story individually on the worksheet provided (activity 3.2). - Go through the directions with the children - Say: First we need three or four characters. Who should be our characters? - Allow children to come up with interesting characters. Encourage them to be creative and allow them to use real and pretend characters. When children are done, recite the 3 or 4 characters so</td>
<td></td>
<td>WK SH 3</td>
<td>15-18 minutes</td>
</tr>
<tr>
<td>Module</td>
<td>Key Learning Objectives</td>
<td>Learning Process</td>
<td>Required Materials</td>
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<tr>
<td></td>
<td></td>
<td>everyone knows who they are.</td>
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<tr>
<td></td>
<td></td>
<td>-Say: Now let us think about a story. Remember a story has to have a beginning, a middle and an ending. So how should our story begin?</td>
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<td></td>
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<td>-Call on one or two children, and state the beginning scene.</td>
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<td></td>
<td></td>
<td>-Say: Ok, and what are our characters doing? Why are they together?</td>
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<td></td>
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<td>-Call on one or two children, and state the middle of the story.</td>
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<tr>
<td></td>
<td></td>
<td>-Say: Ok, and how will our characters resolve this issue. How will our story end?</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>-Call on one or two children and state the ending of the story.</td>
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<td></td>
<td></td>
<td>-Say: Great job! Now that we have characters and a story, I want everyone to create a comic page.</td>
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<td>-Give children some time to complete task as needed.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>-When children are done call on one or two to show entire group.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>-Say: Great job. So now you see that when you make a comic, there is no right or wrong way in doing it. You all had the same story and characters, but look around at your friends and partners comic-strip. They are all completely different, right! Great job everyone!</td>
<td></td>
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<tr>
<td></td>
<td>Wrap-Up</td>
<td>-Say: Alright kids, that is all we are going to do today. Thank you so much for paying attention. Does anyone have any questions?</td>
<td>Comic-book Template</td>
<td>1-3 minutes</td>
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<tr>
<td></td>
<td></td>
<td>-Say: Now, I think you are all ready to begin making your own comic book. I am going to pass out these ‘Comic-book Template’ worksheets, which is just a blank comic book. Up till now you should have been coming up with your own characters and story. If you haven’t yet, that is also alright. Just work on it a little more this week. Take this comic book template home and create your own comic. The story can be just about anything you can think of and draw! Next time when we meet we will talk about your stories, and you will have time putting the finishing touches on your comic. Says: Thanks kids! I’ll see you next time!</td>
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<td></td>
<td></td>
<td>-Make sure children know next day/time they will meet.</td>
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</tbody>
</table>
Session 4: Consuming 5 servings of Fruits and Vegetables per day

1. Identify four basic types of fruits.
2. Identify five basic types of vegetables.
3. Identify the amount of fruits and vegetables children should eat each day.
4. Explain how to create an original comic-book story.
5. Explain how to create original comic-book characters.
6. Demonstrate the ability to create a story using sequential art.
### Introduction & Purpose of Lesson

1. **Identify** four basic types of fruits.
2. **Identify** five basic types of fruits.
3. **Identify** the amount of fruits and vegetables children should eat each day.

<table>
<thead>
<tr>
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<th>Required Materials</th>
<th>Required Time</th>
</tr>
</thead>
</table>
| **Session 4:** Consuming 5 servings of Fruits and Vegetables per day | - Re-introduce yourself as necessary.  
- Explain to children the goal of the lesson.  
- Say: Today, we will be talking about fruits and vegetables. Specifically, what they are and how much we should eat each day!  
- Ask children: What do you think is meant by the word “fruits”? I’m sure you all eat fruits, but how can you tell if something is a fruit?  
- Get responses from the word ‘fruit’ (prompt as needed)  
- Fruits refers to foods that come from trees and plants, that are usually sweet.  
- Ask: But what about foods like Starbursts candy? It’s candy, but the flavors are orange, cherry, lemon, and strawberry. Does that mean that this should count as fruit? Or that there is fruit in these types of foods?  
- Get responses from children.  
- Says: Actually these types of foods are what we call ‘Fruit-Flavored Foods.’ They have flavors of fruits, but are not actually fruits and do not count as a fruit. There are actually four different types of fruits. Can you think of what one type might be?  
- Get responses and explain that the types include: Melons (give example), berries (give example), mixed fruit (give example), and all other fruits.  
- Ask children: So now that we know what fruits are, what about vegetables? I’m sure you all eat vegetables, but how can you tell if something is a vegetable?  
- Get responses from the word ‘vegetable’ (prompt as needed)  
- Vegetables are just like fruits as they refer to plants that are planted and harvested for us to eat.  
- Ask: But what about foods like French fries? French fries come from potatoes, which are a vegetables. Does that mean that this should count as a vegetable?  
- Get responses from children. | WK SH 4 | 5 minutes |
<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>- Says: Actually French fries are not considered a vegetable anymore. It's true that they come from potatoes, BUT to make the French fry they have to cook it in a lot of oil, grease and fat, and after doing all of this, it makes them become unhealthy. There are actually five different types of vegetables. Can you think of what one type might be? - Get responses and Explain that the types include: Green leafy (give examples), orange (give examples), beans (give examples), starchy (give examples), and then other (give examples). - Provide worksheet 4 and show activity 4.1. - Read the directions for activity 4.1 and implement activity 4.1. - After activity Says: Great job! Now that we have a better understanding of what fruit and vegetables are, let me ask you another question. How many do you think we should eat each day? - Get responses from children. - Says: We should make sure we have 5 servings of fruits and vegetables everyday! Does everyone understand? - Ask children if they feel comfortable with this material.</td>
<td></td>
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</tr>
<tr>
<td>Comic Book Activity #1</td>
<td>4. Explain how to create an original comic-book story. 5. Explain how to create original comic-book characters.</td>
<td>- Say: So last time you left with blank comic-book templates. Who wants to share with us what you made? - Allow a few children to talk about the characters in their stories and how they developed them. - Allow a few children to talk about their stories in and how they developed it. - Thank children for sharing.</td>
<td></td>
<td>5-10 minutes</td>
</tr>
<tr>
<td>Module</td>
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<td>Learning Process</td>
<td>Required Materials</td>
<td>Required Time</td>
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<tr>
<td>Comic Book Activity #2</td>
<td>6. Demonstrate the ability to create a story using sequential art.</td>
<td>-Say: Well today is our last day and since it is our last day I brought some comic-books for you to read. So during this time you can read one of the comic books I brought, you can continue to work on your comic-book, or you can start a new comic book. The choice is yours! -Have some children show their comic to the group. -Have they explained how they created their comic book.</td>
<td>Children's comic books. Comic-book template worksheet</td>
<td>15-20 minutes</td>
</tr>
<tr>
<td>Wrap-Up</td>
<td></td>
<td>-Say: Alright kids, well today is our last day together. I hope you learned some really cool health tips and learned a little bit about comic books. Now that you have the skill to make your own comic, you can think about really long stories you want to tell, and make comics for your family and friends. Does anyone have any final questions before I leave today? -Say: Thanks everyone! You all have been great fun!</td>
<td></td>
<td>1-3 minutes</td>
</tr>
</tbody>
</table>
Appendix F. Worksheets for both interventions
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 1

1.1. Screen time comes in many different forms. List the amount of time you currently spend each day in the following screen time activities:

<table>
<thead>
<tr>
<th>Time for TV</th>
<th>Time on the Computer</th>
<th>Time playing video games</th>
<th>Total Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="TV time" /></td>
<td><img src="image2.png" alt="Computer time" /></td>
<td><img src="image3.png" alt="Video games time" /></td>
<td><img src="image4.png" alt="Total time" /></td>
</tr>
</tbody>
</table>

1.2. Making Faces

![Happy Face](image5.png)

In comic books we rely on facial expressions to give us clues for what the characters are feeling. What are four emotions and what do they look like? Use the circles below to try to draw four different emotions.

![Emotion 1](image6.png)
![Emotion 2](image7.png)
![Emotion 3](image8.png)
![Emotion 4](image9.png)
1.3 There are many benefits to being active! Do you see in the first comic panel how being active can also be fun! What’s another benefit? Try to make your own on the next comic panel. (Don’t forget about showing those emotions!)

When I play with my friends I have LOTS of FUN!!!!

1.4

Imagine you are a superhero, king, princess, sport star or someone fun! You have a busy life and it’s important that you make sure you limit your screen time to only 2 hours per day. Write a short story about how you will set this goal, plan to achieve it, and reward yourself when you reach your goal. Be SUPER creative!!!!

Set the Goal  Plan to Achieve  Self-Reward
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 2

2.1 Help Carlo make the right choice!
Carlo is thirsty and needs your help. He can choose 1 drink out of the following three different drinks. Circle the best choice and put an X through the other choice.

![Soda-Pop Nutrition Facts]

- **Soda-Pop**
  - Serving Size 1 can (12 fl. oz)
  - Amount per serving: Calories 140
  - %Daily Value:
    - Total Fat 0g
    - Saturated Fat 0g
    - Trans Fat 0g
    - Cholesterol 0mg
    - Sodium 50mg
    - Total Carbohydrate 38g
    - Dietary Fiber 0g
    - Sugars 30g
  - Protein 0g
  - Vitamin A 0%
  - Vitamin C 0%
  - Calcium 0%
  - Iron 8%

![Water Nutrition Facts]

- **Water**
  - Serving Size 1 bottle (12 fl. oz)
  - Amount per serving:
  - Calories 0
  - %Daily Value:
    - Total Fat 0g
    - Saturated Fat 0g
    - Trans Fat 0g
    - Cholesterol 0mg
    - Sodium 0mg
    - Total Carbohydrate 0g
    - Dietary Fiber 0g
    - Sugars 0g
  - Protein 0g
  - Vitamin A 0%
  - Vitamin C 0%
  - Calcium 0%
  - Iron 0%

2.1 Shape can be ANYTHING!
Remember in comics we rely on the pictures to give us clues about what is going on in the story. Shapes are the building blocks of all pictures. Let's practice making objects out of shapes.
What do you think we can make out of a rectangle, triangle and circle? Don't forget BE CREATIVE!
2.3 There are many benefits to choosing sugar-free drinks like water over sugar-sweetened drinks! Do you see in the first comic panel how drinking water can help you stay active? What’s another benefit? Try to make your own on the next comic panel.

2.4 Imagine you are a superhero, king, princess, sport star or someone fun! You have a busy life and it’s important that you make sure you drink a sugar-free drink instead of a sugar-sweetened drink. Write a short story about how you will set this goal, plan to achieve it, and reward yourself when you reach your goal. Be SUPER creative!!!!
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 3

3.1 List the amount of time you currently spend per day in the following activities:

<table>
<thead>
<tr>
<th>Team Sports</th>
<th>Individual Sports</th>
<th>Other activities like cleaning your room, walking your dog, or yard work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes =</td>
<td>or activity</td>
<td>Minutes =</td>
</tr>
</tbody>
</table>

3.2 There are many benefits to being active! Do you see in the first comic panel how being active helps you stay healthy! What’s another benefit? Try to make your own on the next comic panel. (Don’t forget about showing those emotions!)

Being active for 60 minutes each day helps me keep flexible!
3.3

Imagine you are a superhero, king, princess, sport star or someone fun! You have a busy life and it's important that you make sure you limit your screen time to only 2 hours per day. Write a short story about how you will set this goal, plan to achieve it, and reward yourself when you reach your goal. Be SUPER creative!!!

*Also this time you have different sized panels. Think about how you want to arrange these panels and do your best!

Set the Goal

Plan to Achieve

Plan to Achieve

Self-Reward
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 4

4.1 Circle the foods that count as fruits and vegetables. Put an 'X' though the foods that do not count as a fruit or vegetable.

- Cherry Lollypop
- Strawberries
- French Fries
- Tomato
- The ORANGE Bar
- Red Pepper

4.2 There are many benefits to eating 5 servings of fruits and vegetables! Do you see in the first comic panel how doing this helps you stay healthy? What's another benefit? Try to make your own on the next comic panel.

(Don't forget about showing those emotions!)

Eating 5 servings of fruits and vegetables helps my eyes stay healthy!
4.3
Imagine you are a superhero, king, princess, sport star or someone fun! You have a busy life and it's important that you make sure you eat 5 servings of fruits and vegetables each day. Write a short story about how you will set this goal, plan to achieve it, and reward yourself when you reach your goal. Be SUPER creative!!!
*Also this time you have different sized panels. Think about how you want to arrange these panels and do your best!

Set the Goal

Self-Reward

Plan to Achieve
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 1

1.1. Screen time comes in many different forms. List the amount of time you currently spend each day in the following screen time activities:

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1.2. Making Faces

In comic books we rely on facial expressions to give us clues for what the characters are feeling. What are four emotions and what do they look like? Use the circles below to try to draw four different emotions.

Happy Face

Emotion?
1.3 Shape can be ANYTHING!
Remember in comics we rely on the pictures to give us clues about what is going on in the story.
Shapes are the building blocks of all pictures. Let's practice making objects out of shapes.
Don't forget BE CREATIVE!
Let's do some easy ones first! What can you make out of a rectangle, triangle and circle?

Now let's try some more tricky shapes! What can you make out of these?

1.4 What are they SAYING or THINKING?
Try using WORD BALLOONS OR THOUGHT BALLOONS for the following pictures. What kinds of thinks do you think these people are saying or thinking? Why are they saying/thinking this?
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 2

2.1 Help Carlo make the right choice!
Carlo is thirsty and needs your help. He can choose 1
drink out of the following three different drinks. Which
would be the best choice?

Nutrition Facts
Serving Size: 1 can (12 fl oz)
Serves Per Container:
Amount per serving:
Calories: 140
Calories from Fat: 0

%Daily Value:
Total Fat: 0g | 0%
Saturated Fat: 0g | 0%
Trans Fat: 0g | 0%
Cholesterol: 0mg | 0%
Sodium: 50mg | 2%
Total Carbohydrate: 38g | 13%
Dietary Fiber: 0g | 0%
Sugar: 35g | 0%
Protein: 0g

Vitamin A: 0%  Vitamin C: 0%
Calcium: 0%  Iron: 0%

Soda-Pop

Nutrition Facts
Serving Size: 1 bottle (12 fl oz)
Serves Per Container:
Amount per serving:
Calories: 0
Calories from Fat: 0

%Daily Value:
Total Fat: 0g | 0%
Saturated Fat: 0g | 0%
Trans Fat: 0g | 0%
Cholesterol: 0mg | 0%
Sodium: 0mg | 0%
Total Carbohydrate: 0g | 0%
Dietary Fiber: 0g | 0%
Sugar: 0g | 0%
Protein: 0g

Vitamin A: 0%  Vitamin C: 0%
Calcium: 0%  Iron: 0%

Water
2.2 Comic books tell a story by combining pictures and words. These stories are told through a series of panels that read from **left to right**. Read the small story below and turn it into a 2-panel story. Don't forget about emotions, shapes, and dialogue through word and thought balloons.

**Once there was knight and he was on a quest to save his fair maiden from the dreaded dragon 'Ma'. The knight spent day and night trying to find her, till one day he found nest... A dragon nest...**

---

2.3 Now you are ready to tell your own story! But this time you have **THREE** panels instead of two. Create your own story this time. Think about who the characters might be, and what they might be saying.

**HAVE FUN! BE CREATIVE!**
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 3

3.1 List the amount of time you currently spend per day in the following activities:

<table>
<thead>
<tr>
<th>Team Sports</th>
<th>Individual Sports</th>
<th>Other activities like cleaning your room, walking your dog, or yard work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minutes =</td>
<td>Minutes =</td>
<td>Minutes =</td>
</tr>
</tbody>
</table>

![Team Sports Illustration](image)
![Individual Sports Illustration](image)
![Other Activities Illustration](image)
3.2

As a group you will come up with an original comic book story.

Who are your characters?

What is your story about?
Beginning
Middle
End
Learning Healthy Behaviors With Comics
Activity Worksheet for Session 4

4.1 Circle the foods that count as fruits and vegetables. Put an 'X' though the foods that do not count as a fruit or vegetable.
Learning Healthy Behaviors With Comics
Character Creation Sheet

First, draw a picture of how you look like. If you want, draw a few designs that are different, so you can choose the best one!

Next, who else will be in your story?

Name: ____________________  Program/Site: ____________________
Learning Healthy Behaviors With Comics
Story Creation Sheet

Write out your characters and sketch their final design below

Write out the basic plot of the story your characters will go on. Will you go on an adventure to save a prince or a princess from a dragon or wizard? Will you be on a mission to find a long lost artifact? Or is your story about hanging out and having a good time with friends?
Remember, each story has:
-Beginning - Where you introduce your characters, and the idea of the story
-Middle - Where the action takes place
-End - Where your story concludes

My story is called______________________________________________________________________

In the Beginning of story this happens______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

In the Middle this happens______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

And my story Ends with______________________________________________________________________

______________________________________________________________________

______________________________________________________________________
Comic Book Template
Learning Healthy Behaviors With Comics

Name:____________________ Program/Site_____________________
Learning Healthy Behaviors With Comics
Added Activity Worksheet: Session 1

Do you remember what ‘Screen time’ is?

Screen time is activity that provides little or no activity.

Examples of screen time include:

- Time watching TV
- Time on the computer or internet
- Time playing video games

Also don’t forget that we should only spend

**2 hours or 120 minutes each day**

doing these activities.

Benefits of spending no more than 2 hours or 120 minutes each day of screen time include

- Helps you stay healthy
- Have more fun
- Have fun with friends
- Improves your mood
- Improves your sleep
Sometimes in order to achieve a goal like spending no more than 2 hours with screen time each day, we need to make a small diary. Keep track of the amount of time you spend with screen time every day this week, and see if you can come close to the goal of less than 2 hours of screen time.

<table>
<thead>
<tr>
<th>Day</th>
<th>TV Time =</th>
<th>Video Game Time =</th>
<th>Computer Time =</th>
<th>Total Time =</th>
<th>Did you achieve your goal today?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Goal Time = 2 hours (120 minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Goal Time = 2 hours (120 minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Goal Time = 2 hours (120 minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Goal Time = 2 hours (120 minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Goal Time = 2 hours (120 minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Saturday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Goal Time = 2 hours (120 minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Sunday</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Goal Time = 2 hours (120 minutes)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>

How many days did you meet your goal this week? ________

On the days you did not achieve your goal, why do you think this happened?

What do you think you could do next week so you can achieve your goal everyday?
Learning Healthy Behaviors With Comics
Added Activity Worksheet: Session 2

Do you remember what 'Sugar-Free Drinks' are?

Sugar-free drinks are those that have no added sugars.

The way you find out if a drink has added sugars is by looking at the food label.

Also don’t forget that we should always choose Sugar free drinks instead of drinks with added sugars.

Benefits of spending no more than 2 hours or 120 minutes each day of screen time include:

- Helps you stay healthy
- Have more energy
- Improves your mood
- Have healthy skin
Sometimes in order to achieve a goal like drinking sugar free drinks each day, we need to make a small diary. Keep track of the amount of sugar free drinks and drinks with sugar you have every day this week, and see if you can come close to the goal of choosing sugar free drinks everyday.

<table>
<thead>
<tr>
<th>Monday: Number of sugar free drinks =</th>
<th>Number of drinks with sugar=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the higher number</td>
<td>Did you achieve your goal today?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tuesday: Number of sugar free drinks =</th>
<th>Number of drinks with sugar=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the higher number</td>
<td>Did you achieve your goal today?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wednesday: Number of sugar free drinks =</th>
<th>Number of drinks with sugar=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the higher number</td>
<td>Did you achieve your goal today?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thursday: Number of sugar free drinks =</th>
<th>Number of drinks with sugar=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the higher number</td>
<td>Did you achieve your goal today?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Friday: Number of sugar free drinks =</th>
<th>Number of drinks with sugar=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the higher number</td>
<td>Did you achieve your goal today?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Saturday: Number of sugar free drinks =</th>
<th>Number of drinks with sugar=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the higher number</td>
<td>Did you achieve your goal today?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sunday: Number of sugar free drinks =</th>
<th>Number of drinks with sugar=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circle the higher number</td>
<td>Did you achieve your goal today?</td>
</tr>
<tr>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

How many days did you meet your goal this week? ________

On the days you did not achieve your goal, why do you think this happened?

What do you think you could do next week so you can achieve your goal everyday?
Learning Healthy Behaviors With Comics
Added Activity Worksheet: Session 3

Do you remember what 'Physical Activity' is?

Physical activity is any form of movement that increases their heart rate.

Examples of physical activity include:

Individual sports or activity

Team Sports

Other activities like cleaning your room, walking your dog, or yard work

Also don’t forget that we should only spend

**60 minutes**
doing these activities everyday.

Benefits of doing 60 minutes of physical activity each day include:

- Helps you stay healthy
- Have more fun
- Have fun with friends
- Improves your mood
- Improves your sleep
Sometimes in order to achieve a goal like spending no more than 2 hours with screen time each day, we need to make a small diary. Keep track of the amount of time you spend with screen time every day this week, and see if you can come close to the goal of less than 2 hours of screen time.

<table>
<thead>
<tr>
<th>Day</th>
<th>Team Sports</th>
<th>Individual sports/activity</th>
<th>Other Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>Goal Time = 60 minutes</td>
<td>Did you achieve your goal today?</td>
<td>YES</td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>Goal Time = 60 minutes</td>
<td>Did you achieve your goal today?</td>
<td>YES</td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>Goal Time = 60 minutes</td>
<td>Did you achieve your goal today?</td>
<td>YES</td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>Goal Time = 60 minutes</td>
<td>Did you achieve your goal today?</td>
<td>YES</td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>Goal Time = 60 minutes</td>
<td>Did you achieve your goal today?</td>
<td>YES</td>
</tr>
<tr>
<td>Saturday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>Goal Time = 60 minutes</td>
<td>Did you achieve your goal today?</td>
<td>YES</td>
</tr>
<tr>
<td>Sunday</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Time</td>
<td>Goal Time = 60 minutes</td>
<td>Did you achieve your goal today?</td>
<td>YES</td>
</tr>
</tbody>
</table>

How many days did you meet your goal this week? ________

On the days you did not achieve your goal, why do you think this happened?

What do you think you could do next week so you can achieve your goal everyday?
Learning Healthy Behaviors With Comics
Added Activity Worksheet: Session 4

Do you remember when we talked about Fruits and Vegetables?

Remember there are many different types of fruits and vegetables.

**Fruits include:**
- Melons
- Berries
- Mixed fruit

**Vegetables include:**
- Green leafy
- Orange
- Beans
- Starchy

Also don’t forget that we should have **5 servings of fruits and vegetables everyday.**

Benefits of having 5 servings of fruits and vegetables everyday include:

- Helps you stay healthy
- Helps body heal
- Have more energy
- Improves your mood
- Improves your eye sight
Sometimes in order to achieve a goal like **having 5 servings of fruits and vegetables** each day, we need to make a small diary. Keep track of the amount of fruits and vegetables you have every day this week, and see if you can come close to the goal of 5 servings of fruits and vegetables.

<table>
<thead>
<tr>
<th>Day</th>
<th>Total number of fruits =</th>
<th>Total number of vegetables =</th>
<th>Goal = 5 servings</th>
<th>Did you achieve your goal today?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Total =</td>
<td></td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Total number of fruits =</td>
<td>Total number of vegetables =</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Wednesday</td>
<td>Total number of fruits =</td>
<td>Total number of vegetables =</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Thursday</td>
<td>Total number of fruits =</td>
<td>Total number of vegetables =</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Friday</td>
<td>Total number of fruits =</td>
<td>Total number of vegetables =</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Saturday</td>
<td>Total number of fruits =</td>
<td>Total number of vegetables =</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Sunday</td>
<td>Total number of fruits =</td>
<td>Total number of vegetables =</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
</tr>
</tbody>
</table>

How many days did you meet your goal this week? ________

On the days you did not achieve your goal, why do you think this happened?

What do you think you could do next week so you can achieve your goal everyday?
Learning Healthy Behaviors With Comics
Worksheet for Home: Session 1

Hi! Today you learned about **Screen time**.

Remember screen time is activity that provides little or no activity.

Examples of screen time include:

- **Watching TV**
- **Playing on the Computer**
- **Playing Video Games**

It is also important that we don’t do to much screen time each day. We should only spend **2 hours or 120 minutes** doing these activities each day.

Read the following stories and try to determine whether the person in the story is doing too much screen time, or the right amount of screen time.

Gary wakes up everyday before school and likes to watch his favorite TV show ‘Pirates in Space’ for 30 minutes. Then when he gets home from school he likes to play on the computer for 60 minutes, eat dinner, and watch movies, which usually take about 60 or 90 minutes.

Amber wakes up everyday before school and likes to brush her hair. When she gets home from school she likes to play with her friends outside before dinner. After dinner, she watches her favorite show ‘Ninja Life’ for 60 minutes, then she does her homework for 60 minutes.

**How much screen time does Gary spend on average each day?**

Minutes =

Did he achieve his goal of no more than 2 hours or 120 minutes of screen time?

☐ YES ☐ NO

**How much screen time does Amber spend on average each day?**

Minutes =

Did she achieve her goal of no more than 2 hours or 120 minutes of screen time?

☐ YES ☐ NO
To help us achieve goals like spending only 2 hours or 120 minutes with screen time everyday, it is important for us to plan ahead. This makes it easier for us to achieve our goals.

For example, if we plan out the screen times activities we want to do in advance, then we can do those and not do any more.

2 hours or 120 minutes equals
   Four - 30-minute shows
   One - 2-hour movie
   Two - 60 minute video game sessions
   Any many more combinations

Try to plan out a days activities, so you only have 120 minutes of screen time, and draw three comic book panels that shows your days events.
Learning Healthy Behaviors With Comics
Take Home Worksheet for Session 2

Hi! Today you learned about different types of drinks.

Sugar-Free drinks are those that do not have any sugar.
Sugar-Sweetened drinks are those that do have extra or added sugars.

When we have a choice, we should always choose the sugar-free drinks instead of the sugar-sweetened drinks.

Read the following food labels and identify which drinks are sugar-free drinks and which are sugar sweetened drinks.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving Size 1 can (12 fl oz)</td>
<td>Serving Size 1 bottle (12 fl oz)</td>
<td>Serving Size 1 bottle (8 fl oz)</td>
<td>Serving Size 1 can (12 fl oz)</td>
</tr>
<tr>
<td>Amount per serving</td>
<td>Amount per serving</td>
<td>Amount per serving</td>
<td>Amount per serving</td>
</tr>
<tr>
<td>Calories 140</td>
<td>Calories 0</td>
<td>Calories 50</td>
<td>Calories 0</td>
</tr>
<tr>
<td>Calories from Fat 0</td>
<td>Calories from Fat 0</td>
<td>Calories from Fat 0</td>
<td>Calories from Fat 0</td>
</tr>
<tr>
<td>% Daily Value</td>
<td>% Daily Value</td>
<td>% Daily Value</td>
<td>% Daily Value</td>
</tr>
<tr>
<td>Total Fat 0g</td>
<td>Total Fat 0g</td>
<td>Total Fat 0g</td>
<td>Total Fat 0g</td>
</tr>
<tr>
<td>Saturated Fat 0g</td>
<td>Saturated Fat 0g</td>
<td>Saturated Fat 0g</td>
<td>Saturated Fat 0g</td>
</tr>
<tr>
<td>Trans Fat 0g</td>
<td>Trans Fat 0g</td>
<td>Trans Fat 0g</td>
<td>Trans Fat 0g</td>
</tr>
<tr>
<td>Cholesterol 0mg</td>
<td>Cholesterol 0mg</td>
<td>Cholesterol 0mg</td>
<td>Cholesterol 0mg</td>
</tr>
<tr>
<td>Sodium 50mg</td>
<td>Sodium 0mg</td>
<td>Sodium 110mg</td>
<td>Sodium 40mg</td>
</tr>
<tr>
<td>% Daily Value</td>
<td>% Daily Value</td>
<td>% Daily Value</td>
<td>% Daily Value</td>
</tr>
<tr>
<td>Total Carbohydrate 39g 13%</td>
<td>Total Carbohydrate 0g 0%</td>
<td>Total Carbohydrate 14g 5%</td>
<td>Total Carbohydrate 0g 0%</td>
</tr>
<tr>
<td>Dietary Fiber 0g 0%</td>
<td>Dietary Fiber 0g 0%</td>
<td>Dietary Fiber 0g 0%</td>
<td>Dietary Fiber 0g 0%</td>
</tr>
<tr>
<td>Sugars 39g</td>
<td>Sugars 0g</td>
<td>Sugars 14g</td>
<td>Sugars 0g</td>
</tr>
<tr>
<td>Protein 0g</td>
<td>Protein 0g</td>
<td>Protein 0g</td>
<td>Protein 0g</td>
</tr>
<tr>
<td>Vitamin A 0%</td>
<td>Vitamin A 0%</td>
<td>Vitamin A 0%</td>
<td>Vitamin A 0%</td>
</tr>
<tr>
<td>Vitamin C 0%</td>
<td>Vitamin C 0%</td>
<td>Vitamin C 0%</td>
<td>Vitamin C 0%</td>
</tr>
<tr>
<td>Calcium 0%</td>
<td>Calcium 0%</td>
<td>Calcium 0%</td>
<td>Calcium 0%</td>
</tr>
<tr>
<td>Iron 8%</td>
<td>Iron 0%</td>
<td>Iron 0%</td>
<td>Iron 0%</td>
</tr>
</tbody>
</table>

How much Sugar is this can of soda?
Sugar =

Is this a good choice?
○ YES  ○ NO

How much Sugar is this bottle of water?
Sugar =

Is this a good choice?
○ YES  ○ NO

How much Sugar is this bottle of energy drink?
Sugar =

Is this a good choice?
○ YES  ○ NO

How much Sugar is this can of diet soda?
Sugar =

Is this a good choice?
○ YES  ○ NO
To help us achieve goals like choosing sugar-free drinks instead of sugar-sweetened drinks, it is important for us to plan ahead. This makes it easier for us to achieve our goals.

For example, if we plan out the drinks we want to have in advance, we can make sure they are sugar-free.

Remember the steps that we should take to choose sugar-free drinks.

- Step 1 - Look for the food label
- Step 2 - Look for the ‘Sugar’ on the food label
- Step 3 - Read the ‘Sugar’ on the food label and choose the drink with ‘0 grams’ of sugar

Try to draw a comic book story of you eating breakfast, lunch and dinner. While you eat your meals, show your self choosing sugar-free drinks.

Breakfast  Lunch  Dinner
Learning Healthy Behaviors With Comics
Take Home Worksheet for Session 3

Hi! Today you learned about physical activity.

Physical activity is any form of movement that increases your heart rate. Examples include team sports, individual sports, individual activity, and other types of activity that increase your heart rate.

We should be active everyday for at least 60 minutes.

Look at the following activities and identify whether they are active or not active.

Is taking a bike ride a good choice for physical activity?
☐ YES ☐ NO

Is playing on the computer a good choice for physical activity?
☐ YES ☐ NO

Is cleaning up the house a good choice for physical activity?
☐ YES ☐ NO

Is taking a nap a good choice for physical activity?
☐ YES ☐ NO

Is taking a jog a good choice for physical activity?
☐ YES ☐ NO

Is playing ball with a friend a good choice for physical activity?
☐ YES ☐ NO

Is watching TV a good choice for physical activity?
☐ YES ☐ NO
To help us achieve goals like being physically active for 60 minutes each day it is important for us to plan ahead. This makes it easier for us to achieve our goals.

For example, if we plan out our days activities in the morning, afternoon and evening, then we can make sure we get enough activity.

Remember we should have at least 60 minutes of physical activity each day.
In order to get 60 minutes each day, we can break it up in a lot of different ways.
For example:
We could be active for 30 minutes during recess and 30 minutes when we get home from school.
We could be active for 20 before we go to school, 20 minutes during recess and 20 minutes when we get home from school.
We could be active for 10 before we go to school, 30 minutes when we get home from school, and 20 minutes after dinner.
The important thing is to make sure we are active for AT LEAST 60 MINUTES!

Try to draw a comic book story of you being physically active during the day. Plan for being active for 60 total minutes.
Learning Healthy Behaviors With Comics
Take Home Worksheet for Session 4

Hi! Today we talked about Fruits and Vegetables?

There are 4 different types of Fruits: melons, berries, mixed fruit and other types of fruits.

There are 5 different types of Vegetables: green leafy, orange, beans, starchy and other types of vegetables.

We should eat at least 5 servings of fruits and vegetables each day.

Look at the following foods and identify whether they are fruits, vegetables or neither.

- **Corn on the Cob**
  - Fruit ☐
  - Vegetable ☐
  - Neither ☐

- **Tomato Ketchup**
  - Fruit ☐
  - Vegetable ☐
  - Neither ☐

- **Tater Tots**
  - Fruit ☐
  - Vegetable ☐
  - Neither ☐

- **Grapes**
  - Fruit ☑
  - Vegetable ☐
  - Neither ☐

- **Strawberries**
  - Fruit ☑
  - Vegetable ☐
  - Neither ☐

- **French Fries**
  - Fruit ☐
  - Vegetable ☐
  - Neither ☐

- **Strawberry candy**
  - Fruit ☑
  - Vegetable ☑
  - Neither ☐

- **Tomato**
  - Fruit ☑
  - Vegetable ☐
  - Neither ☐
To help us achieve goals like eating 5 servings of fruits and vegetables each day it is important for us to plan ahead. This makes it easier for us to achieve our goals.

For example, if we plan out the foods we eat each day, we can make sure we get enough fruits and vegetables.

Remember we should eat at least 5 servings of fruits and vegetables each day.

That means we should eat 2 - 3 servings of fruit each day AND 2 - 3 servings of vegetables each day.

You could do this by eating 1 fruit AND 1 vegetable at each meal. OR if you missed a fruit or vegetable at a meal, you could make it up as a snack.

There a MANY way you can get 5 servings of fruits and vegetables each day.

Try to draw a comic book story of you eating 5 servings of fruits and vegetables. Plan for breakfast, lunch and dinner.
Learning Healthy Behaviors With Comics
Added Activity Worksheet for Session 1
1.1. Making Faces Part 2

In comic books we rely on facial expressions to give us clues for what the characters are feeling. We have already talked about simple emotions, like happy, sad, or angry. Let us learn some new emotions and see if we can draw them out.

Use the circles below to try to draw these four different emotions.

Example: **Happy** - Feeling or showing pleasure or contentment

**Courageous** - Brave: not deterred by danger or pain

**Apathetic** - Showing or feeling no interest, enthusiasm, or concern

**Resilient** - Able to withstand or recover quickly from difficult conditions

**Terror** - Extreme fear
1.3 Shapes can be ANYTHING!
Remember in comics we rely on the pictures to give us clues about what is going on in the story. Shapes are the building blocks of all pictures. Let’s practice making objects out of shapes.
Don’t forget BE CREATIVE!

Now let’s try some more tricky shapes! What can you make out of these?
Learning Healthy Behaviors With Comics
Added Activity Worksheet for Session 2

2.1 Comic books tell a story by combining pictures and words. These stories are told through a series of panels that read from left to right. Some stories need 2-panels, some stories need 4-panels and some stories need 8-panels, but the really cool thing about comics is that you can make a story using how many ever panels you want. Read the small story below and turn it into a 2-panel story, a 4-panel story and an 8-panel story.

Once there a pirate named ‘Clo.’ Clo was resting one day, reading over ocean and sea maps and he noticed things were quite around the ship. As he walked around the ship, looking for his crew he felt an overwhelming sense of loneliness. Then out of the corner of his eye he saw that his enemy had taken over the ship. It was ninjas! And they were everywhere...

2-Panel Story

Panel 1

Panel 2

4-Panel Story

Panel 1

Panel 2

Panel 3

Panel 4
Learning Healthy Behaviors With Comics
Added Activity Worksheet for Session 3

Go to your local comic book shop or library and get a few comic books.
Next, read those comic books and choose which one you like the best.
Fill this sheet out for the comic story you liked the best.

Who are your characters?

Out of all these characters, were there any heroes?(list as many as possible)

Out of all these characters, were there any villains?(list as many as possible)

Who was your favorite character?

Draw a sketch of your favorite character below. You can also make drawing of his/her house, car or friends.
Learning Healthy Behaviors With Comics
Added Activity Worksheet for Session 4

Go to your local comic book shop or library and get a few comic books.
Next, read those comic books and choose which one you like the best.
Fill this sheet out for the comic story you liked the best.

What was the setting of the story? A big city? Outer Space?

How did the story start?

What happened in the middle of the story?

How did the story end? Was it ‘to be continued’?

If the story was to be continued, how would you continue the story? Draw a sketch of how you would end the story below.
Learning Healthy Behaviors With Comics
Worksheet for home: Session 1

Hi! Today you learned about word balloons and thought balloons.

To learn more about comic books this week, go to your local comic book store or library and get a few comic books to read on your own.

As you read the comic books pay attention to the word and thought balloons that are used throughout the comic book. Are there more word balloons or more thought balloons on each page?

Count the number of words in each word balloon on page 6 of the comic book.

Count the number of words in each thought balloon on page 8 of the comic book.

Try to calculate the average number of balloons for each page or have your parents help you.

Where you surprised about the number of words that are in the word and thought balloons?
Learning Healthy Behaviors With Comics
Worksheet for home: Session 2

Hil Today you learned about comic book panels.

To learn more about comic books this week, go to your local comic book store or library and get a few comic books to read on your own.

As you read the comic books pay attention to the panels that are used throughout the comic book.

Are there more large panels or more small panels on each page?

Count the number of panels on page 5 of the comic book.

Number of panel =

Count the number of panels on page 10 of the comic book.

Number of panel =

Try to calculate the average number of panels for each page or have your parents help you.

Where you surprised about the number of panels that are on each page?
Learning Healthy Behaviors With Comics
Worksheet for home: Session 3

Hi! Today you learned about story telling.

To learn more about comic books this week, go to your local comic book store or library and get a few comic books to read on your own.

After you read your comic book, explain to a family member the following:

How did the story begin?

What happened in the middle of the story?

How did the story end?

If you could have ended the story in a different way, how would you have ended it?
Learning Healthy Behaviors With Comics
Worksheet for home: Session 4

Hi! Today you learned about story telling.

To learn more about comic books this week, go to your local comic book store or library and get a few comic books to read on your own.

After you read your comic book, choose the one you liked the most:

Why did you like this one the most?

Did the story end in this book or was the story 'to be continued'?

If the story was 'to be continued, use a comic book template worksheet to create an ending to the story.
Role Play Activity Sheet 1

Role-Play 1.1.

Scenario # 1: In this first role play, (X=child’s name) is going to be him/herself, and I am going to be X’s friend. We are going to pretend that it is afterschool, we are bored, and we don’t know what to do. I want to play video games, and X is going to try to teach me that doing something active, instead of playing video games, is better.

- Ask: So what does X need to tell me?
- Wait for children responses and state:
  - 1. What is a Screen time?
  - 2. How much screen time should we have each day?
  - 3. Why should we only have 2 hours of screen time per day.
  - 4. What are active games we could do instead?
- Says: One other thing, if X gets stuck, they can ask someone in the group to help them.
- Asks: Before we get started, does anyone have any questions about our role-play?

-Begins role play by saying: "Boy, that was a tough day at school. Let’s do something fun like play video games."
- Child: No, I think we should be active, and maybe play a game outside.
- Say: What do you mean? I thought you liked to play video games.
Child: Yea, I like to play them once in a while, but video games are considered screen time and I try to limit my screen time to no more than 2 hours per day.
Say: Screen time? What is that?
Child: Well screen time is any activity that gives you little or no activity. It includes things like playing video games, watching TV and playing on the computer.
Say: But, why should I limit my screen time to no more than 2 hours per day? That doesn’t sound like a lot of time.
Child: There are many benefits to being active instead of doing screen time. For example (have child list 2 or 3 benefits).
Say: O, wow. Well that sounds like a good idea. Let’s go play a game outside.

-Processes role play by saying: Asks X: “Did you feel comfortable helping your friend?”
Asks everyone: Would you feel comfortable talking with your friends? Why or why not?
- Says: “Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all.
- Asks: Who would like to play themselves in this next role play??

Role-Play 1.2.

Scenario #2: In this second role play, X is going to be him/herself, and I am going to be X’s parent or guardian. (Asks the child who they should be: Mom? Dad? Grandpa? Uncle?) We are going to pretend that you just got out of school and you are bored. I will ask you if you want to watch TV, but you will try to teach me why being active is better.

- Ask: So what does X need to tell me?
- States:
  - 1. What is a Screen time?
  - 2. How much screen time should we have each day?
  - 3. Why should we only have 2 hours of screen time per day.
  - 4. What are active games we could do instead?
- Says: One other thing, if X gets stuck, they can ask someone in the group to help them.
- Asks: Before we get started, does anyone have any questions about our role-play?
Begins role-play by saying: “Hi X. Did you have a good day at school? Why don’t you watch TV now?”
Child: No, I think I should be active. Maybe we could play a game outside together!
Say: What do you mean? I thought you liked to watch TV.
Child: Yea, I like to watch TV once in a while, but TV is considered screen time and I try to limit my screen time to no more than 2 hours per day.
Say: Screen time? What is that?
Child: Well screen time is any activity that gives us little or no activity. It includes things like playing video games, watching TV and playing on the computer.
Say: But, why should you limit my screen time to no more than 2 hours per day? That doesn’t sound like a lot of time.
Child: There are many benefits to being active instead of doing screen time. For example (have child list 2 or 3 benefits).
Say: O, wow. Well that sounds like a good idea. Let’s go play a game outside together!

Processes role play 1.2 by Asking X: “Did you feel comfortable helping your parent/guardian?
-Asks everyone: Would you feel comfortable talking with your parent/guardian? Why or why not?
-Says: ‘Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all.”
Role Play Activity Sheet 2

Role-Play 2.1.

- Scenario # 2.1: In this first role play, X is going to be him/herself, and I am going to be X’s friend. We are going to pretend that it is afterschool, we were playing soccer and we were both really thirsty. I want to have pop as a drink, and X is going to try to teach me why choosing a sugar-free drink is better.
- Ask: So what does X need to tell me?
- States:
  - 1. What is a sugar-sweetened drink, and what is a sugar-free drink?
  - 2. How do we read the food label to find this information out?
  - 3. Why should we have sugar-free drinks instead of sugar-sweetened drinks?
  - 4. What are sugar free drinks we could have instead?
- Says: One other thing, if X gets stuck, they can ask someone in the group to help them.
- Asks: Before we get started, does anyone have any questions about our role-play?

- Begins role play by saying: “Boy I’m thirsty from running and playing soccer. Let us get a drink. How about pop?”
- Child: No, I think we should have a sugar-free drink or water.
- Say: What do you mean a sugar-free drink?
Child: Well some drinks have sugar and some don’t. Drinks made with sugar are called ‘sugar-sweetened drinks, and drinks without sugar are called ‘sugar-free drinks.’
Say: How can you tell the difference between them?
Child: Well you look at the food label. On the food label it lists sugars, and the more sugar is says, the more sugar is in the drink.
Say: But, why should I have a sugar-free drink? I like pop.
Child: Yea, pop is ok to have once in a while, but you should mostly have sugar-free drinks. There are many benefits to choosing sugar-free drinks over sugar-sweetened drinks. For example (have child list 2 or 3 benefits).
Say: O, wow. Well that sounds like a good idea. Let’s go get some water!

Processes role play by asking X: “Did you feel comfortable helping your friend?”
Asks everyone: Would you feel comfortable talking with your friends? Why or why not?
-Says: ‘Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all.

Role-Play 2.2.

-Scenario # 2: In this second role play, (child’s name) is going to be him/herself, and I am going to be X’s parent or guardian. (Asks the child who they should be: Mom? Dad? Grandpa? Uncle?). We are going to pretend that you just got out of school and we are having dinner. I will ask you if you want to drink, and you will explain to me why choosing a sugar-free drink is better than a sugar-sweetened drink.
States:
- 1. What is a sugar-sweetened drink, and what is a sugar-free drink?
- 2. How do we read the food label to find this information out?
- 3. Why should we have sugar-free drinks instead of sugar-sweetened drinks?
- 4. What are sugar free drinks we could have instead?
-Says: One other thing, if X gets stuck, they can ask someone in the group to help them.
-Asks: Before we get started, does anyone have any questions about our role-play?

-Begins role play by saying: “Alright, are you ready for dinner? What would you like to have to drink? Maybe a pop or kool aid?”

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- Child: No, I think we should have a sugar-free drink or water.
- Say: What do you mean a sugar-free drink?
Child: Well some drinks are made with added sugars and some are not. Drinks made with sugars are called 'sugar-sweetened drinks, and drinks without sugar are called 'sugar-free drinks.'
Say: How can you tell the difference between them?
Child: Well you look at the food label. On the food label it lists sugars, and the more sugar is says, the more sugar is in the drink.
Say: But, why should you have a sugar-free drink? I thought you liked pop?
Child: Yea, pop is ok to have once in a while, but I should mostly have sugar-free drinks. There are many benefits to choosing sugar-free drinks over sugar-sweetened drinks. For example (have child list 2 or 3 benefits).
Say: O, wow. Well that sounds like a good idea. I'll get you some water right away!

Processes role play by asking X: "Did you feel comfortable helping your parent/guardian?
- Asks everyone: Would you feel comfortable talking with your parent/guardian? Why or why not?
- Says: 'Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all.
Role Play Activity Sheet 3

Role-Play 3.1.

- **Explain scenario # 1:** In this first role play, X is going to be him/herself, and I am going to be X’s friend. We are going to pretend that it is afterschool, we are bored, and we don’t know what to do. Since X is my friend, he/she will recommend that we become active.
- Ask: So what does X need to tell me?
- States:
  - 1. What is a physical activity or exercise?
  - 2. How many minutes of physical activity should we do everyday?
  - 3. Why should we be active for at least 60 minutes per day?
  - 4. 60 minutes is also the minimum. The longer the better!
- Says: One other thing, if X gets stuck, they can ask someone in the group to help them.
- Asks: Before we get started, does anyone have any questions about our role-play?

- Begins role play by saying: "Boy that was a stressful day at school. I had a really big math quiz. What do you want to do?"
Child: I think we should be active and play a game.
Say: Active? What exactly do you mean?
Child: Well we should play a game where we are active. Like soccer or football. Something that gets our bodies moving and our heart rates up.
Say: Well I was thinking about watching TV, or playing video games. Is that being active?
Child: No, that’s not being active because when we watch TV or play video games we are usually sitting down.
Say: But, why should we be active? I like playing video games.
Child: Yea, playing video games if fine once in a while but there are many benefits to being active over playing video games. For example (have child list 2 or 3 benefits).
Say: Really? Well I was active at recess. Isn’t that enough activity?
Child: No, recess is only 20 or 30 minutes. We should be active for at least 60 minutes per day.
Say: O, wow. Well that sounds like a good idea. What game do you want to play?

Processes role play asking X: "Did you feel comfortable helping your friend?"
Asks everyone: Would you feel comfortable talking with your friends? Why or why not?
-Says: "Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all.

Role-Play 3.2.

- **Explains scenario # 2:** In this second role play, (child’s name) is going to be him/herself, and I am going to be X’s parent or guardian. (Asks the child who they should be: Mom? Dad? Grandpa? Uncle?). We are going to pretend that you just got out of school and you are bored. I will ask you if you want to watch a movie, but you will try to teach me why being active is better.
- Ask: So what does X need to tell me?
- States:
  - 1. What is a physical activity or exercise?
  - 2. How many minutes of physical activity should we do everyday?
  - 3. Why should we be active for at least 60 minutes per day.
  - 4. 60 minutes is also the minimum. The longer the better!
- Says: One other thing, if (child’s name) gets stuck, they can ask someone in the group to help them.
- Asks: Before we get started, does anyone have any questions about our role-play?
-Begins role-play by saying: "Hi (child's name). Did you have a good day at school? Why don't you watch this movie on TV?"
Child: No, I think I should do something active, like go outside, play with a friend or we could even play something together!
Say: Active? What exactly do you mean?
Child: Well we should play a game where we are active. Like soccer or football. Something that gets our bodies moving and our heart rates up.
Say: Well I thought you like watching these movies.
Child: Yea, I like watching those movies once in a while, but I should really be active for at least 60 minutes today and I didn't have PE class.
Say: But, why should we be active?
Child: There are many benefits to active over playing video games. For example (have child list 2 or 3 benefits).
Say: O, wow. Well that sounds like a good idea. Let us play a game together!

Processes role play asking X: "Did you feel comfortable helping your parent/guardian?
-Asks everyone: Would you feel comfortable talking with your parent/guardian? Why or why not?
-Says: "Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all."
Role Play Activity Sheet 4

Role-Play 4.1.

- Explain scenario # 1: In this first role play, (child’s name) is going to be him/herself, and I am going to be X’s friend. We are going to pretend that it is afterschool, we were playing basketball and we were both hungry for a snack. I want to have potato chips, and X, is going to try to teach me why having a fruit or a vegetable is better?
- What does X need to tell me?
- States:
  - 1. What is a fruit and what are the different types of fruits?
  - 2. What are fruit-flavored foods?
  - 3. What are vegetables and what are the different types of vegetables?
  - 4. How many fruits and vegetables should we have each day?
- Says: One other thing, if X gets stuck, they can ask someone in the group to help them.
- Asks: Before we get started, does anyone have any questions about our role-play?

- Begins role play by saying: “Boy I’m hungry from running and playing basketball. Let us get a snack. How about potato chips?”
- Child: No, I think we should have a fruit or a vegetable.
- Say: What do you mean a fruit or a vegetable? Potato chips are potatoes right? And that is a Vegetable.
Child: Well they are, but to make the chips they have to cook them in oil, grease and fat and when they do that it makes them unhealthy. We should have a REAL vegetable, like salad, carrot sticks, or celery sticks.
Say: Ok, well what about cherry flavored candy? There are cherries in that right and that is a fruit?
Child: Well no, that is actually wrong. That is candy and what is called a ‘fruit-flavored food.’ A REAL fruit is something like an orange, apple, or grapes.
Say: But, why should I have a fruit or vegetable? I like these other foods.
Child: Yea, those other foods are ok to have once in a while, but fruits and vegetables are much better to have. There are many benefits to eating fruits and vegetables. For example (have child list 2 or 3 benefits).
Say: Well I had a fruit at breakfast and a vegetable at lunch, so I have already had enough I think...
Child: Well actually, we should have 5 servings of fruits and vegetables each day!
Say: O, wow. Well that sounds like a good idea. Let’s go get some fruit and vegetables!

Processes role play by asking X: ‘Did you feel comfortable helping your friend?’
Asks everyone: Would you feel comfortable talking with your friends? Why or why not?
- Says: ‘Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all.

Role-Play 4.2.

- Explains scenario # 2: In this second role play, (child’s name) is going to be him/herself, and I am going to be X’s parent or guardian. (Asks the child who they should be: Mom? Dad? Grandpa? Uncle?)
- Says: We are going to pretend that you just got out of school and I am going to give you a snack. I will ask you if you want you want, and you will explain to me that you want a fruit or a vegetable.
- States:
  - 1. What is a fruit and what are the different types of fruits?
  - 2. What are fruit-flavored foods?
  - 3. What are vegetables and what are the different types of vegetables?
  - 4. How many fruits and vegetables should we have each day?
- Says: One other thing, if X gets stuck, they can ask someone in the group to help them.
- Asks: Before we get started, does anyone have any questions about our role-play?
-Begins role play by saying: “Alright, are you ready for a snack? What would you like to have? Maybe some French fries?”
-Child: No, I think I want a fruit or a vegetable?
Child: Well the French fries are made out potatoes. That is a vegetable right?
Child: Well they are, but to make the French fries they have to cook them in oil, grease and fat and when they do that it makes them unhealthy. We should have a REAL vegetable, like salad, carrot sticks, or celery sticks.
Say: Ok, well what about orange flavored candy? There are oranges in that right and that is a fruit?
Child: Well no, that is actually wrong. That is candy and what is called a ‘fruit-flavored food.’ A REAL fruit is something like an orange, apple, or grapes.
Say: But, why should I have a fruit or vegetable? I thought you liked these other foods.
Child: Well, it’s ok to have them once in a while, but there are many benefits to eating fruits and vegetables. For example (have child list 2 or 3 benefits).
Say: Well I packed mixed fruit in your lunch today, so you already had fruit once. Isn’t that enough?
Child: No, I should eat 5 servings of fruits and vegetables each day!
Say: O, wow. Well that sounds like a good idea. Let’s go get you some fruit and vegetables!

Processes role play by asking X: “Did you feel comfortable helping your parent/guardian?
-Asks everyone: Would you feel comfortable talking with your parent/guardian? Why or why not?
-Says: ‘Thank you for agreeing to participate in the role play. You did a wonderful job and helped us all.'
Appendix G. Panel of experts for Process Evaluation worksheets & letter to panel

1. Nancy Brody, Med
   Metropolitan School-Age Quality Education Resource Director
   YMCA OF CENTRAL OHIO
   40 West Long Street, Columbus, Ohio 43215
   Phone: 614 224 1137 ext 166
   nbrody@ymcacolumbus.org
   Expertise: Program Evaluation

2. Amar Kanekar, M.B.; B.S., MPH, PhD
   Assistant Professor of Health Studies
   East Stroudsburg University, East Stroudsburg, PA 18301
   Phone: (570) 422-3211
   akanekar@po-box.esu.edu
   Expertise: Instrumentation, Childhood Obesity, Process Evaluations

3. Manoj Sharma, M.B.; B.S., CHES, PhD
   Professor Health Promotion & Education
   University of Cincinnati Cincinnati, OH 45221
   Phone:513-556-3878
   manoj.sharma@uc.edu
   Expertise: Instrumentation, Childhood Obesity, Process Evaluations

4. Brad Wilson, PhD
   Professor Health Promotion & Education
   University of Cincinnati Cincinnati, OH 45221
   Phone:513-556-3878
   Expertise: Instrumentation

5. Melinda J. Ickes, PhD
   111 Seaton Building
   Department of Kinesiology and Health Promotion
   College of Education
   University of Kentucky
   melinda.ickes@uky.edu
   Expertise: Instrumentation, Childhood Obesity, Process Evaluations

6. Amy Bernard, PhD
   Associate Professor Health Promotion & Education
   University of Cincinnati Cincinnati, OH 45221
   Phone:513-556-3878
   Expertise: Instrumentation, Childhood Obesity, Process Evaluations
To: Dr. Manoj Sharma  
Dr. Amy Bernard  
Dr. Brad Wilson  
Dr. Amar Kanekar  
Dr. Melinda Ickes  
Mrs. Nancy Brody

From: Paul Branscum, PhD (c), MS, RD, LD

Hello. I am a PhD candidate at the University of Cincinnati, and I am currently working on my dissertation study entitled ‘Designing and evaluating social cognitive theory comic book based intervention for the prevention of childhood obesity among elementary aged school children’. The study will entail the implementation of two kinds of obesity-prevention interventions for comparison—(1) a social cognitive theory based type (experimental) and (2) a knowledge-only based type (comparison). Based on your expertise in the area of implementing health education programs, and process evaluations, you have been identified as an expert to help me establish face and content validity of the two sets of structured tally sheets that I have developed for the purpose of assessing the degree of fidelity of the two interventions. Each intervention has four sessions, therefore there are a total of eight process evaluations. Each of these process evaluations will be completed by an independent observer, and the individual implementing the lesson (the individual implementing the lesson will complete this after the lesson has been successfully completed). You are being asked to compare each process evaluation with the corresponding session and comment upon the following:

**Content Validity**, or the extent to which questions adequately assess the session as a whole.

**Face Validity**, or whether given questions "looks like" it is going to measure what it is supposed to measure.

**Readability**, or whether the items are meaningful and easy to read.

If you agree to serve on this expert panel, I would need your comments back within three weeks of you receiving the materials. After the entire panel has responded, I will review all comments, record reoccurring themes that appear within the panels’ responses, and make appropriate/necessary changes. After changes are made, I will then conduct a second round, whereby you will have an additional week to review the changes, which were made, and give any final comments. I would greatly appreciate your expertise for this project. If you are willing to serve on this expert please email or call me. I can be reached at 513-324-9783 or branscpw@mail.uc.edu. I thank you for your time and look forward to hearing back from you on this matter.

Sincerely,

Paul Branscum
Appendix H. Process Evaluation worksheets
# Process Evaluation Sheet for Program ‘Learning Healthy Behaviors With Comics’
## Program A (Experimental): Session 1

**Date:**

**Name of person implementing the program:**

**Program/Site:**

**Name of person observing the program:**

**Did the person implementing the program…**

<table>
<thead>
<tr>
<th>Check if YES</th>
<th>1. Introduce himself/herself?</th>
<th>2. Explain the goal of the lesson?</th>
<th>3. Define screen time?</th>
<th>4. Implement activity 1.1?</th>
<th>5. Tell children they should spend no more than 2 hours with screen time everyday?</th>
</tr>
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</tbody>
</table>

**Benefits (approximate time spent for items #6 - #11= _____)**

<table>
<thead>
<tr>
<th>6. Explain that during the program children will learn about comics?</th>
<th>7. Explain what comic books are?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>8. Explain importance of showing emotions in comics?</th>
<th>9. Implement activity 1.2?</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>10. List benefits of being active with children?</th>
<th>11. Implement activity 1.3?</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

**Role-Play Simulations (approximate time spent for items #12 - #19= _____)**

<table>
<thead>
<tr>
<th>12. Explain to children they will practice talking with parents and peers about why it is important to limit screen time?</th>
<th>13. Explain what a role-play is?</th>
<th>14. Explain scenario 1?</th>
<th>15. Implement scenario 1?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
16. Process scenario 1? 

17. Explain scenario 2? 

18. Implement scenario 2? 

19. Process scenario 2? 

Goal Setting (approximate time spent for items #20 - #24= ______) 

20. Explain importance of goal setting? 

21. Implement activity 1.4? 

22. Explain importance of characters in comic stories? 

23. Explain and distribute ‘Character Creation Sheet’? 

24. Assure children know next time and date they meet?
Process Evaluation Sheet for Program ‘Learning Healthy Behaviors With Comics’
Program A (Experimental): Session 2

Date: ____________

Name of person implementing the program: ________________________________

Program/Site: ________________________________

Name of person observing the program: ________________________________

Did the person implementing the program... Check if YES

**Introduction & purpose of the lesson (approximate time spent for items #1 - #10= ______)***

1. Re-introduce himself/herself? __________
2. Explain the goal of the lesson? __________
3. Define sugar-sweetened drinks? __________
4. List different types of sugar-sweetened drinks? __________
5. Implement activity 2.1? __________
6. Show children where ‘Sugars’ is on food label? __________
7. Ask the children how much sugar soda and water has? __________
8. Ask children which would be a better choice? __________
9. Explain that a lot of drinks have 2 versions:
   A sugar-sweetened and sugar free version? __________
10. Ask if everyone understands? __________

**Benefits (approximate time spent for items #11 - #16= ______)***

11. Explain that during the program children will learn about comics? __________
12. Explain importance of shapes in comic books? __________
13. Implement activity 2.2? __________
14. Ask children if they had any problem with the activity? __________
15. List benefits for having sugar-free drinks instead of sugar-sweetened drinks? __________
16. Implement activity 2.3? __________
Role-Play Simulations (approximate time spent for items #17 - #24= ________)

17. Explain to children they will practice talking with parents and peers about why it is important to have sugar-free drinks instead of sugar-sweetened drinks? __________

18. Re-explain what a role-play is? __________

19. Explain scenario 1? __________

20. Implement scenario 1? __________

21. Process scenario 1? __________

22. Explain scenario 2? __________

23. Implement scenario 2? __________


Goal Setting (approximate time spent for items #25 - #29= ________)

25. Explain importance of goal setting? __________

26. Implement activity 2.4? __________

27. Explain last time they went over importance of characters? __________

28. Explain importance for stories and distribute ‘Story Creator Worksheet? __________

29. Assure children know next time they meet? __________
Process Evaluation Sheet for Program ‘Learning Healthy Behaviors With Comics’
Program A (Experimental): Session 3

Date: ______________

Name of person implementing the program: ________________________________

Program/Site: __________________________________________________________

Name of person observing the program: _________________________________

Did the person implementing the program...

Check if YES

Introduction & purpose of the lesson (approximate time spent for items #1 - #10 = ________)

1. Re-introduce himself/herself as needed? __________
2. Explain the goal of the lesson? __________
3. Define physical activity? __________
4. List different types physical activities? __________
5. Implement activity 3.1? __________
6. Ask how long we should spend doing physical activities each day? __________
7. Take guesses from the children? __________
8. Explain that we should be active for at least 60 minutes per day? __________
9. Ask if everyone understands? __________

Benefits (approximate time spent for items #11 - #14 = ________)

10. Explain that during program children will learn about comic books? __________
11. Ask some children to explain their stories and characters? __________
12. List benefits of being physically active? __________
13. Implement activity 3.2? __________

Role-Play Simulations (approximate time spent for items #15 - #22 = ________)

14. Explain to children they will practice talking with parents and peers about why it is important to be active for at least 60 minutes everyday? __________
15. Re-explain what a role-play is? __________
16. Explain scenario 1?

17. Implement scenario 1?

18. Process scenario 1?

19. Explain scenario 2?

20. Implement scenario 2?

21. Process scenario 2?

**Goal Setting (approximate time spent for items #23 - #27= ________)**

22. Explain importance of goal setting?

23. Implement activity 3.3?

24. Explain comic-book template?

25. Review first three lesson objectives?

26. Assure children know next time they meet?
Date: ________________

Name of person implementing the program: _________________________________________

Program/Site: __________________________________________________

Name of person observing the program: ________________________________

Did the person implementing the program… Check if YES

**Introduction & purpose of the lesson (approximate time spent for items #1 - #11 = ______)****

1. Re-introduce himself/herself as necessary? __________
2. Explain the goal of the lesson? __________
3. Define fruits? __________
4. Explain to children that fruit-flavored candy does not count as fruit? __________
5. List 4 different types of fruit? __________
6. Define vegetables? __________
7. Explain to children that French fries do not count as vegetables? __________
8. List 5 different types of vegetables? __________
9. Implement activity 4.1? __________
10. Explain that we should eat 5 servings of fruits and vegetables each day? __________
11. Ask if everyone understands? __________

**Benefits (approximate time spent for items #12 - #13 = ______)**

12. Remind children about Comic Book Template? __________
13. List benefits for are eating 5 servings of fruits and vegetables everyday? __________

**Role-Play (approximate time spent for items #15 - #22 = ______)**

15. Explain to children they will practice talking with parents and peers about why it is important to eat 5 servings of fruits and vegetables each day? __________
16. Re-explain what a role-play is? 

17. Explain scenario 1? 

18. Implement scenario 1? 

19. Process scenario 1? 

20. Explain scenario 2? 

21. Implement scenario 2? 

22. Process scenario 2? 

**Goal Setting (approximate time spent for items #23 - #26= ______)  

23. Explain importance of goal setting? 

24. Implement activity 4.3? 

25. Have some children share their comic stories? 

26. Review all lesson objectives?
Process Evaluation Sheet for Program ‘Learning Healthy Behaviors With Comics’
Program B (Comparison): Session 1

Date:______________

Name of person implementing the program:_________________________________

Program/Site:________________________________________________

Name of person observing the program: _______________________________

Did the person implementing the program… Check if YES

Introduction & purpose of the lesson (approximate time spent for items #1 - #5= ______)

1. Introduce himself/herself? __________________
2. Explain the goal of the lesson? ______________
3. Define screen time? _______________________
4. Implement activity 1.1? _____________________
5. Tell children they should spend no more than 2 hours with screen time everyday? ___________

Comic Book Activity #1 (approximate time spent for items #6 - #10= ______)

6. Explain that during the program children will learn about comics? ______________
7. Explain what comic books are? ______________
8. Explain importance of showing emotions in comics? __________________
9. Implement activity 1.2? _____________________
10. Ask children if they had any problems with this activity? __________________

Comic Book Activity #2 (approximate time spent for items #11 - #13 = ______)

11. Explain importance of shapes in comics? ______________
12. Implement activity 1.3? _______________________
13. Ask children if they had any problems with this activity? __________________

Comic Book Activity #3 (approximate time spent for items #14 - #20 = ______)

14. Explain what word balloons are? ______________
15. Explain what thought balloons are? ______________
16. Implement activity 1.4?

17. Ask children if they had any problems with this activity?

18. Explain importance of characters in comic stories?

19. Explain/distribute ‘Character Creation Sheet’?

20. Assure children know next time and date they meet?
Process Evaluation Sheet for Program ‘Learning Healthy Behaviors With Comics’
Program B (Comparison): Session 2

Date:______________
Name of person implementing the program:_________________________________
Program/Site:________________________________________________
Name of person observing the program: _______________________________

Did the person implementing the program… Check if YES

**Introduction & purpose of the lesson (approximate time spent for items #1 - #10= _______)**

1. Re-introduce himself/herself? __________
2. Explain the goal of the lesson? __________
3. Define sugar-sweetened drinks? __________
4. List different types of sugar-sweetened drinks? __________
5. Implement activity 2.1? __________
6. Show children where ‘Sugars’ is on food label? __________
7. Ask the children how much sugar soda and water has? __________
8. Ask children which would be a better choice? __________
9. Explain that a lot of drinks have 2 versions:
   A sugar-sweetened and sugar free version? __________
10. Ask if everyone understands? __________

**Comic Book Activity #1 (approximate time spent for items #11 - #16= _______)**

11. Explain that children will be learning more about comics? __________
12. Ask children to share the characters they created? __________
13. Review importance of showing emotions in comics? __________
14. Review importance of shapes in comics? __________
15. Implement activity 2.2? __________
16. Ask children if they had any problems? __________

**Comic Book Activity #2 (approximate time spent for items #17 - #19= _______)**

17. Explain that next activity has 3 panels and they will create own story? __________

18. Implement activity 2.3? __________

19. Ask children if they had any problems? __________

**Wrap up (approximate time spent for items #20 - #22= _______)**

20. Thank children and ask for questions? __________

21. Explain to children they need to create a story
   
   with the Story Creation Worksheet? __________

22. Assure children know next time and date they meet? __________
Process Evaluation Sheet for Program ‘Learning Healthy Behaviors With Comics’
Program B (Comparison): Session 3

Date:______________

Name of person implementing the program:_________________________________

Program/Site:________________________________________________

Name of person observing the program: _______________________________

Did the person implementing the program… Check if YES

Introduction & purpose of the lesson (approximate time spent for items #1 - #9= ________)

1. Re-introduce himself/herself as needed? __________
2. Explain the goal of the lesson? __________
3. Define physical activity? __________
4. List different types physical activities? __________
5. Implement activity 3.1? __________
6. Ask how long we should spend doing physical activities each day? __________
7. Take guesses from the children? __________
8. Explain that we should be active for at least 60 minutes per day? __________
9. Ask if everyone understands? __________

Comic Book Activity #1 (approximate time spent for items #10 - #13= ________)

10. Explain that children will be learning more about comics? __________
11. Ask/Explain what they went over last time concerning comic-panels? __________
12. Ask children to share stories they created with ‘Story Creation Worksheet?’ __________
13. Thank children for sharing? __________

Comic Book Activity #2 (approximate time spent for items #14 - #19= ________)

14. Explain that in the next activity they will come up with a story as a group and each child will create their own comic from this story? __________
15. Identify 3 or 4 characters for the story?

16. Identify a beginning for their story?

17. Identify a middle for their story?

18. Identify an ending for their story?

19. Implement activity 3.2?

Wrap up (approximate time spent for items #20 - #23=

20. Thank children and ask for questions?

21. Explain that they are now ready to make their own comic?

22. Explain to children directions for comic book template?

23. Assure children know next time and date they meet?
Process Evaluation Sheet for Program ‘Learning Healthy Behaviors With Comics’
Program B (Comparison): Session 4

Date:______________

Name of person implementing the program:_________________________________

Program/Site:________________________________________________

Name of person observing the program: _______________________________

Did the person implementing the program… Check if YES

Introduction & purpose of the lesson (approximate time spent for items #1 - #11 = ________)

1. Re-introduce himself/herself as necessary? __________
2. Explain the goal of the lesson? __________
3. Define fruits? __________
4. Explain to children that fruit-flavored candy does not count as fruit? __________
5. List 4 different types of fruit? __________
6. Define vegetables? __________
7. Explain to children that French fries do not count as vegetables? __________
8. List 5 different types of vegetables? __________
9. Implement activity 4.1? __________
10. Explain that we should eat 5 servings of fruits and vegetables each day? __________
11. Ask if everyone understands? __________

Comic Book Activity #1 (approximate time spent for items #12 - #14= ________)

12. Review that last time they received a comic book template? __________
13. Ask a few children to share their comic book story? __________
14. Thank children for sharing? __________

Comic Book Activity #2 (approximate time spent for items #15 - #18= ________)

15. Explain that this was the last day for the program? __________
16. Explain that children may read comics or work on their own comic? __________
Wrap up (approximate time spent_______)

17. Ask if anyone has any questions? __________

18. Thank children for being in the program? __________
Appendix I. Childhood Obesity Prevention Scale v.3

IRB# __________________

University Of Cincinnati
Childhood Obesity Prevention Scale v.3

NAME__________________

Directions: This survey is voluntary, which means you may choose not to complete it or not to answer individual questions. Please fill in the bubble by the response that correctly describes your view. Thank you for your help!

1. How old are you today?
   - [ ] Younger than 9 years old
   - [ ] 10 years old
   - [ ] 11 years old
   - [ ] 12 years old
   - [ ] 13 years old
   - [ ] Older than 13 years old

2. Are you a…?
   - [ ] Girl
   - [ ] Boy

3. What is your race?
   - [ ] Black or African American
   - [ ] Hispanic
   - [ ] White/Caucasian
   - [ ] American Indian/Alaskan Native
   - [ ] Asian
   - [ ] Other______________

4. How many times have you been taught in school about healthy eating?
   - [ ] Never
   - [ ] 1 time
   - [ ] 2 times
   - [ ] 3 or more times

5. How many times have you been taught in school to do physical activity or exercise at home?
   - [ ] Never
   - [ ] 1 time
   - [ ] 2 times
   - [ ] 3 or more times

6. Yesterday, how many servings of melons did you eat? (mark the closest bubble)
   Melons may include cantaloupe, honeydew, and watermelon.
   - [ ] 0 Servings
   - [ ] 1 Serving
   - [ ] 2 Servings
   - [ ] 3 Servings
   - [ ] 4 Servings
   - [ ] 5 Servings
   - [ ] 6 Servings

DO NOT FILL OUT

Height (to nearest 1/8 inch): _____ feet _____ inches _________ fraction of inch

Weight (to nearest ¼ pound): ________ pounds ________ fractions of a pound

Measurement:  PRE___ POST___ Follow-Up___
7. Yesterday, how many servings of berries did you eat? (mark the closest bubble)
   Berries may include strawberries, blueberries, and raspberries.
   - 0 Servings
   - 2 Servings
   - 4 Servings
   - 6 Servings

8. Yesterday, how many servings of mixed fruit did you eat? (mark the closest bubble)
   Mixed fruit can come from a can, a cup, can be fresh fruit or can be frozen fruit.
   - 0 Servings
   - 2 Servings
   - 4 Servings
   - 6 Servings

9. Yesterday, did you eat any other types of fruit like apples, oranges, cherries, pears, or grapes?
   Do not count juice. (mark the closest bubble)
   - 0 Servings
   - 2 Servings
   - 4 Servings
   - 6 Servings

10. Yesterday, how many servings of Dark Green Vegetables did you eat? (mark the closest bubble)
    Dark Green Vegetables may include broccoli, spinach, collard greens or dark green lettuce.
    - 0 Servings
    - 2 Servings
    - 4 Servings
    - 6 Servings

11. Yesterday, how many servings of Orange vegetables did you eat? (mark the closest bubble)
    Orange Vegetables may include carrots, sweet potatoes, or pumpkin.
    - 0 Servings
    - 2 Servings
    - 4 Servings
    - 6 Servings

12. Yesterday, how many servings of Starchy vegetables did you eat? (mark the closest bubble)
    Starchy Vegetables may include corn, green peas or potatoes.
    - 0 Servings
    - 2 Servings
    - 4 Servings
    - 6 Servings

2
13. Yesterday, how many servings of Dry beans or peas did you eat? *(mark the closest bubble)*

Dry beans or peas may include black beans, tofu, pinto beans, and soy beans.

- 0 Servings
- 1 Serving
- 2 Servings
- 3 Servings
- 4 Servings
- 5 Servings
- 6 Servings

14. Yesterday, did you eat any other kinds of vegetable that does not fit into the previous questions, like celery, tomatoes, or cucumbers? *(mark the closest bubble)*

- 0 Servings
- 1 Serving
- 2 Servings
- 3 Servings
- 4 Servings
- 5 Servings
- 6 Servings

15. Yesterday, how many glasses of sugar-sweetened drinks did you have? *(mark the closest bubble)*

Sugar-sweetened drinks may include sodas, pops, any punch, Kool-Aid®, sports drinks, or other fruit-flavored drinks.

- 0 glasses
- 1 glass
- 2 glasses
- 3 glasses
- 4 glasses
- 5 glasses
- 6 glasses
- 7 glasses
- 8 glasses
- 9 glasses
- 10 glasses

16. Yesterday, how many glasses of sugar-free drinks did you have? *(mark the closest bubble)*

Sugar-free drinks may include sugar-free drinks like diet sodas, or sugar-free fruit drinks.

- 0 glasses
- 1 glass
- 2 glasses
- 3 glasses
- 4 glasses
- 5 glasses
- 6 glasses
- 7 glasses
- 8 glasses
- 9 glasses
- 10 glasses

17. Yesterday, how many glasses of water did you drink? *(mark the closest bubble)*

- 0 glasses
- 1 glass
- 2 glasses
- 3 glasses
- 4 glasses
- 5 glasses
- 6 glasses
- 7 glasses
- 8 glasses
- 9 glasses
- 10 glasses
18. Yesterday, how many minutes did you exercise or take part in physical activity that made your heart beat fast and made you breathe hard? (mark the closest bubble) 
(For example: basketball, soccer, running or jogging, fast dancing, swimming laps, tennis, fast bicycling, or similar aerobic activities)

- 0 minutes
- 30 minutes
- 60 minutes
- 90 minutes
- 120 minutes
- 150 minutes
- 180 minutes
- 210 minutes
- 240 minutes

19. Yesterday, how many minutes did you exercise that did not make your heart beat fast and did not make you breathe hard? (For example: fast walking, slow bicycling, skating, pushing a lawn mower, or mopping floors.) (mark the closest bubble)

- 0 minutes
- 30 minutes
- 60 minutes
- 90 minutes
- 120 minutes
- 150 minutes
- 180 minutes
- 210 minutes
- 240 minutes

20. Yesterday, how many minutes did you watch TV, videos or movies? (mark the closest bubble)

- 0 minutes
- 30 minutes
- 60 minutes
- 90 minutes
- 120 minutes
- 150 minutes
- 180 minutes
- 210 minutes
- 240 minutes

21. Yesterday, how many minutes did you spend on the computer? (mark the closest bubble) 
(Time on the computer includes time spent surfing the Internet and instant messaging.)

- 0 minutes
- 30 minutes
- 60 minutes
- 90 minutes
- 120 minutes
- 150 minutes
- 180 minutes
- 210 minutes
- 240 minutes

22. Yesterday, how many minutes did you spend playing video games like Nintendo®, Sega®, PlayStation®, Xbox®, GameBoy® or arcade games? (mark the closest bubble)

- 0 minutes
- 30 minutes
- 60 minutes
- 90 minutes
- 120 minutes
- 150 minutes
- 180 minutes
- 210 minutes
- 240 minutes

354
IRB#  

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Hardly Ever</th>
<th>Sometimes</th>
<th>Almost Ever</th>
<th>Always</th>
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</thead>
<tbody>
<tr>
<td>23</td>
<td>… not get sick as often.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>… have more confidence.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>… have more fun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>… look better.</td>
<td></td>
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</table>

**If I exercise 60 min. daily at home I will . . .**

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<tr>
<th></th>
<th>Never</th>
<th>Hardly Ever</th>
<th>Sometimes</th>
<th>Almost Ever</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>… have more friends.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>… have more free time.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>… have more fun.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>… be more relaxed.</td>
<td></td>
<td></td>
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</tbody>
</table>

**If I spend less than 2 hours/day with screen time I will . . .**

*Screen time includes watching TV, on the computer, and playing video games*

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<tr>
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<th>Never</th>
<th>Hardly Ever</th>
<th>Sometimes</th>
<th>Almost Ever</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>… be more relaxed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>… feel better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>… have more energy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>… have better weight.</td>
<td></td>
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</tbody>
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**If I drink water or sugar-free drinks instead of sugar-sweetened beverages I will . . .**

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<tr>
<th></th>
<th>Never</th>
<th>Hardly Ever</th>
<th>Sometimes</th>
<th>Almost Ever</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>… have more energy.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>… feel better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>… not get sick as often.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>… have better weight.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IRB#  _______________________

How important is it to you that you . . .

39. ... not get sick as often.  ○ ○ ○ ○ ○ ○

40. ... have more confidence.  ○ ○ ○ ○ ○ ○

41. ... have more fun.  ○ ○ ○ ○ ○ ○

42. ... look better.  ○ ○ ○ ○ ○ ○

43. ... have more friends.  ○ ○ ○ ○ ○ ○

44. ... have more free time.  ○ ○ ○ ○ ○ ○

45. ... be more relaxed.  ○ ○ ○ ○ ○ ○

46. ... feel better.  ○ ○ ○ ○ ○ ○

47. ... have more energy.  ○ ○ ○ ○ ○ ○

48. ... have better weight.  ○ ○ ○ ○ ○ ○

How sure are you that you can . . .

49. ... exercise every day for 60 minutes at home?  ○ ○ ○ ○ ○ ○

50. ... exercise for 60 minutes at home even if you are tired?  ○ ○ ○ ○ ○ ○

51. ... exercise for 60 minutes at home even if you are busy?  ○ ○ ○ ○ ○ ○

52. ... set goals to exercise every day for 60 minutes at home?  ○ ○ ○ ○ ○ ○

53. ... reward yourself with something you like for exercising?  ○ ○ ○ ○ ○ ○

54. ... spend no more than 2 hours per day with screen time?  ○ ○ ○ ○ ○ ○

55. ... reduce screen time even if you favorite shows are coming on?  ○ ○ ○ ○ ○ ○

(*Screen time includes watching TV, on the computer, and playing video games)
<table>
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<th>IRB#</th>
<th>Not At All Sure</th>
<th>Slightly Sure</th>
<th>Moderately Sure</th>
<th>Very Sure</th>
<th>Completely Sure</th>
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**How sure are you that you can . . .**

(*Screen time* includes watching TV, on the computer, and playing video games)

56. ...reduce screen time even if everyone else in the family is watching? 

57. ...set goals to spend no more than 2 hours per day with screen time? 

58. ...reward yourself with something you like for reducing screen time? 

59. ...drink more water or sugar-free drinks? 

60. ...drink water or sugar-free drinks everyday instead of sugar-sweetened drinks? 

61. ...drink more water or sugar-free drinks even if you do not feel thirsty? 

62. ...set goals to replace sugar-sweetened drinks with water everyday? 

63. ...reward yourself with something you like for drinking water or sugar-free drinks instead of sugar-sweetened drinks? 

64. ...eat 5 or more servings of fruits and vegetables everyday? 

65. ...eat 5 or more servings of fruits and vegetables everyday even if you do not like them? 

66. ...eat 5 or more servings of fruits and vegetables everyday even if others in your family do not like them? 

67. ...set goals to eat 5 or more servings of fruits and vegetables? 

68. ...reward yourself with something you like for eating 5 or more servings of fruits and vegetables everyday? 

*Thank you for your time!*