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The Information-Motivation-Behavioral Skills Model: An Examination of Obesity Prevention Behavioral Change in Children Who Participated In The Afterschool Program Virginia Beach Let's Move

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THE INFORMATION-MOTIVATION-BEHAVIORAL SKILLS MODEL: AN EXAMINATION OF OBESITY PREVENTION BEHAVIORAL CHANGE IN CHILDREN WHO PARTICIPATED IN THE AFTERSCHOOL PROGRAM VIRGINIA BEACH LET'S MOVE

by

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ABSTRACT

THE INFORMATION-MOTIVATION-BEHAVIORAL SKILLS MODEL: AN EXAMINATION OF OBESITY PREVENTION BEHAVIORAL CHANGE IN CHILDREN WHO PARTICIPATED IN THE AFTERCHOOL PROGRAM VIRGINIA BEACH LET'S MOVE

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The purpose of this study was to examine the utility of the Information-Motivation-Behavioral Skills Model (IMB) as a foundation to design childhood obesity prevention afterschool programs. This study employed a secondary analysis of pre (n=172), post (n=170), and 1-year follow-up (n=32) evaluations of the obesity prevention afterschool program Virginia Beach Let's Move for children ages 5-11 years. Independent variables included demographic characteristics for the participating children and their parents. Dependent variables used in this study were the IMB constructs information and motivation. Motivation was measured by the attitudes of the children and information was measured by the children's knowledge.

The overall frequency of high scores for attitudes and knowledge at post and 1-year follow-up were similar across different demographic groups. The afterschool program had a significant effect on attitudes ($V = .907$, $F(1, 23) = 225.2$, $p < .05$) and knowledge ($V = .790$, $F(1, 23) = 86.62$, $p < .05$) scores. Attendance had a significant effect on the improvement of test scores from pre to post test ($V = .322$, $F(3, 23) = 3.64$, $p < .05$). Demographic variables did not directly influence knowledge or attitudes; however, demographic variables interacted to significantly influence knowledge and attitudes. Significant interactions were followed-up with univariate testing to find most influential variables. Univariate follow-up tests suggested grade, children's gender, and attendance had a significant effect on attitudes and knowledge. The effect of the afterschool program on attitudes and knowledge remained significant at the 1-year

evaluation. The IMB model explained 53% variance in healthy eating, 58% variance in physical activity, 40% variance in consumption of fruits and vegetables, and 35% variance in water consumption.

Overall, this study supports using the IMB model for significant and sustainable changes of the obesity-related behaviors motivation and information. The odds of eating healthy, consuming fruits and vegetables, and physical activity increased with higher levels of knowledge. The effects of behavioral skills and parental engagement could be explored in future studies and results may further support the IMB model as an appropriate framework for afterschool obesity prevention programs in elementary schools.

This dissertation is dedicated to my son Seth,

my daughters Kayla and Kelsey, and my husband Lord John.

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CHAPTER I

INTRODUCTION

Positive health requires a knowledge of man's primary constitution and the powers of various foods, both those natural to them and those resulting from human skill. But eating alone is not enough for health. There must also be exercise, of which the effects must likewise be known. The combination of these two things makes regimen, when proper attention is given to the season of the year, the changes of the winds, the age of the individual and the situation of his home. If there is any deficiency in food or exercise the body will fall sick.

---Hippocrates, 5th Century B.C.

The obesity epidemic in the United States is debilitating this nation's economy, health and social aspects, and even national security defense (Hunter, 2013; State of Obesity, 2014, Wellman, 2002). Childhood obesity in particular is worrisome. Obesity among children has been associated with psychological, social, and health consequences (Williams et al, 2013). Children who are obese are more likely to become obese adults and experience more comorbidities associated with obesity compared to obese adults who were not obese as children (Biro, 2010; Whitaker, 1997; Serdula, 1993).

Healthy eating and physical activity are the basic elements for good health; this has been known for centuries, yet these simple health suggestions have been neglected over the years. In addition, there are a growing number of complex environmental factors that have resulted in an obesity epidemic, which has proven a great task and challenge to combat. Currently, the battle against obesity requires a multidisciplinary approach, which is often not feasible to manage (Montesi et al 2016). We must go back to the basics of health to ameliorate the assiduous obesity

epidemic. Modifying behaviors to adopt healthy lifestyles is a promising approach to help society.

According to Trasande and Elbel, 2012, diet and lack of physical activity in childhood are the "leading suspected" causes of the obesity epidemic. Current efforts to reduce childhood obesity have resulted in modest and mixed results (Branscum & Sharma, 2012; Gonzales-Suarez, Worley, and Grimmer-Somers, 2009; Williams et al, 2013; Yin et al, 2005). It has become a necessity to explore new approaches that could be effectively used to reduce childhood obesity. This proposed study aims to identify whether healthy eating, physical activity, and associated behaviors could be effectively adopted by elementary school children when using the Information-Motivation-Behavioral Skills (IMB) Model.

Problem Statement

Childhood obesity is currently a severe health problem in the United States (State of Obesity, 2014). Obesity prevalence has been increasing over the years (Cunningham et al, 2014). Healthy People (HP) 2020 considers obesity to be a leading health indicator; reducing and preventing obesity is an important goal of HP 2020 (Kamik & Kanekar, 2012). Approximately 17% (or 12.70 millions) of children and adolescents ages 2 to 19 years are obese (Centers for Disease Control and Prevention, 2015). Nearly 30% of US children are either overweight or obese (Wang et al., 2013). Overall, the high prevalence of overweight and obese children presents a national health problem, which has significant implications for the US healthcare system.

Obesity among children has been associated with health, psychological, and social consequences (Williams et al, 2013). Obese children, adolescents, and adults are more likely to have cardiovascular disease, insulin resistance and type 2 diabetes, hypertension, certain cancers,

breathing problems, joint problems and musculoskeletal discomfort, fatty liver disease, gallstones, and gastro-esophageal reflux (Han, 2010; Sutherland, 2008; Taylor, 2006). In addition, obese children could develop behaviors that impact their academic and social life. Obese/overweight children feel discriminated and stigmatized by peers and adults. Obese children are more likely to develop depression, low self-esteem, and eating disorders (Karnik & Kanekar, 2012; Wang et al, 2013). Obesity has an ecological effect, which greatly affects the quality of life of children.

Childhood obesity causes a great burden on the healthcare system (Trasande & Elbel, 2012). The estimated direct costs of childhood obesity, which include prescription medicines and hospital/physician visits, are over $14 billion annually (The Schroeder Center for Health Policy, 2011). Additionally, childhood obesity is likely to be carried into adulthood (Biro, 2010; Whitaker, 1997; Serdula, 1993). Childhood obesity is expected to cause a dramatic decline in life expectancy comparable to the life expectancy decline observed during the Great Depression. Adults who were obese children are expected to spend $3.47 billion for additional lifetime medical needs (Trasande & Elbel, 2012). Childhood obesity is projected to significantly and negatively debilitate the economy of the United States in the near future.

Many efforts have taken place in the United States to reduce childhood obesity since 2001 (Chang, Gertel-Rosenberg, and Snyder, 2014). Some approaches that have been used to prevent childhood obesity include educational programs, policies, and environmental changes (Nihiser, 2013). For example, schools that participate in the U.S. Department of Agriculture's (USDA) school meal programs are required to have policies that address nutrition standards, nutrition education and promotion, and physical activity. After the inaugural *Weight of the Nation* conference in 2009, many initiatives have taken place in school settings to prevent

obesity. The Healthy, Hunger-Free Kids Act of 2010 was passed to improve wellness policies and to require the USDA to improve the nutrition requirements of foods available at schools (Nihiser, 2013). According to a 2006 survey conducted by the Centers for Disease Control and Prevention (CDC), nearly half of schools across the United States did not have a physical education (PE) curriculum. Policies have gradually taken place to design PE curriculums, which keep children moderately to vigorously active for at least half of the PE class. Recommendations have been made to replace games with low levels of physical activity such as softball with high activity sports such as aerobic dance, jump rope, and aerobic games. Another policy focus is to improve the qualifications and skills of PE teachers (U.S. Department of Health and Human Services, 2010). Nevertheless, school policies that focus on only one factor related to obesity--either diet or physical activity--do not seem to be effective in reducing children's weight (Williams et al, 2013) and overall childhood obesity remains high for children and adolescents (National Conference of State Legislatures, 2014).

Intervention programs in afterschool settings have been implemented as flexible options to reach many children; 10.2 million children are enrolled in afterschool programs and 19.4 million children would participate in afterschool programs if they were available (Afterschool Alliance, 2015). Studies suggest obesity prevention programs in afterschool settings could provide an outlet to ameliorate the childhood obesity epidemic. For example, Yin and colleagues, 2005, implemented an afterschool program designed to provide exercise training for 20 minutes, moderate to vigorous physical activity for 40 minutes, and calisthenics for 10 minutes. Participants received a healthy snack before exercise. This afterschool program was delivered five times a week for eight months. Even though the results were statistically non-significant, a reduction of body fat percentage was observed for the participants. Similar

programs have yielded mixed and/or modest results (Branscum & Sharma, 2012; Gonzales-Suarez, Worley, and Grimmer-Somers, 2009; Williams et al, 2013; Yin et al, 2005). The effectiveness of such programs may be improved by considering other important factors that are related to obesity status, which can be feasibly integrated in afterschool settings.

Many obesity prevention afterschool programs are not based on a behavioral theoretical model. Theoretical frameworks, which have been used to create obesity prevention afterschool programs include the Social Cognitive Theory (SCT), the Precede/Proceed Model and the Transtheoretical Model (TTM) (Branscum & Sharma, 2012). The SCT has been the most widely used model to design afterschool obesity programs. However, barriers have been encountered when designing afterschool programs based on the SCT and/or theoretical models, because they are difficult to operationalize due to their complexity and comprehensiveness. It is difficult to address every component of a theoretical framework when designing obesity prevention school-based programs; most of the programs are designed with one or more constructs from a particular theoretical model. For example, programs based on the SCT often focus self-efficacy and ignore modeling, outcome expectancies, and identification (Branscum & Sharma, 2012; Zhang, 2005). The complexity and comprehensiveness of theories have resulted in great variability in the type and quantity of theoretical constructs used for different afterschool programs. Variability of theoretical construct utilization is a likely contributor to the inconsistent results of obesity prevention afterschool programs.

The comparison of different afterschool programs is challenging due to the variation of theoretical construct utilization. Furthermore, the outcome measures used across afterschool program studies are not consistent. For example, some studies report fruit and vegetable consumption as the main outcome while others report only physical activity (PA) outcomes

(Branscum & Sharma, 2012). The same outcome measures are often operationalized differently. For example, the definition for PA is inconsistent; some programs require PA to last 30 minutes every day while others follow the CDC guidelines and require 60 minutes of daily PA for children. The mechanisms used to achieve desired behaviors are inconsistent and are very likely to lead to incorrect comparisons of afterschool programs.

Literature reports regarding obesity prevention school-based programs include multicomponent and single component interventions. Multicomponent programs include nutritional and physical activity aspects as well as enhancing strategies such as telephone calls to improve self-image and parent engagement. Single-component interventions focus on a single strategy; for example, increasing physical activity, reducing the consumption of drinks with high sugar contents, or by providing education aimed to reduce television viewing. A systematic review conducted by Branscum and Sharma, 2012, suggest afterschool programs with wider health promotion, which incorporate a combination of exercise, diet, parent component, and behavioral skills, result in greater effectiveness. This is consistent with other systematic reviews and meta-analyses reporting combined diet, physical activity, parental components, psychological components, and stakeholder engagement, are the most effective programs (Gonzales-Suarez, Worley, and Grimmer-Somers, 2009; Williams et al, 2013). Most of the interventions reported in systematic reviews, which had high methodological critical appraisal scores included interventions with multicomponent strategies.

Motivation, behavioral skills, psychological factors, and parental components, are associated with obesity status but are not always integrated in afterschool programs (Branscum & Sharma, 2012; Williams et al, 2013). The lack of integration of important factors in obesity prevention programs has resulted in mixed and modest effects. For example, the SCT-based

afterschool program *Club Possible* aims to increase physical activity (PA) and healthy eating by targeting the theoretical concepts self-efficacy, social support, and physical activity (PA) enjoyment. While this program had a statistically significant decrease of body mass index (BMI) and increased PA enjoyment, there was no improvement of self-efficacy or social support. Other afterschool programs lacking wide health promotion show similar mixed and/or modest results (Agency for Healthcare Research and Quality, 2013; Branscum & Sharma, 2012; Manley et al, 2014; Williams et al, 2013). There is a need for obesity prevention afterschool programs, which address relevant causal pathways among theoretical constructs and determinant factors of childhood obesity.

Approaches to increase the effectiveness of afterschool programs should be explored. A theory that establishes causal pathways to change behaviors for healthy eating and physical activity could aid in creation and implementation of afterschool obesity prevention programs. A theoretical framework should be easily translated into intervention programs to capture the key determinant factors needed for behavioral initiation and maintenance. This study will examine the utility of the Information-Motivation-Behavioral (IMB) Skills model as a foundation for afterschool obesity prevention intervention programs.

The IMB model has the potential to be useful for the creation of afterschool obesity prevention programs because it is composed of critical elements needed to adopt and maintain healthy behaviors. The constructs of this model are based on relevant social and health psychology theories including the Health Belief Model, Transtheoretical Model, AIDS Risk Reduction Model, Theory of Reasoned Action, Theory of Planned Behavior, and the Social Cognitive Theory. However, the IMB conceptualization was developed to address limitations encountered in social and health psychology theories such as the description of relationships

amongst constructs, predictive validity of key constructs, conceptual parsimony, and the inclusion of constructs that are needed for understanding and changing health behaviors. This model was designed to be easily translated into intervention programs (Fisher, Fisher & Harman, 2003) and has been previously utilized to effectively change behaviors related to diet and physical activity in adults and adolescents (Kelly, Melnyk, Belyea, 2012; Osborn, Amico, Fisher, Egede, Fisher, 2010). Therefore, the IMB model is explored in this study as a feasible and appropriate model to design obesity prevention afterschool programs for children ages 5 to 11.

Background

Childhood obesity is a significant health problem in the United States (State of Obesity, 2014). National prevalence and incidence statistics related to childhood obesity in the United States are described in this section. In addition, childhood obesity statistics for the state of Virginia are presented here since the secondary data used in this study were collected in that state. The background section also incorporates etiology/risk factors, economic burden of childhood obesity, and the position of Healthy People (HP) 2020 regarding this subject.

The childhood obesity crisis has immensely transformed the healthcare for children. Obese children are more likely to suffer from comorbidities such as diabetes, hypertension, and metabolic syndrome (Freedman et al, 2007). Children who are overweight or obese utilize healthcare services more often and have higher medical costs/expenditures (State of Obesity, 2014; The Schroeder Center for Health Policy, 2011). Health economists believe childhood obesity prevention programs could relieve the healthcare economic burden: "Large investments through research and prevention are needed and are likely to provide strong returns in cost savings, and would optimally emerge through a cooperative effort between private and government payers alike." (Trasande & Elbel, 2012, p. 39). Effective afterschool programs

targeting the prevention and reduction of obesity could ameliorate the healthcare system economic burden; thus, a brief discussion about economic burdens associated with childhood obesity is included as part of the background.

Childhood obesity also results in reduced quality of life. Overarching goals of HP 2020 are to improve the quality of life and the health of the U.S. population. Salient objectives of HP 2020 are to prevent and reduce childhood obesity by increasing the level of children's physical activity and healthy eating. Previous objectives to increase physical activity and improve healthy eating were not met or achieved. HP 2020 has revised the list of objectives to include policies and environmental intervention approaches (Healthy People, 2020). This study has the potential to help meet the objectives of HP 2020 by identifying a health promotion intervention that could be effective in preventing and reducing childhood obesity. Thus, HP 2020 goals and objectives related to childhood obesity are also discussed.

Prevalence of Childhood Obesity in the United States

Cunningham et al, 2014, conducted a longitudinal study to assess the prevalence and incidence of children who entered Kindergarten in 1998 and 1999 in the United States. The children were followed up to year 2007. Approximately 14.9% of children who entered kindergarten in 1998 and 1999 were overweight and 12.4% were obese. The prevalence of obesity increased for children as they got older. By the time they reached the eighth grade, 20.8% of the children were obese. There were no significant obesity prevalence increases between ages 11 and 14 years. The prevalence of obesity among Hispanic children was higher at all ages compared to non-Hispanic Whites. In third grade, non-Hispanic Blacks had a higher prevalence of obesity compared to non-Hispanic Whites. The greatest obesity prevalence increase was observed between first and third grades (prevalence increased from 13% to 18.6%).

Between kindergarten and eighth grades, the obesity prevalence for children who were Asian, Pacific Islander, Native American, and multiracial increased 40%, Hispanic children increased 50%, non-Hispanic White children increased 65%, and approximately 120% for non-Hispanic Black children (Cunningham et al, 2014).

Children from families of lower socioeconomic status (SES) had higher prevalence obesity rates compared to those from wealthier families (20%). For all grades, the lowest SES had the highest obesity prevalence. The prevalence for the lowest SES group increased to 25.8% by eight grade. For all ages, children who had a high birth weight (≥4000 g) experienced a higher increase of obesity prevalence (between 21.1% and 31.2%) compared to children who had lower birth weights (Cunningham et al, 2014).

Incidence of Childhood Obesity in the United States

The incidence differed from the prevalence of obesity among children in that the prevalence increased with age but the incidence was highest at younger ages but declined by the eighth grade. Obesity incidence among kindergarteners was 5.4% but decreased to 1.9% for boys and 1.4% for girls between fifth and eighth grades (Cunningham et al, 2014).

From 5 to 14 years, 11.9% of the children became obese (10.1% of the girls and 13.7% of the boys). By eighth grade, the following percentage of children became obese: 16.8% non-Hispanic Black, 10.1% non-Hispanic White and other races/ethnic groups, and 14.3% Hispanic children. The lowest cumulative incidence occurred for the children from the wealthiest families (7.4%) and the highest occurred among the middle SES group (15.4%). Incidence density and cumulative density rates were consistent (26.5 per 1000 person-years between the ages of 5 and 14 years) (Cunningham et al, 2014).

Incidence of obesity between kindergarten and eighth grade was 45.3% and occurred among the 14.9% of children who were overweight when they entered kindergarten. 31.8% of children who were overweight in kindergarten became obese by 14 years. 7.9% of children with normal weight in kindergarten became obese by 14 years. Children who were overweight in kindergarten were 4 times more likely to become obese by age 14 compared to children who had normal weight in kindergarten (Cunningham et al, 2014).

Overweight kindergarteners in the two highest SES groups were 5 times more likely to become obese compare to normal-weight kindergarteners. The lowest SES group of children who were overweight in kindergarten were only 3.4 times more likely to become obese compared to normal-weight kindergarteners. Overweight non-Hispanic Whites and Blacks had higher incidence of obesity compared with normal-weight children. Hispanics had higher incidence of obesity compared to normal-weight children. The highest risk for obesity was seen among children who were born with high birth weight and were also overweight in kindergarten; these children were 5.1 times more likely to become obese compared to children who had high birth weight but normal weights in kindergarten (Cunningham et al, 2014).

A greater incidence of obesity between the ages of 5 and 14 years happened among children who were overweight at younger ages, especially those who were overweight in kindergarten. The authors' expected trajectory is for 72% of children who are overweight in kindergarten will be obese by the time they finish the eighth grade (Cunningham et al, 2014).

Virginia Childhood Overweight/Obesity Status

In Virginia, 31% of children are overweight or obese. Compared to other states, Virginia ranks 27 (1 is best) for childhood obesity prevalence, which has been increasing since 2003 (Data Resource Center for Child and Adolescent Health, 2012). According to the 2008 Pediatric

Nutrition Surveillance System (PedNSS), which reports body weight data for children from low-income families who participate in the Women, Infants, and Children (WIC) program, 39.1% of children ages 2-5 are overweight or obese (Data Resource Center for Child and Adolescent Health, 2012). Overweight/obesity prevalence for older children is slightly lower, 31% of children ages 10-17 are overweight or obese. The overweight/obesity prevalence for children from low SES families are twice as high compared to children from higher SES families (45.8% and 22.3%, respectively). For children ages 10-17, females are less likely to be overweight/obese compared to males (17% and 27%, respectively), and minority groups are more likely to be overweight/obese (26%) compared to non-Hispanic Whites (19%) (Virginia Foundation for Healthy Youth, 2010).

The Central region of Virginia has an equal childhood overweight/obesity prevalence rate as the national childhood obesity average (17%); however, the North, Southeast, and Southwest regions of Virginia have much higher childhood overweight/obesity prevalence rates compared to the national childhood obesity prevalence average (20%, 24%, and 28%, respectively) (Virginia Foundation for Healthy Youth, 2010). See Figure 1.

According to an obesity survey research report, children ages 10-17 who live in the Southwest and Southeast regions of Virginia are more likely to eat fast foods and choose sedentary activities, and are less likely to exercise. Children and youth in the Southwest, Southeast regions of Virginia, and all minority groups across Virginia are more likely to attempt to lose weight and more likely to use extreme weight reduction strategies (Virginia Foundation for Healthy Youth, 2010).

This study examines data collected in Virginia Beach, Virginia. A health needs assessment report for the children population in Southeast Virginia indicate obesity is a major

local health problem. The Children's Hospital of the Kings' Daughters (CHKD) conducted a comprehensive community needs assessment in 2013 for the children populations in Southeast Virginia cities, including Virginia Beach. For the purpose of this assessment, community was defined as the geographic region served by CHKD. Assessment did not exclude individuals without the ability to pay or medical underserved areas. According to this assessment, there are four main priorities for the children: 1) child abuse, 2) childhood obesity, 3) infant mortality/morbidity, and 4) health promotion and prevention (Children's Hospital of the King's Daughters, 2013). This community health needs assessment conducted by the CHKD hospital further emphasizes the need for obesity prevention health programs in Virginia Beach and neighboring cities.

Figure 1. *Childhood Obesity Prevalence in Virginia*

Etiology/Risk Factors of Childhood Obesity

Childhood obesity is a complex medical condition influenced by genetics, food consumption, lack of proper amount of physical activity, and social and environmental factors. In rare cases, childhood obesity results from pathologies such as hypogonadism, poor linear growth, rapid weight gain at early ages, dysmorphic features or developmental delay (Gurnani, Birken, and Hamilton, 2015).

Intrauterine and postnatal factors. Epidemiological and animal studies suggest obesity, diabetes, and heart disease, could be linked to prenatal or early postnatal exposure to unfavorable environmental conditions such as cigarette smoke, being born via Caesarean section, gestational diabetes, maternal adiposity, or consuming infant's formula milk instead of breast milk (Gurnani, Birken, and Hamilton, 2015).

Nutrition/feeding and physical activity behaviors. Childhood obesity has been associated with the consumption of foods with high caloric content, eating solid foods before six months of age, high consumption of sugary drinks, eating while watching television, skipping breakfast, low consumption of milk, fruits and vegetables, and reduced frequency of eating together with family. Guidelines recommend 60 minutes of moderate to rigorous daily physical activity. Lower levels of physical activity and sedentary behavior are associated with higher body mass index (BMI) (Gurnani, Birken, and Hamilton, 2015).

Sociodemographic influences. Aboriginal, Hispanic, and South Asian ethnic groups are more likely to become obese during childhood. Children from more affluent families who live in low-income countries are more like to become obese. Children living in urban areas are more likely to become obese compared to those living in rural areas. In high-income countries,

children from low socioeconomic status (SES) are more likely to become obese compared to those from higher SES families (Gurnani, Birken, and Hamilton, 2015).

Childhood obesity is associated with the education level of parents/guardians. Children whose parents/guardians did not complete high school are twice as likely to be obese compared to children with parents/guardians who completed college. Obese preschool children are more likely to be obese if they come from lower income families. Obesity prevalence was the highest among children in families with an income-to-poverty ratio of 100% or less (CDC, 2014).

Neighborhoods composed of minority or low-income groups have limited access to supermarkets and fresh produce. About 8% of black neighborhoods have one or more supermarkets compared to 31% white neighborhoods with one or more supermarkets. In addition, low-income individuals have limited access to safe places where they can be physically active. Studies suggest mothers who perceive their communities to be unsafe are less likely to let their children play outdoors (State of Obesity, 2014).

Genetic causes. Rare gene defects could result in childhood obesity. About 4% of the early-onset severely obese children have a gene mutation of the melanocortin receptors 4 (MCR4). Certain genetic syndromes, which exhibit neurocognitive delay and dysmorphic features are associated with obesity. Common genetic variants have been found to be associated with high adiposity and weight gain; however, the effect of these variants is weak and cannot contribute to the prediction of obesity (Gurnani, Birken, and Hamilton, 2015).

Other causes. Tumors affecting the central nervous system and the subsequent removal of those tumors could result in rapid weight gain. Certain medications such as antipsychotics and high-dose glucocorticoids can also result in obesity (Gurnani, Birken, and Hamilton, 2015).

Obesity Economic Burden

Generally, obese children incur higher expenditures for medical care (Trasande & Elbel, 2012). For example, 10-year old obese children spend additional $19,000 in medical costs over time compared to 10-year old children with healthy weight. When these costs are multiplied for all obese 10-year old children in the U.S., the total costs for direct medical care amounts to $14 billion (State of Obesity, 2014). Every year, overweight and obese children spend additional $14.1 billion on medications, emergency room and outpatient visits compared to children with healthy weight (The Schroeder Center for Health Policy, 2011). The average yearly health care costs to treat an obese child under Medicaid is $6,730 while the yearly average health care costs to treat all other children under Medicaid is $2,446. Annually, the average health care costs for the treatment of an obese child with private insurance is $3,743 while the annual average health care costs for the treatment of all other children is $1,108 (Robert Wood Johnson Foundation, 2009).

Childhood obesity results in incremental lifetime medical costs (Trasande & Elbel, 2012). Adult obesity is not only more likely to follow childhood obesity (Biro & Wien, 2010; Serdula et al, 1993; Whitaker et al, 1997), but adult obesity is also more severe when it does so (Freedman et al, 2007). Healthcare costs associated with adult obesity are estimated to be between $147 billion to almost $210 billion per year. Job absenteeism related to obesity costs $4.3 billion annually. If obesity rates are not reduced, by 2030, healthcare costs associated with obesity are estimated to increase by $48-$66 billion per year, and the loss of productivity could be as high as $580 billion every year (State of Obesity, 2014).

Obese adults spend 42% more on direct health care costs compared to people with healthy weight. Per capita health care cost for morbidly obese people (BMI > 40) is 81% higher

than the per capita health care cost of people with healthy weight. Moderately obese individuals (BMI between 30 and 35) have double the chances of getting prescribed medications for medical conditions compared to people with healthy weight. The emergency room costs for chest pain are 41% higher for morbidly obese patients and 22% higher for overweight patients compared to patients with normal weight (State of Obesity, 2014). Adult obesity presents a higher economic burden when it follows childhood obesity (Trasande & Elbel, 2012); obese adults who were obese children have more comorbidities compared to obese adults who had healthy weight during childhood (Biro & Wien, 2010; Serdula et al, 1993; Whitaker et al, 1997). For this reason, childhood is an important period for implementing intervention programs to prevent obesity. Health promotion programs have the potential to be effective and cost-effective. Preventing childhood obesity should be the main focus of healthcare cost-containment efforts.

Obesity and Healthy People 2020

HP is a program set by the U.S. Department of Health and Human Services. HP addresses all major public health concerns in the United States. A broad goal of HP 2020 is to increase the quality of years and healthy life (Healthy People, 2020; U.S. Department of Health and Human Services, 2015). Physical activity, nutrition, overweight and obesity status are listed by HP 2020 as very important health indicators (Healthy People, 2020).

According to the final report of HP 2010, none of the objectives of HP 2010 for nutrition and overweight were met or exceeded. One of the objectives was significantly improved and many significantly declined (Appendix A). HP 2020 objectives were expanded to include policies and environmental factors that promote healthy eating and healthy weight status in schools, worksites, health care organizations, and communities. These objectives mainly focus on individual behaviors about healthy eating and achievement and maintenance of healthy body

weight. Policies and environmental factors that affect individual behaviors are also targeted by the objectives of HP 2020.

None of the objectives of HP 2010 for physical activity and fitness were met or exceeded. Some objectives were significantly improved but some significantly declined (Appendix B). For HP 2020, the objectives for physical activity mainly focus on aerobic physical activity behaviors and environmental factors and policies that support physical activity.

The HP objectives related to nutrition, physical activity, overweight and obesity status, have not progressed significantly. It is important to continue to explore novel approaches that could be effective in meeting HP 2020 goals and objectives. Childhood obesity prevention programs in afterschool settings may help to increase physical activity and improve dietary habits, and ultimately reduce overweight and obesity in children.

Purpose of the Study

The purpose of this study is to examine the utility of the Information-Motivation-Behavioral Skills Model (IMB) as a foundation to design obesity prevention afterschool programs in elementary schools. The most commonly used theoretical model for the design of obesity prevention school-based programs is the Social Cognitive Theory. Other theoretical models used for obesity prevention school-based programs include the Theory of Planned Behavior, Social Learning Theory, Behavioral Choice Theory, Organizational Change Theory, the Social Ecological Model, and Pender's Health Promotion Model, and others (Salmon, Brown, and Hume, 2009). Currently, consensus has not been reached concerning the effectiveness of afterschool or other school-based obesity prevention programs. A systematic review study conducted by Salmon, Brown, and Hume, 2009, states seven out of eleven interventions focusing on knowledge had significant improvements; four out of eight programs

targeting self-efficacy had significant improvement; two out of six interventions targeting physical activity enjoyment or preference had significant improvement. Similarly, other systematic reviews report mixed results for school-based afterschool programs (Branscum & Sharma, 2012; Manley et al, 2014; Williams et al, 2013).

The variability of school-based obesity prevention programs is immense even among the programs using the same theoretical model. Researchers report theories used to design obesity prevention school-based programs are complex and are not easily translated into intervention programs (Brug, Oenema, Ferreira, 2005; Fisher, Fisher & Harman, 2003; Zhang, 2005). The majority of variance for physical activity and dietary behaviors remain unexplained (Dewar et al, 2013; Lubans et al, 2012; Plotnikoff et al, 2013; Ramirez, Kulinna, & Cothran, 2012; Resnicow et al, 1997) (see Table 1). There is a need for the clear identification of a theoretical framework that contain key factors and causal pathways to change healthy eating and physical activity behaviors and that can be easily translated into obesity prevention afterschool programs.

Table 1. *Variance in Physical Activity and Healthy Eating Explained by Theoretical Models*

Theory	Behavior	Amount of Variance Explained
Self-Determination Theory & Theory of Planned Behavior (Dewar, Plotnikoff, and Morgan, 2013).	Physical Activity	58%
Social Cognitive Theory (Dewar, Plotnikoff, and Morgan, 2013; Ramirez, Kulinna, and Cothran, 2012)	Physical Activity	2-52%
Health Promotion Model, Theory of Planned Behavior, Social Cognitive Theory, Health Belief Model, & Transtheoretical Model. (Plotnikoff, Costigan, and Lubans, 2013).	Physical Activity	33%*

Table 1. Continued		
Theory	Behavior	Amount of Variance Explained
Social Cognitive Theory (Lubans, et al, 2012).	General Dietary Behavior	13-34%
Theory of Planned Behavior (Martin, Oliver, and McCaughtry, 2007; Rhodes, Macdonald, and McKay, 2006).	Physical Activity	8-50%
Theory of Planned Behavior & Social Cognitive Theory (Lytle, et al, 2003).	Fruits and Vegetables Consumption	31%
Social Cognitive Theory (Parcel, et al, 1995).	Fruits and Vegetables Consumption	10-11%

*This value reflects an average of variances in a systematic review, where the highest variance was explained by Self Determination Theory (37%) and the least variance was explained by the Social Cognitive Theory (24%).

The Information-Motivation-Behavioral Skills (IMB) model has the potential to explain a substantial amount of variance in healthy eating and physical activity greater than what is reported in the literature for the following reasons: the constructs of IMB are based on relevant social and health psychology theories. However, the IMB conceptualization was developed to address limitations found in other relevant theories. Limitations addressed by the IMB include the description of relationship among constructs, predictive validity of key constructs, conceptual parsimony, and the inclusion of constructs that are needed for understanding and changing health behaviors. The IMB was designed to be easily translated into intervention programs. Furthermore, this theory is empirically validated in diverse health areas (Fisher, Fisher & Harman, 2003). Afterschool programs are important outlets to help reduce obesity rates in the nation (Afterschool Alliance, 2015; Hildebrand, 2012; Lau, 2011). Using an appropriate theoretical model and program design may improve the effectiveness of afterschool programs. An effort should be made to explain more variance in physical activity and healthy eating behaviors.

Significance of the Study

Childhood is an important period for implementing intervention programs to prevent obesity (Lau, 2011). Family, friends, schools, and the community reinforce children's lifestyle habits about diet and physical activity. For this reason, the CDC suggests that intervention programs take place in schools and in communities (CDC, 2011). Afterschool programs are potential outlets to reduce and prevent childhood obesity; such programs have the potential to reach many children; 10.2 million children are enrolled in afterschool programs and 19.4 million children would participate in afterschool programs if they were available (Afterschool Alliance, 2015). Health promotion programs are difficult to implement during regular school hours because of time constraints (Lau, 2011), school rules that prevent parents from participating in the program, and low funds to provide wide health promotion (Hildebrand, 2012). In afterschool settings, community organizations are able to help fund the implementation of wide health promotion programs and encourage the participation of parents (Hildebrand, 2012).

Different afterschool programs aimed to increase healthy eating and/or physical activity have taken place in schools. However, program results have yielded mixed and modest results (Branscum & Sharma, 2012; Williams et al, 2013). There is a great variation of obesity prevention afterschool program designs; theoretical construct utilization varies greatly even among programs using the same theoretical model. Variation of program design is a likely contributor to mixed and modest results. The most relevant design for intervention programs could increase the effectiveness of an intervention.

Some investigators argue theory-based obesity prevention programs are more effective compared to programs that were not designed based on a theoretical framework. The usefulness of using theories for the development of obesity prevention programs has been debated in the

International Journal of Behavioral Nutrition and Physical Activity (Brug, Oenema, and Ferreira, 2005). During the debate, it was argued that social cognition theories are impractical for weight management and weight loss interventions (Jeffery, 2004). However, many researchers argue behavior theories are the result of evidence-based processes and are still the best options available to design health promotion interventions. On the other hand, other researchers suggest existing theories need to be studied in depth and refined or rejected according to study findings. An additional suggestion is for theories to be integrated in order to increase their effectiveness (Brug, Oenema, and Ferreira, 2005).

One problem of existing theories is that they help to understand determinants of nutrition and physical activity behaviors or behavioral change but they do not provide any guidelines on how to modify the behaviors (Brug, Oenema, and Ferreira, 2005). Studies suggest the creation of theories that provide guidelines on how the determinants of behavior change can be modified and translated into methods, strategies, and intervention tools (Brug, Oenema, Ferreira, 2005). Investigators have used mainly various constructs from the Social Cognitive Theory to implement childhood obesity afterschool programs. The translation of this theoretical model into afterschool programs has been difficult. The complexity and comprehensiveness of this theory has led to a variation of program designs that lack causal pathways (Branscum 2012; Zhang, 2005)

The Information-Motivation-Behavioral model has the potential to address difficulties encountered by using other theories aimed to promote healthy eating and physical activity in children. The IMB model uses an ecological approach, yet it is simple and parsimonious. The IMB was designed specifically to be easily translated into intervention programs. In addition to helping understand determinants of health behavior, the IMB model provides procedures that can

be followed to identify constructs and causal pathways that are particularly influential for certain populations and health behaviors; this identification is crucial before developing targeted health promotion programs (Fisher, Fisher & Harman, 2003).

There is substantial empirical evidence that supports the use of the IMB model for the design of diverse areas of health promotion (Chang, et al, 2014; Fisher, Fisher, Harman, 2003; Kelly, Melnyk, Belyea, 2012; Osborn et al, 2010). However, to the best of my knowledge, the utility of this model for designing obesity prevention programs in school-based settings has not been studied. Because childhood obesity continues to be a problem in the U.S., it is important to identify approaches that could increase the effectiveness of childhood obesity prevention programs.

Research Questions and Hypotheses

Research Question 1: To What Extent Constructs of the Information-Motivation-Behavioral Skills Model (IMB) Explain Behavioral Change Related to Healthy Eating and Physical Activity?

Associated hypotheses.

Hypothesis 1a. IMB variables will be most influential in the improvement of attitudes and knowledge compared to demographic variables.

Hypothesis 1b. The IMB will explain a substantial amount of variance in healthy eating and physical activity, greater than or equal to what is reported in the literature.

Hypothesis 1c. Those who acquire more knowledge, are well motivated, and acquire behavioral skills will be more likely to engage in physical activity and healthy eating compared to those who are less motivated or less knowledgeable.

Research Question 2: Are the Dependent Variables Attitudes and Knowledge Sustainable at the one-year Follow-Up?

Associated hypothesis.

Hypothesis 2. Attitudes and knowledge will be sustained or improved at the one-year evaluation.

Limitations

The comparison of different afterschool programs is challenging due to the variation of theoretical construct utilization and inconsistent outcome measures used across afterschool programs. This study utilizes a secondary data analysis method. There are limitations inherent to secondary data analysis; one of these limitations is the lack of relevant information. Body mass index (BMI) measurements were not obtained during the collection of primary data. Therefore, a connection between behavioral change and BMI changes cannot be made. Primary data was collected only for children from public schools in Virginia Beach; sample is not representative of the nation. Furthermore, some of the components of the intervention were reported in a qualitative format; therefore, quantitative measures are not available for the psychological, parent engagement, and behavioral skills components of the intervention.

CHAPTER II

LITERATURE REVIEW

Childhood is an important target period for intervention programs to prevent obesity and cardiovascular diseases. Children have replaced physical activities such as riding bikes, playing baseball or basketball, with sedentary leisure activities such as playing video games or watching television. Television viewing has been associated with higher intake of unhealthy foods. Sedentary leisure activities are associated with lower metabolic rates and higher body mass index (Lau, 2011). Family, friends, schools, and the community could reinforce children's lifestyle habits about diet and physical activity. For this reason, the CDC suggests intervention programs should take place in school settings and communities (CDC, 2011).

Afterschool programs have been started as an option to reduce obesity among children. It is challenging to implement obesity prevention programs during regular school hours due to heavy demands on teacher workloads and increased emphasis on documenting academic competencies such as math, reading and writing (Lau, 2011). Other benefits of afterschool programs include more flexibility for parent participation and for community organizations to help fund these programs (Hildebrand, 2012).

Although obesity prevention afterschool programs were viewed as a logical alternative to programs during regular school hours, mixed or modest results have been reported (Branscum & Sharma, 2012). Inconsistent program design is a likely contributing factor to these results. Some afterschool programs are based on theories while others are not. Additionally, theoretical construct utilization for childhood obesity programs vary greatly due to the complexity and comprehensiveness of the theoretical models used (Brug, Oenema, and Ferreira, 2005; Gonzalez-Suarez, 2009; Williams, 2013, Zhang, 2005). Thus, resulting in mixed results and inconsistency

of program design. The utilization of a theoretical model that is comprehensive but simple and parsimonious would be useful in the design and implementation of health promotion afterschool programs to reduce childhood obesity.

The literature review section includes different strategies used to implement obesity prevention programs in afterschool settings; shortcomings and successes of different programs are described. The potential of the Information-Motivation-Behavioral Skills Model in addressing shortcomings of other programs is identified and comparisons are made with related variables of interest from other frequently used theoretical frameworks. Finally, a discussion of the application of the IMB model to this study is presented.

Review of Literature of Strategies Used in Afterschool Programs

The designs of obesity prevention afterschool programs vary greatly; some are based on a theoretical framework while others are not. The Social Cognitive Theory (SCT) is the most widely used theory to design afterschool obesity programs. In addition to the SCT model, the Precede/Proceed model, Transtheoretical Model (TTM), and other theories have also been utilized for designing afterschool programs (Branscum & Sharma, 2012). There is no consistency in program design, even among the programs using the same theoretical framework.

The comparison of different afterschool programs is challenging due to the variation of theoretical construct utilization. Furthermore, the outcome measures used across afterschool program studies are not consistent. For example, some studies report fruit and vegetable consumption as the main outcome while others report only PA (physical activity) outcomes (Branscum & Sharma, 2012). The variation of construct utilization and conceptualization, and the use of diverse outcome measures make comparison of afterschool programs difficult.

A systematic review conducted by Branscum and Sharma, 2012, suggests afterschool programs with wider health promotion including exercise, diet, parent components, and behavioral skills result in greater effectiveness. This is consistent with other systematic reviews and meta-analyses reporting combined diet, physical activity, parental components, psychological components, and stakeholder engagement are the most effective programs (Gonzales-Suarez, Worley, and Grimmer-Somers, 2009; Williams, et al, 2013).

Theory-based afterschool programs often do not include important factors associated with obesity status, such as motivation, behavioral skills, psychological components, parental components, or knowledge. Some afterschool programs are not based on a theoretical framework; these programs typically focus on the reduction of body mass index (BMI) and not on behavioral change. However, sustainability of healthy weight is more likely if healthy behaviors are changed and maintained (Branscum, 2012; Pate et al, 2006). Providing education alone does not seem to improve behaviors related to physical activity or healthy eating. Programs lacking important factors associated with obesity status seem to yield modest and/or mixed results (Branscum & Sharma, 2012; Williams, 2013) (see Table 2). Overall, wide health promotion programs that target different levels of an ecological model seem to be more effective (Agency for Healthcare Research and Quality, 2013).

This literature review includes thirty-six afterschool programs, which are based on the following theoretical models: Social Cognitive Theory (16), Transtheoretical Model (1), Theory of Planned Behavior (1), Social Learning Theory (3), Social Ecological Model (1), a combination of the Social Cognitive Theory and Theory of Panned Behavior or Behavioral Choice Theory (2), and a combination of the Social Learning Theory and Organizational Change (1). Eleven studies did not mention a theory. However, some of them implicitly used elements

belonging to the Social Cognitive Theory, the Health Belief Model, and the Theory of Planned Behavior; for example, self-efficacy, attitudes, attractiveness of physical activity, parent support, and knowledge (see Table 2).

Five out of eleven studies lacking a theoretical framework focused on physical activity: the NutriActive program resulted in significant fitness increase, the Georgia FitKid and the 10-Month PA programs resulted in significant BMI reduction, SCORES resulted in reduced BMI for the Asian children but not all other race/ethnic groups, Pilates resulted in reduced BMI of girls with healthy weight but no BMI changes for overweight/obese girls. Three out ten programs, which implicitly used elements of a theoretical framework resulted in mixed outcomes or no overall behavioral changes. One program used the theoretical concept awareness about physical activity and healthy eating; this program resulted in increased knowledge about healthy eating and physical activity (Branscum & Sharma, 2012; Salmon, Brown, & Hume, 2009)(see Table 2).

Two programs used a combination of the Social Cognitive Theory and Theory of Planned Behavior/Behavior Change Techniques, these programs focused on education only and resulted in significant improvements of knowledge. One program based on the Social Learning Theory focused on knowledge and self-efficacy and yielded significant results for both knowledge and self-efficacy. One program was based on a combination of the Organizational Change and Social Learning Theory; this program focused on behavioral capabilities and self-efficacy and resulted in significant improvements in both areas (Branscum & Sharma, 2012; Salmon, Brown, & Hume, 2009) (see Table 2).

The following theory-based programs yielded mixed results: ten based on the Social Cognitive Theory, one based on the Social Learning Theory, one based on the Transtheoretical Model, and one based on the Theory of Planned Behavior. For example, the only study based on

the Transtheoretical Model resulted in significant increases of fitness levels but the only dietary habit improved was the consumption of green foods (Branscum & Sharma, 2012; Salmon, Brown, & Hume, 2009). These programs did not improve in any of the areas targeted during the intervention: seven based on the Social Cognitive Theory, one based on the Social Learning Theory, one based on the Social Ecological Model, and two lacking a theory (see Table 2).

Table 2. *Comparison of Obesity Prevention Afterschool Programs*

Afterschool Program	Theory	Focus	Significantly Improved Areas	Areas With No Change
SNAP	Social Cognitive Theory	Knowledge about PA and healthy eating.		Knowledge about PA, knowledge about healthy eating, or BMI
SCORES	No theory	Soccer	PA & BMI reduction in Asian children	BMI (all other ethnicities)
NurtiActive	No theory	Healthy snacks, PA, and playtime	Fitness	
Ready, Set, ACTION!	Social Cognitive Theory	Theater activities with health promotion	Self-efficacy	BMI, diet, PA, family/home environment, other SCT constructs
HOP'N	Social Cognitive Theory	PA, healthy snacks, nutrition & PA education	Behaviors related to PA	BMI
Food Fit	No theory mentioned	Healthy foods identification skills	Dietary behaviors	
GEMS	Social Cognitive Theory	Dancing, skills to reduce television and other types of screen time	Depression improvement and cholesterol improvement	BMI
Smart Snack	Social Cognitive Theory	Healthy eating education	Milk, vegetables, and water intake	

Table 2. Continued				
Afterschool Program	Theory	Focus	Significantly Improved Areas	Areas With No Change
Club Possible	Social Cognitive Theory	Self-efficacy, social support, and PA enjoyment	Increased PA enjoyment and reduced BMI	Self-efficacy and social support.
Food and Fitness Fun Education Program (FFFEP)	No theory mentioned	Education about PA and healthy eating, PA	Nutrition & PA knowledge	
Tommie Smith Youth Athletic Initiative (TSYAI)	Transtheoretical Model	Flexibility, resistance, track-and-field training and nutritional education	Cardiovascular fitness and consumption of green foods.	Other dietary behaviors or BMI.
Bienestar and CATCH	Social Cognitive Theory	PA activities and health education		Weight of participants
Nutrition and Media Intervention	Social Cognitive Theory	Nutrition education & parent engagement	Motivation to eat healthy, home nutrition environment, and perceived parental support.	Fruit & vegetable intake and self-efficacy
The Youth Fit For Life	Social Cognitive Theory	Cardiovascular and resistance exercise training, mood & self-appraisal factors, and nutrition education.	BMI, self-efficacy, self-concept, and mood factors.	Fruit and vegetable intake.
Georgia FitKid	No theory	80 min PA every day for 3 years.	BMI reduction	
10-Month PA Intervention	No theory	25 min PA skills, 35 min rigorous PA, 20 min toning and stretching every day for 10 months	BMI reduction	
Middle-School Physical Activity and Nutrition (M-SPAN)	Social Ecological Model	Enjoyment		Enjoyment

Table 2. Continued				
Afterschool Program	Theory	Focus	Significantly Improved Areas	Areas With No Change
Pilates Program	No theory	Basic pilates every day x 4 weeks	BMI reduction in healthy girls	BMI was not reduced in overweight/obese girls
Know Your Body	Social Learning Theory	Knowledge, attitudes, and psychosocial factors	Knowledge	Attitudes & psychosocial factors
Pathways USA	Social Learning Theory	Knowledge & self-efficacy	Knowledge & self-efficacy	
No name (In Greece)	Theory of Planned Behavior	Attitudes & intentions	Intentions	
CATCH	Social Cognitive Theory	Beliefs, perceived support, self-efficacy, intentions, and knowledge	Knowledge, intentions, & self-efficacy	Beliefs and perceived support
Promoting Lifetime Activity in Youth (PLAY)	No theory mentioned	Exercise attractiveness	Girls improved exercise attractiveness	Boys did not improve exercise attractiveness
Interactive Multimedia for Promoting Physical Activity (IMPACT)	Social Cognitive Theory	Beliefs, outcome expectancies, social norms, and self-efficacy	Effects marginal but insignificant.	
Eat Well and Keep Moving	Social Cognitive Theory & Behavioral Change Techniques	Knowledge	Knowledge	
Cardiovascular Health in Children (CHIC)	Social Cognitive Theory & TPB	Knowledge	Knowledge	
Know Your Body	Social Learning Theory	Knowledge		Knowledge
Go For Health	Organizational Change & Social Learning Theory	Behavioral capability & self-efficacy	Capability & self-efficacy	
Family-Based Studies	No theory mentioned. SCT constructs used	Knowledge & Self-efficacy		Knowledge & Self-efficacy

Table 2. Continued

Afterschool Program	Theory	Focus	Significantly Improved Areas	Areas With No Change
No Name	No theory mentioned	Knowledge & attitudes	Knowledge	Attitudes
No Name (UK)	No theory mentioned	Parental concerns		Parental concerns
Baylor GEMS	Social Cognitive Theory	Preference		Preference
Memphis GEMS	Social Cognitive Theory	Self-efficacy, self-concept, outcome expectations, and preferences		Self-efficacy, self-concept, outcome expectations, and preferences
Stanford GEMS	Social Cognitive Theory	Preference		Preference
Minnesota GEMS	Social Cognitive Theory	Self-concept, preference, outcome expectancies, self-efficacy, parental support, and home environment		Self-concept, preference, outcome expectancies, self-efficacy, parental support, and home environment
Active Winners	Social Cognitive Theory	Self-efficacy, beliefs, social norms, and intentions		Self-efficacy, beliefs, social norms, and intentions

PA: physical activity
BMI: body mass index

(Adapted from Branscum & Sharma, 2012; Salmon, Brown, & Hume, 2009)

The Information-Motivation-Behavioral-Skills (IMB) Model is a promising approach to overcome shortcomings of other theories for obesity prevention programs in afterschool settings. The IMB model incorporates a causal pathway with three constructs, which have been found to impact physical activity and healthy eating behaviors in adolescents and adults (Amico, 2015; Chang, et al, 2014; Fisher, Fisher & Harman, 2003; Kelly, Melnyk and Belyea, 2012; Osborn et al, 2010).

The first construct is information and it is addressed by providing education. Some studies suggest knowledge alone is insufficient to increase healthy eating and physical activity (Deeb, et al, 2015; Reinehr et al, 2001); however, others studies suggest obesity status is related to knowledge levels about healthy behaviors (Klohe-Lehman et al, 2006; Triches, Regina, and Giugliani, 2005). The IMB posits knowledge alone may be sufficient to change behavior if the behavior is not complex. According to the IMB, knowledge may interact with motivation; this interaction may translate into healthy practices when mediated by necessary behavioral skills. In addition, the IMB posits knowledge may be more important to certain target populations compared to others. For this reason, an elicitation research process is recommended by the IMB before designing a health promotion program (Fisher, Fisher & Harman, 2003). Obesity prevention afterschool programs focusing on education alone do not seem to result in behavioral change (Williams et al, 2013).

Motivation is the second construct of the IMB. Intrinsic and extrinsic motivation are essential elements for changing behaviors related to physical activity and healthy eating in children and adolescents (O'Dea, 2003). For the children population, rewards and fun activities seem to be effective in influencing motivation (O'Dea, 2003). In addition, parental support greatly influences the practice of healthy behaviors. For example, according to the Framingham Children's Study, children with active mothers are twice as likely to be active compared to children with inactive mothers. Children with active mothers and fathers are 5.8 times more likely to be active compared to children with sedentary mothers and fathers (Lindsay, Sussner, Kim, and Gortmaker, 2006). Parents' misperceptions about body weight results in the lack of support for their children to eat healthy. For example, a study conducted by McKee et al, 2016, found 86.2% of parents with overweight/obese children misperceived their children's weight as

being healthy. Parents' misperception of body weight is a main indicator of children's obesity/overweight status (Mckee, Long, Southward, Walker, and McCown, 2016). Therefore, parents impose negative or positive influences in children concerning healthy foods and physical activity.

The conceptualization of the behavioral skills construct greatly differentiates the IMB from other theoretical frameworks. The IMB includes objective self-efficacy in addition to perceived self-efficacy (Fisher, Fisher & Harman, 2003). Other theories used for obesity prevention programs such as the Social Cognitive Theory and the Theory of Planned Behavior conceptualize self-efficacy as a perceived belief of ones' ability to perform a behavior (Glanz, Rimer, and Viswanath, 2008). Objective self-efficacy has been associated with the improvement of healthy eating and physical activity in studies using behavioral skills of the IMB model to promote healthy behavior (Kelly, Melnyk, and Belyea, 2012).

Even though the IMB is parsimonious and designed to be easily translated into intervention programs, it allows for the inclusion of factors from different levels of an ecological model; for example, intrinsic and extrinsic motivational aspects (Fisher, Fisher & Harman, 2003). Including factors from different levels of an ecological model in an obesity prevention afterschool program is essential. For example, parent & stakeholder engagement improves the effectiveness of health promotion afterschool programs for elementary school children (Gonzales-Suarez et al, 2009; Williams et al, 2013).

Theoretical Framework

This section discusses the Information-Motivation-Behavioral Skills (IMB) model, examples of how it has been used in the past, the potential usefulness of this model for the design

of obesity prevention afterschool programs, and the application of this model to the afterschool program Let's Move.

Background of Information-Motivation-Behavioral Skills Model

The Information-Motivation-Behavioral Skills Model (IMB) is a general social psychological model for understanding and promoting health-related behavior. The constructs of IMB are based on relevant social and health psychology theories. However, the IMB conceptualization was developed to address limitations found in other relevant theories such as description of relationship among constructs, predictive validity of key constructs, conceptual parsimony, and the inclusion of constructs that are needed for understanding and changing health behaviors. The IMB was designed to be easily translated into intervention programs and has been used to address obesity-related behaviors, adherence to complex medication regimens, HIV preventive behaviors, safety gear utilization behaviors, etc. (Fisher, Fisher & Harman, 2003).

The IMB model was originally developed to explain HIV risk and preventive behavior. The constructs were selected based on: 1) a critical review and integration of other social and health psychology theories, and 2) an analysis of different HIV interventions reported in the literature. Later, the IMB was found to be applicable in diverse health domains such as diabetes self-care, tuberculosis infection control, motorcycle safety gear utilization, performance of breast self-examinations (Fisher, Fisher, and Harman, 2003), and tuberculosis infection control (Kanjee et al, 2012). An extensive literature review supports the constructs of the IMB as critical elements for the prediction and promotion of health behaviors (Chang, et al, 2014; Fisher, Fisher, and Harman, 2003; Kelly, Melnyk, and Belyea, 2012; Osborn et al, 2010). The IMB is based on a critical review and integration of constructs of behavioral theories, which contain key factors needed for the modification of a wide range of health-related behaviors.

Information, motivation, and behavioral skills are factors associated with health-related behavior and are often addressed separately in health promotion interventions. However, the IMB model postulates a causal relationship among the three factors and includes procedures that can be used to translate this model into health promotion interventions (Fisher, Fisher & Harman, 2003). According to the IMB, complex behaviors require that individuals are well-informed, well-motivated, and have the necessary objective and perceived skills to engage in the complex behaviors (Fisher, Fisher & Harman, 2003).

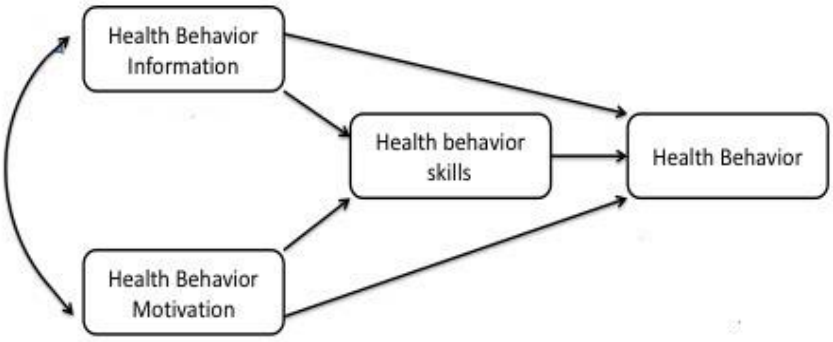
Overview of the Information-Motivation-Behavioral Skills Model

The IBM model postulates the information and motivation constructs can be independent or interrelated. Well informed individuals may not be motivated to perform a health-related behavioral change. Highly motivated individuals may not be well informed about health promotion practices. Figure 2 displays the relationships of the IMB's constructs. According to the IBM model, information and motivation may have direct effects on behavioral change if complicated or new skills are not required to perform the desired behavior. For example, pregnant women who are HIV+ might be willing to adhere to an anti-retroviral medication simply by learning this medication can prevent HIV transmission to their babies. Another example is an individual maintaining a sexually abstinent behavior because he or she is highly motivated (Fisher, Fisher & Harman, 2003).

The IBM also assumes behavior is influenced by information and motivation via behavioral skills. In other words, the initiation and maintenance of behavioral change happen when health promotion behavioral skills are added to the health promotion information and motivation components. For example, individuals who are well informed about HIV facts, have personal and social motivation to perform HIV preventive behaviors, and apply necessary

behavioral skills, are expected to initiate and maintain HIV preventive behaviors (Fisher, Fisher, and Harman, 2003).

Figure 2. *The Information-Motivation-Behavioral Skills Model of Health Behavior*



From J. D. Fisher and W. A. Fisher (1992). Changing AIDS risk behavior. *Psychological Bulletin*, 111, 455-74.

Constructs of Information-Motivation-Behavioral Skills Model

The IMB model assumes that health-related information, motivation, and behavioral skills are necessary to adopt health behaviors. Individuals who are well informed, motivated to act, and have the fundamental skills to perform a behavior, are very likely to adopt health behaviors and obtain beneficial health outcomes. On the other hand, individuals who are not well informed, are not motivated to act, and do not possess the skills needed to perform a behavior, are very likely to engage in risky behaviors and thus experience unfavorable health outcomes (Fisher, Fisher & Harman, 2003).

Information. Facts, heuristics, and implicit theories are different sources of information that could influence the performance of health behavior. According to the IMB model,

information that is directly relevant to the performance of behavior and can reasonably be accomplished within an individual's social ecology, is necessary to perform health behaviors (Fisher, Fisher & Harman, 2003). For example, to promote HIV prevention, an intervention program would include: 1) the fact that condoms prevent HIV transmission, 2) the heuristic information about monogamous sex being safe, and 3) the implicit theory that *"known and trusted people who dress and act reasonably and who possess a variety of normative characteristics are safe partners"* (Fisher, Fisher & Harman, 2003, p. 83). The three pieces of information mentioned above have been found to produce a powerful effect in the adoption of HIV preventive behaviors (Hammer, et al., 1996; Misovich et al., 1996; Williams et al., 1992).

Motivation. Motivation determines the performance of a behavior by influencing individuals' willingness to comply with the health promotion information given. According to the IMB model, personal and social motivations are two critical elements that influence the performance of health-related behaviors. Personal motivation is the attitude of an individual towards the health-related behaviors. Social motivation happens when there is social support that facilitates the performance of health-related behaviors. For example, personal attitudes towards condom use and perceptions of social support strongly influence whether individuals use condoms or not (Albarracin et al., 2001). Similarly, behaviors in other health areas such as adherence to medications and performing breast self-examinations, can also be predicted by social support and personal attitudes (Champion, 1990; W. Fisher et al., 2000; Lierman et al., 1991; Misovich et al., 2001).

Behavioral skills. In addition to information and motivation, behavioral skills provide the capability for individuals to perform health-related behaviors. This construct of the IMB emphasizes objective abilities and perceived self-efficacy associated with performing the desired

behaviors. Continuing with the HIV example mentioned above, the likelihood of using condoms is higher when an individual knows how to negotiate with a partner about condom usage. Many studies support the essentiality of self-efficacy to perform diverse health-related behaviors. For example, smoking cessation, breast and testicular self-examination, and medication adherence (Fisher, Fisher, and Harman, 2003; Glanz, Rimer, and Viswanath, 2008).

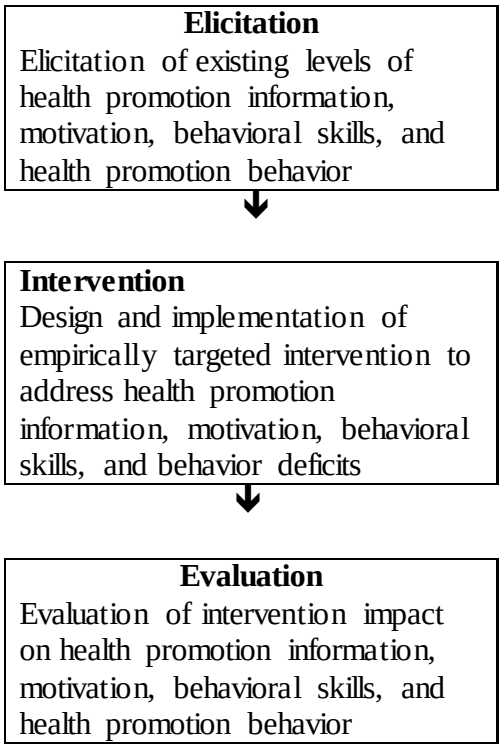
The constructs of the IMB model and their relationships are considered "highly" generalizable across populations and diverse health domains. However, this model assumes the content of each construct will be specific to relevant population's health-related behaviors. The content of constructs for an HIV prevention program will vary depending on the unique characteristics of individuals; for example, men or women, heterosexual or homosexual, African Americans or Hispanics. According to this model, not every construct or causal pathway will have the same level of influence on health behaviors of diverse populations. The strength of each construct and causal pathways in influencing health behaviors will depend on the target population and the particular health behavior. The IMB model provides procedures that can be followed to identify constructs and causal pathways that are particularly influential for certain populations and health behaviors; this identification is crucial before developing targeted health promotion programs. (Fisher, Fisher, and Harman, 2003).

The first step of the IMB approach to designing a health promotion program is to conduct elicitation research with a small sample of the target population. Elicitation research is used to analyze how well the model fits the health behavior and the constructs of the IMB model in relation to the target population. Open-ended surveys or focus groups are suggested in addition to close-ended techniques in order to avoid prompting answers that may not be a valid representation of the IMB for a certain population.

The second step is to design and implement interventions based on elicitation research. The interventions should be "conceptually based, empirically targeted, and population-specific." (Fisher, Fisher, and Harman, 2003, p. 87). The program design should address the deficits and capitalize on the assets that were found during the elicitation research process. (Fisher, Fisher, and Harman, 2003).

The third step is to conduct a "rigorous" program evaluation to determine the effectiveness of the program. Long-term evaluations are suggested to determine if a program is sustainable (Fisher, Fisher, and Harman, 2003). The IMB's approach of elicitation, intervention, and evaluation to conduct health promotion is illustrated in Figure 3.

Figure 3. *The Information-Motivation-Behavioral Skills Model Approach to the Promotion of Health Behavior*



From W. A. Fisher and J. D. Fisher (1993). A general social psychological model for changing AIDS risk behavior. In J. Pryor and G. Reeder (Eds), *The Social Psychology of HIV Infection* (pp. 27-53).

Comparison of Related Variables of Interest

Related theoretical variables of interest used in obesity prevention health promotion afterschool programs will be reviewed next.

Self-efficacy. This construct was developed by Albert Bandura for the Social Cognitive Theory. Self-efficacy has been adopted and used in other theories such as the Health Belief Model and the Transtheoretical Model. It is defined as the "conviction that one can successfully execute the behavior required to produce the outcomes." (Glanz, Rimer, and Viswanath, 2008, p. 87). Theoretical models, which include self-efficacy, operationalize this construct as a perceived belief, confidence or conviction that an individual can engage in healthy behaviors in different challenging situations without reverting to their original unhealthy behaviors (Glanz, Rimer, and Viswanath, 2008). See Table 3 for a list of methods proposed by Bandura to increase self-Efficacy.

Table 3. *Social Cognitive Theory's Methods for Increasing Self-Efficacy*

Mastery experience	Aiding in the gradual performance of challenging tasks via experience mastery. SCT posits this type of method to be the strongest in increasing self-efficacy beliefs.
Social modeling	Demonstration that similar people can do the desired behavior. This is achieved gradually in small steps to perform a complex task.
Improving physical and emotional states	Ensuring the well-being of an individual before attempting to perform a challenging task. For example, by reducing stress and calming fear.
Verbal persuasion	Encouraging an individual by reassurance in order to boost confidence.

(Bandura, 2004)

The IMB's behavioral skills construct is similar to self-efficacy; however, it focuses on the objective abilities in addition to perception of self-efficacy. According to the IMB, behavioral skills are critical requirements to perform complex behaviors in individuals who are well-motivated and well-informed about a particular health-related behavior. The IMB posits that methods used to improve behavioral skills depend on the target population and the health promotion behavior of interest. Causal pathways among IMB's constructs will be more or less influential depending on the target population and health promotion behavior of interest. Behavioral skills deficits and assets should be evaluated before designing an intervention (Fisher, Fisher, and Harman, 2003).

Consciousness raising. Consciousness raising is a construct used in the Transtheoretical Model and focuses on the provision of facts, ideas, and tips that support a target health-related behavior (Glanz, Rimer, and Viswanath, 2008). This construct is similar to the information construct of the IMB model. However, the IMB model also includes heuristics and implicit theories in addition to facts about a health-related behavior. Heuristics and implicit theories have shown to produce a significant effect in the adoption of health-related behaviors (Fisher, Fisher & Harman, 2003). Similarly, other theoretical models such as the Health Belief Model and the Social Cognitive Theory aim to raise awareness or consciousness in individuals to promote the adoption of healthy behaviors (Glanz, Rimer, and Viswanath, 2008).

Attitudes and social norms. According to the Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB), intention is the most critical factor in predicting behavior performance. These theories posit intention is directly influenced by social norms and attitudes of individuals. The beliefs about outcomes of a behavior determine the attitudes of an individual toward that behavior. Therefore, individuals with positive beliefs about the outcomes will have

positive attitudes toward a behavior and individuals who have negative beliefs about the outcomes will have negative attitudes toward a behavior (Glanz, Rimer, and Viswanath, 2008).

Similarly, the SCT states outcome expectancies or the beliefs about the outcomes of performing a particular behavior, are critical factors in determining the performance of a behavior. The Health Belief Model (HBM) has a similar construct named perceived benefits and posits individuals who perceive the behavior to be beneficial (outcome expectancies) are more likely to engage in the behavior (Glanz, Rimer, and Viswanath, 2008).

The SCT, TRA, and TPB and other theories emphasize social norms or social outcome expectations as critical determinants of behavior performance. These variables are expectations about how people who are important to an individual will evaluate the behavior and the willingness of the individual to be guided by their evaluation. Therefore, an individual who believes people agree with the performance of a certain behavior and is willing to meet their expectations, will have positive social norms. On the other hand, if an individual believes people do not agree with the performance of a certain behavior will have a negative social norm. An individual who is not willing to comply with the evaluation of other people will have a neutral subjective norm (Glanz, Rimer, and Viswanath, 2008).

The IMB has similar concepts that include social support and positive attitudes to achieve the motivation needed to perform a behavior. In SCT, motivation is not achieved through social support and attitudes, but by outcome expectations about the costs and benefits of a particular observed behavior. The SCT also posits incentive motivation in the form of rewards and punishments can be used for behavior modification (Fisher, Fisher, and Harman, 2003; Glanz, Rimer, and Viswanath, 2008).

Empirical Support for the Information-Motivation-Behavioral Skills Model

Diet and exercise behaviors among diabetic Puerto Ricans. Osborn, et al., 2010, conducted a study to analyze the role of the IMB model in explaining diet and exercise behaviors in adult Puerto Ricans with type 2 diabetes. Diet and exercise behaviors were subsequently analyzed in relation to the final health outcome: glycated hemoglobin (A1C) levels.

The information construct consisted of specific diabetes self-care behaviors. For example: exercise requirements for glycemic control and daily-recommended carbohydrate intake. The authors suggest this construct should contain heuristic accurate decision rules such as "foods with carbohydrates raise blood glucose levels" and "exercise and insulin lower blood glucose levels" (Osborn, Amico, Fisher, Egede, and Fisher, 2010, p. 3). In addition, incorrect heuristics and implicit theories should be included; for example: only sweet foods raise blood sugar levels or diet without exercise is enough to manage diabetes (Osborn, et al, 2010).

The motivation construct of the IMB is subdivided into two different components: personal and social motivation. Personal motivation for individuals with diabetes type 2 includes beliefs about the consequences of a diabetes self-care behavior. For example, the belief that exercise and monitoring carbohydrate intake will improve blood glucose levels, will lead to positive motivation. On the other hand, the belief that exercise and monitoring carbohydrate intake will be intrusive or wasteful, will lead to negative motivation. Social motivation includes the perceptions about support from significant others in performing the self-care behaviors and whether or not they are willing to comply with the wishes of significant others (Osborn et al, 2010).

The behavioral skills construct contains the skills needed to perform specific diabetes self-care behaviors. For example, the ability and confidence to monitor carbohydrates by calculating carbohydrate grams per serving or food, and reading food labels (Osborn et al, 2010).

Osborn et al, 2010, measured the constructs information, motivation, and behavioral skills by giving the participants a questionnaire. The information construct was measured by asking participants to identify which foods from a list contain carbohydrates. Also, questions about knowledge of benefits of exercise for glycemic control were asked. Attitudes and subjective norms items were used in the questionnaire to measure the motivation construct. The behavioral skills were measured with questions about perceived easiness and perceived effectiveness for performing diabetes-specific behaviors. The diabetes self-care behaviors included food labeling reading, diet and exercise behaviors; the latter two were measured with subscales of standardized questionnaires for diabetics. The glycated hemoglobin (A1C) levels were measured immediately after the questionnaire was completed. This type of test measures an average of blood glucose for three months; it is unaffected by food consumption on the day of the test (Osborn, et al, 2010).

A structural equation modeling program was used to analyze relationships among the IMB constructs. All analyses were conducted with the correlation matrix generated by 118 cases. The comparative fit index (CFI) and root mean error of approximation (RMSEA) statistical tests were used to measure the fit of the model. Hypothesis about construct relationships were evaluated via direction and magnitude of the path coefficients (Osborn, et al, 2010).

For the diet model, the results suggested the IMB model is well suited to explain diet behavior of type 2 diabetic adult Puerto Ricans. Information about diet and motivation to comply with the diet behavior were related with behavioral skills ($r = 0.19$, $p < 0.05$ and $r = 0.39$, $p <$

0.01, respectively), which in turn was related with diet behavior ($r = 0.42$, $p < 0.01$ and $r = 0.32$, $p < 0.05$). A1C levels were related to the diet behaviors ($r = -0.26$, $p < 0.05$). These results support the IMB assumption that information and motivation alone are not sufficient to perform a complex behavior. Information and motivation with applied behavioral skills led to the adherence of a diet specific for diabetics (Osborn, et al, 2010).

For the exercise model, performance of exercise was only explained by the attitudes towards exercise ($r = 0.53$, $p < 0.001$), which were related to exercise behavioral skills ($r = 0.45$, $p < 0.001$). A1C levels, social norms and information about exercise, were not significantly related to exercise behavior or behavioral skills. The authors speculate the measures might lack sensitivity since information and motivation about exercise were not covered thoroughly. The type and duration of physical activity used for measurement purposes might not have been appropriate to improve A1C levels. Other studies have shown associations between exercise and glycemic control (Osborn, et al, 2010).

In conclusion, findings suggest the diet behaviors can be improved for diabetic Puerto Ricans by targeting attitudes, perception of norms and social support, and behavioral skills. According to this study's findings, attitudes and behavioral skills should be the focus for interventions aiming at increasing physical activity in diabetic Puerto Rican individuals. The IMB model is appropriate for the design of intervention targeting these behaviors for this particular population.

Parental information, motivation, and behavioral skills correlate with child sweetened beverage consumption. Goodell, Pierce, Amico, and Ferris, 2012, utilized the IMB model to examine parental factors affecting their children's consumption of sweet beverages. This was a cross-sectional design study including parents of ethnic minority groups of low socio

economic status (SES). Children of participants had to be between 1 and 5 years of age. This study used an IMB-based survey and a self-reported Home Beverage Inventory (HBI) to collect data for analysis. A structure equation modeling statistical analysis was used to investigate whether sweet beverage consumption can be explained by behavioral skills mediating information and motivation.

Results suggest the IMB model can be used to explain parental factors related to children's consumption of sweet beverages. Parents with more knowledge significantly correlated with lower children's sweet beverage consumption. This suggests nutrition information may help parents limit the amount of sweet beverages their children consume. The correlation between information and sweet beverage consumption was stronger when behavioral skills were incorporated as mediators. Therefore, teaching parents behavioral skills can help lower the amount of sweet beverages children consume. Behavioral skills such as nutritional identification on labels can help parents select drinks with lower sugar content; for example, 100% juice instead of juice with added sugars. Motivation alone did not correlate with sweet beverage consumption. Children consumed less sweet beverages when their parents were motivated and had the skills to limit intake. According to this study, necessary parental skills to reduce children's consumption of sweet beverages include modeling, developing and implementing rules, providing alternative beverages to children, and being able to gather relevant information regarding the consumption of sweet beverages. Authors suggest further research using comprehensive scales of IMB constructs related to sweet beverage consumption is necessary.

Predicting physical activity and fruit and vegetable intake in adolescents. Kelly, Melnyk, and Belyea, 2012, conducted a study to investigate the utility of the IMB model in

predicting physical activity and fruit and vegetable intake in adolescents. The purpose of this study was to understand factors associated with physical activity and fruit and vegetable intake within the context of the IMB to assist in the development of health promotion programs; the authors argue most adolescents do not eat the recommended amounts of fruits and vegetables, and do not perform physical activity for at least 60 minutes every day.

Physical activity and the consumption of fruits and vegetables behaviors are determined by a number of factors from different levels of an ecological model such as demographic, intrapersonal, interpersonal, institutional, community, and public policy. Previous theory-based studies have focused on intrapersonal and interpersonal factors. Recently environmental and community factors have been included in theory-based studies seeking to predict physical activity and fruit and vegetable intake. Authors suggest theory-based studies should integrate different level factors to have a greater understanding of intervention programs that could be more effective. In this study, demographic, intrapersonal, interpersonal, and community factors were integrated (Kelly, Melnyk, and Belyea, 2012).

Gender, race, and age, are factors that affect physical activity behavior in adolescents. Boys are more active than girls and all adolescents decrease their level of physical activity as they get closer to young adulthood. Perceived support for physical activity is different depending on the race. For example, adolescent Hispanic girls perceived support for physical activity is lower than adolescent white girls. Age and socioeconomic status (SES) affect fruit and vegetable consumption in adolescents. Adolescents from lower SES families eat less fruits and vegetables compared to adolescents from higher SES families. Fruit and vegetable intake decrease from middle to late adolescence (Kelly, Melnyk, and Belyea, 2012).

Intrapersonal factors. Intrapersonal factors that affect physical activity behavior and the consumption of fruits and vegetables are knowledge, personal motivation (intentions), perceived self-efficacy, perceived barriers, and cognitive-behavioral skills. Knowledge can promote behavioral change of complex behaviors, but not by itself. Studies using the Theory of Planned Behavior (TPB) and Theory of Reasoned Action (TRA) have found intentions (measured as choices) to be predictive of physical activity and fruit and vegetable intake in children, youth, and adults. The intentions of adolescents have been found to be moderated by gender. Girls have reported more intentions to be healthy compared to boys; however, boys reported a greater amount of healthy behaviors compared to girls (Kelly, Melnyk, and Belyea, 2012).

Adolescents with higher perceived self-efficacy reported higher levels of physical activity. However, perceived self-efficacy has not consistently predicted fruit and vegetable intake. Some studies have reported no association between perceived self-efficacy and fruit and vegetable consumption while others have reported a significant association $R^2 = .14$, $p < .001$ (Kelly, Melnyk, and Belyea, 2012).

Time constraint is the most common intrapersonal level barrier for physical activity that is reported by adolescents. Barriers related to fruit and vegetable consumption include lack of access to healthier foods, preferences, and perceived benefits of unhealthy foods such as mood enhancement and rewards (Kelly, Melnyk, and Belyea, 2012).

Cognitive-behavioral skills are very important determinants for physical activity and consumption of fruits and vegetables for adolescents. Self-monitoring, goal setting, problem solving, stimulus control, self-reward, and preplanning skills mediate self-efficacy, which in turn result in higher levels of physical activity and consumption of fruits and vegetables (Kelly, Melnyk, and Belyea, 2012).

Interpersonal factors. Support from parents and other individuals affect physical activity behaviors of adolescents. Social support is also correlated with the consumption of fruits and vegetables. Parents are role models for children, who tend to follow the same dietary habits as their parents. Neighborhood safety is a community factor associated with physical activity levels of children, youth, and adults (Kelly, Melnyk, and Belyea, 2012).

Methods. In this study, gender and race were analyzed as moderators and cognitive-behavioral skills were analyzed as mediators. The Information-Motivation-Behavioral Skills Model was used because it includes cognitive-behavioral skills as a mediating variable. This study conducted a secondary analysis of existing data. Variables for secondary analysis were selected based on a literature review. The inclusion criteria for the primary study indicated students ages 13-18 had to be enrolled at a health/PE class. The constructs of the IMB model were operationalized by existing scales of knowledge, motivation, beliefs, choices, perceived difficulties, and cognitive behavioral skills related to physical activity and fruit and vegetable consumption. Contextual variables were used and included age, school, and neighborhood safety. Structural Equation Modeling was used to evaluate the fit of the data to the IMB model (Kelly, Melnyk, and Belyea, 2012).

Results and discussion. Results indicate all paths of the IMB model were significant and in the expected direction except for knowledge, which was positive but not significant. The relationship among variables about healthy lifestyle behaviors from the IMB model were similar across males, females, and all ethnic groups; moderation was not present for the structural portion of the model. Cognitive-behavioral skills mediated both physical activity and the consumption of fruits and vegetables. Goal setting and intentions mediated perceived self-efficacy related to physical activity. The authors suggest the integration of cognitive-behavioral

skills in intervention programs to improve perceived self-efficacy and decrease difficulty related to physical activity. Thus, increasing physical activity and consumption of fruits and vegetables (Kelly, Melnyk, Belyea, 2012).

Gender and race moderated the measurement portion of the IMB model and the contextual variables. Each contextual variable was significant for at least one variable of the IMB model; therefore, authors suggest tailoring interventions according to race and gender may be beneficial. Social support significantly influenced physical activity and consumption of fruits and vegetables. Overall, there are similarities of the theoretical paths that lead to physical activity and fruit and vegetable intake; therefore, similar interventions may be beneficial to increase physical activity and fruit and vegetable intake. The overall model fit the data nearly adequately and the fit improved to adequate with the use of contextual variables (Kelly, Melnyk, Belyea, 2012).

Even though this study resulted in significant findings, the variance the IMB explained in relation to physical activity and consumption of fruits and vegetables was similar to the variance explained by other theoretical frameworks such as the Theory of Planned Behavior or the Social Cognitive Theory. The authors suggest much of the variance might be explained by factors that are difficult to measure. For example, present and past experiences have been associated with physical activity and fruit and vegetable intake behaviors (Kelly, Melnyk, Belyea, 2012).

Systematic review of strategies based on the IMB to change behavior. Chang et al, 2014, conducted a systematic review to investigate whether strategies based on the IMB theoretical framework are effective in changing behaviors of individuals with chronic medical conditions. Authors argue effective strategies need to be identified given that the prevalence of chronic medical conditions is rapidly increasing worldwide. Behavioral changes are essential

components for the management of chronic medical conditions. Behavioral theories used for designing health promotion programs of chronic medical diseases include the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, the Transtheoretical Model, and the Information-Motivation-Behavioral (IMB) Skills Model. All of these theories contain determinant factors for behavioral interventions. The IMB model has received special attention to develop interventions that target chronic medical conditions because it provides relative simple postulations for complex health behaviors, which identify constructs needed for management and adherence behaviors associated with chronic medical conditions (Chang et al, 2014).

This systematic review followed the guidelines of both the National Evidence-based Healthcare Collaborating Agency and guidelines by Im and Change, 2012. Chang et al, 2014 used electronic databases to search for literature. Studies included used randomized controlled trials to test the effectiveness of the IMB in changing behaviors and health outcomes of individuals with chronic medical conditions. The quality of the studies was assessed independently by four different reviewers. A total of twelve studies were included. The majority of the studies targeted HIV/AIDS behaviors (9), the remaining studies were about type 2 diabetes mellitus, coronary artery disease, and cervical or endometrial cancer. The studies that targeted HIV/AIDS focused on medication adherence and the prevention of risky sexual behaviors. The type 2 diabetes study focused on self-care behaviors such as healthy eating and physical activity. The study about cervical or endometrial cancer focused on compliance with vaginal dilation. The study about coronary artery disease focused on healthy eating management, physical activity regimens, smoking cessation, cardiac rehabilitation, stress management, and medication

adherence. Five of the twelve studies included biological measures such as counts/HIV loads and HbA1c levels in diabetics (Chang et al, 2014).

To address the IMB's motivation construct, most studies used techniques to increase positive attitudes and perceived social norms. Techniques used to increase motivation include motivational interviewing, counseling, social support groups, and group discussions. Techniques to address the information construct included the use of handouts, flip charts, and educational films. Finally, the behavioral skills construct was addressed by improving both the perceived and objective self-efficacy. Techniques to improve objective and perceived self-efficacy included role playing (hand-on experience), proper condom use, skills to quit smoking, skills to refuse alcohol, and educational methods with psychological components (Chang et al, 2014).

Ten out of twelve studies using the IMB resulted in significant behavioral change; these included the studies targeting physical activity, healthy eating behaviors, and other self-care behaviors. Three studies that compared IMB based interventions with interventions using other theoretical frameworks suggest the individuals who participated in the IMB-based interventions were less likely to engage in risky behaviors compared to individuals who participated in other interventions based on other theoretical frameworks. Five out of six IMB interventions targeting medication adherence for HIV/AIDS had significant results. Two out of five studies using biological measures had significant reductions in counts/HIV loads and HbA1c levels (Chang et al, 2014).

Chang et al, 2014, suggest the IMB is a "strong" model to use in order to change behaviors that will help individuals with the management of chronic medical conditions (Chang et al, 2014, p. 180). Authors indicate the use of "disease-specific and behavior-specific" educational information in the form of handouts, flip charts, films, interactive discussion, and

counseling (Chang et al, 2014, p. 179). To increase motivation, they indicate the use of motivational interviewing and social support groups. Finally, the authors suggest the use of strategies such as role playing (hands-on skills), behavior games, memory blocking, and skill building modules to increase both objective and perceived self-efficacy (Chang, et al, 2014).

Utility of the IMB for chronic medical conditions. The American Medical Association has classified obesity to be a chronic disease (American Medical Association, 2013). To keep a chronic medical condition (CMC) under control, it is necessary to monitor, manage, and continuously evaluate the condition (as cited in Amico, 2011). In 2012, about half of the adults in the United States had one or more CMCs. One in four adults had two or more chronic health conditions. In 2010, seven of the ten top causes of yearly deaths were caused by CMCs (Centers for Disease Control and Prevention, 2015). Approximately 63% of all people who suffer from a CMC do not comply with their treatments (as cited in Amico, 2011). There is a need to promote preventive behaviors among individuals with CMCs. In particular, behaviors that need to be improved among all individuals with CMCs include diet, exercise, medication adherence, and utilization of health care services (Amico, 2011).

Amico, 2011, argues there is a lack of guidance procedures to promote preventive behaviors among individuals with CMCs. Health care utilization models that can be translated into interventions are absent. For example, the Anderson's Behavioral Model and the Chronic Care Disease Model are comprehensive models, which focus on access of care for underserved populations and system responsiveness. However, these models fail to address preventive behavioral approaches (Amico, 2011).

Amico, 2011, suggests the use of the Information-Motivation-Behavioral Skills Model to promote care initiation and maintenance of preventive behaviors among individuals with CMCs.

This suggestion is based on the fact that the IMB model is parsimonious but comprehensive at the same time. Also, the IMB model has been used in the past to successfully promote preventive behaviors among HIV positive individuals. In addition, the IMB "offers a unique characterization of the core's determinants of one's care initiation and subsequent maintenance in care over time that can be efficiently translated to comprehensive, feasible, and actionable intervention strategies." (Amico, 2011, p. 1072).

Application of the Information-Motivation-Behavioral Skills Model for This Study

In this study, the utility of the IMB model as a theoretical foundation for an obesity prevention afterschool program is examined. Let's Move is an interactive afterschool program to prevent obesity by promoting healthy eating, physical activity, parent engagement, and emotional well-being (Geraghty, 2014). This program was originally developed by the Virginia Beach Public Health Department and Virginia Beach Parks and Recreation. The program was developed as part of the Virginia Beach Mayor's initiative to implement Let's Move to answer First Lady Obama's call to create a healthier America (The White House, 2014). Later on, the Center for Global Health at Old Dominion University partnered with Virginia Beach Parks and Recreation and the Virginia Beach Public Health Department to assist in the evaluation and modification of the Let's Move curriculum based on current and accurate guidelines and a theoretical framework. The theoretical framework Information-Motivation-Behavioral Skills was selected based on literature review (Geraghty, 2014). The application of the IMB model for VB Let's Move is illustrated in Figure 4.

Application of the information construct for Let's Move. According to the IMB, a health promotion program should include different types of relevant information that may potentially influence target behaviors. For example, psychological factors improve the

effectiveness of obesity prevention health promotion programs when integrated with other information related to healthy eating and physical activity (Gonzalez-Suarez, 2009; Williams, 2013). The curriculum for Let's Move incorporates self-esteem enhancing information in addition to healthy eating and physical activity information.

Let's Move has a total of four interactive classes given once a week. Children learn hands-on skills; for example, plastic food materials are used for children to learn how to put plates together with different food groups. Discussions take place during classes in order to correct misperceptions about healthy eating and physical activity. Classes are followed with exercise activities and behavioral skills building techniques. For example, relay races with food group identification objectives; children have to place a food item card in the correct wall pocket before finishing the relay race. Every class is used to iterate the importance of exercising 60 minutes every day. Children learn different ways to practice moderate to rigorous physical activity. Nutrition classes include the following:

a) Week 1: Rethink Your Drink…*WATER* you waiting for?!? This lecture focuses on education about drinks with high sugar content such as soda, juice with added sugars, flavored fruit drinks, energy drinks, sports drinks, and other sugary drinks. Lecture includes information about ill effects caused by high amounts of sugar and the benefits of drinking water.

b) Week 2: My Plate. This lecture is about the five different food groups. Children learn the benefits of food groups, proper portions per food group (½ of plate should be fruits and vegetables, ¼ a lean protein, and ¼ whole grains). Children are instructed to eat the healthier choices within food groups. For example, choosing baked chicken instead of chicken nuggets, brown whole wheat bread instead of white bread.

c) Week 3: Portion Distortion. This lecture is about eating the correct portions of foods and learning that food can be compared to everyday items to help identify the correct portion size to eat. For example, the correct amount of cheese to eat shouldn't be bigger than a domino.

d) Week 4: Week 4 – *Let's Move! Let's Eat Healthy! Let's Be Happy!* This last lecture includes a brief review of previous lectures. In addition, it emphasizes that being happy with oneself helps the body to be healthy. Children are taught they are all different and unique and are given ideas on how to be happy, for example, by making wise decisions, volunteering, getting involved in fun activities, etc.

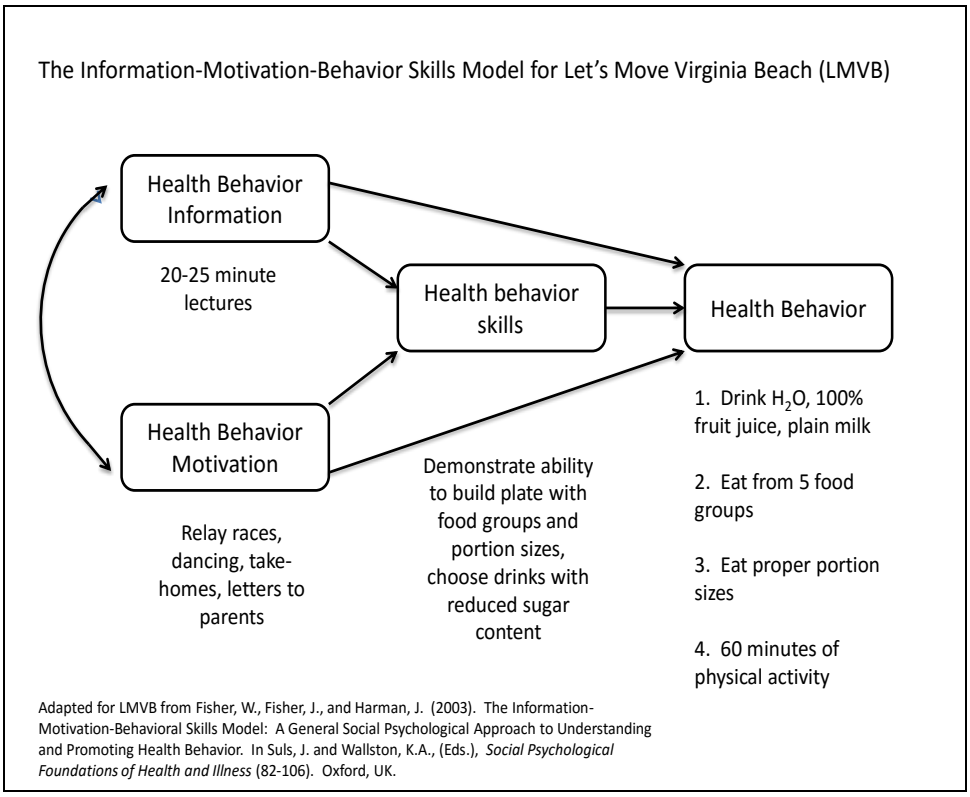
Application of the motivation construct for Let's Move. Motivation determines the performance of a behavior by influencing individuals' willingness to comply with the health promotion information given. Personal and social motivations are two critical elements that influence the performance of health-related behaviors. Parent engagement is a component of Let's Move to enhance social motivation for the children. Parents are given letters about what the children learn during this program along with tips on how to help their children achieve the desired behaviors targeted by this program: 1) drinking more water and reducing the amount of sweetened beverages; 2) eating from the 5 food groups; 3) eating appropriate portions; and 4) getting 60 minutes of physical activity every day. In addition, parents are invited to participate in the afterschool program.

Dancing is introduced to children as a fun way to practice physical activity. A discussion takes place to review various ways to make physical activity fun and healthy foods palatable. Children receive items to reinforce lessons learned; for example, backpack bottles for water and a colorful plate with illustrations of food groups.

Application of the behavioral skills construct for Let's Move. In addition to information and motivation, behavioral skills provide the capability for individuals to perform health-related behaviors. It is difficult to start a new behavior related to food preferences. For this reason, the children are given the skills to know how to gradually improve healthy behaviors. For example, reducing the amount of chocolate milk by adding low fat white milk to the chocolate milk and gradually increasing the low fat milk and decreasing the chocolate milk to accustom to the taste. Another example is to make water more palatable by infusing fruit into it. Other behavioral skills addressed by Let's Move include the ability to identify different types of enjoyable physical activities, drinks with high sugar content, and healthier choices within food groups. Children practice hands-on skills for food group identification and for assessing proper food group rations.

Application of IMB to Let's Move summary. Healthy eating and physical activity are complex behaviors that require different types of information, social and personal motivation, and necessary objective and perceived skills. The IMB takes an ecological approach, which allows for wide health promotion of important key factors necessary to initiate and sustain healthy eating and physical activity.

Figure 4. *Application of the Information-Motivation-Behavioral Skills Model for Let's Move in Virginia Beach*



Chapter II Summary

Afterschool programs have the potential to be important outlets to reduce and prevent childhood obesity. Many afterschool programs have been designed, implemented, and evaluated. Program designs are variable and evaluations have yielded mixed results. Those with wider health promotion seem to be more effective (Branscum & Sharma, 2012; Gonzales-Suarez, Worley, and Grimmer-Somers, 2009; Williams et al, 2013). Since childhood obesity is still a serious public health concern (Healthy People, 2015), an effort should be made to increase the effectiveness of afterschool programs. Changing behaviors associated with obesity risk is crucial for sustainability of healthy practices (Brug, Oenema, and Ferreira, 2005; Pate et al, 2006). Some afterschool programs have succeeded at changing behaviors to some extent. The identification of

key determinant factors along with causal pathways could result in greater effectiveness of afterschool programs to prevent and reduce obesity in children.

Although the IMB model is simple and parsimonious, it consists of three important key constructs for changing health-related behaviors. The IMB is based on relevant social and psychological theories and is designed specifically for the easy translation into health promotion programs. The causal pathways among information, motivation, and behavioral skills provide a mechanism for developing strategies that change behaviors related to healthy eating and physical activity. According to the IMB model, a well informed and well-motivated individual who acquires behavioral skills will be more likely to engage in complex healthy behaviors (Fisher, Fisher & Harman, 2003).

CHAPTER III

METHODOLOGY

The main objective of this study was to explore the utility of the IMB as a foundation for the design of an obesity prevention afterschool program for children ages 5-11. There are three constructs in the IMB Model. The primary study collected behavioral skills in a qualitative format (Geraghty, 2014). Knowledge data is used to test the information construct, data about attitudes is used to test the motivation construct, and data about healthy practices is used to predict practices based on knowledge and attitudes scores.

A secondary data analysis was performed in this study. Data was collected by the Center for Global Health at Old Dominion University, Virginia Beach Public Health Department, and Virginia Beach Parks and Recreation for an afterschool obesity prevention program called Virginia Beach (VB) Let's Move. The study sample included children in public elementary schools in Virginia Beach who received consent from their parents and who assented to be in the study. The main independent variable was an IMB-based prevention program that promoted healthy eating and physical activity (Appendix C). Demographic characteristics for the participating children and their parents were considered to be potential predictor (independent) variables in this study. Demographic characteristics for the parents included age, gender, race/ethnicity, marital status, and education level. Children's demographics included gender, grade level, and attendance rate to the obesity prevention VB Let's Move (see Table 4). Dependent variables in this study included attitudes, knowledge, physical activity, and healthy eating (see Table 5).

Table 4. *Definitions for Independent Variables*

Independent Variables	Definition
Gender (parents and children)	Female, male, prefer not to answer
Parent's marital status	Single, married, living with a partner, separated, divorced, widowed, prefer not to answer
Parent's race/ethnicity	White, Black or African American, Hispanic or Latino, Asian or Pacific Islander, American Indian or Alaskan Native, other, prefer not to answer
Parent's education	Some high school, high school, some college, bachelor, and masters or above, prefer not to answer
Parent's age	18-24; 25-34; 35-44; 45-54; 55-64; 65 and older, prefer not to answer
Children's Grade level	Kindergarten, first, second, third, fourth, fifth
Children's Attendance Rate	4 sessions, 3 sessions, 2 sessions, 1 session.

Table 5. *Definitions for Dependent Variables*

Dependent Variable	Definition
Physical activity	Daily engagement of moderate to vigorous physical activity for 60 minutes every day.
Healthy eating	Reducing consumption of sugary drinks, eating from the 5 food groups, selecting healthier choices within the 5 food groups, and eating proper portions of foods
Attitudes	Motivation toward healthy eating and physical activity.
Knowledge	Knowledge about nutrition of 5 food groups, portion sizes, sugary drinks, and physical activity benefits and recommendations. Ill-effects of practicing unhealthy behaviors.

One approach to test a theory is to examine associations between variables derived from a theory and a behavior of interest in order to determine if the theory can help understand and predict the behavior of interest. A second approach to test a theory involves the evaluation of an intervention to determine whether the targeted factors related to behavioral change are modified by the intervention or not (Bauman et al., 2002). This dissertation study used a combination of both approaches to assess the potential of the IMB model as a suitable framework to understand and predict behaviors related to healthy eating and physical activity among elementary school children.

Research Methodology

Methodology includes the use of data collected by Old Dominion University (ODU) Center for Global Health, Virginia Beach Public Health Department, and Virginia Beach Parks and Recreation, for the VB Let's Move obesity prevention program during the 2014-2015 academic year; which was analyzed previously. Appendix D includes details of the VB Let's Move project.

This study used pre, post, and 1-year data to assess the usefulness of the IMB model in changing attitudes and knowledge related to healthy eating and physical activity. In addition, data about healthy practices obtained at the 1-year assessment were used to examine whether a model using the IMB along with significant demographic variables produce a good model for obesity prevention afterschool programs.

Data Collection Procedures

A secondary analysis was performed with data originally collected with the goal to evaluate the effectiveness of the afterschool health promotion program Let's Move. Questionnaire used for the Let's Move evaluation was designed by the Center for Global Health

and reviewed by an expert panel composed of members from Old Dominion University and the Virginia Beach Public Health Department. Questionnaire was piloted and modified according to pilot test results.

The questionnaire was designed to assess participants' knowledge, attitudes, and perceptions/practices related to nutrition and physical activity. Demographic data collected for the children included gender, grade, and attendance. Demographic data collected for the parents included gender, marital status, race/ethnicity, age, and education level. Data was collected in person and occurred in four phases:

Pretest. A piloted questionnaire was used to assess baseline knowledge, attitudes, and perceptions about healthy eating and physical activity. Demographic characteristics were collected for the parents and children.

Intervention. VB Let's Move is an educational and interactive program delivered once a week for a total of four weeks. Sessions lasts for one hour. Participants learn information and behavioral skills related to healthy eating and physical activity. VB Let's Move is designed to address intrinsic and extrinsic motivational factors related to physical activity and healthy eating. During the intervention, behavioral skills of participating children were assessed for the primary study.

Posttest. Questionnaire data were collected for the evaluation of knowledge, attitudes, perceptions/practices about healthy eating and physical activity.

Follow-up at 1-year. Questionnaire data was obtained to evaluate sustainability of behaviors targeted by VB Let's Move, including attitudes, knowledge, and practices about healthy eating and physical activity.

Description of Population, Setting, and Sampling Strategy

The data represented children (ages 5-11) from eight different elementary schools in Virginia Beach who completed the pretest (n=172), posttest (n=170), and 1-year follow-up (n=32) for the evaluation of the VB Let's Move program. VB Let's Move is expected to be gradually delivered to all public schools in Virginia Beach. The initial eight schools were selected based on high percentage of children enrolled in the free and reduced lunch program. Participation rate for children ranged from 66% to 91% across the eight schools. See Table 6 for participation rates and percentage of participants who completed both the pre-tests and post-tests.

Table 6. *VB Let's Move Afterschool Program's Participation Rate Per School and Test Completion*

Elementary School	Participation Rate (%)	Participating children who completed pre & post tests (%)
School 1	66	100
School 2	79	89
School 3	67	92
School 4	66	90
School 5	91	74
School 6	75	81
School 7	75	88
School 8	79	96

Research Questions and Hypotheses for Testing

Research question 1: to what extent constructs of the Information-Motivation-Behavioral Skills Model (IMB) explain behavioral change related to healthy eating and physical activity?

Associated Hypotheses.

Hypothesis 1a. IMB variables will be most influential in the improvement of attitudes and knowledge compared to demographic variables.

Hypothesis 1b. The IMB will explain a substantial amount of variance in healthy eating and physical activity, greater than or equal to what is reported in the literature.

Hypothesis 1c. Those who acquire more knowledge, are well motivated, and acquire behavioral skills will be more likely to engage in physical activity and healthy eating compared to those who are less motivated or less knowledgeable.

Research question 2: are the dependent variables attitudes and knowledge sustainable at the one-year follow-up?

Associated Hypothesis.

Hypothesis 2. Attitudes and knowledge will be sustained or improved at the one-year follow-up.

Data Analysis

Data were analyzed in relation to the dissertation study research questions/ hypotheses for testing. The analyses methodology involved descriptive statistics, multivariate analyses repeated measures MANOVA, and ordinal regression analyses. Descriptive statistics include means and Chi-square tests. Chi-square tests are used to analyze pre, post, and 1-year questionnaire high frequency scores according to demographic variable characteristics of the respondent parents and children. Scores for pre, post, and 1-year assessments were considered high if they were higher than the baseline/pre median (54%). The Chi-square tests are useful for a preliminary examination of the data; they helped to identify whether the frequency of high scores related to attitudes and knowledge is more prevalent among particular demographic groups. However,

since the primary study was a repeated measures design (pre, post, and 1-year follow-up), a repeated measures MANOVA was conducted due to multiple independent variables and the repeated measures design.

MANOVA tests are useful to explore interactions among dependent and independent variables. Significant MANOVA tests are followed with univariate ANOVA tests on each of the dependent variables to better understand where the group differences lie. ANOVAs that follow a significant MANOVA are protected from type I error rates only for the dependent variables with true group differences (Field, 2009). Therefore, a Bonferroni correction was applied to the data for follow-up ANOVAs.

Finally, four ordinal regression analyses were used to assess the utility of the Information-Motivation-Behavioral Skills (IMB) model in predicting physical activity, and the consumption of water, fruits and vegetables, and healthy foods such as whole grains and lean proteins. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.0 for Windows software.

Chi-square test. The Chi-square test for independence is a statistical test to examine if the frequencies are different for categorical variables (Field, 2009). For example, one can examine if the frequencies for having better attitudes about healthy eating and physical activity are greater among boys or girls. The Chi-square test is useful in this study to investigate whether the frequencies of high scores for attitudes and knowledge are more prevalent among a particular demographic group in each phase of the study: pre, post, and 1-year follow-up evaluation.

Assumptions for the Chi-square test. The first assumption is independence of data. The Chi-square cannot be used to analyze repeated measures at the same time. For this test to be meaningful, it is essential that each person, item, or entity only appears in one cell of the

contingency table. Second, the expected frequencies should be greater than 5. When the expected frequencies are below 5, there is a loss of statistical power; therefore, the test may fail to detect a genuine effect (Field, 2009).

Repeated measures MANOVA. A MANOVA test can be used when groups need to be compared on multiple outcome variables and for examining the relationships among independent and dependent variables. MANOVA tests require that the dependent variables be measured at the interval/ratio levels and the independent variables consist of two or more categorical independent groups (Lund & Lund, 2013). In this study, the dependent variables attitudes, knowledge, and practices are measured at the ratio level; questions add up to 100% for every dependent variable. The independent variables in this study consist of two or more categorical and independent groups (see Table 4).

Assumptions for repeated measures MANOVA are tested for the secondary data used in this study: 1) observations are statistically independent 2) multivariate normality is assumed by checking univariate normality for each dependent variable; random sampling with replacement (bootstrapping) is used for parameter estimates, and 3) homogeneity of covariance is checked by examining variance-covariance matrices.

MANOVA assumptions.

Normality assumption. According to Field, 2009, it is more effective to look at kurtosis and skewness statistics and to visually look at the data distribution rather than calculating significance values when the samples are very large (~200 or more). When sample sizes are very large, small standard errors cause significant values even when the deviations from normality are very small. On the other hand, the normality for small samples can be evaluated by looking at kurtosis and skewness z-scores significance values. For small samples, it is acceptable to look for

values above 1.96, which is significant at $p < .05$. For larger samples, the criterion should be increased to 2.58, which is significant at $p < .01$. For very large samples, no criterion should be set for the reasons mentioned above; for large samples, it is satisfactory for all the values of kurtosis and skewness to be below the upper threshold of 3.29 (Field, 2009). This study uses kurtosis and skewness values along with visual q-q plots to assess the dependent variables' normality status (Appendix C). The q-q plots for pre and post attitudes DVs show deviation from normality while the q-q plots for the pre and post knowledge DVs show a normal distribution (see Figures 5-8). For skewness and kurtosis, the further the value is from zero, the more likely it is that the data are not normally distributed. Values beyond 1 or -1 reflect substantial deviation from normality. The DV pre attitude is positively skewed; it has too many low scores in the distribution (1.192). On the other hand, the DV post attitude has too many high scores in the distribution (-1.481). Kurtosis values for pre and post attitude DVs are positive (1.710 and 1.440, respectively). These positive kurtosis values indicate a narrow distribution that is pointy and heavy-tailed. The DV pre knowledge is very close to normality according to both skewness and kurtosis (.259 and -.097, respectively). Similarly, the skewness and kurtosis values for the DV post knowledge are close to normality (.209 and -.604, respectively).

Another way to establish normality status is by using the Central Limit Theorem, which states when samples are over 30, the sampling distribution will take the shape of a normal distribution regardless of the shape of distribution for the population from which the sample was taken (Field, 2009). In this study, the Central Limit Theory may be applied for the pre (n=172) and post (n=170) samples for knowledge and attitudes.

The dependent variables in this study form a combination of normal and non-normal distributions. Therefore, a robust MANOVA test must be applied. There are four different tests

that can be used to assess the eigenvalues of a MANOVA test (Pillai-Bartlett trace, Hotelling's Ts, Wilk's Lambda, and Roy's largest root). All four tests are robust to violations of the normality assumption. When sample sizes are equal, the Pillai-Bartlett trace is the most robust to violation of normality assumptions (Field, 2009). For the purpose of this study, the Pillai-Bartlett trace test (*V*) is appropriate to assess the MANOVA's eigenvalues. *V* is the sum of the proportion of explained variance on the discriminant function variates of the data. *V* is similar to $R^2 = SS_M/SS_T$, where SS_M represents model improvement in predicting variables, and SS_T represents the total amount of differences present when the most basic model is applied to the data. This measure is useful to explain the proportion of improvement made by a proposed model. As a percentage, R^2 or *V*, represent the variation in the outcome that can be explained by a model (Field, 2009).

Figure 5. *Normality Q-Q Plot for Pre Attitudes*

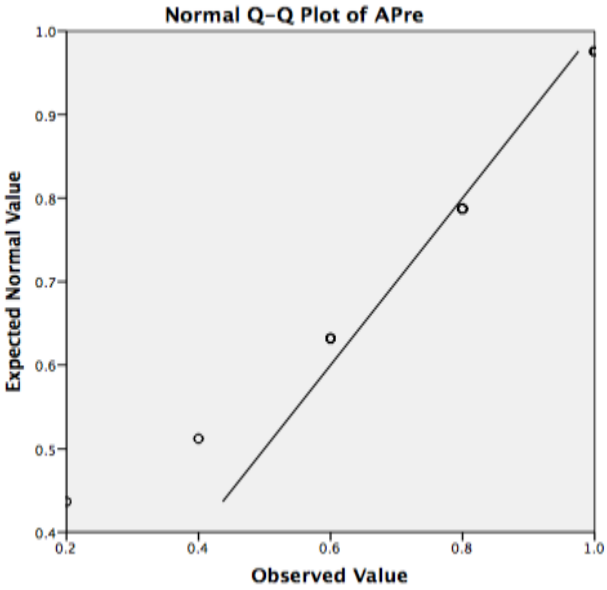


Figure 6. *Normality Q-Q Plot for Post Attitudes*

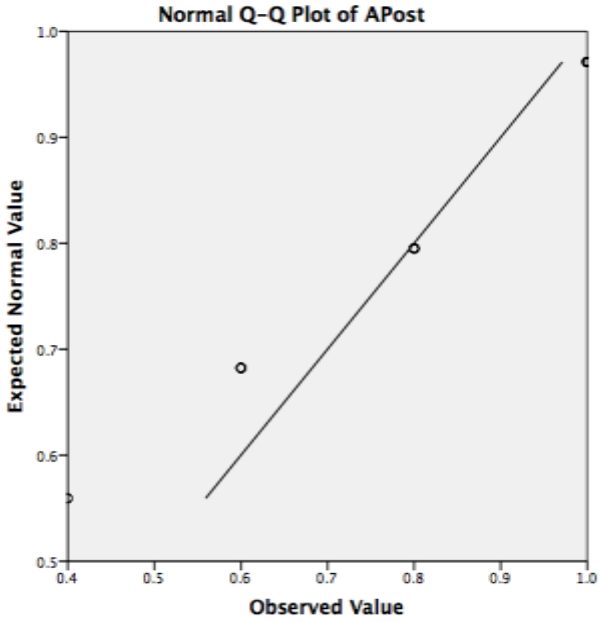


Figure 7. *Normality Q-Q Plot for Pre Knowledge*

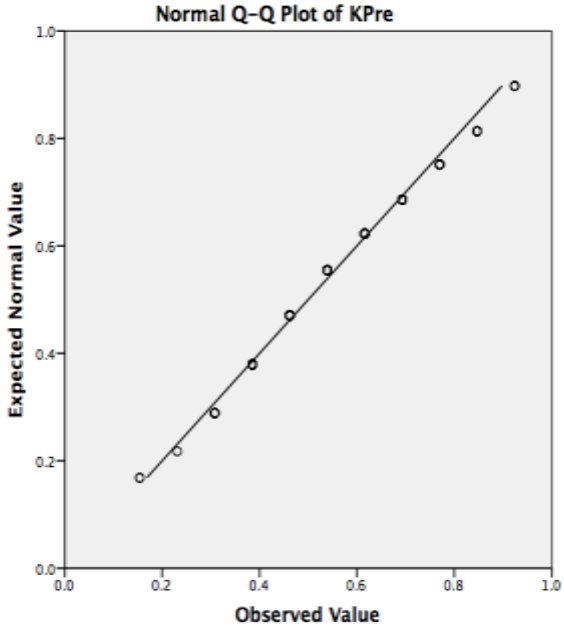
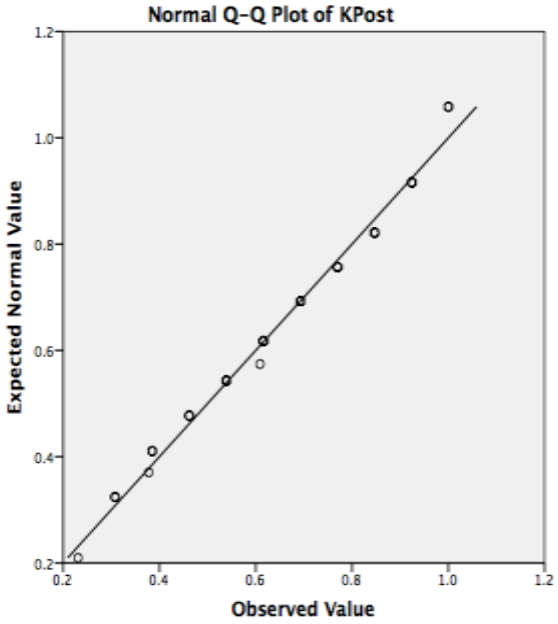


Figure 8. *Normality Q-Q Plot for Post Knowledge*



Homogeneity of covariance assumption. The variance-covariance matrices suggest the group variances and covariances are similar for pre and post data (see Figure 9); therefore, the assumption of homogeneity of covariance is tenable. Any of the MANOVA tests could be used in this case: Pillai-Bartlett trace, Hotelling's Ts, Wilk's Lambda, or Roy's largest root. The latter test is not robust when the homogeneity of covariance assumption is not tenable. The Pillai-Bartlett trace is chosen in this study for the normality reasons mentioned above.

Figure 9. *Variance and Covariance Matrix to Test for Homogeneity Assumption*

Residual SSCP Matrix

		APre	APost	KPre	KPost
Sum-of-Squares and Cross-Products	APre	.267	.033	.033	.103
	APost	.033	.247	.175	.098
	KPre	.033	.175	.518	.274
	KPost	.103	.098	.274	.576
Covariance	APre	.012	.001	.001	.004
	APost	.001	.011	.008	.004
	KPre	.001	.008	.023	.012
	KPost	.004	.004	.012	.025
Correlation	APre	1.000	.130	.090	.262
	APost	.130	1.000	.488	.259
	KPre	.090	.488	1.000	.501
	KPost	.262	.259	.501	1.000

Based on Type III Sum of Squares

Ordinal logistic regression. Ordinal logistic regression is used to predict an ordinal dependent variable given one or more independent variables. Similar to other regression types, ordinal logistic regression can also account for interactions between independent variables to predict the dependent variable. Four ordinal logistic regressions are carried out for the following practices: drinking water every day, eating fruits and vegetables every day, eating healthy foods every day, and physical activity every day. Each practice item can be answered in three different ways: yes, no, or I don't know. The answers for all practices are answered in an ordinal manner; the answer yes is best, the answer I don't know is worse than yes but potentially better than no, and no is the worst answer.

In linear regression, the multiple correlation coefficient R and the corresponding R^2 are used to measure how well the model fits the data and to report variance explained by models. In

logistic regression, a pseudo R^2 value called the Cox and Snell's R^2 is used; this value is based on the log likelihood of the model and the log likelihood of the original model. However, this statistic never reaches the theoretical value of 1; therefore, Nagelkerke made a modification to Cox and Snell's formula to behave like a linear regression. Both values can be used as analogs to the R^2 in linear regression. The interpretation is not the same for the pseudo R^2 values but they can be interpreted as an approximate variance in the outcome accounted for by the strength of association. Pseudo R^2 values are 0 when the predictor variable does not predict the outcome variable and 1 when the predictor variable predicts the outcome variable perfectly (Field, 2009). The Nagelkerke R^2 values are used in this study to report variance in physical activity and healthy eating explained by the Information-Motivation-Behavioral Skills Model.

In addition, ordinal logistic regression is used in this study to assess the overall fit of the models for healthy eating and physical activity. The SPSS output of the model fitting information includes an intercept value that describes a model without predictor variables to control the model; it fits an intercept to predict the outcome variable. The final value includes selected predictor variables; this value is obtained by an iterative process, which maximizes the log likelihood of the outcomes. The improvement can be seen by subtracting the -2 Log likelihood values of the intercept and final models. An insignificant value for the goodness of fit test indicates the model fit is good (Field, 2009; Institute for Digital Research and Education, 2016).

Assumptions of logistic ordinal regression.

Independence of errors is one of the assumptions for logistic regression. This regression uses 1-year follow up data only. The cases of data are not related; pre and post data are excluded

from this test. Data do not display overdispersion; assumption is tenable. Multicollinearity and proportional odds assumptions can be examined with statistical tests:

Testing for multicollinearity. Tolerance and VIF statistics can be used to test for multicollinearity. Tolerance values less than .01 and VIF values greater than 10 indicate severe collinearity problems. This study uses the 1-year follow-up data to conduct the ordinal logistic regression. Tests indicate no collinearity (see Figures 10 and 11); for attitudes, VIF=1 and tolerance = 1, and for knowledge, VIF = 1 and tolerance = 1.

Figure 10. *Collinearity Test for 1-Year Follow-up Knowledge*

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	ATotal1yr	1.000	1.000

a. Dependent Variable: K1yrTotal

Figure 11. *Collinearity Test for 1-Year Follow-up Attitudes*

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	K1yrTotal	1.000	1.000

a. Dependent Variable: ATotal1yr

Testing for proportional odds. The proportional odds can be verified by conducting a test of parallel lines, which is provided by SPSS output. This test must be insignificant for the assumption of proportional odds to be tenable (see Table 7).

Table 7. *Test of Parallel Lines to Examine Proportional Odds*

Model	-2 Log Likelihood	Chi-square	df	Significance
Null hypothesis (exercise)	18.913			
General (exercise)	15.612	3.300*	7	.856
Null hypothesis (Fruits&veggies)	41.531			
General (Fruits&veggies)	27.080	14.451*	9	.107
Null hypothesis (water)	27.735			
General (water)	18.723	9.012*	9	.436
Null hypothesis (healthy foods)	34.656			
General (healthy foods)	37.368	A	9	**a**

* When there are too many parameters to be considered, the validity of the Chi-Square statistic may be uncertain.
a The log likelihood value of the general model is smaller than the value of the null model; therefore, test of parallel lines cannot be performed.

Limitations

Generalizability is limited if cause-effect relationships can only be found when pretests and posttests are carried out. A pretest-posttest design without a control group is vulnerable to many threats to validity. The findings might not apply to other regions of the nation; this project was carried out in Virginia Beach. The situation (time, location, and study staff) of a study could affect the results. The instrument survey was not balanced, seven of the questions assessed knowledge, four assessed practices, and two assessed attitudes.

CHAPTER IV

RESULTS

In this chapter, findings of the data analyses are presented. The study population included children who completed pre (n=172), post (n=170), and 1-year (n=32) evaluation questionnaires about knowledge and attitudes related to healthy eating and physical activity. Findings included demographic characteristics of the participating children and demographic characteristics of the parents as well.

Demographic and Descriptive Analysis

Children who answered pre, post, and 1-year surveys items correctly are shown in Table 10. The proportion of boys and girls was similar (~ 54% and 46%, respectively). The average number of children per grade was 28 with a standard deviation (SD) of 9. Only about 5% of the children were in the Kindergarten group (see Table 8). The majority of students (~78%) attended all four sessions of Let's Move. The majority (69%) of the responding parents were mothers, 21% were fathers, and 10% were other type of guardians such as grandparents or siblings. Over half of the parents (50%) were married. Most of the parents obtained some college education (43.33%). The majority of the parent participants were white (51.33%) and between 35 and 44 years old (38.87%) (see Table 9).

The 1-year follow-up evaluation included 32 children who completed pre, post, and 1-year assessment of knowledge and attitudes about healthy eating and physical activities. In addition, children reported their practices about physical activity and healthy eating. There were 20 females and 12 males. The majority of children were in fourth grade (31.25%), followed by second grade (25%), first grade (21.88%), third grade (18.75%), and fifth grade (3.13%). There were no children in kindergarten in the 1-year follow-up group (see Table 8). Most of the parents

for the 1-year follow-up evaluation were white and black (~ 45% and 32%, respectively). About 6.45% of the parents had a masters' degree or above, 39% had some college education, ~ 26% had a bachelors' degree, ~ 16% had completed high school, 3% of the parents did not complete high school. Individuals who did not want to report their education level accounted for 10% of the parents. The majority of parents were married (58%) and between the ages of 24-44 (71%) (see Table 9).

Table 8. *Demographics of Children Who Completed Pre (n=172), Post (n=170), and 1-Year Evaluations (n=32)*

Characteristic	Respondent Children	Pre n (%)	Post n (%)	1-Year n (%)
Gender	Females	79 (45.93)	78 (45.88)	20 (62.50)
	Males	93 (54.07)	92 (54.12)	12 (37.50)
Grade	Kindergarten	8 (4.65)	8 (4.71)	0
	1st	33 (19.19)	33 (19.41)	7 (21.88)
	2nd	31 (18.02)	29 (17.06)	8 (25.00)
	3rd	37 (21.51)	37 (21.76)	6 (18.75)
	4th	31 (18.02)	31 (18.24)	10 (31.25)
	5th	32 (18.60)	32 (18.82)	1 (3.13)

Table 9. *Demographics of Parents/Guardians of Children Who Completed Pre/Post (n=150), and 1-Year Evaluations (n=31)*

Characteristics	Respondent Parents	Pre-Post n (%)	1-Year n (%)
Gender	Males	33 (22.00)	7 (22.58)
	Females	116 (77.33)	24 (77.42)
	Prefer not to answer	1 (0.67)	0
Education	Some high school	2 (1.33)	1 (3.23)
	High school	16 (10.67)	5 (16.13)
	Some college	65 (43.33)	12 (38.71)
	Bachelor	45 (30.00)	8 (25.80)
	Masters or above	17 (11.33)	2 (6.45)
	Prefer not to answer	5 (3.33)	3 (9.68)

Table 9. Continued			
Characteristics	Respondent Parents	Pre-Post n (%)	1-Year n (%)
Ethnicity/Race	White	77 (51.33)	14 (45.16)
	Black/ African American	47 (31.33)	10 (32.26)
	Hispanic/Latino	5 (3.33)	0
	Asian/Pacific Islander	5 (3.33)	1 (3.23)
	Other	9 (6.00)	3 (9.68)
	Prefer not to answer	7 (4.67)	3 (9.68)
Marital Status	Married/living with partner	84 (56.00)	20 (64.52)
	Divorced/single/separated/widowed	55 (36.67)	8 (25.8)
	Prefer not to answer	11 (7.33)	3 (9.68)
Age Group	34 years and younger	56 (37.33)	13 (41.94)
	35-44 years	58 (38.67)	9 (29.03)
	45-54 years	18 (12.00)	4 (12.90)
	55 years and older	12 (8.00)	0
	Prefer not to answer	6 (4.00)	5 (16.13)

Table 10. *Percentage of Children Participants Who Answered Pre, Post, and 1-Year Survey Questions Correctly*

Behavior Assessed	Survey Question	Pre % n= 172	Post % n= 170	1-Year % n= 32
Attitude	**Which drink would you pick for a snack?** **A**. White low fat milk **B.** Chocolate or strawberry milk **C.** Water **D.** Juice with no added sugars **E**. Other drinks **F.** I don't know	65.29	84.71	78.81
Practice	**Do you drink water every day?** **A.** Yes **B.** No **C.** I don't know.	Collected Qualitatively (Geraghty, 2014)	Collected Qualitatively (Geraghty, 2014)	81.25
Knowledge	**Which one has more sugar?** **A.** A glass of white milk **B.** A glass of water **C.** A glass of soda **D.** I don't know	51.76	53.53	100

Table 10. Continued

Behavior Assessed	Survey Question	Pre % n= 172	Post % n= 170	1-Year % n= 32
Practice	**Do you eat fruits and vegetables every day?** **A.** Yes **B.** No **C.** I don't know	Collected Qualitatively (Geraghty, 2014)	Collected Qualitatively (Geraghty, 2014)	65.63
Knowledge	**Circle the one you think is better for your body (pictures used)** Orange or Ice Cream	96.47	94.12	96.88
Knowledge	**Circle the one you think is better for your body (pictures used)** Cookies or Bananas	94.71	96.47	100
Knowledge	**Circle the one you think is better for your body (pictures used)** Baked Chicken or Chicken Nuggets	63.53	82.94	84.34
Knowledge	**Circle the one you think is better for your body (pictures used)** White Bread or Brown Whole Wheat Bread	57.06	78.82	68.75
Knowledge	**Circle the one you think is better for your body (pictures used)** Corn or Chips	93.53	94.12	100
Knowledge	**Which of the following vitamins help you to heal cuts and wounds?** **A.** Vitamin A **B**. Vitamin B **C.** Vitamin C **D.** Vitamin E **E.** I don't know.	6.47	52.94	34.38
Knowledge	**Which one is a whole grain?** **A.** White rice **B.** Brown rice **C.** Baked potato **D.** I don't know	29.41	65.29	40.63
Knowledge	**Which one is a dairy product?** **A.** Chicken **B**. Apple **C.** A glass of milk **D**. I don't know	73.53	78.82	87.50

Table 10. Continued

Behavior Assessed	Survey Question	Pre % n= 172	Post % n= 170	1-Year % n= 32
Knowledge	**11. How much of your plate should be a protein? (Pictures and text used here)** **A**. One half (1/2) **B.** Three quarters (3/4) **C.** <u>One quarter (1/4)</u> **D**. I don't know	29.41	44.12	59.38
Practice	**12. Do you eat foods that are good for your body every day?** **A.** <u>Yes</u> **B.** No **C.** I don't know	Collected Qualitatively (Geraghty, 2014)	Collected Qualitatively (Geraghty, 2014)	65.63
Knowledge	**13. How much of your plate should be fruits and vegetables? (Pictures and text used here)** **A**. <u>One half (1/2)</u> **B.** Three quarters (3/4) **C.** One quarter (1/4) **D**. I don't know	32.35	39.41	34.38
Practice	**Do you exercise every day? (for example: running, gymnastics, or rope jumping)?** **A.** <u>Yes</u> **B.** No **C.** I don't know	Collected Qualitatively (Geraghty, 2014)	Collected Qualitatively (Geraghty, 2014)	84.38
Knowledge	**15. How long do you think you should exercise every day (for example: riding a bike, swimming, or playing tag)?** **A.** Never **B.** 30 minutes every day **C.** <u>60 minutes every day</u> **D**. I don't know	48.24	67.65	43.75
Attitude	**16. Which one is more fun?** **A.** Watching TV or playing video games. **B.** <u>Doing sports like: soccer, running, swimming, baseball, or riding a bike</u>. **C**. I don't enjoy either	73.53	80.59	87.50

Table 10. Continued
* Underlined answers are correct.

Research Questions and Testing of Hypotheses

Research Question 1: To What Extent Constructs of the Information-Motivation-Behavioral Skills Model (IMB) Explain Behavioral Change Related to Healthy Eating and Physical Activity?

Hypothesis 1a: IMB variables will be most influential in the improvement of attitudes and knowledge compared to demographic variables.

Table 11. *Children's Pre, Post, and 1-Year Survey High Score Frequencies According to Parents' Demographic Characteristics*

Characteristics		Pre Test High Score (n=150)	Post Test High Score (n=150)	1-Year High Score (n=31)
Gender	Females	78	102	21
	Males	15	28	6
	X^2 and p	X^2=5.20 p=0.02*	X^2=0.22 P > 0.05	X^2=0.02 P > 0.05
Education	Bachelor & higher	45	52	9
	Some college & lower	46	74	16
	X^2 and p	X^2=4.47 p=0.03*	X^2=0.87 P > 0.05	X^2=0.01 P > 0.05
Marital Status	Married/ Partner	53	73	19
	Not married	33	46	5
	X^2 and p	X^2=0.14 P > 0.05	X^2=0.29 P > 0.05	X^2=4.93 p=0.03*
Race/Ethnicity	White	46	71	12
	Black	30	38	10
	Other	13	16	2
	X^2 and p	X^2=0.56 P > 0.05	X^2=3.63 P > 0.05	X^2=2.89 P > 0.05

Table 11. Continued				
Characteristics		Pre Test High Score (n=150)	Post Test High Score (n=150)	1-Year High Score (n=31)
Age Group	34 & younger	35	47	12
	35-44	39	50	9
	45 & older	16	28	3
	X^2 and p	X^2=1.63 p > 0.05	X^2=1.54 p > 0.05	X^2=2.44 p > 0.05
*Statistically significant at p < 0.05				

Chi-square tests are used to provide descriptive statistics for pre, post, and 1-year assessments according to parents' demographic characteristics (see Table 11) and children's demographic characteristics (see Table 12). For the parents, the demographic characteristics include gender, education, marital status, race/ethnicity, and age group. Demographic characteristics for the children include grade and gender. Scores are considered high if they were above the baseline/pre median (54%). The variable attendance frequency is not used here since it does not meet the Chi-square assumption that expected frequencies should be higher than 5.

Table 12. *Children's Pre, Post, and 1-Year Survey High Score Frequencies According to Children's Demographic Characteristics 1-Year (n = 32)*

Characteristics		Pre Test High Score (n =172)	Post Test High Score (n = 170)	1-Year High Score (n = 32)
Gender	Females	55	72	19
	Males	50	75	9
	X^2 and p	X^2 =4.67 p=0.03*	X^2 = 4.20 p=0.04*	X^2 = 2.74 p > 0.05

Table 12. Continued				
Characteristics		Pre Test High Score (n =172)	Post Test High Score (n = 170)	1-Year High Score (n = 32)
Grade	K & 1st	24	33	7
	2nd and 3rd	41	59	12
	4th and 5th	40	55	9
	X^2 and p	X^2 = .39 p > 0.05	X^2 =1.66 p > 0.05	X^2 =1.37 p > 0.05
* Statistically significant at p < 0.05				

Repeated measures MANOVA's Pillai's trace indicate the effect of the afterschool program was significant for attitudes ($V = 0.91$, F (1, 23) = 225.20, $p < 0.05$) and knowledge ($V = 0.79$, F (1, 23) = 86.62, $p < 0.05$). The independent variable attendance had a significant effect on the improvement of attitudes from pre to post test ($V = .32$, F (3, 23) = 3.64, $p < 0.05$). The dependent variable attitude significantly interacted with the dependent variable knowledge in the improvement of scores from pre to post test ($V = 0.17$, F (1, 23) = 4.64, $p < 0.05$).

The independent variables marital status, race/ethnicity of the parents, parents' age, educational level of the parents, and gender of parents, did not significantly influence changes in attitudes or knowledge from pre to post evaluations when considered separately. However, interactions occurred among some independent variables to produce significant changes in attitudes and knowledge from pre to post assessments (see Table 13).

Table 13. *Significant Effects of Interacting Independent Variables*

Interaction	Pillai's Trace (*V*)	*F* Test	P
Grade of children X education of parents	.41	F (6, 23) = 2.63	< 0.05
Marital status X education of parents	.48	F (3, 23) = 6.97	< 0.05
Marital status X grade of children	.36	F (4, 23) = 3.30	< 0.05
Race/ethnicity of parents X gender of children	.28	F (1, 23) = 8.79	< 0.05

Separate univariate ANOVAs on the outcome variables suggest grade had a significant effect on attitudes (F (5, 23) =5.57, $p < 0.05$) and knowledge (F (5, 23) = 3.48, $p < 0.05$). Gender had a significant effect on attitudes (F (1, 23) = 12.96, $p < 0.05$) and knowledge (F (1, 23) = 7.14, $p < 0.05$). Educational level (F (3, 23) = 3.91, $p < 0.05$) and marital status (F (5, 23) = 3.51, $p < 0.05$) had a significant effect on attitudes. Attendance significantly affected knowledge (F (1, 23) = 9.05, $p < 0.05$) and attitudes (F (1, 23) = 11.19, $p < 0.05$).

Hypothesis 1b: The IMB will explain a substantial amount of variance in healthy eating and physical activity, greater than or equal to what is reported in the literature.

Hypothesis 1b is answered by using an ordinal logistic regression statistical analysis. Ordinal regression models are constructed based on the independent variables that were significant at the MANOVA level for both attitudes and knowledge: gender, grade, and attendance. Four ordinal regressions are used to predict four healthy practices: eating healthy every day, eating fruits and vegetables every day, drinking water every day, and physical activity every day. The model fitting information and goodness of fit of the model for every practice dependent variable are provided by SPSS output of the ordinal regression. The model fitting information output includes an intercept value that describes a model with no predictor variables to control the model; it fits

an intercept to predict the outcome variable. The final value includes selected predictor variables. In this study, all four final models were improved compared to the intercept model. However, only the models for eating healthy and physical activity were significantly improved at $p < 0.05$ (see Table 13). The overall fit of the four healthy practices models is good when using an IMB-based intervention and the independent variables gender of children, grade of children, and attendance rate (see Table 14).

Variance in physical activity and healthy eating explained by the Information-Motivation-Behavioral Skills Model is reported by using the Nagelkerke R^2 from the ordinal logistic regression analysis. In addition, a comparison is made of the variance in physical activity and healthy eating explained by other theoretical models as shown in Table 16.

Table 14. *Model Fitting Information for Eating Healthy Foods, Eating Fruits & Vegetables, Physical Activity, and Drinking Water*

Model		-2 Log Likelihood	Chi-Square	df	Significance
Healthy Eating	Intercept Final	52.69 34.66	18.03	9	.04
F&V	Intercept Final	54.07 41.53	12.54	9	.18
Physical activity	Intercept Final	34.47 18.91	15.56	7	.03
Water	Intercept Final	36.29 27.74	8.56	9	.48
F&V: fruits and vegetables					

Table 15. *Goodness of Fit for the Models Eating Healthy Foods, Eating Fruits & Vegetables, Physical Activity, and Drinking Water*

Model		Chi-Square	Df	Significance
Healthy Eating	Pearson Deviance	61.73 33.27	49 49	.11 .96
F&V	Pearson Deviance	49.40 41.53	49 49	.46 .77
Physical Activity	Pearson Deviance	29.17 18.91	51 51	.99 1
Water	Pearson Deviance	39.39 27.74	49 49	.84 .99
F&V: fruits and vegetables				

Table 16. *Variance Explained by the Information-Motivation-Behavioral Skills Model (IMB) and Other Theoretical Frameworks*

Model	Variance explained by IMB in this study	Variance explained by other theoretical models
Healthy Eating	53%	13-34%
Physical Activity	58%	8-58%
F&V	40%	10-31%
Water	35%	N/A*
*N/A = Not applicable, not found in the literature		

Hypothesis 1c: those who acquire more knowledge, are well motivated, and acquire behavioral skills will be more likely to engage in physical activity and healthy eating compared to those who are less motivated or less knowledgeable.

The odds ratio values obtained from the ordinal logistic regression analysis are used in this study to test hypothesis 1c. Models are built according to survey questions about healthy

practices. Survey included a broad question about eating healthy foods every day and a narrow question about eating fruits and vegetables every day. The broad question about eating healthy foods every day is meant to encompass the selection of healthier choices within food groups, eating whole grains, eating proper portions of foods, and choosing drinks lower in sugar content.

A) Eating Healthy Foods Every Day

An increase in knowledge (expressed in percentages) was associated with an increase in the odds of eating healthy, with an odds ratio of 2.52 (95% CI, 1.22 to 3.06), Wald $\chi^2(1) = 7.29$, $p < 0.05$.

B) Eating Fruits and Vegetables Every Day

An increase in knowledge (expressed in percentages) was associated with an increase in the odds of eating fruits and vegetables, with an odds ratio of 2.06 (95% CI, -0.01 to 2.69), Wald, $\chi^2(1) = 5.04$, a strong but insignificant effect.

C) Exercising Every Day

An increase in knowledge (expressed in percentages) was associated with an increase in the odds of performing physical activity, with an odds ratio of 2.45 (95% CI, -0.97 to 3.12), Wald $\chi^2(1) = 4.11$, a strong but insignificant effect.

D) Drinking Water Every Day

The model for drinking water every day with the variables gender, grade, and attendance, did not significantly influence the practice of drinking water every day.

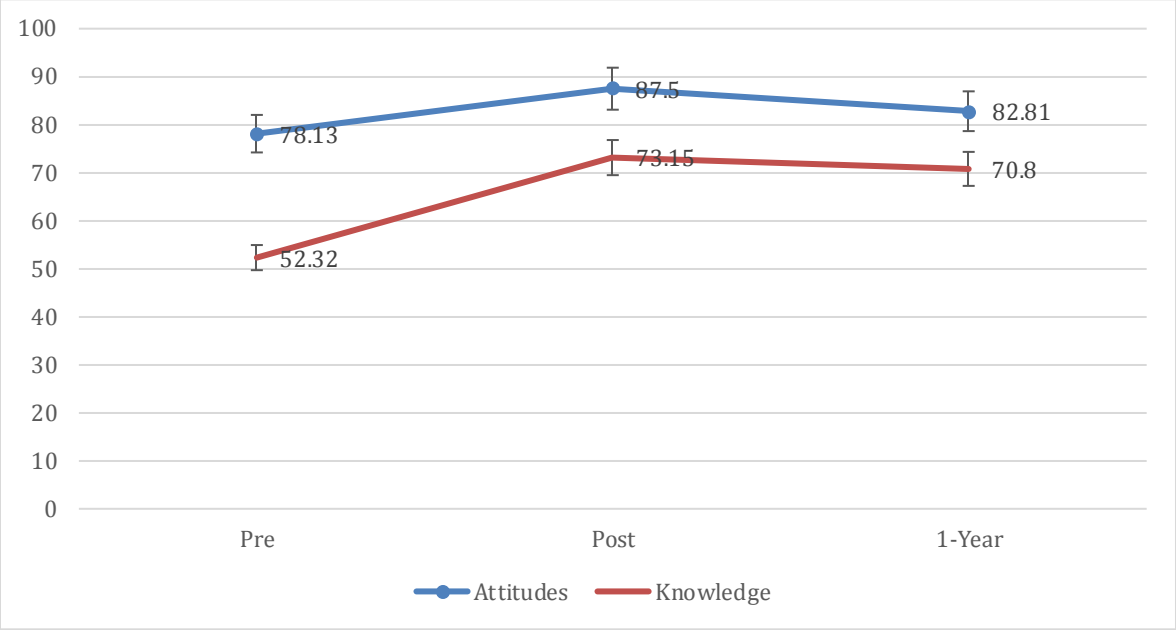
Research Question 2: Are the Dependent Variables Attitudes and Knowledge Sustainable at the One-year Follow-up?

Hypothesis 2: attitudes and knowledge will be sustained or improved at the one-year follow-up.

Children's attitudes are used to measure their motivation level. According to repeated measures MANOVA, the effect of intervention on attitudes and knowledge remained significant at the 1-year follow up; for attitudes ($V = 0.34$, F (1, 31) = 15.83, $p < 0.05$) and knowledge ($V = 0.20$, F (1, 31) = 7.67, $p < 0.05$). The interaction between pre and 1-year attitudes with pre and 1-year knowledge was significant ($V = 0.12$, F (1, 31) = 4.31, $p < 0.05$).

Even though knowledge and attitudes remained significant at the 1-year assessment, a small decline was observed for both knowledge and attitudes (see Figure 12).

Figure 12. *Changes in Knowledge and Attitude Over One Year, n=32**



* Error bars represent confidence intervals.

CHAPTER V

DISCUSSION AND CONCLUSION

Overview

Afterschool health promotion programs are outlets to help reduce and prevent childhood obesity. Systematic reviews and meta-analyses suggest afterschool programs with wider health promotion seem to be more effective in changing health-related behaviors and reducing body mass index (BMI) of children. Wider health promotion includes nutrition, physical activity, parent and stakeholder engagement, and psychological components (Gonzales-Suarez, Worley, and Grimmer-Somers, 2009; Williams et al, 2013). Furthermore, studies suggest health promotion programs based on a theoretical framework are more effective and sustainable (Brug, Oenema, and Ferreira, 2005; Glanz, Rimer, and Viswanath, 2009). The variation of obesity prevention afterschool programs is immense; some are based on theoretical frameworks while others are not (Branscum & Sharma, 2012; Gonzales-Suarez, Worley, and Grimmer-Somers, 2009; Williams et al, 2013). Different theoretical frameworks are used for obesity prevention afterschool programs; the most widely used theory is the Social Cognitive Theory (SCT). The afterschool obesity prevention programs based on the SCT are not standardized; some use the construct self-efficacy only while others use various constructs belonging to the SCT. The same can be said of obesity prevention afterschool programs based on the Theory of Planned Behavior, Transtheoretical Model, Health Belief Model, Health Promotion Model, Protection Motivation Theory, etc. In addition to using a great variation of theoretical constructs, outcomes measures are reported in a variety of ways; for example, some programs report physical activity for 30 minutes and others for 60 minutes. Some programs focus only on the consumption of fruits and vegetables while others use a wider nutrition program. Since childhood obesity

continues to be a major national health problem, efforts should be made to refine current programs for greater effectiveness.

The complexity and comprehensiveness of the Social Cognitive Theory, Theory of Planned Behavior, and/or the theories are barriers for the implementation of obesity prevention afterschool programs (Branscum & Sharma, 2012; Zhang, 2005). These theories cannot be easily translated into afterschool programs; a potential solution to overcome this problem is to explore a theoretical model, which has been assessed for translation feasibility and that is empirically supported.

The Information-Motivation-Behavioral Skills (IMB) Model is a promising theoretical framework to shape obesity prevention afterschool programs. This model was specifically designed to be easily translated into health promotion programs (Fisher, Fisher & Harman, 2003). There is empirical evidence suggesting this model is effective for preventing and reducing obesity in adolescents and adults (Amico, 2011; Chang et al, 2014; Kelly, Melnyk, and Belyea, 2012; Osborn, et al., 2010). According to this model, complex behaviors require individuals to be well-informed, well-motivated, and have the necessary objective and perceived skills to engage in the complex behaviors (Fisher, Fisher & Harman, 2003).

In this study, secondary data from the health promotion program VB Let's Move was used to test the utility of the IMB model as a framework for afterschool obesity prevention health programs. The curriculum for the Let's Move afterschool program in Virginia Beach was originally developed by the Virginia Beach Public Health Department in partnership with Virginia Beach Parks and Recreation in response to the Mayor's call to support First Lady Obama's quest for a healthier America. Later on, the Center for Global Health at Old Dominion

University joined the partnership for evaluation and modification of the Let's Move curriculum based on current & accurate guidelines, and a theoretical framework (Geraghty, 2014).

Discussion and Conclusions for Tested Hypotheses

Hypothesis 1A: IMB Variables Will Be Most Influential in the Improvement of Attitudes and Knowledge Compared to Demographic Variables.

Hypothesis 1a is supported by this study. Overall, the frequency of high scores increased from pre to post/1-year similarly across children of parents from different demographic groups. Improvements of attitudes and knowledge were mainly influenced by the obesity prevention intervention based on the IMB Model. This study suggests an IMB-based obesity prevention program is beneficial to children across different demographic characteristics.

According to this study, children's gender, grade, and attendance rate significantly influenced attitudes and knowledge. Overall, girls had better attitudes about healthy practices compared to boys. A greater proportion of girls consumed fruits and vegetables compared to boys. However, a greater proportion of boys ate general healthy foods. Girls were marginally more active than boys. Approximately the same proportion of boys and girls drank water every day. Second grade children were the most inactive and consumed the least amounts of healthy foods, fruits and vegetables, and water. Boys and girls increased knowledge similarly after the intervention. Children from the kindergarten group did not improve their knowledge; however, only five children represented the kindergarten group from pre to post assessments. There were not any children from kindergarten in the 1-year follow-up assessment. The majority of children attended all four sessions of the intervention, these children learned more and had better attitudes compared to children who attended three or less sessions of the intervention.

Other studies suggest gender and grade affect physical activity and healthy eating

practices among children. For example, girls tend to select healthier foods compared to boys (Parcel et al, 1995) and boys are more active than girls (Plotnikoff et al, 201; Ramirez, Kulinna, Cothran, 2012). Health promotion programs targeting physical activity attractiveness are effective for girls but not for boys (Salmon, Brown, & Hume, 2009). Third graders are more likely to eat healthier foods compared to fourth graders (Parcel et al, 1995). While these studies indicate there are differences in healthy behaviors among boys and girls; consensus has not been reached regarding whether it is the boys or the girls who have healthier behaviors. There may be underlying factors affecting the healthy practices of boys and girls. For example, boys and girls who have siblings may be more active compared to boys and girls who don't have siblings. Similarly, there is no consensus about healthy practices according to grade level of children. Future studies should explore potential underlying factors affecting healthy practices among children.

Parents' demographic characteristics, which interacted to significantly influence attitudes and knowledge are: 1) marital status and educational level of the parents, 2) grade of the children and educational level of the parents, 3) marital status of parents and grade of the children, and 4) race/ethnicity of the parents and gender of the children. Other studies have reported similar findings about the association of marital status, race/ethnicity, and education of the parents with children's obesity status. Obese children are more likely to live in single-parent families; nutritional and physical activity needs of children are less likely to be met in single-parent households due to stress, depression, and lower education (Gable and Lutz, 2000). Children who are black, children who live with single mothers, and children whose mothers did not complete high school, are more likely to be obese (Garcia-Rodriguez et al, 1999). Hispanic children are more likely to be obese compared to black and white children (Kimbro, Brooks-Gunn, and,

McLanahan, 2007). While this study doesn't support the direct influence of parent's demographic variables on knowledge, attitudes, or healthy practices, the interaction of these variables produced significant influential effects. Future studies exploring demographic variable interactions may benefit health promotion programs.

Attitude and knowledge improvement highlights. At baseline (pre-test), children (n=172) strongly recognized fruits and vegetables are beneficial to their bodies. As a group, 93.53% to 96.47% of children had correct answers for recognizing fruits and vegetables being healthier than cookies or other energy-dense foods. For all other areas of knowledge and attitudes about healthy eating and physical activity at baseline, 6.47% to 73.53% of the children answered the survey questions correctly. These findings suggest there are health efforts being made to inform children about the benefits of fruits and vegetables; these efforts could possibly originate from parents, the school system, or other programs. Afterschool health promotion efforts should coordinate with the school system in order to focus on nutrition and physical activity areas not met by programs during regular school hours. For example, for Virginia Beach afterschool programs, it may be beneficial to focus less on fruits and vegetables and more on teaching how to select healthier choices within food groups.

The post-test (n=170) results show positive attitudes were increased in over 80% of the children. The percentage of children who correctly answered the knowledge question about drinks with high sugar content only increased from 51.76% to 53.53% from pre to post assessment. Many of the children answered water has the most sugar. It is possible they circled water without reading the question thoroughly and possibly assumed the question was about the healthiest drink choice. Unlike the pre and post survey results, the 1-year follow-up assessment reports 100% of the children were able to identify soda as the drink with the most sugar content

instead of water or white milk. It is possible children read this survey question more carefully at the 1-year follow-up evaluation.

Knowledge about vitamins, whole grains, and healthier choices within food groups was increased significantly. The percentage of children who were knowledgeable about vitamins increased from 6.47% to 52.94%. The percentage of children who recognized baked chicken is healthier than chicken nuggets increased from 63.53% to 82.94%. The percentage of children who could identify a whole grain increased from 29.41% to 65.29%, and the percentage of children who recognized brown whole wheat bread is healthier than white bread increased from 57.06% to 78.82% from pre to post tests. These nutritional areas are important for preventing obesity. Some health promotion afterschool programs focus on the consumption of fruits and vegetables only (Lytle, et al, 2003; Parcel, et al, 1995). However, other nutritional areas are associated with obesity status. For example, individuals who consume white processed breads are more likely to be obese compared to individuals who consume whole grain breads. Diets high in fiber protect against weight gain; fiber reduces hunger by stimulating a satiety response. In addition, individuals who have diets with high energy density are more likely to be obese (Crino et al, 2015).

Hypothesis 1B: The IMB Will Explain a Substantial Amount of Variance in Healthy Eating and Physical Activity, Greater Than or Equal to What is Reported in the Literature.

The physical activity and healthy eating models were significantly better compared to the intercept model at $p < 0.05$. The variance in physical activity explained by the IMB model is comparable to the variance explained by the Self-Determination Theory in combination with the Theory of Planned Behavior (58% of variance explained) (Dewar, Plotnikoff, and Morgan, 2013). The Social Cognitive Theory has explained 2-52% of variance in physical activity

(Dewar, Plotnikoff, and Morgan, 2013; Ramirez, Kulinna, and Cothran, 2012). The Theory of Planned Behavior and other theories have explained 8-50% of the variance in physical activity (Martin, Oliver, and McCaughtry, 2007; Rhodes, Macdonald, and McKay, 2006). The model used in this study is competent and comparable to models explaining the most variance in physical activity. The IMB model may explain a larger amount of variance in physical activity when behavioral skills and parental motivation factors are accounted for. Future studies could benefit from the development of a measurement tool for every component of the IMB model.

The variance in healthy eating explained by the IMB model was 53%. Other models have explained 13-34% variance in healthy eating (Lubans, 2012). The fruits and vegetables, and the water consumption models were not significantly better compared to the intercept model. Variance in fruits and vegetables consumption was 40%; this result is higher than what is reported in the literature by the Social Cognitive Theory and the Theory of Planned Behavior (10-31%) (Lytle et al, 2003; Parcel et al, 1995). Variance in water consumption was 35%. The latter model could not be compared to other models; there is a lack of studies addressing water consumption behaviors among children. While the explained variance in consumption of fruits and vegetables, and healthy eating is higher compared to other models; caution is advised as other models used more in-depth questionnaires for children in third grade and above. Nevertheless, this study provides a foundation for explaining variance of healthy behaviors among children from kindergarten to fifth grades. These results support the hypothesis that the IMB explains a substantial amount of variance in healthy eating and physical activity, greater than or equal to what is reported in the literature.

The disparity of variances explained by the SCT and the TPB could be due to the great variability of construct utilization and program design. For example, some programs using the

SCT focus on perceived self-efficacy while others include knowledge and/or other components. A systematic review conducted by Plotnikoff, Costigan, and Lubans, 2013, included the theories Health Promotion Model, Theory of Planned Behavior, Protection Motivation Theory, Social Cognitive Theory, Health Belief Model, Self-Determination Theory, and the Transtheoretical Model. These theories explained an average of 33% of variance in physical activity; the highest variance was explained by the Self-Determination Theory and the lowest was explained by the Social Cognitive Theory (SCT). The great variability of program design and measuring tools limits the comparison of variance explained by theoretical frameworks. There is a need for valid and reliable standardized measuring tools for the evaluation of theoretical frameworks for the design of obesity prevention afterschool programs.

Overall, the variance explained in physical activity, consumption of fruits and vegetables, and general healthy eating practices is similar or higher compared to variance explained by other theoretical models. It is possible for future studies exploring the IMB model to explain a greater amount of variance in these healthy behaviors when the behavioral skills and parental motivational factors are included. In addition, the methodology used in this study limits the amount of variance that can be explained. In ordinal regression, the Cox & Snell's pseudo R^2 is used as an analog to the R^2 in linear regression. Nagelkerke modified Cox & Snell's pseudo R^2 formula to behave like a linear regression. Nagelkerke R^2 should not be interpreted in the same way as a linear regression R^2 but it is a relative measure that provides numerical relationships and may be used for comparisons of amount of variance that is explained by a model. A limitation of using Nagelkerke is it yields lower estimates compared to linear regression R^2 (Hu, Shao, and Palta, 2006; Smith and McKenna, 2013). Thus, variance explained by the IMB may be higher if linear regression models are used.

Hypothesis 1C: Those Who Acquire More Knowledge, are Well Motivated, and Acquire Behavioral Skills Will Be More Likely to Engage in Physical Activity and Healthy Eating Compared to Those Who are Less Motivated or Less Knowledgeable.

This study partially supports hypothesis 1c. Contrary to this hypothesis, an increase in knowledge but not attitudes (motivation), is associated with an increase in the odds of exercising every day, eating fruits and vegetables, and eating healthy foods. Only the effect for increased healthy eating is significant. The effect for increased consumption of fruits and vegetables, and water, is strong but insignificant. Strong but insignificant results may happen for three reasons: 1) there is a large standard error, 2) the sample size is small, or 3) there is no genuine difference between the two groups. Effect size is independent of sample size; however, statistical significance depends upon both sample size and effect size (Sullivan and Feinn, 2012). In this study, health practices reported at the 1-year follow-up assessment included only 32 children. The model for drinking water every day with the variables gender, grade, and attendance, did not significantly influence the practice of drinking water every day. Overall, these findings support the construct information measured by knowledge but does not support the construct motivation measured by the attitudes in influencing obesity preventive behaviors. A larger sample size is necessary to reinforce this study's findings about healthy practices.

The survey used in this study evaluated intrinsic motivation only. Parent engagement is associated with higher levels of extrinsic motivation for children and was addressed as part of the VB Let's Move intervention; however, the effect of parents in motivating the children was not evaluated in this study. In addition, the 1-year follow-up evaluation included 32 children only. It may be that a smaller sample was not sufficient to capture the relationship between the attitudes and the healthy behaviors. However, this study suggests there is significant relationship between

attitudes and knowledge in the improvement of scores from pre to post tests. It may be possible that attitudes alone are not sufficient to induce healthy behaviors but attitudes interact with knowledge for the effective adoption of healthy behaviors. According to the Information-Motivation-Behavioral Skills model (IMB), individuals must be well-informed, well-motivated, and possess the necessary skills to adopt a complex behavior such as physical activity and/or healthy eating. However, the IMB also postulates a particular construct of the IMB may be more important than others depending on unique characteristics of the target population (Fisher, Fisher, and Harman, 2003).

These results are consistent with other studies, which suggest knowledge levels about healthy foods are associated with obesity status in children (Triches and Giugliani, 2005) and adults (Klohe-Lehman et al, 2006). On the other hand, other studies suggest knowledge is not associated with obesity status but attitudes are (Deeb, et al, 2015; Thomas et al, 2001). Knowledge about the benefits of fruits and vegetables may not be sufficient to motivate the children to eat fruits and vegetables. In this study, children were very knowledgeable about the health benefits of fruits and vegetables at baseline before the intervention. It could be possible that children need to learn about the ill-effects of eating unhealthy foods in order to be more likely to consume fruits and vegetables. The VB Let's Move curriculum included lectures about the benefits of eating healthy foods and detrimental effects of eating unhealthy foods. This study suggests an increase in knowledge is associated with an increase in the odds of eating healthy, eating fruits and vegetables, and performing physical activity. Therefore, children may need to learn both the benefits of healthy behaviors along with the harmful effects of unhealthy behaviors. In addition, the Let's Move curriculum included a component about emotional well-being. A psychological component is essential to increase the adoption of healthy behaviors

(Williams et al, 2013). Studies reporting knowledge as not being important in changing behaviors may be missing a psychological component or information about harmful effects of unhealthy behaviors.

A potential explanation for the lack of support of attitudes as being influential in practicing healthy behaviors is the VB Let's Move questionnaire is not balanced. There are more knowledge questions compared to attitude questions. It may be possible that the effect of attitudes on practices was not captured by the VB Let's Move questionnaire. The primary study survey was not originally created to study the IMB model but for the evaluation of the VB Let's Move program. This survey was designed by the Center for Global Health at Old Dominion University and the Virginia Beach Public Health Department. Existing surveys were not used since they are not appropriate for children in kindergarten, first, or second grades. Most studies utilizing existing questionnaires about healthy eating and physical activity are used for children in third grade and/or higher grades. Furthermore, questionnaire was tailored to reflect the curriculum for the obesity prevention afterschool program VB Let's Move. Future researchers should consider modifying the survey to specifically study the IMB model. The survey length should be appropriate for children ages 5-11, yet capture all aspects of the IMB model. Let's Move survey results provide a limited foundation for the assessment of the IMB model. Future studies could use advanced data analysis methods such as structural equation modelling to examine in more detail the theoretical mediating effect of behavioral skills on healthy practices.

Another potential explanation for the lack of support for attitudes to influence practices in this study is children who have positive attitudes may not have accessibility to healthy foods at home or at nearby stores. Low-income level is often cited as being strongly related to obesity status. Energy-dense foods are inexpensive and convenient when there are barriers such as lack

of kitchen facilities, cooking skills, money, or time. More affluent families are more likely to buy whole grains, seafood, lean meats, low-fat milk, and fresh vegetables and fruits. Lower-income families often buy cereals, pasta, potatoes, legumes, and fatty meats. Fruits and vegetables consumed by lower-income families usually include iceberg lettuce, potatoes, canned corn, bananas, and frozen orange juice (Drewnowski and Eichelsdoerfer, 2010). It could be possible for low-income families to adopt a healthy nutritional low-cost diet. Diet optimization techniques that are sensitive to costs and social norms may help low-income families be able to identify "affordable, good tasting, nutrient-rich foods that are part of the mainstream American diet" (Drewnowski and Eichelsdoerfer, 2010, p. 246). Instructional materials about diet optimization techniques should be made available to families during obesity prevention interventions.

Children may be motivated to practice physical activity but may not have accessibility to parks in their neighborhoods. Lower-income neighborhoods often have limited access to safe places where they can be physically active. Mothers who perceive their neighborhoods to be unsafe do not allow their children to play outdoors. Some studies suggest black neighborhoods often lack access to public parks, pools, and green space; in addition, the sidewalks for these communities are 38 times more likely to be in poor condition (State of Obesity, 2014).

Behavioral skills are evaluated in a qualitative manner and reported elsewhere (Geraghty, 2014). One of the reasons for using an interactive discussion to obtain behavioral skills data during the primary study was the opportunity to provide feedback in order to correct misperceptions and to further build behavioral skills. For example, some children believed ice cream is healthy because it has calcium in it; healthier choices for the dairy group were advised. Children mentioned the types of new healthy foods they were eating. One child stated she tried a whole grain waffle but it was very dry. The instructor for the Let's Move program provided ideas

to make the whole grain waffle palatable; for example, by adding applesauce to the whole grain waffle (Geraghty, 2014).

Hypothesis 2: Attitudes and Knowledge Will Be Sustained or Improved at the One-Year Follow-Up.

Hypothesis 2 is supported in this study. Attitudes and knowledge were significantly higher at the 1-year follow-up compared to pre/baseline assessment results. However, a small decline can be observed for both knowledge and positive attitudes related to healthy eating and physical activity from post to 1-year assessments. To sustain obesity prevention behaviors over many years, children and parents may need reinforcing interventions. The 1-year follow-up evaluation included 32 children; the kindergarten group was not represented. Further research with a larger sample is necessary to verify sustainability of an IMB-based obesity prevention afterschool program for all children from kindergarten to fifth grades.

Overall Strengths and Limitations

Theories such as the Social Cognitive Theory and Theory of Planned Behavior are commonly used for obesity prevention afterschool programs. These theories are comprehensive and complex; therefore, afterschool programs do not address all elements within such theoretical frameworks (Branscum & Sharma, 2012; Zhang, 2005). The IMB Model is a theoretical framework designed specifically for easy translation into intervention programs (Fisher, Fisher & Harman, 2003). The IMB has been used to effectively increase physical activity and healthy eating behaviors in adolescents and adults (Amico, 2011; Chang et al, 2014; Kelly, Melnyk, and Belyea, 2012; Osborn, et al., 2010). However, the utility of the IMB has not been evaluated for children. This study provides a foundation for the usefulness of the IMB in improving attitudes and knowledge among elementary school children ages 5-11.

Even though there are many studies evaluating the effectiveness of obesity prevention afterschool programs; very few studies use a theoretical framework to explain variance in physical activity and healthy eating among children ages 5-11. Most studies explain variance in physical activity among third and fourth grade elementary school children and among adolescents. Questionnaires used to assess theoretical frameworks such as the Social Cognitive Theory and the Theory of Planned Behavior are appropriate for older children. This study explains variance in physical activity, healthy eating, consumption of fruits and vegetables, and consumption of water among children ages 5-11. Variance explained about water consumption behaviors among children is absent in the literature.

The use of secondary data limits the amount of support that can be provided for the IMB model in this study. Part of the data for the evaluation of the Let's Move afterschool program was collected in a qualitative format. Therefore, the theoretical mediating effects of behavioral skills on healthy practices could not be evaluated. The effects of parental engagement were not evaluated either. Sample for 1-year follow-up analysis was very small (n=32), limiting the generalizability of this study. Future studies should include a larger sample for long-term evaluations. Physical activity data was obtained via self-reports; devices such as pedometers and accelerometers were not used. Data obtained via self-report may be subject to social desirability bias. In addition, the primary study did not use a control group; therefore, causality cannot be claimed in this study.

Conclusions

Overall, this study's findings support the IMB model for significant and sustainable changes of the obesity-related behaviors motivation (measured by attitudes) and information (measured by knowledge). The independent variables grade, gender, and attendance rate,

significantly affected attitudes and knowledge levels. Overall, the odds of eating healthy, consuming fruits and vegetables, and physical activity increased with higher levels of knowledge. The effects of behavioral skills and parental engagement could be explored in future studies and results may further support the IMB model as an appropriate framework for afterschool obesity prevention programs in elementary schools.

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APPENDICES

APPENDIX A

PROGRESS TOWARD TARGET ATTAINMENT FOR FOCUS AREA 19: NUTRITION AND OVERWEIGHT.

LEGEND — Moved away from target[1] | Moved toward target | Met or exceeded target

	Objective	Percent of targeted change achieved[2] (0 25 50 75 100)	2010 Target	Baseline (Year)	Final (Year)	Baseline vs. Final: Difference[3]	Statistically Significant[4]	Percent Change[5]
19-1.	Healthy weight in adults (age adjusted, 20+ years)		60%	42% (1988–94)	31% (2005–08)	-11	Yes	-26.2%
19-2.	Obesity in adults (age adjusted, 20+ years)		15%	23% (1988–94)	34% (2005–08)	11	Yes	47.8%
19-3.	Obesity							
	a. Children 6–11 years		5%	11% (1988–94)	17% (2005–08)	6	Yes	54.5%
	b. Adolescents 12–19 years		5%	11% (1988–94)	18% (2005–08)	7	Yes	63.6%
	c. Children and adolescents 6–19 years		5%	11% (1988–94)	18% (2005–08)	7	Yes	63.6%
19-4.	Growth retardation in low-income children (<5 years)	0.0%	4%	6% (1997)	6% (2009)	0	Not tested	0.0%
19-5.	Fruit intake—At least two daily servings (age adjusted, 2+ years)	2.8%	75%	39% (1994–96)	40% (2003–04)	1	No	2.6%
19-6.	Vegetable intake—At least three daily servings with at least 1/3 dark green or orange (age adjusted, 2+ years)	0.0%	50%	4% (1994–96)	4% (2003–04)	0	No	0.0%
19-7.	Grain product intake—At least six daily servings with at least three being whole grains (age adjusted, 2+ years)		50%	4% (1994–96)	3% (2003–04)	-1	Yes	-25.0%
19-8.	Saturated fat intake—Less than 10% of caloric intake (age adjusted, 2+ years)		75%	36% (1994–96)	34% (2005–08)	-2	No	-5.6%
19-9.	Total fat intake—No more than 30% of caloric intake (age adjusted, 2+ years)		75%	33% (1994–96)	31% (2005–08)	-2	No	-6.1%
19-10.	Total sodium intake—No more than 2,400 mg daily (age adjusted, 2+ years)		65%	15% (1988–94)	13% (2003–04)	-2	No	-13.3%
19-11.	Total calcium intake—At or above recommended level (age adjusted, 2+ years)	25.6%	74%	31% (1988–94)	42% (2003–04)	11	Yes	35.5%
19-12.	Iron deficiency							
	a. Children 1–2 years	0.0%	5%	9% (1988–94)	9% (1999–2002)	0	No	0.0%
	b. Children 3–4 years		1%	4% (1988–94)	6% (2003–06)	2	No	50.0%
	c. Nonpregnant females 12–49 years		7%	11% (1988–94)	16% (2003–06)	5	Yes	45.5%

APPENDIX B

PROGRESS TOWARD TARGET ATTAINMENT FOR FOCUS AREA 22: PHYSICAL ACTIVITY AND FITNESS.

LEGEND — Moved away from target[1] | Moved toward target | Met or exceeded target

	Objective	Percent of targeted change achieved[2] (0 25 50 75 100)	2010 Target	Baseline (Year)	Final (Year)	Baseline vs. Final: Difference[3]	Statistically Significant[4]	Percent Change[5]
22-1.	No leisure-time physical activity (age adjusted, 18+ years)	20.0%	20%	40% (1997)	36% (2008)	-4	Yes	-10.0%
22-2.	Regular physical activity—Moderate or vigorous (age adjusted, 18+ years)	0.0%	50%	32% (1997)	32% (2008)	0	No	0.0%
22-3.	Regular physical activity—Vigorous (age adjusted, 18+ years)	14.3%	30%	23% (1997)	24% (2008)	1	No	4.3%
22-4.	Regular muscle-strengthening activity (age adjusted, 18+ years)	33.3%	30%	18% (1998)	22% (2008)	4	Yes	22.2%
22-5.	Flexibility training (age adjusted, 18+ years)	7.7%	43%	30% (1998)	31% (2001)	1	No	3.3%
22-6.	Moderate physical activity in students (grades 9–12)	25.0%	35%	27% (1999)	29% (2009)	2	No	7.4%
22-7.	Vigorous physical activity in students (grades 9–12)	15.0%	85%	65% (1999)	68% (2009)	3	No	4.6%
22-8a.	Physical education requirement in middle and junior high schools	50.0%	9.4%	6.4% (2000)	7.9% (2006)	1.5	No	23.4%
22-8b.	Physical education requirement in senior high schools		14.5%	5.8% (2000)	2.1% (2006)	-3.7	Yes	-63.8%
22-9.	Student participation in daily physical education in schools (grades 9–12)	19.0%	50%	29% (1999)	33% (2009)	4	No	13.8%
22-10.	Student physical activity in physical education class (grades 9–12)	25.0%	50%	38% (1999)	41% (2009)	3	No	7.9%
22-11.	Student television viewing—At most 2 hours per school day (grades 9–12)	55.6%	75%	57% (1999)	67% (2009)	10	Yes	17.5%
22-12.	Access to school physical activity facilities during nonschool time		50%	35% (2000)	29% (2006)	-6	No	-17.1%
22-14.	Walking for transportation							
	a. Adults—Trips ≤1 mile (age adjusted, 18+ years)	50.0%	25%	17% (1995)	21% (2001)	4	Yes	23.5%
	b. Children and adolescents—Trips to school ≤1 mile (5–15 years)	26.3%	50%	31% (1995)	36% (2001)	5	Yes	16.1%
22-15.	Bicycling for transportation							
	a. Adults—Trips ≤5 miles (age adjusted, 18+ years)		2.0%	0.6% (1995)	0.4% (2001)	-0.2	Yes	-33.3%
	b. Children and adolescents—Trips to school ≤2 miles (5–15 years)		5.0%	2.4% (1995)	1.5% (2001)	-0.9	No	-37.5%

APPENDIX C

PRE AND POST DATA SKEWNESS AND KURTOSIS.

Descriptive Statistics

				Bootstrap[a]			
						95% Confidence Interval	
		Statistic	Std. Error	Bias	Std. Error	Lower	Upper
APre	N	170		0	0	170	170
	Minimum	.2					
	Maximum	1.0					
	Mean	.852	.0129	.000	.013	.827	.876
	Std. Deviation	.1676		-.0011	.0120	.1436	.1905
	Skewness	-1.192	.186	.047	.233	-1.573	-.665
	Kurtosis	1.710	.370	-.205	.944	-.418	3.295
APost	N	170		0	0	170	170
	Minimum	.4					
	Maximum	1.0					
	Mean	.906	.0113	.000	.011	.884	.928
	Std. Deviation	.1478		-.0008	.0103	.1263	.1671
	Skewness	-1.481	.186	.014	.198	-1.889	-1.101
	Kurtosis	1.440	.370	-.040	.786	.061	3.160
KPre	N	170		0	0	170	170
	Minimum	.154					
	Maximum	.924					
	Mean	.55123	.011852	.00001	.01178	.52813	.57433
	Std. Deviation	.154536		-.000793	.008064	.138146	.169560
	Skewness	.259	.186	.003	.160	-.055	.576
	Kurtosis	-.097	.370	-.013	.258	-.583	.430
KPost	N	170		0	0	170	170
	Minimum	.231					
	Maximum	1.000					
	Mean	.67975	.013448	.00006	.01333	.65349	.70562
	Std. Deviation	.175345		-.000828	.007797	.159018	.189727
	Skewness	-.209	.186	.005	.118	-.433	.031
	Kurtosis	-.604	.370	.003	.182	-.918	-.211
Valid N (listwise)	N	170		0	0	170	170

a. Unless otherwise noted, bootstrap results are based on 10000 bootstrap samples

APPENDIX D

CURRICULUM FOR LET'S MOVE

Let's Move VB Nutrition and Fitness Class
Week 1 – Rethink Your Drink…*WATER* you waiting for?!?

CORE COMPETENCIES

Children should be able to demonstrate:

- Knowledge that drinks such as soda, juices, flavored fruit drinks and other beverages such as energy drinks, sports drinks and other similar drinks can include a large amount of sugar.
- Knowledge that too much sugar can have ill-effects for the body including
- Knowledge that water has health benefits including:
  - Helps cleanse your body and keep bodily functions moving which can help to keep you from getting sick
  - Brain Power!
  - Gives you increased energy and just makes you feel better!
- Knowledge of ways to increase water consumption such as
  - Mixing ½ juice with water and then slowly increase the amount of water and decrease the amount of juice.
  - Making fruit infused water. It's easy, tasty and fun to make!
  - Get a cool bottle to use just for your water!

LESSON RESOURCES:

- http://kidshealth.org/kid/nutrition/food/calorie.html
- http://www.superkidsnutrition.com/nutrition-articles/nutrition_answers/nutrition_weight/nw_whatisacalorie/
- http://www.choosemyplate.gov/preschoolers/daily-food-plans/about-empty-calories.html
- https://edis.ifas.ufl.edu/fy1358
- http://life.familyeducation.com/nutritional-information/obesity/64270.html#ixzz2IuP7dSxn
- http://kidshealth.org/kid/stay_healthy/food/water.html

SUPPLIES NEEDED (For up to 50 children)

- For Lesson
  - 1 Box of various empty bottles filled with corresponding amounts of sugar in the bottle
- For Relay Race (If up to 50 children)
  - Sugar cubes
  - 5 Cups
  - 10 plastic bowls
  - 5 drink card packets
- For Dancing
  - CD for dance music
- Take Home:
  - Water bottle for each child
  - Letter Home to parents

LESSON ***Note:*** *When conducting this class, just have a conversation with the children! Ask them questions to get them interested in the lesson topic.*	**TIME: Approximately 30 minutes**

Introduction (Approximately 5 minutes)

- Icebreaker Game: Introduce yourself and your favorite drink.

Sugary drink demonstration (Approximately 10-15 minutes)

- Some drinks contain a lot of sugar!
  - Mention the suggested daily amount of added sugar for children: * About 3 sugar cubes a day!!!
  - Talk about the sugar amounts in drink bottles while showing the children each drink
    - Can pass around bottles for children to look at
    - Can use actual bottles filled with sugar or pictures of drinks

Why should we watch how much sugar we drink? (Approximately 5 minutes)

- What is a calorie?
  - We get calories from food-it's what gives us energy. It's fuel for our bodies!
  - But some sugars have empty calories. Empty calories do not provide any vitamins or minerals for our body. So some drinks with added sugars can contain empty calories which causes us to consume more calories than our body needs. And if we don't have enough energy to burn the empty calories off quick enough
  - It can also cause us to have issues with our teeth like getting cavities

What is so good about drinking water? (Approximately 5 minutes)

- Water is over half of our body weight!
  - When we have enough water in our body-it's called being hydrated
  - When we sweat or even go to the bathroom-we lose water or else we become dehydrated-so we need to get back that water that we lost.
  - If we're dehydrated, not be as energetic as we usually are and can even make you sick
  - Water keeps your skin looking healthy.
    - Give them an example of watering a plant or flower. After it gets some water it perks back up.
- Water doesn't have empty calories! Remind them how soda can have empty calories.
- Water energizes your muscles!!!
  - When muscles do not have enough water their performance lacks

Conclusion (Approximately 5 minutes)

- Encourage students to drink more water, low fat-fat free milk, and 100% natural juices, and to limit the amount of sugary drinks they drink each week. Even try reducing juice by mixing half of it with water.
- Bring a water bottle with you when you go somewhere so you can always have water on the go!
- Be sure to drink when you' are thirsty and drink extra water when it's warm out.

RELAY RACE	**TIME: Approximately 15 Minutes**

- Warm Up: Shake your sillies out, arm circles, trunk twists (to warm up the core of the body and get the blood flowing)
- Divide children into groups of 10, and give each child a drink card
- Place a plastic bowl in front of each group and a plastic bowl at the other end of the room from each group
  - One at a time, each child will gather the number of sugar cubes indicated on their drink card, place them in their cup and run down to their team's bowl to add their sugar to it, then hurry back so the next person can go!
    - To make it more fun, alternate activities having students to hop, skip etc. to their bowls

FITNESS	**TIME: Approximately 15 minutes**

Let's Dance!

- ***** ***Before dancing***: Emphasize taking a rest or slowing down if getting tired while dancing, or not feeling well.
- **Freeze dance:** Every time the music is on encourage them to dance and when the music stops everybody freeze!!!
- **Play an oldies song!** Play an oldies song and teach children an oldies dance. Some examples of songs include *The Twist, Peppermint Twist, The Locomotion, Land of 1000 dances*
- **Stroll Line / Soul Train Line dance:** Separate students into 2 line formations. Have one or two children at the beginning of the line go in between the two parallel lines and do their own dance. The children standing in the parallel lines can then imitate the dance of the children going down the center. Have each child at the head of the line dance down the center aisle until everyone has had a chance to go.

CONCLUSION	**TIME: Approximately 5 minutes**

- Sit the children down to cool down (They may need to get a drink of water after dancing and before sitting down)
- Encourage children to try drinking less sugary soft drinks and try drinking more water!
- Be sure to drink when you' are thirsty and drink extra water when it's warm out.
- Bring a water bottle with you when you go somewhere so you can always have water on the go!
- Do some fun exercise this next week whether it is dancing like we did today or something else. We're going to ask you next week what kind of exercises you did by yourself or with your family!
- Give them take home item for this week
- Leave parent take home weekly letter at sign out table for parents to get when they pick their child up

Let's Move VB After School Program Nutrition and Fitness Class
Week 2 – My Plate

CORE COMPETENCIES

Children should be able to demonstrate:

- Knowledge of the five different food groups
- Knowledge as to why each food group is good for the body
- Being able to identify and categorize various foods within the proper food group by using the MyPlate visual
- Knowledge that ½ of plate should be fruits and vegetables

LESSON RESOURCES:

- http://superhealthykids.com/K-2myplatelessonideas.pdf
- http://www.opi.mt.gov/pdf/SchoolFood/EatSmart/K/FunFruitVeggieLesson.pdf
- http://www.choosemyplate.gov/kids/downloads/ServingUpMyPlate-level1-TeachersGuide.pdf
- http://www.choosemyplate.gov/food-groups/vegetables-why.html
- http://www.choosemyplate.gov/food-groups/fruits.html
- http://www.choosemyplate.gov/food-groups/grains-why.html
- http://www.superhealthykids.com/grains.htm
- http://www.choosemyplate.gov/food-groups/protein-foods-why.html
- http://www.choosemyplate.gov/food-groups/dairy.html
- http://www.heart.org/HEARTORG/GettingHealthy/HealthierKids/ActivitiesforKids/Happy-Healthy-Eating-for-Kids_UCM_312475_Article.jsp

SUPPLIES NEEDED (For up to 50 children)

- For Lesson:
  - 1 set of food props
  - 1 MyPlate plate to demonstrate food group sections and /or MyPlate Banner
- For Relay Race
  - 5 food card packets (each child will receive one food card)
  - 5 MyPlate Posters
  - Sticky tack or tape to hang up MyPlate posters
- For Dancing
  - CD for dance music
- Take Home:
  - ChooseMyPlate Fruit and Veggie Fun Guide
  - Letter Home to parents

LESSON ***Note:*** *When conducting this class, just have a conversation with the children! Ask them questions to get them interested in the lesson topic.*	**TIME: Approximately 45 minutes**

Introduction (Approximately 5 minutes)

- Recap: Ask the children what they learned last week, and how many of them drank more water.
- Ask the children if they know what the different food groups are, name their favorite food, and what food group it is.
- Use the MyPlate visual throughout the lesson to discuss the five food groups and their importance

Vegetables (Approximately 5-10 minutes)

- Ask children to name some examples of vegetables
- Ask children what they like about vegetables (color, texture, flavor, etc.) and what vegetables are good to eat
- Give examples of different types of vegetables using food props
- Discuss some of the ways eating vegetables help you to stay strong healthy, grow strong and feel good
  - Nutrients including vitamins which are good for you body
  - Vitamin A: Helps keeps eyes and skin healthy and protects against infect
  - Vitamin C: Helps heal cuts and wounds and keeps teeth and gums healthy
- Ask the children different ways that they can try eating vegetables (stir-fries, soups, salads, snacks)

Fruits (Approximately 5-10 minutes)

- ❖ Ask children to name some examples of fruits
- ❖ Ask children what they like about fruits (color, texture, flavor, etc.) and what fruits are good to eat
- ❖ Give examples of different types of fruits using food props
- ❖ Discuss some of the ways eating vegetables help you to stay strong healthy, grow strong and feel good
  - ➢ Vitamin C: Important for growth /repair of all body tissues, helps heal cuts and wounds, keeps teeth and gums healthy
  - ➢ Fiber: Fruits have fiber, help you to feel full so that you do not eat as much and helps to keep everything inside the body and stomach moving along
- ❖ Ask the children different and fun ways that they can try eating vegetables (snacks, smoothies, breakfast pizza). They can even mix veggies with fruits and make a smoothie that tastes great!
- ❖ By using the sample MyPlate, reinforce that half of our plate should be made up of fruits and vegetable
- ❖ ***Eat the Rainbow!*** Eat as many different colors as you can at each meal. For example, you can have a meal with lots of different colors and are all good for your body
- ❖ Ask the children what color different fruits and veggies are.
- ❖ Give an example of a meal with different colors of the rainbow. Some examples can be:
  - ➢ You have a pancake or waffle and you also have some bananas and blueberries with it
  - ➢ You have a sandwich and have some slices of apple and grapes on the side
  - ➢ You have some spaghetti and you have a little salad with some lettuce and shredded carrots

Grains (Approximately 5-10 minutes)

- ❖ Ask children to name some examples of grains
- ❖ Ask children what they like about grains (color, texture, flavor, etc.) and what grains are good to eat
- ❖ Give examples of different types of grains using food props
- ❖ Discuss some of the ways eating grains help you to stay strong healthy, grow strong and feel good
  - ➢ Vitamin B: Helps the body release energy from other foods we eat-gives us energy.
  - ➢ Iron: Our blood needs oxygen to work and grains have iron which helps carry oxygen to our blood.
- ❖ Whole grains: Whole grains help to build our bones and releasing energy from muscles. It helps build a healthy immune system (ask children what that means and tell them that a healthy immune system means it keeps us from getting sick
  - ➢ Mention that ½ of our grains should be at least whole grains-whole grains are like super healthy grains!
- ❖ Ask the children different and fun ways that they can try eating grains (mini pizza with whole grain piece of bread, tortilla with banana and peanut butter).

Protein (Approximately 5-10 minutes)

- ❖ Ask children to name some examples of proteins
- ❖ Ask children what they like about proteins (color, texture, flavor, etc.) and what proteins are good to eat
- ❖ Give examples of different types of proteins using food props
- ❖ Discuss some of the ways eating proteins help you to stay strong healthy, grow strong and feel good
  - ➢ Proteins are the building blocks for bones, muscles, cartilage, skin, and blood
  - ➢ Vitamin B: Helps the body release energy from other foods we eat-gives us energy.
  - ➢ Iron: Our blood needs oxygen to work and grains have iron which helps carry oxygen to our blood.
- ❖ Ask the children different and fun ways that they can try eating vegetables (peanut butter with apple, scrambled eggs)

Dairy (Approximately 5-10 minutes)

- ❖ Ask children to name some examples of dairy
- ❖ Ask children what they like about dairy(color, texture, flavor, etc.) and what types of dairy are good to eat
- ❖ Give examples of different types of dairy using food props
- ❖ Discuss some of the ways eating dairy help you to stay strong healthy, grow strong and feel good
  - ➢ Calcium: Used for building bones and teeth and in maintaining bone mass. We get our main source of calcium from dairy foods
  - ➢ Vitamin D: Helps the body maintain proper levels of calcium so that our bones can grow and stay strong
- ❖ Ask the children different and fun ways that they can try eating dairy (snacks, yogurt parfait, smoothies)

Conclusion (Approximately 5 minutes)

- ❖ Remind them to try to eat well balanced meals, with foods from each food group on their plate
- ❖ *Eat the Rainbow!* Eat as many different colors as you can at each meal.

Lesson Activity (Optional) (Approximately 5-10 minutes)

- ❖ Show the children 3 different types of meals and have them identify which foods on the plate go in which food group.

RELAY RACE	**TIME: Approximately 15 Minutes**

- Warm Up: Shake your sillies out, arm circles, trunk twists (to warm up the core of the body and get the blood flowing)
- Divide children into groups of 10 and give each child a food card
- Place a MyPlate poster for each group at the other end of the room.
- One at a time, children will run down to place the food card in the correct MyPlate section, and run back so the next person in their group can go!
  - To make it more fun, alternate activities having students hop, skip etc. to the MyPlate poster

FITNESS	TIME: Approximately 15 minutes

Let's Dance!

- ***** ***Before dancing***: Emphasize taking a rest or slowing down if getting tired while dancing, or not feeling well.
- **Freeze dance:** Every time the music is on encourage them to dance and when the music stops everybody freeze!!!
- **Play an oldies song!** Play an oldies song and teach children an oldies dance. Some examples of songs include *The Twist, Peppermint Twist, The Locomotion, Land of 1000 dances*
- **Stroll Line / Soul Train Line dance:** Separate students into 2 line formations. Have one or two children at the beginning of the line go in between the two parallel lines and do their own dance. The children standing in the parallel lines can then imitate the dance of the children going down the center. Have each child at the head of the line dance down the center aisle until everyone has had a chance to go.

CONCLUSION	TIME: Approximately 5 minutes

- Sit the children down to cool down (They may need to get a drink of water after dancing and before sitting down)
- Remind them to try to eat well balanced meals, with foods from each food group on their plate
- *Eat the Rainbow!* Eat as many different colors as you can at each meal.
- Do some fun exercise this next week whether it is dancing like we did today or something else. We're going to ask you next week what kind of exercises you did by yourself or with your family!
- Give them take home item for this week
- Leave parent take home weekly letter at sign out table for parents to get when they pick their child up

Let's Move VB Nutrition and Fitness Class
Week 3 – Portion Distortion

CORE COMPETENCIES

Children should be able to demonstrate:

- Knowledge of what a portion size is.
- Knowledge of why the correct portion size is important.
- Knowledge that different food groups have different portion sizes.
- Knowledge that food can be compared to everyday items to help identify the correct portion size to eat.

****This lesson also builds upon previous information taught in the MyPlate lesson*

LESSON RESOURCES:

- http://www.eatright.org/kids/article.aspx?id=6442468830
- http://lh6.ggpht.com/--vleZXS9AcY/UZy04gAXQgI/AAAAAAAAMQY/R6xZZRD3k14/s1600-h/portion-distortion-23.png

SUPPLIES NEEDED (For up to 50 children)

- For Lesson
  - The Portion Plate
  - And /or Health Edco *Visualize Your Portion Size* briefcase
- For Relay Race
  - 5 portion size card packets (each child will receive one food card)
  - 5 MyPlate Posters
  - Sticky tack or tape to hang up MyPlate posters
- For Dancing
  - CD for dance music

- Take Home:
  - MyPlate Laminated Place Mats for each child
  - Letter Home to parents

LESSON ***Note:*** *When conducting this class, just have a conversation with the children! Ask them questions to get them interested in the lesson topic.*	**TIME: Approximately 30 minutes**

Introduction (Approximately 5 minutes)

- Recap: Ask the children what they learned last week, and how many of them ate a plate that was half fruits and veggies, and drank more water.
- Ask the children: *What is a portion size?* Answer: A portion is basically the amount of food that happens to end up on the plate. Sometimes portion sizes of our food can bigger larger or smaller than what we should be eating

Why is paying attention to our portion sizes important? (Approximately 5-10 minutes)

- Too big of portion sizes results in too many calories our body receives. If we can't burn off the calories, it can just stay on our bodies and we can gain weight. Ask children how their body feels when they have eaten too much food. (tired, uncomfortable, sluggish etc.)
  - Show children poster showing portion sizes 20 years compared to portion sizes today

Comparing portion sizes to everyday items (Approximately 15 minutes)

- Use the *beBetter Health* Portion Plate visual and / or the Health Edco *Visualize Your Portion Size* briefcase to discuss the portion sizes of the five food groups.
  - Vegetables- Baseball
  - Starches (like noodles) about the size of a computer mouse
  - Fruits- tennis ball
  - Protein- deck of cards
  - Cheese- a domino
  - Grains- CD/DVD

Lesson Activity (Optional) (Approximately 10-15 minutes)

- Show the children foods from different food groups outside of what was demonstrated and have them:
  - Identify what food group they belong to
  - Based on the food group an item is in, identify about what portion size that food should be

Conclusion (Approximately 5 minutes)

- Encourage students to be more aware of the portion sizes that they are eating, and to try to apply the information they learned in the class by comparing the size of their foods to household items when they are eating at home.

RELAY RACE	**TIME: Approximately 15 Minutes**

- Warm Up: Shake your sillies out, arm circles, trunk twists (to warm up the core of the body and get the blood flowing)
- Divide children into groups of 10. Pass out cards with items representing various portion sizes.
- One at a time, children will run down to place the portion size card in the correct MyPlate food group section, and run back so the next person in their group can go!
  - To make it more fun, alternate activities having students hop, skip etc. to the MyPlate poster

FITNESS	**TIME: Approximately 15 minutes**

Let's Dance!

- ***** ***Before dancing***: Emphasize taking a rest or slowing down if getting tired while dancing, or not feeling well.
- **Freeze dance:** Every time the music is on encourage them to dance and when the music stops everybody freeze!!!
- **Play an oldies song!** Play an oldies song and teach children an oldies dance. Some examples of songs include *The Twist, Peppermint Twist, The Locomotion, Land of 1000 dances*
- **Stroll Line / Soul Train Line dance:** Separate students into 2 line formations. Have one or two children at the beginning of the line go in between the two parallel lines and do their own dance. The children standing in the parallel lines can then imitate the dance of the children going down the center. Have each child at the head of the line dance down the center aisle until everyone has had a chance to go.
- Cool down

CONCLUSION	TIME: Approximately 5 minutes

- ❖ Sit the children down to cool down (They may need to get a drink of water after dancing and before sitting down)
- ❖ Remind children to pay attention to their portion sizes when they are eating their meals
- ❖ Don't forget to eat those veggies and fruits and drink more water!
- ❖ Do some fun exercise this next week whether it is dancing like we did today or something else. We're going to ask you next week what kind of exercises you did by yourself or with your family!
- ❖ Give them take home item for this week
- ❖ Leave parent weekly take home letter at sign out table for parents to get when they pick their child up

Let's Move VB Nutrition and Fitness Class

Week 4 – *Let's Move! Let's Eat Healthy! Let's Be Happy!*

CORE COMPETENCIES

Children should be able to demonstrate:

- Knowledge that overall wellness is not only about exercising and eating healthy, but about being happy with oneself
- We are each different and that makes us unique
- There are a number of different ways to be happy including volunteering, learning and working hard at everything you do (giving it your best), getting involved in activities that one likes to do, making wise decisions.

LESSON RESOURCES:

http://www.cdc.gov/physicalactivity/everyone/guidelines/children.html
http://www.cdc.gov/nutrition/everyone/fruitsvegetables/index.html
http://www.choosemyplate.gov/
http://www.utc.edu/Administration/ChancellorsChallenge/UTCWellness.php
http://healthandwellness.vanderbilt.edu/news/2011/09/eat-move-feel/
http://www.aafp.org/patient-care/public-health/fitness-obesity/aim-hi/ready-set-fit.html#teachers
http://teenshealth.org/teen/your_mind/emotions/self_esteem.html#
http://kidshealth.org/parent/emotions/feelings/confidence.html

SUPPLIES NEEDED (For up to 50 children)

- ❖ For Lesson
  - Wellness Wheel poster with removable sections
- ❖ For Dancing
  - ➢ CD for dance music
  - ➢ Or Wii Dance Party ***(Will need additional set up time for this equipment)*** **/Only 1 set of Wii equipment available**
    - Wii gaming system with controller
    - Wii Just Dance Game
    - Wii cables
    - Speakers
    - Speaker cables
    - Extension cord
    - Surge protector
    - Projector
- ❖ Take Home:
  - ➢ MyPlates for each child
  - ➢ Letter Home to parents
- ❖

LESSON ***Note:*** *When conducting this class, just have a conversation with the children! Ask them questions*	TIME: Approximately 25 minutes

to get them interested in the lesson topic.	

Introduction (Approximately 5 minutes)

- Recap: Ask the children what they learned last week, and how many of them paid attention to their portion sizes, ate food from each food group, and continued to drink more water.

What does healthy mean to you? (Approximately 5-10 minutes)

- Ask the children what they think of when they think of when they think of the word healthy
- Ask the children what are differences about themselves (ex. Eye color, hair color, have any of them lost teeth, height, etc)

Lesson (Approximately 20 minutes)

- Use the Wellness Wheel concept to discuss 3 aspects of health and how they fit together for total health and wellness.
- ***Let's Move!*** – Place the *Let's Move* section on the wellness wheel.
- What exercises do you do?
  - dancing, running, playing in the park, jumping rope, walking the dog, playing sports, riding your bike, playing relay races
  - Exercise can be fun and easy to do!
  - Recommended to get 60 minutes of exercise each day (does not have to be all at once).
    - You can dance for 20 minutes / run around for 20 minutes / walk your dog with your parents for 20 minutes
- ***Let's Eat Healthy!*** –Place the *Let's Eat Healthy!* section on the wellness wheel.
- What have we learned about eating and drinking healthily?
  - Rethink You Drink!
    - Drinking more water and reducing the amount of sugary drinks we drink
    - Why is water good for us? Hydration, energy, no empty calories
  - MyPlate
    - Eat a variety of different foods from the different food groups.
    - Quickly review the different food groups and some foods in each of the food groups
    - Remember what we discussed about eating the rainbow?
    - Making ½ your plate fruit and veggies
    - ¼ protein and ¼ grains
  - Portion Distortion
    - Review portion sizes and compare them to items around their home:
      - Vegetables- Baseball
      - Starches (like noodles) about the size of a computer mouse
      - Fruits- tennis ball
      - Protein- deck of cards
      - Cheese- a domino
      - Grains- CD/DVD
- ***Let's Be Happy!*** – Place the *Let's Be Happy!* section on the wellness wheel.
- What makes you happy?
  - All of these things that we learned the past 3 weeks are definitely important.
  - But just as important is YOU being happy with yourself and who you are.
    - You are a unique individual and there are lot of cool things that make you who you are!
    - What does volunteering mean? It means helping someone else out! Ask children different ways that they have volunteered
      - You can do things with your parents like:
        - Cleaning up someone's yard, cleaning up your neighborhood
        - Helping out a friend or family member in need
    - Make smart decisions (do what is right)
    - Learning and doing the best that you can do. Working hard in school-or whatever else you work at.
    - Try new things! Do you like to sing, or dance? Do you like sports or nature? Doing things that you enjoy and are good for you. Ask children different things that they like to do outside of school.
  - Reiterate to the children that we all like and do different things and that is what makes you…YOU! (Place the YOU! Section in the middle of the wellness wheel
  - Reiterate that all of these areas are important to being well-rounded.

FITNESS	TIME: Approximately 15 minutes

Let's Dance!

- ***** ***Before dancing***: Emphasize taking a rest or slowing down if getting tired while dancing, or not feeling well.
- **Freeze dance:** Every time the music is on encourage them to dance and when the music stops everybody freeze!!!
- **Play an oldies song!** Play an oldies song and teach children an oldies dance. Some examples of songs include *The Twist, Peppermint Twist, The Locomotion, Land of 1000 dances*
- **Stroll Line / Soul Train Line dance:** Separate students into 2 line formations. Have one or two children at the beginning of the line go in between the two parallel lines and do their own dance. The children standing in the parallel lines can then imitate the dance of the children going down the center. Have each child at the head of the line dance down the center aisle until everyone has had a chance to go.

~OR~

WII DANCE PARTY!!!!!

- ***** ***Before dancing***: Emphasize taking a rest or slowing down if getting tired while dancing, or not feeling well.
- Break out the Wii and dance with the kids as you all engage in a fun dance party to reward them for their participation in the program!!!
- Adult leader has control of the Wii remote and selects the songs. This will eliminate fighting over control of the remote.

CONCLUSION	TIME: Approximately 5 minutes

- Sit the children down to cool down (They may need to get a drink of water after dancing and before sitting down)
- Remind the children that being active and eating healthy are very important for your body-but so is being happy with who you are and being the best you that you can be.
- Remind children to pay attention to their portion sizes when they are eating their meals
- Don't forget to eat those veggies and fruits
- Don't forget to drink more water!
- Try and continue to do some more fun exercising!
- Give them take home item for this week
  - Use their *MyPlate* when creating well balanced meals.
- Leave parent weekly take home letter at sign out table for parents to get when they pick their child up

APPENDIX E

LET'S MOVE QUESTIONNAIRE

ID:

Date:

Name:

School:

1. What grade are you in? _____

2. Are you a boy or a girl? ☐ Boy ☐ Girl

3. Which drink would you pick for a snack?

A. White low fat milk
B. Chocolate or strawberry milk
C. Water
D. Juice with no added sugars.
E. Other drinks
F. I don't know

4. Do you drink water every day?

A. Yes
B. No
C. I don't know.

5. Which one has more sugar?

A. A glass of white milk
B. A glass of water
C. A glass of soda
D. I don't know

6. Do you eat fruits and vegetables every day?
A. Yes
B. No
C. I don't know

7. Circle the one you think is better for your body.

A.  **Orange** **OR**  **Ice cream**

B.  **Cookies** **OR**  **Bananas**

C.  **Baked chicken** **OR**  **Chicken nuggets**

D.  **White bread** **OR**  **Brown whole wheat bread**

E.  **Corn** **OR**  **Chips**

8. Which of the following vitamins help you to heal cuts and wounds?

A. Vitamin A
B. Vitamin B
C. Vitamin C
D. Vitamin E
E. I don't know.

9. Which one is a whole grain?

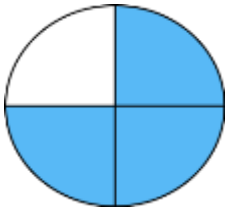
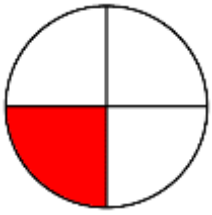
A. White rice
B. Brown rice
C. Baked potato
D. I don't know.

10. Which of the following is a dairy product?

A. Chicken
B. Apple
C. A glass of milk
D. I don't know.

11. How much of your plate should be a protein?

A. One half (1/2) **B.** Three quarters (3/4) **C.** One quarter (1/4) **D**. I don't know.

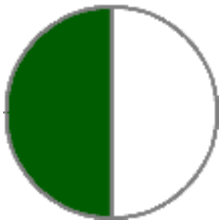
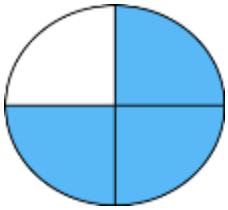
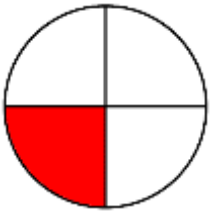




12. Do you eat foods that are good for your body every day?

A. Yes
B. No
C. I don't know

13. How much of your plate should be fruits and vegetables?

A. One half (1/2) **B.** Three quarters (3/4) **C.** One quarter (1/4) **D**. I don't know.

14. Do you exercise every day? (for example: running, gymnastics, or rope jumping)?

A. Yes
B. No
C. I don't know.

15. How long do you think you should exercise every day (for example: riding a bike, swimming, or playing tag)?

A. Never
B. 30 minutes every day
C. 60 minutes every day
D. I don't know.

16. Which one is more fun?

A. Watching TV or playing video games.
B. Doing sports like: soccer, running, swimming, baseball, or riding a bike.
C. I don't enjoy either.

Thank you!

APPENDIX F

Abbreviation List

AIDS	acquired immune deficiency syndrome
A1c	glycated hemoglobin
ANOVA	analysis of variance
BMI	body mass index
CDC	Centers for Disease Control and Prevention
CFI	comparative fit index
CHKD	Children's Hospital of the Kings' Daughters
CMC	chronic medical condition
Etc	et cetera
HBI	Home Beverage Inventory
HFFI	Healthy Food Financing Initiative
HHS	U.S. Department of Health and Human Services
HIV	Human Immunodeficiency Virus
HP	Healthy People
IMB	Information-Motivation-Behavioral Skills Model
MANOVA	multivariate analysis of variance
MCR4	Melanocortin Receptors 4
NRPA	National Recreation and Parks Association
ODU	Old Dominion University
PE	physical education
PedNSS	Pediatric Nutrition Surveillance System

RMSEA	root mean error of approximation
SCT	Social Cognitive Theory
SES	socioeconomic status
SPSS	statistical package for the social sciences
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
TTM	Transtheoretical model
US	United States
USDA	US Department of Agriculture
VIF	variance inflation factor
WIC	Women, Infants, and Children Program

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