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SCHOOL-BASED INTERVENTIONS TO REDUCE CHILDHOOD OBESITY: AN INTEGRATIVE REVIEW

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ABSTRACT

Effective school-based obesity prevention and intervention programs are vital to the management of childhood obesity in the United States. This is because one third of American children exceed the National Institutes of Health (NIH) healthy Body Mass Index (BMI) guidelines for children. PURPOSE: To examine recent literature on school-based obesity prevention and intervention programs and determine the effectiveness of these programs in reducing BMI, increasing physical activity and improving nutritional choices while identifying common features of the most effective programs. METHODS: Using the PubMed and CINAHL databases, an integrated review of the literature was conducted using the search terms *obesity prevention, elementary school* and *school-based.* Only articles published between 2001 and 2012 were selected for this review. SUBJECTS: Children in elementary schools between the ages of five and twelve were included in this review per their participation in the ten studies selected. RESULTS: Three studies used solely nutrition education and two used only a physical activity component while five of the ten studies used a combined approach of both physical activity and nutrition education. The studies included in this review were either randomized control trails or quasi-experimental studies. Studies varied in their duration and their intervention approach, with some having an after school component, parent involvement and community involvement. Additionally, studies differed with regard to the assessment of obesity prevention behaviors, weight status and obesity measures. The most effective programs included physical activity, nutritional education, behavioral modification, and parental involvement. DISCUSSION: There were several studies that showed significant reduction in BMI and from them emerged components that are most effective in reducing BMI. Future studies need to be longitudinal in nature to determine the effectiveness of programs over time.

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Chapter 1: Introduction

Introduction to Childhood Obesity

In the last thirty years the overall prevalence of childhood obesity has nearly tripled (Centers for Disease Control and Prevention [CDC], 2011). Childhood obesity is defined, by the National Institutes of Health, as a Body Mass Index (BMI) at or above the 95th percentile for children of the same age and sex, while overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex (National Institutes of Health [NIH], 2012). Since 1980, the percentage of obese children between the ages of six to eleven has almost quadrupled, increasing from seven percent to 32.6% in 2010 (Ogden, Carroll, Kit & Flegal, 2012).

Historically, childhood obesity was not considered a problem; while today, children lead more sedentary lives (e.g play video games and sit inside). In the past children were more likely to be outside playing (Jan et al., 2009) and they walked everywhere, but now children usually ride in cars to get where they need to go. Additionally, in previous times, people did not eat in fast food places like they do today, and junk food was not readily available like it is in today's society (Jan et al., 2009). As such, there is a need to increase physical activity and improve healthy food consumption. Given the rapid increase in childhood obesity, if effective interventions are not implemented then childhood obesity rates will continue to rise.

This childhood obesity crisis is particularly pronounced in certain populations. African American and Hispanic children have a greater risk of being overweight or obese compared to Caucasian children, with 24.5% of Hispanic children and adolescents and 24.3% of African American children and adolescents being obese as compared to 14% of Caucasian children (Ogden et al., 2012). Additionally, there are regional variations with children who live in

southern states including, Mississippi, Kentucky and Tennessee, at greater risk for being overweight or obese (Ogden et al., 2012).

To be overweight and/or obese during childhood can have many short-term and long-term health consequences. There are several studies which show that overweight children tend to become overweight adults (Budd & Volpe, 2006; Ferraro, Thorpe & Wilkinson, 2003; Ogden et al., 2012). This can ultimately result in negative outcomes (Morrison-Sandberg, Kubik, & Johnson, 2011), such as increased risk of osteoporosis, cardiovascular disorders, high cholesterol, high blood pressure, respiratory distress, and diabetes, all of which are associated with significant morbidity (Morrison-Sandberg et al., 2012).

Introduction to Interventions for Childhood Obesity

Due to the childhood obesity crisis, interventions have been developed to address this issue. A major call to action came in 2002 when Congress published the Labor, Health and Human Services Education Appropriations Act Conference Report. This report instructed the Centers for Disease Control and Prevention (CDC) to request that the Institute of Medicine (IOM) develop a plan of action targeted specifically for the prevention obesity in U.S. children. The IOM began a 24-month study in which they hoped to gain insight into childhood obesity and appropriate prevention methods. They investigated various approaches to combat childhood obesity, compiling evidence from multiple types of prevention programs to obtain the best possible results. These programs were in various settings, at home with families, in communities, schools, cities and large-scale modifications at the state and national levels ("Preventing childhood obesity:," 2005).

Introduction to School-Based Interventions for Childhood Obesity

Recognizing the severity and grave consequences if the increasing obesity trend is not reversed, various approaches have been investigated in several disciplines to combat this problem. One such approach is school-based obesity prevention and control programs which are those that occur at the facility in which the child attends classes (Spiegel & Foulk, 2006). There are several benefits of a school-based program, the most important is convenience because the children are already there, there is no need for additional transportation or interference with parents' work schedules, and there is easy access to children at school (Hollar et al., 2010). According to Morrison-Sandberg et al. (2011), the optimal setting to provide obesity prevention interventions is elementary school, especially since a child's dietary habits, exercise patterns and risk factors for becoming overweight are founded early in life (Morrison-Sandberg, 2011).

Physical activity. Physical activity focuses on increasing cardiovascular fitness thereby decreasing obesity risks (Spiegel & Foulk, 2006). School curriculum should include adequate physical activity both in structured, i.e. physical education class, and unstructured activities, i.e. recess. Physical activity interventions in schools should include at least thirty minutes of moderate to vigorous physical activity within physical education classes ("Preventing childhood obesity:," 2005). It is recommended that children in schools partake in unstructured physical activity, but that it does not substitute for physical education classes ("Preventing childhood obesity:," 2005). Education about physical activity is also key. The IOM report recommended that schools teach children about the importance of incorporating physical activity into their daily lives thus forming good lifelong habits ("Preventing childhood obesity:," 2005). Additionally, extra-curricular physical activity programs, such as intramurals or physical activity

clubs, are great components to promoting adequate physical activity among children ("Preventing childhood obesity:," 2005).

Nutrition. Nutritional interventions usually focus on educating children about healthy food choices, and decreasing the consumption of unhealthy food choices (Jan et al., 2009). School lunches are a big focus of these interventions since children receive one third of their daily energy requirement from their lunch at school ("Preventing childhood obesity:," 2005). Therefore, programs are advised to focus on improving the nutritional choices offered to children as part of the federal school meal at lunch by ensuring they meet national nutritional guidelines. Additionally, competitive foods, or any beverage or food in the school that is not part of the federal school meal program, need to be monitored ("Preventing childhood obesity:," 2005).. These competitive foods include: "à la carte" items sold by the school cafeteria, foods sold as part of school fundraisers, foods served in vending machines, foods and drinks offered in after-school activities and items offered to children as snacks or rewards in schools ("Preventing childhood obesity:," 2005). The IOM report recommends that schools put restrictions on the types of competitive foods they offer to improve nutrition within the school. Furthermore, classroom components including nutrition education and behavior skills are important nutritional interventions ("Preventing childhood obesity:," 2005)..

Combined interventions. Obesity prevention programs are designed to promote healthy lifestyle behaviors in children. A majority of programs tend to include both physical activity and nutrition, two major components of a healthy lifestyle (Jan et al., 2009). The reason that both components are needed in programs is that including both increases healthy living. It is important to not only include physical activity but nutrition education and behavioral skills to ensure children's overall health ("Preventing childhood obesity:," 2005).

There is increasing research on childhood obesity prevention and intervention programs in schools. Among these studies, different approaches are used to address this issue, including: extracurricular programs (Lamberg & McKenna, 2011; Perman et al., 2008; Yin et al., 2012), physical education programs (Foster et al., 2008; Hawthorne et al., 2011; Lamberg & McKenna, 2011; Muth et al., 2008; Schetzina et al., 2011; Spiegel & Foulk, 2006; Tucker et al., 2011; Yin et al., 2011) nutrition education (Muth et al., 2008; Schetzina et al., 2011; Spiegel & Foulk, 2006; Tucker et al., 2011), and parent (Foster et al., 2008; Hollar et al., 2010; Lamberg & McKenna, 2011; Muth et al, 2008; Perman et al., 2008; Tucker et al., 2011) and community (Muth et al., 2008) involvement in school programs. Nonetheless, the studies have resulted in varied findings. Overall, the effectiveness of these obesity prevention programs has been determined by three criteria: 1) BMI reduction, 2) increase in physical activity and 3) a reduction in the consumption of unhealthy foods and an increase in knowledge of healthy food choices (Muth, Chatterjee, Williams, Cross, & Flower, 2008).

Measurement in School-based Interventions

BMI. Since children are still growing and girls and boys mature at different rates, there is a different way to calculate BMI for children than adults. To calculate BMI in children, their height and weight is compared against growth charts norms, taking into account age and sex. A child with a BMI less than fifth percentile is considered underweight while children with a BMI percentile of greater than the fifth percentile to less than the 85^{th} percentile are considered a healthy weight. Children having a BMI greater than the 85^{th} percentile and less than 95^{th} percentile are considered overweight, and children with a BMI greater than 95^{th} percentile are considered obese. (National Institutes of Health [NIH], 2012).

Weight. Weight, part of the BMI calculation, is measured by having the child stand on a standardized scale. Healthy weight ranges cannot be estimated for children because with each month of age for each sex, healthy weight ranges for children change. Additionally, healthy weight ranges change in children as height increases ("About BMI for," 2011).

Body fat percentage. Body fat percentage is calculated in a different manner for children than adults due to height-related increases in BMI for children. To calculate body fat percentage the formula: (1.51 x BMI) – (0.70 x age) – (3.6 x gender) + 1.4 (Deurenberg , Weststrate & Seidell, 1991) is used.

PACER test. The PACER test is used in physical activity interventions to measure cardiorespiratory fitness. It is a 20-meter shuttle run which starts out at a slow pace and gradually increases in difficulty. The children continue to run until they cannot keep up the pace, or they cannot reach the end of the course before the beep signaling the end of time is sounded. The children are signaled to start running from a preprogrammed compact disc, which plays an audio beep. For this test, fitness is determined by the longer the child is able to run indicating a higher rate of estimated oxygen uptake and therefore fitness (Hawthorne, et al., 2011).

The purpose of this integrative review is to: 1) examine the effectiveness of school-based programs designed to prevent and decrease childhood obesity by reducing BMI, increasing physical activity and improving nutritional choices; 2) identify common features of the most effective programs which can be included in future childhood obesity interventions in other settings. As such, these findings will help to inform the development and implementation of effective sustainable childhood obesity prevention programs.

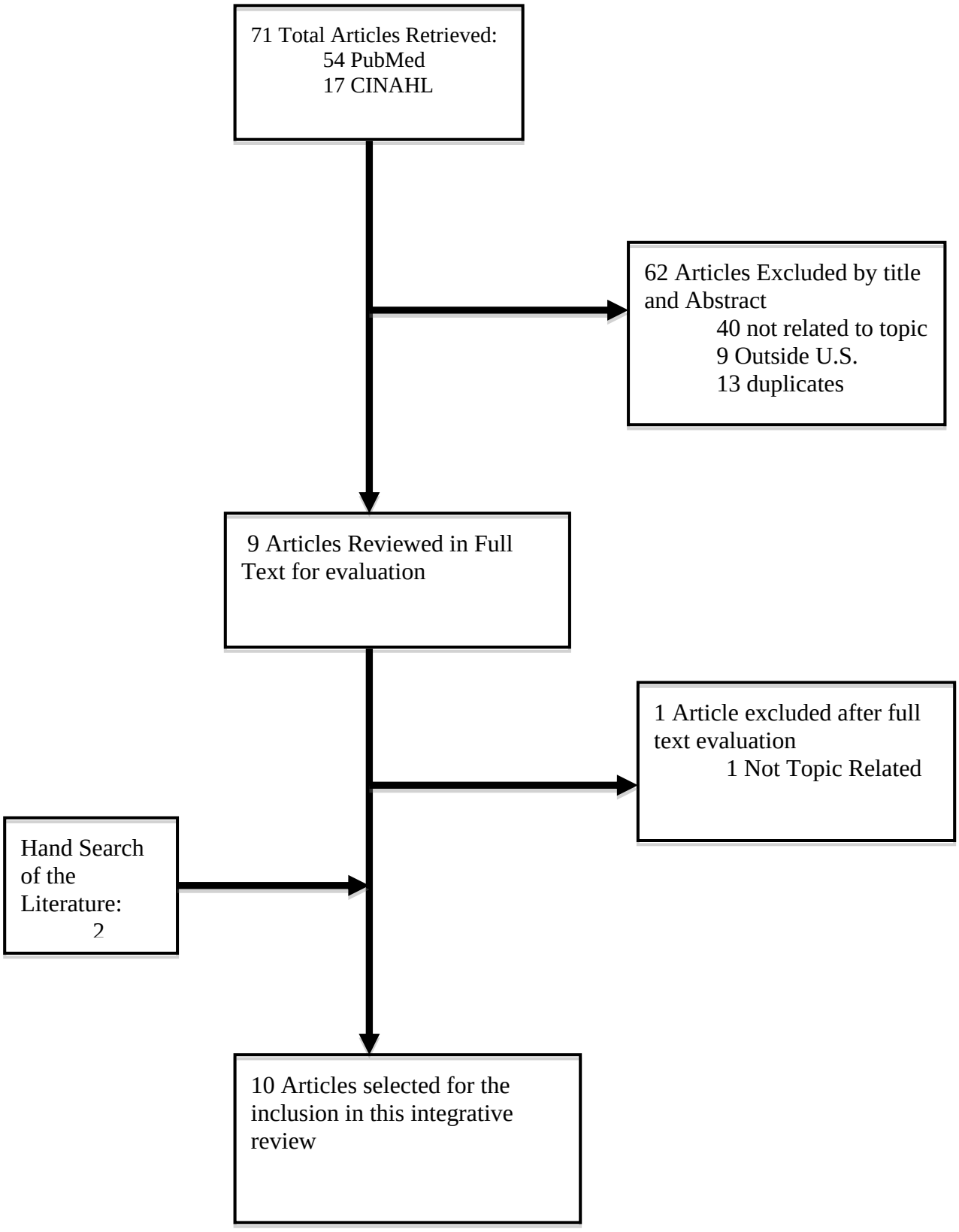
Chapter 2: Methods

An examination of the literature was required to perform an analysis of current school-based obesity prevention and intervention programs for children. This chapter discusses the literature search process that was used for this integrative review and the method for selecting articles for inclusion.

The literature search was conducted using both CINAHL and PubMed online databases. The key terms used were "obesity prevention," "elementary school" and "school-based." In both CINAHL and PubMed only studies from 2001- 2012 were included to focus on the most recent evidence. An initial pool of 71 potentially relevant articles was identified (Figure 1). The inclusion criteria were: 1) articles had to be conducted in the United States, 2) be focused on the population between five and twelve years old, 3) include a school-based intervention and 4) focus on the prevention or treatment of obesity. During the title and abstract review, articles were excluded if they did not pertain to obesity, interventions did not include school-aged children (ages 5-12) and if they were published before 2001. After application of exclusion criteria, 62 articles were excluded. Of those 62 articles excluded after title and abstract review, 40 were excluded because they did not include school-aged children or were not conducted within a school. Additionally, nine of the 62 excluded articles were excluded because they were conducted outside of the United States. Furthermore, 13 duplicate articles were excluded.
A total of nine articles were obtained for a full text review. One of the nine articles was excluded because it was not related to the topic. Eight of these articles met the inclusion criteria and were selected for inclusion in this review. Additionally, a hand search of the literature was completed and references of the studies were examined, producing two additional articles for

inclusion. Thus, a total of ten articles were selected for inclusion in this review and are denoted in the Reference section with an asterisk.

See Figure 1. Selection of Articles for Inclusion in the Review.



Chapter 3: Results

This chapter reviews the results of the literature review. The authors, type of intervention, age group, sample characteristics, study design and outcome are described within this section. The studies analyzed in this integrative review are summarized in Table 1.

Table 1: Summary of Studies Reviewed

#	Author group	Type of intervention	Age group	Sample characteristics	Study design	Outcomes
1	Foster et al., 2008	Nutrition In school program	Grades: 4-6	1349 students in the Philadelphia School District, 50% eligible for free or reduced-price meals	RCT	The prevalence of overweight was lower in the intervention schools. (Decreased by 10.3% in intervention & increased by 25.9% in control)
2	Hawthorne et al., 2011	Physical activity In school program	Grades: K-6	1293 students in an urban Arizona school district, 43% Hispanic	Quasi-experimental	Cardiorespiratory fitness increased by 37.1% over baseline (for the entire sample)
3	Hollar et al., 2010	Physical activity and Nutrition In school program	Grades: K-6 Average: 8 years	3,769 students in Central Florida elementary schools, 50.2% Hispanic	Quasi-experimental	Decrease in BMI % during year one (-1.46%) Statistically significant BMI % decrease in year two (-1.73%)
4	Lamberg & McKenna, 2011	Physical activity and Nutrition After school program	Grades: 3-4	49 students in a New York elementary school	Quasi-experimental	Increased # of days children were physically active (from 3.3 to 5) & increased # of days parents were active with their children (1.8 to 2.3) BMI decrease of 0.2% post-program for all weight classifications combined
5	Muth et al., 2008	Physical activity	Grade 4	75 students in a rural North	RCT	Increase in daily fruit and vegetable servings in

#	Author group	Type of intervention	Age group	Sample characteristics	Study design	Outcomes
		and Nutrition In school program		Carolina Elementary school		intervention group (from 2.3 to 2.7) compared to a decrease in control group (from 2.6 to 2.2) Statistically significant increase in knowing which food group most servings should come from (0.4 to 0.5) No significant decreases in BMI
6	Perman et al., 2008	Physical activity and Nutrition After school program	Grades: K-6	350 students in a Lexington Kentucky elementary school, 67% African American, 13% Hispanic, 93% on free/reduced lunch	Quasi-experimental	Significant decreases in BMI % in the intervention group (3.57% reduction in BMI %) compared to the control group (1.39% reduction in BMI %)
7	Schetzina et al., 2011	Physical activity and Nutrition In school program	Grade 4	66 students in a Rural Tennessee elementary school	Quasi-experimental	Healthier food choices selected (statistically significant: scores 46.05 at baseline to 67.18 post-intervention) Statistically significant increase in daily pedometer steps (3272.87 steps per day at baseline to a mean of 4644.3 steps per day post-intervention)
8	Spiegel & Foulk, 2006	Physical activity and Nutrition In school program	Grades: 4-5	1013 students from 69 classes in 4 states (Delaware, Florida, Kansas and North Carolina)	RCT	Increased fruit & vegetable consumption Increased physical activity levels Statistically significant reduction in BMI in overweight group (1.5% in intervention group)
9	Tucker	Physical	Grades:	99 children	Quasi-	EHS: Increased servings

#	Author group	Type of intervention	Age group	Sample characteristics	Study design	Outcomes
	et al., 2011	activity and Nutrition In school program	4-5	from 2 schools in Minnesota (Elton Hills (EHS) and Harriet Bishop (HBS) Elementary Schools)	experimental	of fruits and vegetables per day and decreased servings of soda per day (1.1 per day in control group and 0.3 per day in intervention group) HBS: decrease in BMI percent, servings of fruit juice per day (decreased from 0.9 at baseline to 0.3 post intervention) and minutes of TV per day
10	Yin et al., 2012	Physical activity After school program	Grade 3	574 students in 18 elementary schools in a Georgia school district	RCT	Decreased BMI Significant improvements in cardiorespiratory fitness (Intervention decreased from 162.81 at baseline year 3 to 158.26 at the posttest)

Legend: RCT: Randomized Control Trail, %: percent(ile), K: Kindergarten, -: decrease(d), #: number, EHS: Elton Hills Elementary School, HBS: Harriet Bishop Elementary School, TV: television

Type of Intervention

All of the studies included a school-based program for the prevention or reduction of obesity. Six studies had parent involvement as well as the school component (Foster et al., 2008; Hollar et al., 2010; Lamberg & McKenna, 2011; Muth et al., 2008; Perman et al., 2008; Tucker et al., 2011). In addition, one study included both parent and community involvement with the school-based program (Muth et al., 2008).

The approach of each program varied. Four studies used a combined approach of nutrition education, such as learning about the food pyramid and healthy food choices and a physical activity component, such as teaching the importance of physical activity and participating in various exercise activities (Hollar et al., 2010; Muth et al., 2008; Perman et al.,

2008; Schetzina et al., 2011). Three studies included a classroom component in their program (Lamberg & McKenna, 2011; Spiegel & Foulk, 2006; Tucker et al., 2011) and two studies solely had a physical activity component (Hawthorne et al., 2011; Yin et al., 2012). In addition, one study had only a nutrition component to their program (Foster et al., 2008)

The duration of the interventions ranged from one week (Tucker et al., 2011) to three years (Yin et al., 2012). The frequency of the interventions ranged from one time per week (Tucker et al., 2011) to several days per week, depending on the activity implemented (Spiegel & Foulk, 2006). In two of the ten studies, the intervention took place after school (Lamberg & McKenna, 2011; Yin et al., 2012), while in the other seven studies, the intervention was implemented during the school day. One of the programs had components that took place both in and outside of school (Perman et al., 2008).

The studies varied with regard to the assessment of obesity prevention behaviors, weight status and obesity measures. Two of the ten studies measured BMI (Hollar et al., 2010; Perman et al., 2008), four measured BMI and physical activity using the PACER test, or a 20 meter shuttle run which starts out at a slow pace and gradually increases in difficulty, or a student questionnaire (Foster et al., 2008; Hawthorne et al., 2011; Lamberg & McKenna, 2011; Yin et al., 2012) Physical activity and nutrition were measured by one study (Schetzina et al., 2011). BMI, nutrition and physical activity were measured by three studies (Muth et al., 2008; Spiegel & Foulk, 2006; Tucker et al., 2011).

Age Group

Although all studies included school-aged children between the ages of five and twelve, there was variation in the mean ages between studies. However, the majority of studies involved fourth grade participants.

Sample Characteristics

Nine of the ten studies were conducted on all children, regardless of BMI (Foster et al., 2008; Hawthorne et al., 2011; Hollar et al., 2010; Lamberg & McKenna, 2011; Muth et al., 2008; Schetzina et al, 2011; Spiegel & Foulk, 2006; Tucker et al., 2011; Yin et al., 2012). Several studies included subgroups specifically, overweight/obese children (Perman et al., 2008), low socioecomonic status (SES), children (Foster, et al., 2008; Hawthorne et al., 2011; Hollar et al., 2010; Perman et al., 2008; Yin et al., 2012) and minority children (Foster, et al., 2008; Hawthorne et al., 2011; Hollar et al., 2010; Perman et al., 2008; Yin et al., 2012).

Study Design

The ten studies included in the review were conducted in several states within the U.S., including: Arizona, Delaware, Florida, Georgia, Iowa, Kansas, Kentucky, Minnesota, New York, North Carolina, Pennsylvania and Tennessee. Sample size of the studies ranged from 49 participants (Lamberg & McKenna, 2011) to 3,769 participants (Hollar et al., 2010).

Quasi-experimental. A quasi-experimental study is one that has a pre and post-test design and is does not have randomization (Harris , Bradham, Baumgarten, Zuckerman, Fink & Zuckerman, 2004). Six studies were quasi-experimental designs, one with four intervention groups (Hollar et al., 2010), while the others had one intervention group (Hawthorne et al., 2011; Lamberg & McKenna, 2011; Perman et al., 2008; Schetzina et al., 2011; Tucker et al., 2011). All but two of the quasi-experimental studies included a control group (Lamberg & McKenna, 2011; Schetzina et al., 2011).

Randomized control trails. A randomized control trial is a study that assigns participants to either the experimental group or the control group at random ("Study Design

101," 2011). Four studies were randomized control trials (Foster et al., 2008; Muth et al., 2008; Spiegel & Foulk, 2006; Yin et al., 2012) with multiple intervention groups.

Outcomes

Effectiveness of school-based programs on BMI. All but one (Schetzina et al., 2011) of the studies reported on change in BMI as well as measures of effects indicating BMI or weight reduction in the intervention group compared to the control group. Three studies reported a statistically significant reduction in BMI for the intervention group (Hollar et al., 2010; Perman et al., 2008; Spiegel & Foulk, 2006) compared to the control group while five studies, although reporting a reduction, the reduction was not statistically significant (Foster et al., 2008; Lamberg & McKenna, 2011; Muth et al., 2008; Tucker et al., 2011; Yin et al., 2012). Of the studies reporting a significant reduction, the study by Perman et al. (2008) reported the largest reduction, with a 3.57 reduction in the mean BMI percentile for the intervention group, compared to a 1.39 reduction in the mean BMI percentile for the comparison group. The study by Spiegel & Foulk (2006) although statistically significant, reported the lowest reduction. There was a 1.5 reduction in BMI percentile for the intervention group compared to the control group which had a 0.5 reduction in BMI percentile (Spiegel & Foulk, 2006). A correlation was shown between BMI reduction and duration of the intervention, with those programs having a longer duration, ranging from six months to two years, and showing statistically significant reductions in BMI (Hollar et al., 2010; Perman et al., 2008; Spiegel & Foulk, 2006).

Effectiveness of school-based programs on obesity prevention behaviors on nutrition. All of the studies that included a nutrition component and measured nutrition showed improved nutrition following the intervention (Hollar et al., 2010; Muth et al., 2008; Schetzina et al., 2011; Spiegel & Foulk, 2006; Tucker et al., 2011) except one study (Foster et al., 2008).

Muth et al. (2008) included 40 minutes of nutrition education that was adapted from preexisting curricula, specifically, MyPyramid for Kids, and weekly homework assignments requiring parent or guardian participation. Foster et al. (2008) included 50 hours of food and nutrition education showing how food choices are tied to personal behavior, individual health and the environment, but also included lessons about nutrition into varying classroom subjects. Additionally, the study by Foster et al. (2008) altered the foods sold and served so that they met the nutritional standards based on the Dietary Guidelines for Americans. Hollar et al. (2008) included modified dietary offerings in schools, a fruit and vegetable garden to teach kids how nutritious fruits and vegetables can be served, and educated children on nutrient dense foods, the benefits of healthy eating and the importance of making healthy lifestyle choices. The lessons in Muth et al. (2008) educated children on healthy food selection including reading nutrition labels, helped them set nutrition goals and identify benefits of healthy eating, and how to choose healthy fast food alternatives. The studies by Schetzina et al. (2011) and Spiegel and Foulk (2006) used similar methods for their nutritional education component as were used in the study by Muth et al. (2008) except the parent participation in these studies did not have weekly homework assignments with parents. In the study by Tucker et al. (2011) healthy eating habits and education on proper food choices were part of the curriculum in addition to the 1:1 student, nurse healthy living coaching sessions.

Studies that did not include a nutrition component in the intervention also did not measure changes in nutrition. The nutritional interventions resulted in increased fruit and vegetable consumption in the intervention group (Muth et al., 2008; Schetzina et al., 2011; Spiegel & Foulk, 2006; Tucker et al., 2011). In two other studies, in comparison to the control group, students who received the intervention made healthier food choices on surveys and food

choices when in the cafeteria for lunch (Muth et al., 2008; Schetzina et al., 2011). Schetzina et al. (2011) reported the lowest increase in healthier food choices post intervention compared to baseline, $p < .001$. The healthy food score, in the study by Schetzina et al., (2011) went from 46.05 at baseline to 67.18 on follow up where higher scores indicate healthier food choices. Muth et al. (2008) reported the highest increase in healthier food choices for the intervention compared to the control. In the study conducted by Muth et al. (2008), the number of students in the intervention group that knew which food group the servings come from increased from a proportion of 0.4 to 0.5, $p = .01$. The proportion of students in the control group that knew which food group the servings come from decreased from a proportion of 0.4 to 0.3. Additionally, when measured, it was found that soda and fruit juice consumption decreased after children received the intervention (Tucker et al., 2011). Children in the intervention compared to the control at Elton Hills School, one of the intervention schools, were less likely to drink soda, sports drinks or fruit juice after the intervention. Consumption of sports drinks/fruit juice was significantly lower in the intervention group than the control group, with a mean of 1.1 drinks consumed daily in the control group and a mean of 0.3 drinks consumed daily in the intervention group, $p = .04$. Children in the Harriet Bishop School, another intervention school in the study by Tucker et al. (2011), reported a decrease in mean servings of soda/punch per day, which decreased from 0.9 at baseline to 0.3 post-intervention, $p = .024$.

Effectiveness of school-based programs on obesity prevention behaviors on physical activity. Of the seven studies that measured physical activity (Hawthorne et al., 2011; Lamberg & McKenna, 2011; Muth et al., 2008; Schetzina et al., 2011; Spiegel & Foulk, 2006; Tucker et al., 2011; Yin et al., 2011) all but one (Muth et al., 2008) reported increased physical activity and/or a decrease in sedentary behaviors in the intervention group when compared to the control

group. Hawthorne et al. (2011) implemented their walking trail program during recess time three days a week. Lamberg and McKenna (2011) used the Move your Feet! program which included one hour sessions, twice a week, that consisted of a brief warm-up of stretching and light aerobic activities, and four different physical activities that were 10-12 minutes each and designed to improve agility, endurance, power and strength. In the study by Muth et al. (2008) the IMPACT program was used which included various physical activities to go along with the nutrition component. Those physical activities included: dancing, acting out different activities, modified versions of tag and running around keeping up a beach ball (Muth et al., 2008). The study by Schetzina et al. (2011) included both indoor and outdoor walking trails, dancing and aerobic exercises based on a DVD to be done in classrooms as components of their programs. Spiegel and Foulk (2006) educated children on F.I.T.T. or Frequency, Intensity, Time and Technique, principles, how to incorporate physical activities into their daily lives and ways to design a basic workout routine. The study by Tucker et al. (2011) educated students on the importance of physical activity and reducing sedentary behaviors like watching TV and playing video games. In the study by Yin et al. (2012), each day there was 80 minutes of physical activity broken down into the following components: 20 minutes of skill-based physical activity, 40 minutes of moderately vigorous physical activity that was developmentally appropriate and based on the monthly theme and a 20 minute cool down with stretching and resistance training. Physical activity was either measured by student survey, pedometer steps or by the PACER test. Pedometer steps, within the intervention group, increased from a mean of 3272.87 steps per day to a mean of 4644.3 steps per day (Schetzina et al., 2011). Specifically, students who received an intervention displayed decreased screen time compared to the control (Foster et al., 2008; Tucker et al., 2011). When measured, Foster et al., (2008) had the lowest decrease in screen

time with a 5% reduction in television viewing in the intervention compared to the control, p = .001. Total television hours per weekday in the intervention group decreased from 2.92 hours at baseline to 2.89 hours at follow up while they increased from 2.81 hours at baseline to 3.02 hours at follow up in the control group (Foster et al., 2008). Tucker et al. (2011) had the highest with a 34.9 minute decrease in hours of TV viewed on weekdays at follow-up compared to baseline for Elton Hills School, p = .001. Lamberg and McKenna (2011) reported that when parents were involved there was an increase in the number of days that the parent participated in physical activity with their child, from 3.3 days to five days. After receiving the intervention, children reported significant improvements in terms of cardiorespiratory fitness. The study by Yin et al. (2012) had the highest improvement, $p < .001$. During year three, beats per minute, or bpm, decreased from 162.81 at baseline to 158.26 at the posttest in the intervention group, in comparison the control group, decreased from 162.2 bpm at baseline to 160.55 bpm at the posttest. The study by Hawthorne et al. (2011) had the lowest improvement, $p < .01$. Hawthorne et al. (2011) reported a 37.1% increase in cardiorespiratory fitness for the entire sample over baseline, with differing improvements in the percent of improved cardiorespiratory fitness per grade. Kindergarteners had the least improvement with 50% improved fitness and second graders had the most improvement with 68.9% improved fitness (Hawthorne et al., 2011). It was noted that the length of the intervention affected the degree of increase in physical activity and that seasonality also impacted the amount of time students participated in moderate physical activity (Yin et al., 2012).

Common features of effective programs. The most effective programs reported a statistically significant reduction in BMI (Hollar et al., 2010; Perman et al., 2008; Spiegel & Foulk, 2006). These programs integrated both physical activity and nutrition education into their

intervention. Additionally, they focused on behavior modification, or changing the children's beliefs and attitudes about health and fitness. Children were taught the importance of eating healthy and physical activity and how they could incorporate it into their daily lives. The participants in these studies were taught about foods that were good for them, specifically nutrient dense foods. Each of these programs also incorporated the parents into the child's nutrition education, teaching parents about healthy eating so they could help their children. A brief period of aerobic physical activity was integrated into the student's typical school day, in each of the programs. This physical activity was in addition to recess and physical education classes at schools. In all three programs teachers played a part in implementing the program. Moreover, each of these programs had a duration that was at least a couple of months long, allowing adequate time for proper education.

Table 2: Summary of Common Features of Effective Programs

Author	**Type of Program**	**Type of Intervention**	**Duration**	**Program Component**
Hollar et al., 2010	In School	Nutrition and Physical Activity	2 years	• School Menu Modeling: modified menus offering healthy choices and alternatives to current foods • Classroom curriculum: teaching about good nutrition and the benefits of daily physical activity. Education on nutrient dense foods. Behavior modification to help children understand why it is important to make healthy lifestyle choices and how they can make those changes in their own lives. • Fruit and vegetable garden at intervention schools taught children how nutritious foods were served. • Physical activity: 10-15 minute desk-side physical activity daily (either the TAKE10! Or WISERCISE programs) in addition to physical education classes and recess. Schools were encouraged to have structured physical activity during recess, such as walking clubs. • Parent involvement: student's were sent home with information about healthy eating and physical activity • Implemented by teachers
Perman et al., 2008	In School and After School	Nutrition and Physical Activity	6 months	• To all children in the school: o Nutrition education: student's were taught about healthy food choices, foods were removed as rewards o Healthy breakfasts and lunches were served in schools

				○ Physical activity: in class physical activity • To children with a BMI > 85% ○ Parent education on healthy living, and cooking healthy on a limited budget and lifestyle changes. This was to give parents an understanding of why it was important to have dietary, exercise and behavioral modifications at home in addition to at school. ○ After school physical activity: 2 times a week for 90 minutes (lasting 6 months) ○ Nutrition education: time spent educating the children on nutritional information of foods ○ Student's were given a backpack with healthy snacks to take home each week ○ Behavior modification: meetings with University of Kentucky pediatric psychiatry residents which taught children about good choices and proper motivations in life • Physical education teachers supervised and assisted the after school program
Spiegel & Foulk, 2006	In School	Nutrition and Physical Activity	7 months	• Physical activity: student's were taught how to integrate physical activity into their everyday routine. Teachers implemented a 10 minute aerobic exercise routine into class time each day in addition to daily physical education classes and recess. • Nutrition education: students were taught about nutrients, the food pyramid, eating balanced meals, balancing energy input with output,

				serving sizes and nutrient density in foods. Student's then compared their beliefs about nutrition to their food choices and behaviors. They learned how different things influence their behavior and learned about and practiced critical thinking skills and also decision making in terms of health issues. • Parent involvement: student's brought information and skills they learned in class home and were taught how to share this with their parent's and discuss health issues. • Implemented by teachers, with interactions between physical education and classroom teachers

Legend: BMI: Body Mass Index, %: percentile, >: greater than

Translation into Routine Practice

Interventionist demographic. Elementary school teachers or elementary school physical education teachers were the interventionists for the program in all but one study (Hawthorne et al., 2011) included in this review. In addition one of the studies (Perman et al., 2008) had both teachers, physical education teachers, and pediatric psychiatry residents as interventionists for the program. In the study by Hawthorne et al. (2011) the researchers were the interventionist because the program could not solicit enough parent volunteers to implement the program. Additionally, Muth et al. (2008) was implemented by not only elementary school teachers but also by trained medical and high school students. The study by Perman et al. (2008) also included academic medical center students as mentors and chefs for the cooking classes.

Interventionist training. For a majority of the programs teachers were trained to implement the program (Foster et al., 2008; Hollar et al., 2010; Lamberg & McKenna, 2011; Schetzina et al., 2011; Spiegel & Foulk, 2006; Tucker et al., 2011; Yin et al., 2012). For the specific intervention they participated in, they were given instructions in regards to the program goals, the structure of the program as well as the activities to be preformed. In addition, teachers were told how to properly implement the program. Other programs that utilized other interventionists used a variety of training methods. The study by Perman et al. (2008) used pediatric psychiatry residents, who had received a degree, to implement the behavioral part of their program. Hawthorne et al. (2011) used the research team that was involved in creating the program to implement the program because at the parent orientation night they could not get enough volunteers to administer the program. In Muth et al. (2008) the high school students who implemented the program received at least thirty minutes of physical activity training and two high school specific nutrition/activity lessons that were adapted from the California LEAN

Project. Additionally, the interventionists were instructed on classroom management and public speaking development exercises on top of practice teaching sessions. Furthermore, the high school students, medical students and regular elementary school students that were to deliver the IMPACT lessons, in the study by Muth et al. (2008), were given specific training on the program.

Resources needed to implement in routine practice. Lamberg & McKenna (2008) used only resources that were already available in the school for their study, and the school district paid the teachers per their contract to promote feasibility. In the study completed by Hollar et al. (2010) multimedia educational and instructional materials, including Foods of the Month (FoM) Posters, FoM student activity packets and school gardening instructions would be needed to implement the program, as well as, on top of the OrganWise Guys kit materials, a fruit and vegetable garden and pedometers. The resources needed to implement the study by Spiegel & Foulk (2006) in routine practice would be journals, home reference materials on health education, stethoscopes, tape measures, scales, aerobic exercise DVD and DVD player, teacher guidebook and resources and finally printed reference material and a large format reference book on the human body. For the study by Perman et al (2008) non-food reward items, such as stickers, pencils and erasers, access to a large area and a pool, backpacks of healthy snacks, cooking classes offering provided meals, recipes to take home, prizes and childcare would be needed to implement this program in routine practice. Furthermore, healthy breakfast and lunch choices and individuals trained in behavior modification would be needed to implement the program by Perman et al. (2008) in routine practice. Foster et al. (2008) would require healthy foods options for meals and snacks, raffle tickets for healthy eating with prizes, such as bikes, indoor basketball hoops, jump ropes and calculators, in addition to settings for parent meetings

and weekly nutrition workshops. In the study by Hawthorne et al. (2011) the following resources would be needed to implement the program in routine practice: a ¼ mile walking trail clearly marked, mileage cards and posters, hole punches, weekly sports related prizes (basketballs, hula hoops, etc.), "I Hiked the Canyon" T-shirts, a parfait celebration for a reward, family swim passes for rewards and gift cards as rewards for staff. For the Tucker et al. (2011) study, space for parent evening offerings, pedometers, coupons for teaching, healthy foods and unhealthy foods for comparison and teaching materials on the program will be needed to apply this program to routine practice. Free USDA approved snacks, a school bus for transportation home, classrooms and a gym for the intervention, teachers to help with homework, monthly themed session plans based on developmental needs and a reception for instructor appreciation would be needed to implement the study by Yin et al. (2012) in routine practice. Schetzina et al.'s (2011) intervention program would require exercise DVDs for each classroom, a DVD player, pedometers, educational posters, indoor and outdoor walking trails and newsletters and handouts on nutrition and physical activity in order to implement the program in everyday practice. Additionally, discounted memberships to area fitness clubs, free health screenings for teachers and staff and an on-site behavioral pediatrician for primary care services would also be necessary to carry out the program executed by Schetzina et al. (2011) in every day practice. In the study by Muth et al. (2008) nutrition lessons, music and CD player, cards with activities on them, a beach ball, 20 different types of sports equipment, My Pyramid chart, different food labels with the Winner's Circle logo, and areas for classroom teaching and physical activity would be required in order to implement the program in regular practice.

Chapter 4: Discussion

This integrative review examined the effectiveness of school-based obesity prevention and reduction programs in reducing BMI, increasing physical activity, and improving nutritional choices. It also identified common features in the effective programs.

Effective Programs

Effective programs included both nutrition education, specifically education on healthy foods that were nutrient dense, and physical activity, specifically daily aerobic activity on top of physical education and recess. The most effective programs also focused on behavior modification and teaching children how to live healthier lives and the importance of that. Furthermore, the duration of these programs was at least a half of a year long and included parent and teacher involvement. Parent and teacher involvement helped the program effectiveness because these are people who see the children each day and have a big impact on their lives as a whole. Effective programs focused on not just telling children why they should eat healthy and be active, but by showing them why these changes were important. However, since dietary offerings were not controlled in each school this may have effected what the results. Additionally, physical education is not a daily requirement in some of the schools and recess may not have been offered thereby affecting the outcomes.

Duration plays an important role in program outcomes, with programs having a duration of at least a few months being most effective. Studies that reported a statistically significant decrease in BMI were at least six months in duration (Hollar et al., 2010; Perman et al., 2009; Spiegel & Foulk, 2006). Furthermore, studies that had a statistically significant reduction in BMI used a combined approach of both physical activity and nutrition education (Hollar et al., 2010; Perman et al., 2009; Spiegel & Foulk, 2006). When parents were involved there was also

an increase in the number of days the parent participated in physical activity with their children, thereby making children more active (Lamberg & McKenna, 2011).

Interventions Suitable for General Use in Schools

Several interventions were found to be suitable for general use in schools. Programs that require little training are more feasible for general use in schools due to limited resources and time constraints. Those interventions that incorporated their program into the daily schedule already in place were also more likely to be feasible as this did not require the children to stay after school. Additionally, by having the program incorporated into the school curriculum, extra pay for teachers will not be required. If children did stay after school, transportation would need to be provided in order to facilitate increased participation. The interventions that used walking trails were suitable for general use as these trails could be used in almost all locations and are a great way to promote physical activity. Those interventions that provide some sort of incentive, such as stickers, t-shirts or sports paraphernalia were better received and can draw more participation but would call for monetary investment by potentially underfunded schools. However, studies that included variations of fun activities and provided appropriate nutrition education incorporated into the school curriculum would be economically feasible for schools. One way to make interventions suitable for general use in schools is to change the foods that are available to children in the school in order to promote better nutrition. Programs that would be most suitable for general use in schools were those that did not require additional resources that the school did not already have.

Interventions Not Suitable for General Use in Schools

The interventions that required specialists, such as pediatric psychiatrists or nutritionists, are not suitable for all schools because these professionals may not be available to all schools in

part due to location and cost. Additionally, programs that require a lot of extra materials and time from professionals could be costly, and therefore not suitable for use in all schools, particularly those in lower SES communities. Although these interventions demonstrated good results in term of improved health, the costs make them not suitable for general use in schools. However, the money spent on these programs may be offset in the future if the rates of obesity can be decreased. Money can be saved by implementing these programs early on the healthcare needs of obese adults.

Diversity in Methods and Measurement

Ultimately the material published on obesity programs implemented in schools is diverse. The inclusion and exclusion criteria varied between studies. Some studies included only overweight or obese children while others included kids of various weights. There were several studies that focused on minority children, while most included all racial groups. Additionally, some of the studies focused on children who were of low socioeconomic status, whereas, some studies had a variety of socioeconomic statuses. Thus, the study populations varied between the studies making comparison of outcomes difficult.

Moreover, the components of each study varied. Some programs were delivered during school hours while others were delivered after school as an extracurricular program. Additionally, some had parent involvement while others included a community component to them. The outcomes of the programs also differed. For example, some studies measured BMI, some measured physical activity, some measured nutrition and still some used varying combination of these measures. The duration of each study varied significantly, ranging from one week to three years. Still, a few studies did not have a control group which made it difficult to make inferences on the effectiveness of the program. Therefore, it was difficult to synthesize

the results and ultimately examine the true effectiveness of the programs due to the lack of uniformity among the study samples, designs and measures.

Several other reviews in this domain reported the same issues that were explored in this integrative review (Budd & Volpe, 2006; Katz, O'Connell, Njike, Yeh, & Nawaz, 2008). However, it has been found that school-based obesity prevention programs are effective at increasing physical activity in students, as well as improving students' knowledge and attitudes about eating and physical activity (Budd & Volpe, 2006). Zenzen and Kridli (2008) performed an integrative review of school-based obesity prevention programs in children to examine the quality of present research. They established that obesity prevention in schools were most effective if they include intervention components that modify dietary habits, modify physical activity, include healthy lifestyle education and have parental involvement (Zenzen & Kridli, 2008). The studies examined in this integrative review were different than those in the review by Zenzen and Kridli (2008); however, they did support their findings. This analysis was different in that it incorporated more articles, which examined BMI and had fewer articles that included healthy lifestyle education. Additionally, the purpose in this review differed from the purpose in Zenzen and Kridli (2008) because they sought to display the degree of variability within school-based obesity prevention programs in terms of framework and approaches. While this review did in fact note the variation in the framework and approaches of school-based obesity prevention programs, it was able to identify common features that make programs most effective, just as Zenzen and Kridli (2008) were able to identify from their research.

Strengths and Limitations

Within this integrative review several limitations were identified. First, there is the possibility that relevant research articles were missed, although the literature identification

process was thorough and should have identified all relevant studies. Second, most studies varied with respect to outcomes examined, making it difficult to directly compare the results. A third limitation is that each study examined different measures, such as BMI, physical activity and nutrition. This limited the comparison between each study because they had to be split into subcategories and compared within the category their measures fit into. However, each study had a component that was a part of the criteria for determining the effectiveness of school-based obesity prevention programs and thus provided valuable evidence on these programs. Despite the limitations there are several strengths to this literature review. One of which is that several studies produced similar results. This allows for a certain degree of generalization to be made, especially since the studies were conducted in various geographic locations throughout the United States thus eliminating certain biases. Finally, all of the studies were published within the last ten years, making the results current.

Implications

Healthy eating habits and physical activity are significant factors that should be advocated for all children in society. By encouraging these practices children will fundamentally live healthier lives. It is imperative that children who are already overweight or obese be taught these behaviors because they are already at a greater risk for multiple health problems. There is limited research about the use of and the components of these programs, and these should be studied further. There are few studies that evaluate the effective components of the intervention and the length of time necessary to produce changes. It is unclear how long programs need to be in order to be successful, however, maintaining the desired effects are key. Based upon these shortcomings, further longitudinal studies are recommended to assess sustainability and to determine the duration of intervention needed for effective reductions in BMI, improved

nutrition and physical activity. Additionally, programs including each component, physical activity and nutrition on its own, need to be implemented in similar populations to assess which of these has a greater significance in reducing BMI or if they are both equally important.

Physical activity in schools needs to be increased in order to improve fitness levels. Nowadays children are more sedentary and so perhaps increasing the level of physical activity in schools will help to stimulate physical activity elsewhere. Teaching about the importance of physical activity in schools will decrease screen time outside of school (Foster el al., 2008, Tucker et al., 2011). Based upon the different types of physical activity in the included studies, children can participate in a wide variety of exercise. Further research is needed to determine which components work best at increasing physical activity while decreasing BMI.

Since schools are where children spend the greater part of their waking hours they must be utilized as a base for childhood obesity prevention and intervention programs (Spiegel & Foulk, 2006). There are great resources in schools that could be utilized, such as teachers, counselors and nurses, to help educate students on healthy lifestyles. The knowledge that students learn in school is immeasurable. This knowledge must include information on proper nutrition to teach children how to make better nutritional choices (Muth et al., 2008; Schetzina et al., 2011). Instead of consuming fruit juices, sports drinks and soda, children should drink water and fat free milk (Tucker et al., 2011). Children need to be taught how to eat better in terms of food selection and the portions of each type of food the select.

Ultimately, since school-based obesity prevention programs have been shown to decrease BMI, (Foster et al., 2008; Hollar et al., 2010; Lamberg & McKenna, 2011; Muth et al., 2008; Perman et al., 2008; Spiegel & Foulk, 2006; Tucker et al., 2011; Yin et al., 2012) they should be an aspect of education in schools. That being said, more research needs to be done in order to

determine if school-based obesity prevention and intervention programs produce statistically significant results since only three of the studies included in this review did (Hollar et al., 2010; Perman et al., 2008; Spiegel & Foulk, 2006). Additionally, the length of a program is an element of its effectiveness (Yin et al., 2012). Future studies need to examine the length of programs in comparison to their effectiveness in reducing BMI, improving nutrition and increasing physical activity. It was found that parent involvement bolstered program effectiveness (Lamberg & McKenna, 2011). Thus, future studies need to be completed to determine if programs that incorporate parental participation are more effective than those that do not.

Continued research is necessary to guide schools in determining effective obesity prevention programs. Those studies that were successful in reducing BMI should be referred to, to provide a basis for future investigations. Demonstrations of success involved both nutrition and physical education. It is important to include both of these aspects to improve health and sustain healthy lifestyles. More longitudinal randomized control trials need to be completed in order to determine effective components of BMI reduction and move the science forward.

Table 3: Data Extraction Matrix

Citation	**Purpose and/or Hypothesis or Research Question**	**Sample and Setting**	**Study Design**	**Data Collection**	**Main Component of Intervention**	**Comparison Group**	**Major Findings**	**Strengths & Limitations**
Hollar, et al. (2010). Effective multi-level, multi-sector, school-based obesity prevention programming improves weight, blood pressure, and academic performance, especially among low-income, minority children. *Journal of Health Care for the Poor & Underserved, 21*(2), 93-108.	Reduce childhood obesity rates, and improve health status and academic achievement	N=3,769; (50.2% Hispanic) Central Florida (5 elementary schools- 4 intervention, 1 control)	Quasi-experimental design Convenience sample	Outcome Measures: BMI Wt. Other variables: Ht. Systolic blood pressure Diastolic blood pressure Pulse	(1) modified dietary offerings, (2) nutrition/lifestyle educational curricula (sent home packets of information to parents); (3) increased opportunity for physical activity and (4) wellness projects. Duration: 2004-2006	1 elementary school: received no intervention Similar characteristics to intervention groups	Intervention children experienced a greater decrease in BMI % during year 1 (2004–5) of the study. Statistical significance in BMI % in year 2 (2005-6) with intervention children having a decreased BMI %	*Strengths:* large sample size, diverse sample *Limitations*: can't control eating or exercise habits outside of school. & holidays & summer vacation, Measurements taken in nonclinical settings: susceptible to error, BP susceptible to error, study population wasn't selected at random & there was only 1 control school

Foster et al. (2008). A policy-based school intervention to prevent overweight and obesity. *Journal of the American Academy of Pediatrics, 121*(4), 794-802.	Examine the effects of a multi-component, School Nutrition Policy Initiative on the prevention of overweight and obesity among children in grades 4 through 6 over a 2-year period.	N= 1349 Grades 4-6 Philadelphia School District (10 schools) (50% of students eligible for free or reduced-price meals.)	Randomized control trial	Outcomes Measures: Wt. BMI Dietary intake, physical activity and sedentary behavior (via the Youth/Adolescent Questionnaire) Other variables: Ht.	SNPI (School Nutrition Policy Initiative): (1) School-self assessment, (2) nutrition education, (3) nutrition policy, (4) social marketing, (5) parent outreach Duration: 2 years	Control schools: didn't receive intervention	The intervention resulted in a 50% reduction in the incidence of overweight. Significantly fewer children in the intervention schools (7.5%) than in the control schools (14.9%) became overweight after 2 years. The prevalence of overweight was lower in the intervention schools. (Decreased by 10.3% in intervention & increased by 25.9% in control) Especially in black students (41% less likely) Decreased sedentary behavior in the intervention group	*Limitation:* limited ability to create identically equivalent groups Self-reported questionnaires were used

Spiegel & Foulk (2006). Reducing overweight through a multidisciplinary school-based intervention. *Obesity (Silver Spring), 14*(1), 88-96.	Evaluate the effectiveness of a multi-disciplinary elementary school– based intervention entitled Wellness, Academics & You	Sample: 1013 students in fourth and fifth grades from 69 classes (at 16 schools) in 4 states (Delaware, Florida, Kansas and North Carolina) Intervention and comparison classes were randomly selected at each schools	Multi-disciplinary school-based intervention Randomized control trial	Outcome Measures: Wt. & BMI Physical activity (via questionnaire) Fruit & vegetable consumption (via questionnaire) Other variables: Ht.	Delivered by teachers Intervention during school yr: w/ ranging engagement time from 20min to 1hr Via directed-reflective journaling & class discussion students formed their own attitudes & beliefs about health Module 1-7 Intervention integrated into the core curriculum (language arts, math, & health content) Questions about eating habits, physical activity, weight, self-image, and other behaviors and attitudes Duration: November 2003-June 2004 (7 months)	Control Group selected randomly at each site N=35	Increased fruits and vegetables consumption in both (a notably higher increase in the intervention group) Increased physical activity levels Significant 2% reduction in overweight group BMI	*Limitations:* The evaluation covered a limited time period and, therefore, warrants additional studies to determine whether long-term program fidelity will result in continued improvement No data with respect to increased fruit and vegetable consumption or physical activity

Yin et al (2012). The impact of a 3-year after-school obesity prevention program in elementary school children. *Journal of Childhood Obesity, 8*(1), 60-70.	To determine the effects of a 3-year after-school physical activity (PA) program without restriction of dietary energy intake, on percent body fat (%BF), cardio-respiratory fitness (CRF), and cardio-metabolic markers in children	N= 574 (3^{rd} graders) 18 elementary schools in a school district in Georgia	Randomized control design	Outcome Measures: Wt. BMI Cardiorespiratory Fitness via HR after PACER test Other variables: Ht. Waist circumference % Body Fat (%BF) Nonfasting total cholesterol High-density lipoprotein cholesterol BP	FitKid Program: 120 min after school program: 1.) 40 minutes of snack & teacher assisted homework and academic activities 2.) 80 minutes: w/ 20 minutes for skill based PA, 40 minutes of vigorous PA, 20 minutes of stretching/ resistance training & cool down Duration: 3 years	Control schools: didn't receive the FitKid Program	Intervention group showed: Significant improvements in CRF Significant decreases in %BF and waist circumference (but they rebounded over the summer months when the program was not implemented) BMI was less in intervention group than the control group A program that provides a sufficient dose of MVPA, without restriction of energy intake, can enhance body composition and fitness	*Strengths*: Measures longitudinally, assessed fidelity of study design & intervention implementation *Limitations:* unable to assess the reasons of discontinuation in FitKid, costly and logistically challenging to send kids home after the program on school buses

Hawthorne et al. (2011). Grand Canyon Trekkers: School-based lunchtime walking program. *Journal of School Nursing, 27*(1), 43-50.	Examine the effects of a structured walking program on components of health-related physical fitness of low-income, primarily Hispanic students in kindergarten through sixth grade.	N= 1293 (43% Hispanic population at the school) (51% girls & 49% boys) 10 Title 1 elem schools in a large, urban school district in the Southwestern U.S. (Arizona)	A quasi-experimental design	Outcome Measures: Wt. BMI Cardiorespiratory fitness (via PACER test) Other variables: Ht. Waist circumference	Structured walking during recess 3 days per week Duration: 16 weeks	Recess time to do with whatever they wanted	Obese participants walked sig less miles. Cardio-respiratory fitness inc by 37.1% over baseline in the entire sample Obese youth had a smaller overall change in fitness compared to overweight or healthy weight participants No sig changes in BMI percentile or waist circumference	*Limitations*: no control group, the use of volunteers for obtaining measurements, & a single geographic location (limiting generalizability).

Schetzina et al. (2011). The Winning with Wellness pilot project: Rural Appalachian elementary student physical activity and eating behaviors and program implementation 4 years later. *Journal of Family and Community Health, 34(*2), 154-62.	To describe the pilot school's role in the WWW project by investigating progress in promoting physical activity and healthier eating 4 years later	N= 66 Rural Appala-chian (TN) elementary schools	Quasi-experimental design	Outcome Measures: Physical activity (via questionnaire) Eating behavior via questionnaire) Pedometer data, Cafeteria data (foods purchased) Other variables: Teacher surveys about students activity & the program	WWW Project: Nutrition Services (grade specific lesson plans), health education (pedometers, charts with goals, and incentives), physical education (indoor walking trail, Prerecorded Move-It Moments on DVD), school health services (referrals made to physicians), healthy school environment (healthy rewards, parties, etc), family & community involvement & school site health promotion for staff Duration: 4 years after the WWW Project	No control group	Significant changes in student health behaviors in 2009 compared w/ 2005: 1.) Healthier food choices selected on student surveys, 2.) an increase in daily pedometer steps during the school day 3.) healthier foods offered in the cafeteria 4.) healthier food selections/purchases by students in the cafeteria Teachers felt students were getting about the right amount of physical activity & that the program was improving students overall health	*Limitations:* No control group, and that it may be lengthier and less straightforward process *Strength:* the 4-year duration follow-up is a strength lacking in many published studies of school-based prevention programs

Muth et al. (2008). Making an IMPACT: Effect of a school-based pilot intervention. *North Carolina Medical Journal, 69*(6), 432-40.	The objective of this pilot study was to evaluate the IMPACT program's effect on HS and ES participants' knowledge, attitudes, and behavior regarding nutrition and physical activity.	N= 75 (Grade 4) Rural NC elementary school	Randomized control trial	Outcome Measures: Wt. BMI Nutrition behavior/fruit & vege consumption (via questionnaire) Physical activity (via questionnaire) Other variables: Ht. BMI Percentile	Two classrooms Implemented by HS students & 2 med students 20 mins of physical activities & 40 mins of a nutrition lesson Weekly HW assignments that required parent or guardian participation for each lesson Duration: 12 weeks	Two control classrooms N= 37 students	Intervention group: increase in daily fruit & vegetable servings (decrease in control group) Intervention group: increase in calcium-rich foods & grains & significant increase in proportion of students who knew which food group most servings should come from No significant changes within the control group for BMI, physical activity behaviors, sedentary behaviors, dietary attitude	*Limitations:* Small sample size, risk of cross-contamination, and short program duration. Curriculum did not include a substantial family component or an after school component, (may be needed to increase physical activity) Difficult to detect small changes in physical activity due to self-reported questionnaires

Lamberg & McKenna (2011). Development of an after-school wellness club to promote physical activity and healthy lifestyle. *Internet Journal Of Allied Health Sciences & Practice, 9*(1), 403-13.	To deliver a quality program that was fiscally responsible and to gain acceptance and support from students, parents, teachers and school and district administrators.	N= 49 (Grades 3-4) 33 third graders (18 male, 15 female) 16 fourth graders (9 male & 7 female) Setting: one elementary school (after school) in New York	Quasi-experimental design	Outcome Measures: Wt. BMI Physical activity (based on questionnaires Other variables: Ht.	After school program that met for 1 hr, twice a week Exercise program w/ at least 44 minutes of vigorous physical activity (60min, twice a week) Healthy lifestyle education for 10-15 minutes, once a week (3 days total) Parents met for education classes over 3 days Duration: 4 weeks	No comparison group	Increased # of days children participated in moderate physical activity (from 3.3 to 5) Increase in days parent participated in moderate physical activity with their child (from 1.8 to 2.3) More kids were in a healthy weight post-intervention but the changes in weight BMI or weight classification were not statistically significant	*Strengths:* Low cost program *Limitation:* Length of program (4 weeks) No control group for comparison Small sample size Poor parent participation for obese and overweight children due to failure to recognize and value the importance of physical activity and healthy lifestyle

Perman et al. (2008). *A community-driven obesity prevention and intervention in an elementary school. Journal of the Kentucky Medical Association, 106*(3), 104-8.	To design & implement an intervention intended to slow the accretion of BMI in elementary students who are at the 85th percentile or greater.	N= 40 Students selected had a BMI > 85%. (N= 350 for both project & comparison schools) (Minority population: 67% African-American & 13% Hispanic) (Low-income population: 93% on free/reduced lunch) Setting: Lexington Kentucky	Quasi-experimental design	Outcome Measures: Wt. BMI Other variables: Ht.	Program met for 90min twice a week Students participated in activities such as: swimming at the YMCA & hop-hop dancing. Nutrition class and small group sessions w/ UK pediatric psychiatry residents (focused on good choices & proper motivations in life). Kids also got a backpack each week with healthy snacks to take home Families got 4 healthy cooking lessons Duration: 6 months	Comparison school: no intervention	The mean post-intervention BMI percentile of children at the project school was significantly different than that of the comparison group. (Decrease in BMI percentile) A trend toward slower accretion in mean BMI noted in the project school.	*Limitation:* Family participation, duration of the program, cost of the program was fairly high compared to other programs of the same nature

Tucker et al. (2011). A school based community partnership for promoting healthy habits for life. *Journal of Community Health*, *36*(3), 414-22.	Objective: compare a healthy habits classroom program (control group) to the healthy habits classroom program plus 1:1 coaching delivered by nursing students (intervention group) on outcomes of physical activity levels, screen time and nutrition patterns among 4-5th grade children	99 children from 2 schools in Minnesota (Elton Hills Elementary School (EHS) and Harriet Bishop Elementary School (HBS))	Quasi-experimental design	Outcome Measures: Wt. BMI Nutrition/health habits (via Healthy Habits Survey) Physical activity (via the StepWatch Activity Monitor) Other variables: Ht.	Lets Go 5-0-1-2 program, plus nurse coaching, plus parent evenings Duration: EHS: 7 months HBS: 4 months	Only Lets go 5-0-1-2	EHS: BMI: NS (no difference) fruits & vegetables per day: increased Servings of soda per day: decreased HBS BMI: decrease Servings of fruit juice per day: decrease Minutes of TV per day: decrease	*Limitations:* Lack of pure control group & consolidation of groups for analyses Multiple interventionists(student nurses) may have resulted in varying styles of interaction thus varying impact

Legend: BMI: Body Mass Index, Inc.: increased, Yr: year, Sig: significant(ly), Vege: vegetables, Elem: elementary, ES: elementary school, HS: high school, Hr: hour, Min: minute(s), Ht.: height, Wt.: weight, %: percent(ile), BP: blood pressure, %BF: percent body , fat, HR: heart rate, PA: physical activity, CRF: cardiorespiratory fitness, W/: with, HW: homework, #: number, UK: University of Kentucky, TV: television

References

Budd, G. M., & Volpe, S. L. (2006). School-based obesity prevention: Research, challenges, and recommendations. *The Journal of School Health*, *76*(10), 485-495.

Center for Disease Control and Prevention, Division of Adolescent and School Health. (2011). *About BMI for children and teens*. Retrieved from the CDC website: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

Center for Disease Control and Prevention, Division of Adolescent and School Health. (2011). *Childhood obesity facts*. Retrieved from the CDC website: http://www.cdc.gov/healthyyouth/obesity/facts.htm

Center for Disease Control and Prevention, Division of Nutrition, Physical Activity and Obesity. (2011). *Overweight and obesity- data statistics*. Retrieved from the CDC website: http://www.cdc.gov/healthyyouth/obesity/facts.htm

Department of Health and Human Services, National Institutes of Health. (2012). *How are overweight and obesity diagnosed?*. Retrieved from http://www.nhlbi.nih.gov/health/health-topics/topics/obe/diagnosis.html

Deurenberg , P., Weststrate , J. A., & Seidell, J. C. (1991). Body mass index as a measure of body fatness: age- and sex-specific prediction formulas. *British Journal of Nutrition*, *65*(2), 105-114. Retrieved from http://www.halls.md/bmi/fat.htm

Ferraro, K. F., Thorpe, R. J., & Wilkinson, J. A. (2003). The life course of severe obesity: Does childhood overweight matter?. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, *58*(2), S110-S119.

*Foster G.D., Sherman, S., Borradaile, K.E., Grundy, K.M., Vander Veur, S.S., Nachmani J,…. Shults, J. (2008). A policy-based school intervention to prevent overweight and obesity.

Journal of the American Academy of Pediatrics, 121(4), 794-802. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/18381508

Harris , A. D., Bradham, D. D., Baumgarten, M., Zuckerman, I. H., Fink, J. C., & Zuckerman, E. N. (2004). The use and interpretation of quasi-experimental studies in infectious diseases . *Clinical Infectious Diseases, 38*(11), 1586–91. doi: 10.1086/420936. Retrieved from http://cid.oxfordjournals.org/content/38/11/1586.full.pdf+html

*Hawthorne, A., Shaibi, G., Gance-Cleveland, B., McFall, S. (2011). Grand Canyon Trekkers: School-based lunchtime walking program. *Journal of School Nursing, 27*(1), 43-50. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/21123848

The Himmelfarb Health Sciences Library. (2011). *Study design 101*. Retrieved from http://www.gwumc.edu/library/tutorials/studydesign101/rcts.html

*Hollar, D., Lombardo, M., Lopez-Mitnik, G., Hollar, T. L., Almon, M., Agatston, A. S., & Messiah, S. E. (2010). Effective multi-level, multi-sector, school-based obesity prevention programming improves weight, blood pressure, and academic performance, especially among low-income, minority children. *Journal of Health Care for the Poor & Underserved, 21*(2), 93-108. doi: 10.1353/hpu.0.0304

Institute of Medicine , Committee on Prevention of Obesity in Children and Youth. (2005). *Preventing childhood obesity: Health in the balance*. Washington, DC: The National Academic Press.

Jan, S., Bellman C., Barone, J., Jessen, L., & Arnold M. (2009). Shape it up: A school-based education program to promote healthy eating and exercise developed by a health plan in collaboration with a college of pharmacy. *Journal of Managed Care Pharmacy, 15*(5), 403-13. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19496637

Katz, D. L., O'Connell, M., Njike, V. Y., Yeh, M., & Nawaz, H. (2008). Strategies for the prevention and control of obesity in the school setting: systematic review and meta-analysis. *International Journal of Obesity*, *32*, 1780-1789.

*Lamberg, E. M., & McKenna, R. F. (2011). Development of an after-school wellness club to promote physical activity and healthy lifestyle. *Internet Journal Of Allied Health Sciences & Practice*, *9*(1), 403-13.

Morrison-Sandberg, L.F., Kubik, M.Y., & Johnson, K.E. (2011). Obesity prevention practices of elementary school nurses in Minnesota: findings from interviews with licensed school nurses. *Journal of School Nursing, 27*(1), 13-21. Retrieved from http://www.ncbi.nlm .nih.gov/pubmed/20966488

*Muth, N.D., Chatterjee, A., Williams, D., Cross, A., & Flower, K. (2008). Making an IMPACT: Effect of a school-based pilot intervention. *North Carolina Medical Journal, 69*(6), 432-40. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19256179

Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2012). Prevalence of obesity and trends in body mass index among us children and adolescents, 1999-2010. *Journal of the American Medical Association*, *307*(5), E1-E8.

*Perman J.A., Young T.L., Stines E., Hamon J., Turner L.M., & Rowe M.G. (2008). *A community-driven obesity prevention and intervention in an elementary school. Journal of the Kentucky Medical Association, 106*(3), 104-8. Retrieved from http://www.ncbi.nlm. nih.gov/ pubmed/18488968

Resnick, E.A., Bishop, M., O'Connell, A., Hugo, B., Isern, G., Timm, A….Geller, A.C. (2009). The CHEER study to reduce BMI in Elementary School students: A school-based, parent-directed study in Framingham, Massachusetts. *The Journal of School Nursing, 25(*5),

361-72. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19564251

*Schetzina, K.E., Dalton, W.T. 3rd, Pfortmiller, D.T., Robinson, H.F., Lowe, E.F., & Stern, H.P. (2011). The Winning with Wellness pilot project: Rural Appalachian elementary student physical activity and eating behaviors and program implementation 4 years later. *Journal of Family and Community Health, 34(*2), 154-62. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/21378512

*Spiegel S.A., Foulk D. (2006). Reducing overweight through a multidisciplinary school-based intervention. *Obesity (Silver Spring), 14*(1), 88-96. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/16493126

*Tucker S., Lanningham-Foster L., Murphy, J., Olsen, G., Orth, K., Voss, J….Lohse, C. (2011). A school based community partnership for promoting healthy habits for life. *Journal of Community Health, 36*(3), 414-22. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20976532

*Yin, Z., Moore, J. B., Johnson, M. H., Vernon, M. M., & Gutin, B. (2012). The impact of a 3-year after-school obesity prevention program in elementary school children. *Journal of Childhood Obesity*, *8*(1), 60-70.

Zenzen, W., & Kridli, S. (2008). Integrative review of school-based childhood obesity prevention programs. *Journal of Pediatric Health Care*, *23*(4), 242-258.

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