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**Child and Adolescent Obesity: A Review of Community-based
Approaches to a Growing Problem**

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**Child and Adolescent Obesity: A Review of Community-based
Approaches to a Growing Problem**

by

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Capstone

Presented to the Faculty of the Graduate School of

The University of Texas Medical Branch

in Partial Fulfillment

of the Requirements

for the Degree of

Masters of Public Health

The University of Texas Medical Branch

December 2007

Acknowledgements

I would like to acknowledge my committee for their outstanding guidance and tremendous patience in helping me to complete this project. Dr. Rudkin for providing a number of resources that aided me in selecting a topic that would allow me to continue my future work. I would also like to thank Dr. Campbell for providing me with a basic design for a literature search and assistance in finding programs that met my project criteria. Dr. Reifsnider, thank you for the points of contact and the extremely helpful comments. Dr. Kristen Peek, thank you for saving the day by stepping in as my committee member on short notice. I truly appreciate your willingness to help with this project.

Additionally, I would like to thank the entire GSBS department for their prayers and support during my illness. To my classmates who provided a number of pertinent articles related to my topic, I appreciate your true team approach to getting the job done. I extend a special thanks to my mother, for all of her support, helpful suggestions and reassurances that I would complete this task.

Child and Adolescent Obesity: A Review of Community-based Approaches to a Growing Problem

Publication No. _____

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The University of Texas Medical Branch, 2007

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The prevalence of overweight/obesity among adults and children in our society has increased to levels which render it a public health priority. These conditions are known to be causal factors in the onset of many chronic diseases in adulthood, but are now affecting the youth population as well. Though genetics are partially responsible, the increase in prevalence of obesity is more likely due to dietary factors and sedentary behavioral practices.

The purpose of this project is to identify community based programs within the United States and conduct a preliminary assessment of their effectiveness using existing health promotion guidelines. I will identify community approaches that have been initiated and present preliminary self-reported data as to their effectiveness in recruitment, overall results, and compliance with guidelines as outlined by the Human Health Services Department for community based programs. The results of this project should be helpful in the establishment of additional community based programs and possibly provide policy makers with information that will facilitate the creation of more effective programs. The specific aims are as follows:

- Conduct a literature search to identify the established nutritional and physical fitness guidelines that address child or adolescent obesity.

- Conduct a literature search of community based programs from 1990-2006 that used physical activity as a component to reduce or prevent childhood or adolescent obesity.
- Use published review articles to identify the most effective programs that target either prevention of childhood / adolescent obesity or reduction of childhood / adolescent obesity and comment on their use of established guidelines.

This work identified a number of interventions that targeted both adults and youth. Most studies reported some measure of success, but lacked any definitive replicable results due to design limitations and lack of long-term follow-up. Societal methods to successfully address the issue will require multi-faceted efforts of individuals, families, and institutions at the local, state and national levels.

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List of Abbreviations

ACS	American Cancer Society
ACSM	American College of Sports Medicine
ADA	American Diabetes Association
AHA	American Heart Association
AOA	American Obesity Association
BMI	Body Mass Index
CATCH	Child and Adolescent Trial for Cardiovascular Health
CDC	Centers for Disease Control and Prevention
CKC	CATCH Kids Club
CLASS	Children's Lifestyle and School-Performance Study
DGAC	Dietary Guidelines Advisory Committee
FDA	Food and Drug Administration
GAO	Government Accounting Office
IOM	Institutes of Medicine
K	Kindergarten
MA	Multimedia Action
MD	Doctor of Medicine
MPH	Masters of Public Health
NCI	National Cancer Institute
NHANES	National Health and Nutrition Examination Survey
NHLBI	National Heart, Lung and Blood Institute
NIH	National Institutes of Health
OPRA	Obesity Prevention for Pre-adolescents
OW	Overweight
PA	Physical Activity
PACE	Provider-Based Assessment and Counseling for Exercise
PCPFS	President's Counsel on Physical Fitness and Sports
RCT	Randomized Controlled Trials
SB	Senate Bill
SHPPS	School Health Policies and Program Study
SPARK	Sports Play and Recreation for Kids
TEA	Texas Education Agency
UI	University of Iowa
US	United States
USDA	United States Department of Agriculture
USDHEW	United States Department of Health, Education and Welfare
USDHHS	United States Department of Health and Human Services
UT	University of Texas
WA	Written Action
YNFI	Youth Nutrition and Fitness Initiative

Chapter 1: Introduction

In the introduction we will provide a brief background of increasing prevalence of child and adolescent obesity and why this emergence is an important public health issue today. For the purpose of clarity, we will define some of the key terms used throughout the literature and give the significance to public health today. The final portion of the chapter will address the capstone project and list the specific aims.

PREVALENCE OF OBESITY AND OVERWEIGHT AS A PUBLIC HEALTH ISSUE

One of the most important public health issues facing the United States and other industrialized nations today is the increasing prevalence of children who are overweight or obese (Bascetta, 2005). The implications are alarming when recognizing that the problem extends beyond the adult population to young adults and children. According to the 2001-2002 National Health and Nutrition Examination Survey (NHANES), the data monitoring source for the United States (US), among children ages 6-19, 31.5% were at risk for overweight and 16.5% were overweight. These numbers are slightly increased from 1999-2000 figures which were 29.9% and 15% respectively (Hedley et al, 2004). As with many of the health issues in the United States, minority children are disproportionately affected. Studies consistently report higher prevalence of obesity in African and Mexican Americans as compared with white, non-Hispanic population. Statistics from NHANES 1999-2002 Report, reveal that 13.6 % of white non-Hispanic children aged 6-19 are overweight; in contrast to 20.5% of non-Hispanic Black / African American children and 22.2% Mexican American children in that same age range (NHANES, 2002). When developing programs to address the issue, it will be important to keep in mind the cultural differences and social norms that will affect these populations of people.

DEFINITIONS

When attempting to delineate the significance and consequences of the problem, it is important to define the terms referenced in the literature that describe the conditions – obese and overweight. The definition of obesity, a condition of excess body fat, is relatively arbitrary and usually based on an approximation of body fat, using what is called the body mass index (BMI / Quetelet's index = weight in kg/ height in m²). In adults a BMI >25 but <30 is considered overweight, and >30 is considered obese for both males and females. It is important to note that overweight may or may not be due to increased body fat, but may be due to increased lean muscle mass (NIH, 1998).

In children there is an additional dimension of age which is also factored into the equation criterion. The Centers for Disease Control and Prevention (CDC) avoids using the term “obesity,” and identifies every child and adolescent above the 85th percentile as “overweight” or at risk for obesity. Consistent with this classification, the American Obesity Association (AOA) uses the 95th percentile as criteria for obesity because it corresponds to a BMI of 30, obesity in adults, and the 85th percentile as overweight because it corresponds to a BMI of 25. Additionally, the 95th percentile is associated with increased risk of persistence of obesity into adulthood, and increased risk of other diseases such as hypertension and hyperlipidemia (AOA, 2006). The percentile criterions are based on a growth chart revised from data from the NHANES study which incorporates national averages for age and weight (Barlow and Dietz, 1998). The most recent growth charts are available from the CDC website <http://www.cdc.gov/growthcharts.pdf> or <http://www.brightfutures.org/bf2/pdf/pdf/GrowthCharts.pdf> and are used by health profession offices and schools as a basic measure for obesity in children. (CDC, 2006)

SIGNIFICANCE TO PUBLIC HEALTH

Obesity in adulthood is a significant risk factor for hypertension, diabetes, heart disease, gallbladder disease, and some forms of cancer (Jung, 1997 as cited in Swinburn et al, 2004). Once obesity has been established in adulthood, the probability of achieving ideal body weight voluntarily is very low (Stunkard and Penick, 1979 as cited in Serdula et al, 1993). In general, children in the past were not considered at risk for the many chronic health diseases associated with overweight and obesity, primarily because the prevalence of obesity was much lower. Consider now research shows that 26-41% of obese *preschool* students become obese adults and 42-63% of obese *school-aged* children become obese adults (Serdula et al, 1993). Further, childhood obesity is associated with increased risk factors for chronic adulthood diseases such as hypercholesterolemia and hypertension, and there is an increased incidence of co-morbid conditions such as type 2 diabetes, irregular menstruation, dyslipidemia, liver dysfunction and orthopedic complications in early adolescence (Dietz, 1998; Hill & Trowbridge, 1998). If no actions are taken to reverse this deadly trend, obesity is soon predicted to overtake cigarette smoking as the most preventable cause of death (Mokdad et al, 2004). Recent studies also suggest that long-term consequences of childhood obesity may include low self-esteem, eating disorders, depression and cardiovascular disease (Guo et al, 2002). In order to effectively execute a prevention strategy, intervention at the early childhood juncture is paramount. Recent studies have shown that the greatest increase in the prevalence of obesity is among 6-11 year olds, with an increase of 54% over the last 30 years (Landers, 2004).

In identifying possible causes for this trend, much has been attributed to the nature of American society, specifically, convenience of fast food restaurants, increased sedentary entertainment (e.g. computer gaming), and heavy marketing of unhealthy foods

(Nestle, 2003). From a public health perspective, interventions that target childhood obesity are important and offer the best hope for prevention of obesity associated diseases.

THE CAPSTONE PROJECT

There is a familiar saying that states “it takes a village to raise a child.” When considering the enormity of the obesity epidemic, changing the trend of obesity must involve interventions at the family, local, state, and national level communities. In 2002, the Public Health Approaches to the Prevention of Obesity Working Group of the International Obesity Task Force recommended a wide range of actions as a part of a comprehensive approach to abate obesity. Aside from the obvious need to address both the dietary habits and physical activity patterns of the population, the group specifically stated a need for multiple focal points and levels of intervention. Of note, the plan must include both societal and individual level factors with links between sectors that might otherwise be considered independent (Connolly, 2005).

Community based programs and interventions have proven to be effective in other health promotion campaigns such as preventing tobacco use (IOM, 2005). Although there have been a number of programs initiated that address nutrition, weight reduction and childhood obesity, there have been a limited number of studies that address the effectiveness of these community based programs. In order to better address the growing epidemic of childhood obesity and create more effective programs, we must identify positive aspects of programs that work and modify the negative aspects that do not to create new programs that are effective for target communities. In their October 2005 report to Congress, the Government Accounting Office (GAO) reported that surveyed experts in the field of childhood obesity felt that increasing physical activity

was the highest ranked strategy for prevention and/or reduction of childhood obesity. (Bascetta, 2005).

The specific aims of this project are as follows:

- Conduct a literature search to identify the established nutritional and physical fitness guidelines that address child or adolescent obesity.
- Conduct a literature search of community based programs from 1990-2006 that used physical activity as a component to reduce or prevent childhood or adolescent obesity.
- Use published review articles to identify the most effective programs that target either prevention of childhood / adolescent obesity or reduction of childhood / adolescent obesity and comment on their use of established guidelines.

Childhood obesity is an increasing problem world wide that has especially affected western populations. Though the problem is wide spread, African American and Mexican American communities are disproportionately affected. In designing programs geared toward reducing the problem, it is imperative to consider those cultural differences when creating effective programs. This project will examine the established guidelines and identify existing programs that specifically address childhood and /or adolescent obesity and assess their compliance with established guidelines. Additionally, it will identify innovative techniques used by communities for participant recruitment, effective practices, and areas where regulatory agencies can provide assistance. The benefits of this project include insight into community barriers to initiation and the understanding of the transfer of guidelines to action.

In this chapter we have introduced the growing problem of child and adolescent obesity and the far reaching consequences that are associated with allowing the problem to continue at its current pace. Reducing the rate of child and adolescent obesity is of national interest and has been the subject of a number of studies. In this paper we will identify physical activity guidelines and focus on those programs that address increasing physical activity in accordance with those guidelines and their relative success.

Chapter 2: REVIEW OF LITERATURE

Shadrach Ricketson, a New York physician who wrote the first American text on hygiene and preventive medicine, *Means of Preserving Health and Preventing Diseases*, stated in 1806 that...

exercise is not much less essential to a healthy or vigorous constitution than drink, food, and sleep; for we see that people whose inclination, situation, or employment does not admit of exercise, soon become pale, feeble, and disordered (Ricketson as cited by Satcher and Lee, 1996).

This purpose of this chapter is to review the current physical activity guidelines as outlined by major medical and health organizations. This information will be used to illustrate why there may be some degree of difficulty in devising programs to meet these guidelines due to ambiguity and lack of direct or specific responsibility of action. This is relevant to the first specific aim identifying current physical activity guidelines which should be addressed in selected programs as a component and measure of overall effectiveness. There is a brief discussion of dietary guidelines, because the new guidelines include physical activity as a part of the dietary formula. We will not discuss specific guidelines for school-based physical education as the topic is very broad and beyond the scope of this project.

LITERATURE SEARCH

We conducted a literature search of the internet, OVID and PUB MED for any physical activity guidelines for children and adolescents. Essentially there was no specific guidance on physical activity before 1952, so the search was from 1952 to present. There were a number of websites that provide general guidance and two fairly comprehensive articles that summarize the guidelines from slightly differing points of view. In the 1996 Surgeon General's Report on Physical Activity and Health (USDHHS, 1996) there was

an extensive discussion regarding the research and evolution of physical activity guidelines as they exist today. Where as Nestle and Jacobson, (2000) in their article Halting the Obesity Epidemic, reviewed the guidance from the obesity prevention point of view. Below is a historical narrative of the evolution of physical activity guidelines as they exist in the United States. In short, there is no one national agency that has established the national guidelines for physical activity. There are a number of US government agencies and health organizations that have issued similar guidelines and recommend physical activity for prevention of disease or risk reduction.

PHYSICAL ACTIVITY

The first policy guideline published by a U.S. health organization for the prevention of obesity was written in 1952 by the American Heart Association (AHA). The AHA had identified obesity as a cardiac risk factor modifiable through diet and exercise. The AHA in conjunction with other agencies issued guidelines to reduce caloric intake and increase physical activity to maintain a healthy weight. Despite the early identification of obesity as a risk factor, specific verbiage addressing how to avoid or reduce obesity was lacking. The emphasis at that time was geared toward cardiovascular fitness as opposed to reduction of obesity. In the 1977 Senate report on chronic disease prevention, the Dietary Goals section also failed to address obesity but was revised to state that one should consume only as much as they expended to avoid becoming overweight. Over nearly 50 years of national guidelines have made vague recommendations with no emphasis on individual behavior changes or specific practices that affect the factors which contribute to obesity plagued the U.S. population. (Nestle and Jacobson, 2000). See Figure (1) for an illustration of organizations that have issued policy guidelines on prevention of obesity through diet, exercise or both.

Figure 1 Policy Guidelines published by US Governmental Agencies and Health Organizations.

Year	ACS	ACSM	ADA	AHA	AICR	NCI	NHLBI	NIH	NRC	PCPF	USDA	USDHHS	USSC	WCRF	WHC
1952				X											
1965				X											
1968				X						X					
1970															X
1971			X												
1972				X											
1974				X				X							
1975		X		X											
1977								X							
1978		X		X									X		
1979			X			X						X			
1980											X	X			
1984	X							X							
1985								X							
1986			X	X							X	X			
1988				X		X							X		
1989							X								
1990									X		X	X			
1991	X														
1992				X											
1993				X			X								
1994			X	X											
1995				X							X	X			
1996	X		X	X											
1997				X										X	
1999				X											
See list of abbreviations listed at the beginning of paper.															

Adapted from Nestle and Jacobson (2000) Halting the Obesity Epidemic. *Public Health Reports* and Physical Health Activity

Summary: A Report from the Surgeon General (1996)

One exception to the vague reports and non-specific guidelines was produced as a result of the National Institutes of Health conference held in 1977 which called for a review of research to date and for recommendations on obesity treatment and prevention. A.J. Stunkard (1979) who identified both social and environmental influences on obesity made recommendations which provided the committee with information to make proposals that were not only in depth but far reaching. The resultant proposal was a comprehensive broad scoped approach which included recommendations that spanned almost every agency ranging from a national insurance program that recognized obesity as a disease, to changes in regulations for cuts of meat. These recommendations were compiled into the “Matrix for Action” appendix and included both community and school actions. Unfortunately because of its length (23 pages) and lack of funding provisions for these numerous recommendations, the proposal was underutilized and was never implemented (Nestle, 2000).

In 1980, prevention of obesity became one of the national objectives outlined in the national 10 year public health policy guideline Promoting Health / Preventing Disease (Nestle, 2000). In this document, Promoting Health / Preventing Disease (1980) as cited in (Nestle, 2000), the emphasis was on adults, not children. The three stated objectives were:

1. Reduce the prevalence of obesity in adult men and women,
2. Have 50% of overweight population adopt a weight loss regimen combining a balance of diet and physical activity
3. Have 90% of adults understand weight loss requires consumption of fewer calories and increased physical activity

Though the objectives were fairly broad, they addressed the issue, and served as a basis for future obesity driven objectives. By the year 1990, the policy recommendations included objectives for overweight children 12 years and older, and by 2000, the guidelines included recommendations for both children and adolescents.

Recommendations included guidance for schools to include diet and physical activity education in at least three grades or more. Some of the objectives that support obesity reduction include increasing moderate physical activity among children and adults; encouraging consumption of “more healthful diets”, and reducing sources of unnecessary calories in food products in schools and restaurants (Nestle, 2000). The policy guidelines addressed above are good general guidance, but lack in specific recommendations for physical activity.

In 1978, the American College of Sports Medicine (ACSM) provided the FITT recommendation for exercise:

- Frequency – Physical activity three to five times weekly
- Intensity – (60-90%) of maximum heart rate (vigorous)
- Time – (15-90) minutes in duration
- Type – Rhythmic movement of large muscle groups

These recommendations were made to address cardiovascular fitness, but became widely accepted as exercise requirements for good health in general. Activity intensity as defined by FITT was vigorous and for many not achievable on a regular basis. However, by the 1990's the effectiveness of moderate-intensity exercise was recognized as a viable alternative to the vigorous exercise outlined by the ACSM in 1978 (Dubbert, 2002). In 1990 the guidelines were updated to include resistance training and in 1995, the ACSM and the CDC collaborated to issue new recommendations that specified that every adult should accumulate 30 minutes or more of moderate physical activity 5-7 days a week (Pate et al, 1995). Later in that same year the National Institutes of Health (NIH) issued a consensus statement that was in agreement with the recommendations of the ACSM and CDC. The statement included mention that these recommendations also applied to children. This addition was significant, because prior to 1994 when the International

Consensus Conference on Physical Activity Guidelines for Adolescents issued a recommendation for adolescents to engage in 20 minutes of moderate to vigorous activity 3 times a week (Sallis and Patrick, 1994) there had been no specific mention of activity specifically for youth. The assumption that children should adopt adult guidelines came from Rowland (1985) based on a study in 1959 using Karvonen's heart rate reserve method which did not take into account the unique exercise needs and skills of children (Pangrazi et al, 1996).

More appropriately the CDC, ACSM, and PCPFS published a recommendation concerning children that encourages at least 30 minutes of activity almost everyday, and 60 minutes of accumulated activity as an optional standard for young children, for the following reasons:

1. People who are not active are at higher risk of disease and death than those who are.
2. One hour of accumulated activity is recommended for children because evidence shows that activity decreased with age.
3. Activity should be combined with skill learning.
4. Lifestyle activities such as walking or yard work are helpful in keeping children active and control body fatness. (Epstein et al, 1982).

According to Dubbert (2002), the most important publication to date was the first Surgeon General's Report of Physical Activity and Health (USDHHS, 1996). The report concludes that moderate-level activity has significant health benefits, but emphasizes that vigorous activity is recommended for those able to execute the guidance. Dubbert compared this guidance to the first Surgeon General's report on smoking, stating the effectiveness or lack thereof, will not be seen for years to come. Most recently, Healthy People 2010, reasserts that both children and adults should complete activity at least 3 or more periods of 20 minute periods of moderate to vigorous activity each week (USPHS, 2000). Additionally, the policy suggests that all groups should reduce sedentary activity. More specifically, children and adolescents should engage in 3 or more 20 minute

sessions of vigorous activity per week. This differs from adults because the guidance emphasizes that the activity should be vigorous. This guidance was echoed by the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition. This group added that the activity be age appropriate and enjoyable and that for post-pubertal children and obese children, weight training is recommended because the activity adds to lean muscle mass. Across organizations, the consensus guidelines for physical activity in children appears to be 60 minutes of moderate to vigorous age appropriate activity broken into three 20 minute periods over a week. The consensus is based on limited research studying physical activity in relation to other health outcomes, such as cardiovascular risks, or psychological benefit. At the time of these recommendations, there was very little research conducted to specifically address exercise and its effects to reduce or prevent obesity in adolescents.

Although there is general consensus that there should be a minimum period of physical activity to help prevent disease there is controversy and confusion about time, type, target group, and age. Twisk (2001) in his critical review of Physical Activity Guidelines for Children and Adolescents set out to explain the scientific rationale behind the guidelines and present his rationale for vague population based guidance with a goal of simply increasing physical activity in general with likely the same or more health benefit. The scientific rationale is predicated on these three premises:

1. Physical activity during youth is related to health status during youth. This is important because literature supports that health during youth is a predictor of health in adulthood. (Strong et al, 1992 as cited in Twisk, 2001)
2. Physical activity during youth is related to physical activity in adulthood; again important because of the relationship between adult activity and adult health. (Powel and Blair, 1994 as cited in Twisk, 2001)
3. Physical Activity in youth is directly related to adult health status. (Twisk, 2001)

Twisk argues that there is very little research and even less evidence that the relationship between physical activity in childhood, translates into activity during adulthood. He asserts that total populations should be considered as target populations for physical activity intervention programs, and that these intervention programs must not be limited to children and adolescents. (Twisk, 2001)

See Figure (2) NASPE Physical Activity Guidelines for children. This guidance was published in 2003 and outlines requirements for activity not necessarily associated with physical education as conducted in school. On the website, they offer additional information to help the reader interpret the guidelines.

DIETARY GUIDELINES

The Dietary Guidelines were established as a joint effort between the United States Department of Health and Human Services (DHHS) and the United States Department of Agriculture (USDA). The document resulted from collaborative efforts that evolved through three stages. During the first stage an external advisory committee called the Dietary Guidelines Advisory Committee (DGAC) conducted an analysis of the latest scientific information. In stage two, key recommendations were established using the analysis of the latest research. In the third and final stage, DHHS and USDA developed messages and publications for dissemination to the public.

An interactive website was established to provide this information and presents food guide models for two respective age groups. Figure 3 illustrates the pyramid for younger children and Figure 4 shows the second pyramid which is more complex and designed for ages 6-11 year old children. On the web sight participants are able to enter the amount of activity to be conducted and the pyramid program outlines the number of servings of each food group they should consume. The new guidelines emphasize the importance of activity with consumption of the correct amounts of foods from the

appropriate food groups. Additionally, there are 12 different plans based on desired caloric intake.

Figure 2 NASPE Physical Activity Guidelines for Children

<p>Physical Activity for Children: A Statement of Guidelines for Children Ages 5 - 12, 2nd Edition</p> <p>NASPE seeks to provide meaningful physical activity guidelines for parents, physical education teachers, classroom teachers, youth physical activity leaders administrators, physicians, health professionals, and all others dedicated to promoting physically active lifestyles among children. The guidelines provide information concerning how much physical activity is appropriate for preadolescent children (ages 6 to 12). Physical activity, broadly defined, includes exercise, sport, dance, as well as other movement forms.</p> <p>The full document contains detailed interpretations of the following brief guideline statements. Other sections include a rationale for the guidelines, importance of sound nutrition, important concepts about physical activity for children, appropriate activity models for children, using the physical activity pyramid to help children make activity choices, and recommendations for promoting physical activity in schools and physical education.</p>	
Guideline 1.	Children should accumulate at least 60 minutes, and up to several hours, of <i>age-appropriate</i> physical activity on all, or most days of the week. This daily accumulation should include moderate and vigorous physical activity with the majority of the time being spent in activity that is intermittent in nature.
Guideline 2.	Children should participate in several bouts of physical activity lasting 15 minutes or more each day.
Guideline 3.	Children should participate each day in a variety of age-appropriate physical activities designed to achieve optimal health, wellness, fitness, and performance benefits.
Guideline 4.	Extended periods (periods of two hours or more) of inactivity are discouraged for children, especially during the daytime hours.
<p>Interpretation Guideline 1: Sixty minutes is the minimum amount of daily activity recommended for children. To attain optimal benefits, children need to accumulate more than 60 minutes per day. Physical activity minutes accumulated each day should include some moderate activity equal in intensity to brisk walking and some vigorous activity of greater in intensity than brisk walking. Most physical activity accumulated throughout the day will come in intermittent activity bursts ranging from a few seconds to several minutes in length alternated with rest periods. Continuous vigorous physical activity of several minutes in length should not be expected for most children, nor should it be a condition for meeting the guidelines.</p> <p>Interpretation Guideline 2: Much of a child's daily activity will be in short bursts and accumulated throughout the waking hours. However, if optimal benefits are to accrue, as many as 50% of the accumulated minutes should be in bouts of 15 minutes or more. Examples of physical activity bouts are recess, physical education, play-periods, and sport's practices. Typically, most bouts of activity include both physical activity and time for rest and recovery for participants. For example, a child at recess may be active for 5 minutes and inactive for 10 minutes.</p> <p>Interpretation Guideline 3: Three different levels of physical activity are described in the Physical Activity Pyramid (see Figure 1). It is recommended that children select from all of the first three levels of activities in the pyramid each week. A special section on the Physical Activity Pyramid provides information that can be useful in implementing Guideline 3.</p> <p>Interpretation Guideline 4: Research suggests that people (including children) who watch excessive amounts of television, play computer games, work on computers for extended periods of time, or engage in other low energy expenditure activities will likely fail to meet guidelines 1, 2 and 3 (Gordon-Larsen, McMurray, & Popkin, 2000). In general, extended periods (two hours or more in length) of sedentary behavior (in and out of school) are discouraged. Because many positive things can happen during times of relative inactivity (homework, studying, learning to read, write and think, and family time), some periods of relative inactivity may be necessary in a typical day. It is the accumulation of excessive inactivity (lack of activity accumulation) that is of concern. It is important that children be active when opportunities to be active are available such as before and after school, at appropriate times during school, and on weekends.</p>	

http://www.aahperd.org/naspe/template.cfm?template=ns_children.html, accessed 15 July 2007

Figure 3 Food Guide Pyramid for younger children – USDA

<http://www.mypyramid.gov/kids/index.html> accessed 11 June 2006.

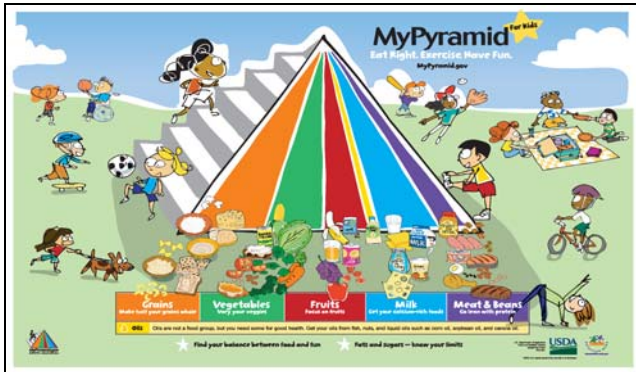
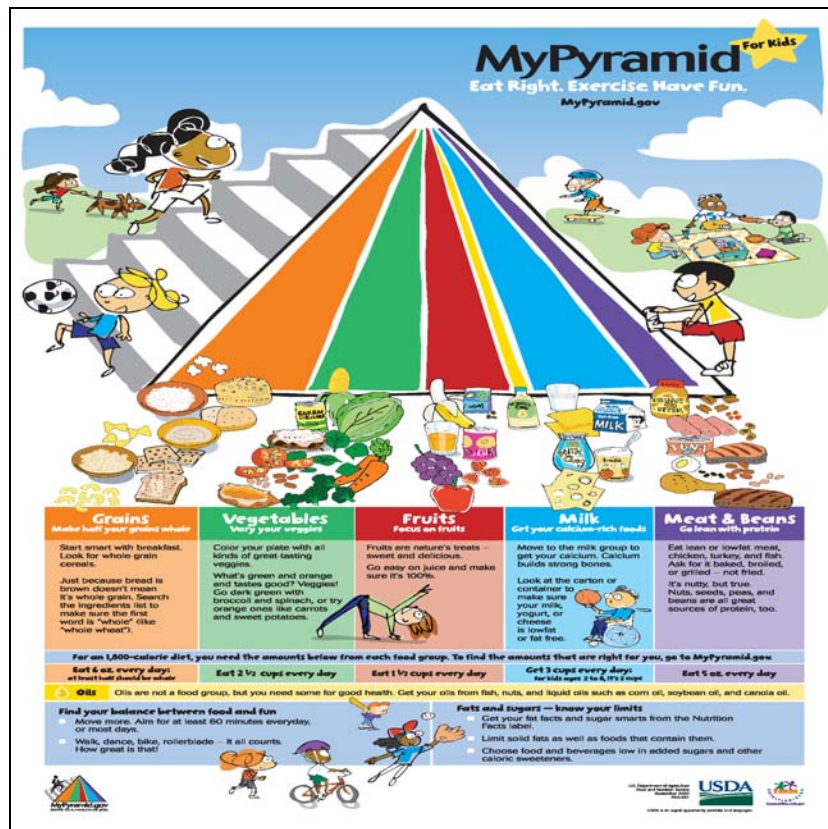


Figure 4 Advanced food guide pyramid for children 6-11yo.

http://teamnutrition.usda.gov/Resources/mpk_poster2.pdf accessed 11 June 2006.



The dietary guidelines are based on science-based advice on food and physical activity choices. The key recommendations cover four major categories: required nutrients, weight management, physical activity and food group recommendations. In the area of nutrient requirements the recommendation is to consume a variety of nutrient-dense foods and beverages within the five food groups, with emphasis on avoiding high intake of saturated and trans fat, cholesterol, and refined sugars, salt and alcohol. (USDA, 2005) When considering weight management, the key is simply to balance calories from food and beverages with energy expenditure. The physical activity guidelines are the same as other recommendations discussed earlier.

In this chapter we have given a brief history of the origin of the current physical activity guidelines and why they can be a potential source for confusion. In short there is no one source for national guidelines, and several national agencies and health organizations have issued guidance that has no substantial scientific research to substantiate the guidance. The dietary guidelines are now linked very closely with physical activity and can be found on the new USDA website that delineates caloric intake based on age and activity level. There is consensus that adults and children should conduct some type of physical activity daily and that their caloric intake should be adjusted based on their activity level.

Chapter 3: MULTI-DISCIPLINED INTERVENTIONS

Given the enormity of the overweight and obesity problem, the national goal as outlined in Healthy People 2010 (US Public Health Service, 2000) is to halt this deadly trend and reduce childhood obesity to a baseline of 5%. The many factors that contribute to the obesity epidemic demand that interventions be not only innovative, but multifaceted and should include healthcare providers, school officials, family members, and the corporate and legislative communities. In an effort to accomplish this goal, there have been a number of programs developed to promote physical activity and improved dietary habits among children and adolescents. The majority of these programs have been school based in their approach and their success has been varied.

This chapter will cover some of interventions at different levels that have had limited effects on the obesity epidemic. There will be a brief discussion of the role of health care workers and why interventions at this level have been ineffective. The next brief discussion on one of the most effective areas will be school-based interventions, and why its promise is limited. The next section discusses a third level of opportunity, the family and some of the limited research that has been conducted in this area. Overall this chapter is a prelude to show why the community based approach with an emphasis on physical activity is more likely to be effective, because addressing the problem from single areas in the chain without cooperation along the whole chain doesn't have the far reaching effects needed to truly address the obesity problem.

HEALTH CARE WORKERS

Healthcare providers should be key players in the battle against obesity in that they are generally the first to identify the presence of obesity. Unfortunately, many providers do not counsel patients on the need to lose weight. In a recent study of primary

care physicians, it was found that only 42% of overweight pediatric patients reported being counseled about weight loss and only 52% of medical records of obese patients reflected documentation concerning the obesity status of the patient (Connolly, 2005; IOM, 2005). When providers identify the problem, they can offer recommendations for dietary changes and the need for increased physical activity, and track the patient's success through rigorous charting of progress. Often, the child is not the only member of the family that can benefit from the modifications or changes. Epstein (1994) showed in a study of overweight children that the greatest success was achieved when the whole family was involved in the process. Behavioral changes are more effective when adopted by the entire group or family unit. Health care workers prove to serve as a good starting point but their contributions are limited by environmental factors outside their control. In order to make a significant impact in addressing the problem, health care workers need to be more diligent in addressing the problem, and documenting the progress or lack thereof. One of the first steps in addressing a problem is identification that there is a problem. Health care professionals are a key player in this step.

SCHOOL-BASED PROGRAMS

One of the most logical intervention points for overweight children is school. Epstein (1990) showed that offering education that emphasizes healthy eating and exercise habits for children and their families may have long lasting effects on the lifestyle of at-risk patients. School based programs have targeted interventions in three different areas: education, diet/nutrition, and physical activity. Many schools have placed limitations on the caloric content of foods placed in vending machines, removed soda machines from school campuses and structured cafeteria food choices to include the daily recommended allowances of fruits and vegetables. Though nearly all 50 states, have initiated bills to address physical activity in schools, as of December 2004, only 11 had

enacted legislation to enforce it (Netscsan, 2004). In light of this gross shortfall, the US Department of Health and Human Services has outlined physical activity guidelines to insure that students are getting a minimum of 150 minutes of physical activity per week (IOM, 2005). Addressing the problem at the school level is extremely important as children spend approximately half of their wakeful hours in school, but the enormity of the problem demands the consideration of additional measures.

School-based programs have been the vehicle for many interventions geared toward children and adolescents because most young people between the ages of 6-16 years attend school. In 1994, the School Health Policies and Programs Study (Kann et al, 1995) examined the nation wide status of policies and programs for multiple facets of a school health program. As a result of the study, the Centers for Disease Control and Prevention (CDC) issued guidelines for school programs aimed at promoting physical activity and healthy eating practices. These guidelines include recommendations for school policies, curricula, instructions to students, integration of school food service and nutrition staff, education of families, and community involvement (CDC, 1996). Due to the lack of conformity with variability in content, community involvement, financial support and delivery, evaluation of school-based projects has been extremely difficult (Campbell et al, 2001; Wilson et al, 2003). The development of effective evidence-based health policies which promote broader implementation of successful programs will require careful evaluation of existing programs to establish baselines for future programs (Veugelers, Fitzgerald, 2005).

There have been a number of school-based programs geared toward interventions to combat risk factors for obesity. In their study of the effectiveness of school based programs in Canada et al (2005) determined that school-based healthy eating and physical activity programs provide a great opportunity to enhance the future health and

well-being of children but failed to show statistically significant differences in overweight and obese children. The inability to show statistical differences is likely due in part to the small sample size of schools with dedicated programs. Additionally, there were no statistical differences in health outcomes between schools with healthy eating choices and practices when compared to those that did not. The implication is that even when the choice is available, without education on the importance of choosing a healthier diet (high in fruits and vegetables), as well as increasing physical activity, children will not make the healthy choice. Although this article makes the claim of adding to the current knowledge base that demonstrates the effectiveness of some programs, the reality is that there were relatively few studies identified that showed a significant impact (Campbell et al, 2001).

FAMILY BASED PROGRAMS

As previously mentioned, the prevalence of obesity has substantially increased over the last decade which suggests that the problem is not primarily genetically based but more environmentally based (decreased physical activity and availability of high caloric foods) combined with a genetic component (Connolly et al, 2002). In light of this situation, a logical approach to combat the problem would be to explore family-based interventions because families share these factors in common (genetics and environment). Epstein and colleagues provided the framework for this theory by conducting a follow-up study that examined treatments that utilized reinforcement of behavior change and weight loss in obese parents and children. In the ten year follow-up study, it was determined that family-based behavioral treatment emphasizing reinforcement for child and parent behavioral changes resulted in children's weight loss that can persist through adulthood if initiated when children were between the ages of 6 and 12 (Epstein et al, 1990). The

specific practices that proved to be effective were variations in contracting, self-monitoring, social reinforcement, modeling and contingency management.

The next set of supporting studies conducted by Golan et al (1998) suggested that when parents are involved and receive training in addition to training for the children, there is a significant difference in energy intake, weight loss and physical activity in children. Golan and colleagues suggested that “the agent of change” is the most important factor in weight loss for children. If the parents are the agent of change then there is greater success. One draw back to this approach was that the children were not given direct behavioral treatment and therefore lacked the skills needed to make appropriate food choices outside the influence of their parents, thus the results are not sustained outside the household.

Connolly and colleagues (2002) concluded in their review of obesity treatment, that behavioral programs have both short and long term efficacy, but that the results for adults are refractory, suggesting that intervention before adult onset of obesity is essential. The general goal of treatment is the establishment of healthy eating and physical activity regimens. The authors suggest the following guidelines:

- Limit television and computer gaming to 2 hours daily
- Eliminate high caloric beverages (fruit drinks, soda, lemonade and iced tea)
- Limit fruit juice to 12 oz per day,
- Low fat milk for children over 2 years of age
- Established eating style rules which include eating breakfast
- A minimum of 30 minutes of activity per day.

Families need access to facilities that will enable them to participate in group activities, purchase healthy food items and learn about effective methods for weight loss. Many urban communities lack safe areas for walking tracks and ball fields.

Considering that children spend a great deal of time outside the home and school in recreational areas, entertainment centers, shopping malls, and fast food establishments,

the community must take an active role in providing much needed education and exposure to healthy foods and activities. Additionally, if done effectively, the community setting can provide parents with the opportunity to take action by serving as role models and encouraging healthy behaviors (IOM, 2005). The most relevant evidence of the effectiveness of community based programs and obesity come from studies designed to evaluate the reduction of cardiovascular risk factors and diabetes. There were six programs that combined multiple strategies (media campaigns, education for health care professionals and families, changes to physical environment and health screenings). The program from North Karelia, Finland exhibited the strongest positive results (IOM, 2005). There are very few programs in the United States that have been formally evaluated for their effectiveness of prevention or prevalence reduction. Some of these programs will be discussed in chapters to follow. In the Government Accounting Agency (GAO) 2005 report to Congress, in which they surveyed 233 experts in academia and the private sector working in the fields of physical activity, nutrition, and childhood obesity and increasing physical activity was identified as the top-ranked strategy (Bascetta, 2005).

In this brief chapter we have reviewed some of the relevant interventions that have been used to address the growing problem of childhood and adolescent obesity. Though many of these programs offer some degree of promise it is evident that these interventions alone are insufficient. In order to truly address the obesity problem in the U.S., it will take a combined effort at multiple levels with a strong emphasis on increasing physical activity.

Chapter 4: SCHOOL AND COMMUNITY PROGRAM REVIEW SUMMARIES

We conducted a literature search using the internet, OVID and Pub Med for community based programs that addressed childhood or adolescent obesity from 1990-2006. We further narrowed the search to programs that used physical activity as a component of the program. We then included programs that had nutrition or nutritional education as a component of the program. We found that a number of programs were school-based with an additional family or community based component. The programs were combined and utilized one of three approaches to increase physical activity: informational, behavioral, or environmental. (Connelly, 2005) In this chapter, we will address specific aim numbers two and three. We will summarize some of the programs that have been initiated to address child and adolescent obesity utilizing published review articles of obesity prevention programs.

In this search we found nine articles that reviewed different aspects of obesity prevention programs. Three articles reviewed only school-based approaches to prevent obesity. Five articles reviewed interventions that may or may not include school-based approaches, one of which specifically examined programs that were used in the state of Texas. One article looked across all programs to determine the common factor present in “successful” programs (with successful defined as programs that were able to prevent weight gain.) We will summarize the review the articles and comment on compliance with the use of national physical activity guidelines as described in the article.

SCHOOL-BASED APPROACHES FOR PREVENTING AND TREATING OBESITY.

Story (1999) reviewed the research literature on school-based interventions to prevent and treat obesity published from 1965 to 1999. Twelve controlled experimental

studies were identified with 11 of 12 showing positive short-term results. Overall, interventions aimed at younger children were more successful than those targeting adolescents. The studies were administered to overweight children in a variety of age ranges, over different durations using many different intervals of intervention. Four studies evaluated children ages (5-10 years), six evaluated adolescents (12-15 years), and two examined a combined age range from (8-15 years). The program duration varied from nine weeks to as long as 18 months and frequency of intervention ranged from once a week to five times a week. The major findings are summarized in Table 1. Overall the treatment groups show some measure of success. Story used these findings to create a model for success.

The premise is that each component closely relates to the others with an overall goal of increasing physical activity and promoting healthy eating practices. Though promising, the model could not be the stand alone program to prevent childhood obesity because on average across the U.S., physical education classes do not afford students sufficient time to complete the recommended daily physical activity goals (USDHHS, 1997, as cited in Story, 1999). The model does show promise because the eight areas work together to educate children and provide them and their families with resources to properly address the problem and decrease the risks for the development of obesity.

INTERVENTIONS TO PREVENT WEIGHT GAIN: A SYSTEMIC REVIEW

When considering the effectiveness of prevention interventions, there is not a great deal of literature available. Hardemen et al (2000), completed a systemic review of published psychological and behavioral model interventions aimed at the prevention of weight gain in children. Their review was unique in that the goal was to find programs that specifically targeted prevention of weight gain. Using eight different data bases, with no

restriction on study design, age, weight, but excluding specific subgroups, multifaceted interventions, or ambiguous aims, they identified nine programs. Of the nine

Table 1 Summary of School-based treatment studies adapted from (Story, 1999).

Study	Subjects	Intervention Components					Duration	Design	Major Findings
		NE	BM	PA	PI	PS			
Botvin (1979)	T:50 C:69 (12-14y)	X		X			10 weekly classes	Random assignment of schools	70% of treatment and 43% control decreased skin folds
Brownell &Kaye (1982)	T:63 C:14 (5-12y)	X	X	X	X	X	10 weeks	Self selection	T: 95% lost weight mean + -4.4kg
Christakis (1966)	T:49 C:33 Boys (13-14y)	X		X			18 months	Random selection	Net weight change 3.5kg; treatment effects to obese only
Collipp (1975)	T:25 (9-10y)	X		X			12 weeks	Phase I – 6 wks PA Phase II – 6 wks PA+ D	Phase I – no effect, Phase II weight loss (mean =10 lbs)
Figueroa-Colon (1996)	T:12 C:7 (8-13y)	X	X	X	X		6 months	Random assignment	Supper obese lost 5.6 kg, and the control gained (mean =2.8kg)
Foster (1985)	T:48 C:41 (7-11y)	X	X	X	X		12 weeks	Random assignment	T: lost 0.15kg and reduce overweight by 5.3% C: gained 1.3kg and increased % overweight by 0.3%
Jette (1979)	T:11 C:10 (15y)				X		Twice/wk 5 months	Random assignment	No significant changes in skinfold or body composition
Lansky & Brownell (1982)	T:71 (12-15y)	X	X	X			15 weeks	3 schools (BM or PA& NE) No untreated controls	64% of children in BM group and 63% of PA and NE groups decreased percent overweight
Lansky& Vance (1983)	T:30 C:84	X	X	X	X		12 weeks	Random assignment	T: decreased % overweight mean = 5.7% C: decreased % overweight mean = 2%
Ruppenthal& Gibbs (1979)	T:14 C:28 (5-10y)	X		X			5 months	Self selected	T: 13/14 decreased % overweight C: 3/28 decreased % overweight
Seltzer &Mayer (1970)	T:189 C:161 (8-15y)	X	X	X			5-6 months	Self selected	T: -11% overweight C: -2% overweight
Zakus (1981)	T:10, C:12 (Girls, 14y)	X	X	X			9 weeks	Random assignment	T: -9% overweight C: -1 % overweight

Legend: NE – Nutrition Education; BM- Behavior Modification; PA- Physical Activity; PI- Parent Involvement; FS- Food Service; T- Treatment; C- Control; D- Diet.

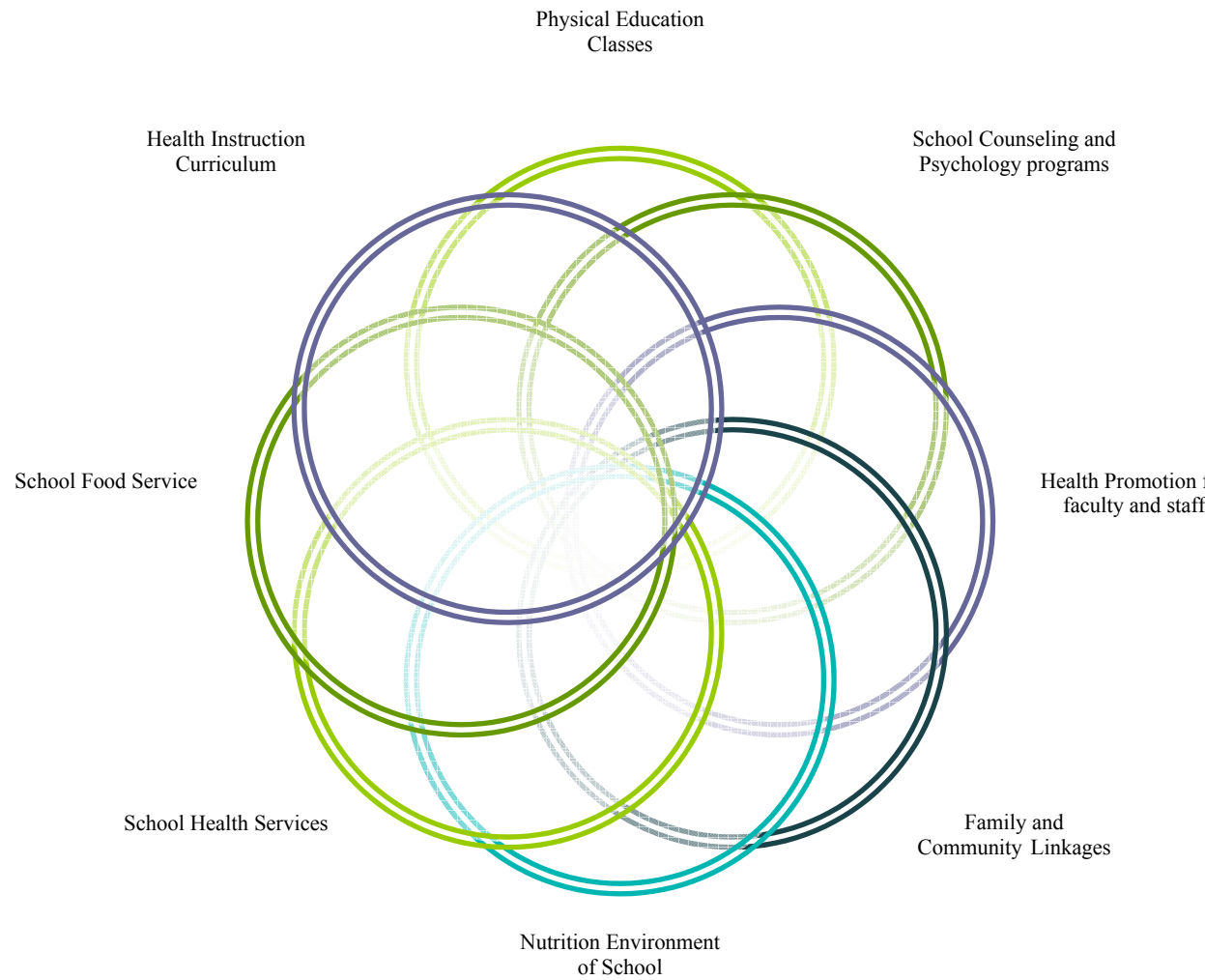


Figure 5 Adapted from Story (1999) - School Obesity Programs

studies (published in eleven articles), they identified five distinct school-based interventions and four interventions that involved the immediate community. Seven of the programs took place in the United States and two were conducted in Italy.

The specific aims of the review included a description of target behaviors, the psychological models used underlying the interventions, and outcomes of the studies. Results from the interventions showed that programs that utilized diet and physical activity behaviors as program outcomes usually achieved positive (self-reported) results. The effects on actual weight as an outcome were mixed. Lower income participants, students and smokers tended to have lesser effects on weight than other participants. Community-based programs tended to have a larger proportion of overweight and obese participants.

Additionally they found that there was a higher drop-out rate among thinner and lower-income subjects. The authors concluded that interventions to prevent weight gain exhibited various degrees of effectiveness. They did not provide any definitive statements about the elements of the interventions associated with increased effect size because only one of the five studies showed a significant effect on weight. Many studies did not distinguish between physical activity and exercise which again made generalizations difficult. The authors concluded that future interventions would be more effective if they focused on behavioral changes, used objective measures of physical activity and diet and utilized longer follow-up (Hardemen et al, 2000).

Three programs specifically involved children:

- Fitzgibbon, ML (1995). An Obesity prevention pilot program mother and daughters
- Stolley, MR(1997).Effects of an obesity prevention program on the eating behavior of African American Mother and Daughters
- Simonetti, DA (1986) Prevention of Obesity in elementary & nursery school children

In these programs it was difficult to determine the amount of physical activity and/or exercise performed by the participants. One of the three programs listed was a pilot program that focused on diet education only and involved no physical activity. The fully implemented program, included education about physical activity and incorporated an aerobics class. Although the modification may have improved the amount of physical activity performed, there is no evidence to support compliance with recommended physical activity guidelines. The Italian program used education materials to encourage changes in physical activity and diet; however there were no specific means to measure amount of physical activity executed. Though helpful, this review of these studies does not allow for reliable evaluation of compliance with established physical activity guidelines and their effectiveness in the prevention of obesity. Future programs should include a measure of a physical activity as a part of the outcome measures.

INTERVENTIONS FOR PREVENTING OBESITY IN CHILDHOOD: A SYSTEMIC REVIEW

Campbell (2001) and colleagues completed a systematic review of prevention programs targeted at childhood obesity in Australia. The review was geared toward programs that gave emphasis to prevention based on diet modification as well as activity modification. The review period covered a 14 year span from (1985-1999). They were able to find seven studies that met their review criteria. Of the seven studies, three were long-term studies greater than one year and four were short-term ranging between three months and one year. Although Stephenson and Imrie in their 1998 article concluded that the value of assessing the efficacy of lifestyle and behavioral interventions using randomized controlled trials (RCT) is considered contentious, the authors chose to use RCT because there is strong evidence that they provide the least biased estimates of effect size. The participants included children less than 18 years of age at the

Table 2 Program Results Summary adapted from Tables 3&4 (Hardeman et al, 2000).

Study	Subjects	Intervention			Results
		Target Behavior	Design	Duration of Intervention	
Cairella et al (1998)	School children (6-8y) N= 180	Improve nutritional knowledge and promote active lifestyle	NRT	I = 36 mos F/U = none	Mean Baseline BMI for boys =17.7 (21% obese) Mean Baseline BMI for girls =18.2 (29% obese) Overall effect on weight = NOT REPORTED
Davis(1993)	Children 5 th Grade (9-13y) N=1543	Changing fat and calorie intake, exercise and smoking	RCT	I = 1 semester F/U = variable up to 3 yrs	Baseline BMI greater than 85 th percentile boys (36%) and girls (33%) Overall effect on weight = NOT REPORTED
Donnelly et al (1996)	Children 3-5 th Grade N= 338	Improve physical & metabolic fitness by diet and exercise	NRT	I = 24 mos F/U = twice/yr during and 2yrs later	I: baseline BMI 17.9, FU 18.9 C: baseline BMI 18.1 , FU 19.3 Between group difference at FU : P>0.05
Fitzgibbon et al (1995)	Daughters (8-12y) & Mothers N=24 diads	Change diet	NRT	I = 6 wks F/U = 6 wks	Baseline mean wgt I: mothers =81kg, daughters =39kg C: mothers = 84kg, daughters = 40kg Overall effect on weight = NOT REPORTED
Forster et al (1988)	Health Dept Survey participants N= 219	Change diet and exercise	RCT	I = 12 mos F/U = 12 mos	Mean wgt Δ I (N=103): mean = -1.0kg C(N=108): mean = -0.1kg Between group difference P = 0.03
Gittelsohn et al (1998)	Children 3 rd Grade N= 2000 4 schools	Promote healthier diet at school, home, and increase physical activity to vigorous	RCT	I = 3 school yrs F/U = none	BMI / weight NOT REPORTED
Jeffery & French (1997)	Adults (20-45y) N=1226	Changing eating and exercise habits	RCT	I = 36 mos F/U = 12 mos	Mean wgt Δ (M) BMI 28 (N=198) Ed =0.33kg, Ed + L =0.10kg, C =0.88kg (HIW)BMI 26 (N=523) Ed =0.47kg, Ed + L =0.23kg, C =0.63kg (LIW)BMI 28 (N=331) Ed =0.96kg, Ed + L =1.47kg, C = 0.59kg
Simonetti et al (1986)	Children (3-9y) N=1321	Change in diet and nutrition	NRT	I = 12 mos F/U = 12 mos	Obese/Overweight MA 27% FU 23.7% Δ -3.3% WA 24.3% FU 23.7% Δ -0.6% C 22.0%, FU 22.2% Δ 0.2%
Stolley &Fitzgibbon (1997)	Mother and Daughter pairs N=62m&65d	Physical activity and low-fat, low-cal diets	RCT	I = 18 mos F/U = 12 mos	Base line BMI I (N=62)mothers = 29.1, (N=65)daughters = 18.4 C (N=32) mothers = 30.8, (N=32) daughters = 20.1 End BMI/Weight NOT REPORTED

Legend: NRT non-randomized trial, RCT randomized control trial, BMI body mass index, I intervention, C control, M men, HIW high income women, LIW low income women, MA media action, WA written action, FU follow up

commencement of the study. There was no restriction on who administered the intervention. The studies had to report one or more of the following: estimates of percent body fat, body mass index, ponderal index/ skin-fold thickness, and report outcome data at baseline and post intervention. Refer to Table 3, Campbell for a brief summary of each of these programs.

When considering the three programs it is difficult to conclusively determine the formula for success. Active nutritional education, and increases in physical activity seem to be factors that contribute attaining desired results. However, this combination alone does not produce consistent results as seen in the study conducted by Donnelly in which desired behaviors did not produce significant decreases in obesity prevalence.

The results of the review revealed that two of three long-term studies had a reduction in the prevalence of obesity; one focused on dietary education and physical activity, while the other focused on dietary education alone. Of the two of the long term studies that had a specific outcome measure focused on physical activity, only one had successful reduction in the prevalence of obesity. Of the short-term studies, three of the four focused on physical activity and reduction of sedentary behaviors versus control. Two interventions resulted in significant reduction of obesity as compared with control groups and the third had a non-significant reduction. The fourth study focused on both dietary education as well as physical activity. There was no effect on prevalence of obesity, but the intervention group did show a reduction in fat intake. Only two of the studies specifically measured physical activity as an outcome measure and both had positive results in overall reduction of obesity.

Table 3 Interventions for preventing obesity in childhood: A systemic review adapted from (Campbell, 2001).

Author	Program	Intervention	Duration	N	Age	Success	Remarks
Simmonetti (1986)	Diet Education Vs Control	Diet Education	12mos	1321	3-9yo	Decrease 12.2% O Decrease 12.1% OW	No measure of physical activity
Gortmaker (1999) Planet Health	Diet and Physical Education and PA	Behavioral Choice	24 mos		6-8 th grade	Not given, TV reduction correlated to reduced obesity prevalence	Questionnaire to measure PA
Donnelly, (1996)	Nutrition and PA		24 mos		3-5 th grade	No change in obesity, but reduction in fat, and increases in CHO and fiber consumption	1 Mile walk to assess fitness, treadmill testing, and physical activity questionnaire
Flores, (1995)	Physical Activity (50 minute dance class)	Behavioral RCT	12 wks	130	10-13yo	Significant reduction in BMI	Dance Class
Mo-Suwan (1998)	Physical Activity	Behavioral RCT	12 mos	607		Not reported	15 min walk and 20 min aerobic dance 3x wk
Robinson (1999)	Physical Activity education	Behavioral Choice	18 wks	384		Not reported	Reduction in sedentary activity, dietary logs
Stolley (1997)	Dietary Education	Behavioral Choice	unclear	62 mother daughter dyads	NR	Decrease in fat consumption and calorie consumption	No measure of PA

Legend: N – number of participants, O – obesity. OW – overweight, PA – Physical Activity, BMI – body mass index, min – minute, mos – months, yo – years old, wk – week, RCT – randomized control trial, NR – not reported

SCHOOL-BASED OBESITY PREVENTION: A BLUEPRINT FOR TAMING THE EPIDEMIC

Baronowski et al (2002) reviewed the literature for school-based obesity prevention programs. The aim of their review was to identify measures needed to minimize the increasing levels of obesity. They identified 20 studies reporting school-based dietary or physical activity change programs that used BMI or skinfolds as part of the evaluation. Only seven of these studies showed change in BMI.

These programs differed from others reviewed in three major ways:

1. Program implementers were not classroom teachers
2. Interventions targeted middle or high school age children; and
3. Reduction of inactivity was a major goal

In direct response to these findings, the eight step research strategy was developed and is summarized in Table 4. This strategy was defined for use in developing and evaluating programs with the greatest chance for success. The review did not give the individual components of the seven programs used to develop the strategy, nor did it specifically comment on the use of physical activity as an outcome measure, but the implication is that effective programs had some objective measure of the theoretical variables used to assess effectiveness.

EFFECTIVENESS OF INTERVENTIONS IN THE PREVENTION OF CHILDHOOD OBESITY.

Bautista-Castaño, Doreste, and Serra-Majem (2004) conducted a review of randomized controlled trial interventions directed towards prevention of childhood obesity published from 1993 to 2003 that involved families, schools and communities. The studies all involved participants between the ages of 0-18. They were able to identify 14 interventional studies, 12 school-based and two community-based. The majority of the studies were conducted in the USA, with one each in Germany, the United Kingdom, and

Thailand. Follow-up for the studies varied from as short as 3 months (3 studies), 7-12 months (5 studies), 2 years (4 studies) to as long as 3 years (2 studies).

Due to the differences in design, duration and outcome their ability to make direct comparisons was difficult. Ten of the programs were school-based, general population, and four involved high risk groups (African Americans, American Indians, and Hispanics). The most common variables used were BMI, skin folds, and body fat percentage measurements. See table for summary of study variables, measured outcomes, and overall success ratings.

Overall, they were able to surmise that nutritional education and promotion of physical activity together with behavior modifications, decrease in sedentary activities, and family involvement potentially were the major components of prevention. Like many other studies of this kind the authors also concluded that there is a great need for well-designed studies that examine a range of interventions. There was no specific measure that allowed for an assessment of compliance with physical activity guidelines, but all except one program had a physical activity component, and five of those were deemed effective. Ironically, enough the one study that did not have a physical activity component was also successful. The study focused on decreasing of sedentary behaviors (television and video games), but not specifically on increasing physical activity.

EFFECTIVENESS OF SCHOOL BASED PROGRAMS ON PREVENTING CHILDHOOD OBESITY: A MULTILEVEL COMPARISON

The 2003 Children's Lifestyle and School Performance Study (CLASS) compared excess body weight, diet and physical activity across schools with and without nutrition programs. Paul Veugelers and Angela Fitzgerald conducted a survey of over 291 schools in Nova Scotia. Each school had approximately 50% overall participation per school; and included 5200, 5th grade students, their parents, and principals.

Table 4 Eight Step Research Strategy adapted from (Barronowski, 2002).

Step	Narrative
1	<i>Effective Behavior Identification</i> Demonstrate amount of anthropometric change can be attained from defined diet and physical activity changes on specific populations (focusing on individuals).
2	<i>Theory/Conceptual Model Development and Testing</i> Demonstrate that malleable variables in conceptual or theoretical frameworks predict the targeted dietary or PA behaviors at a sufficiently high level in the target population.
3	<i>Testing Effects of Procedures on Theoretical Variables</i> Demonstrate that specific well-defined intervention procedures can change the malleable variables in the selected conceptual frameworks at a sufficiently high level in the target population.
4	<i>Testing Effects of Procedures on Behaviors</i> Demonstrate that specific well defined intervention procedures that change the mediating variables in turn result in changing the target behaviors at a sufficiently high level in the target population.
5	<i>School Efficacy Interventions</i> Demonstrate that a combination of previously validated intervention procedures can change the target behaviors at a sufficiently high level in the target population in optimal circumstances, and demonstrate that process and mediating factors are related to outcome behaviors in the expected direction.
6	<i>School Effectiveness Studies</i> Demonstrate that programs that worked under efficacy circumstances can be made to work under effectiveness circumstances, and what adaptations, modifications or enhancements need to be made to ensure their success.
7	<i>Stability of Implementations Over Time</i> Demonstrate in a community laboratory that interventions that work in effectiveness circumstances continue to work over the longer term with specific target groups and what adaptations need to be made to enhance continued effectiveness.
8	<i>Dissemination</i> Demonstrate what types of schools continue to implement the proven effective interventions, the level of fidelity of the implementation after adoption, and what behavior outcome changes can be obtained.

Table 5 Program Results Summary adapted from (Bautista-Castano, 2004).

Study	Duration	Age	N	NE	BM	PA	PI	SFI	Obesity Prevention Evaluation	Effectiveness
Luepker, 1996	3 yrs	8.7	4019	X		X		X	Changes in BMI, TS, SS after adjustment for baseline values, gender, age, race, and school random effect	No
Cabello, 2003	3 yrs	7.6	1704	X	X	X	X	X	Changes in BMI, TS, SS and percentage body fat	No
Sallis, 1993	2 yrs	9.25	305			X			Changes in BMI, TS, SS, adjusted for gender and baseline values	No
Donnelly, 1996	2 yrs	9.2	338	X		X		X	Changes in BMI and % body fat mass	No
Gortmaker, 1999	2 yrs	11.7	1295	X	X	X			Prevalence, incidence and remission of obesity; (85 th) percentile	Girls Only
Sallis, 2003	2 yrs	?	1109			X	X	X	Changes in BMI	Boys Only
Mueller, 2001	1 yr	5-7	297	X	X	X	X		Change in TS and fat mass % of obese children in (90 th of TS age/sex specific	Yes
Sahota, 2001	1 yr	7-11	636	X	X	X		X	Changes in BMI, TS, SS, adjusted by age, sex and baseline values	No
Robinson, 1999	8 mos	8.9	192		X		X		Changes in BMI, TS, WC, and WHR adjusted by sex and baseline values	Yes
Neumark-Sztainer, 2003	8 mos	9-12	208	X		X	X		Changes in BMI	No
Mo-Suwan, 1998	7 mos	4.5	292			X			Obesity prevalence (>95 th percentile); BMI and TS adjusted for age, gender, baseline values, parental income, and family history of obesity	Yes
Flores, 1995	3 mos	10-13	81	X	X	X			Changes in BMI adjusted by maturity stage and age	Girls Only
Stolley, 1997	3 mos	9.9	65	X	X	X	X		Changes in BMI overweight prevalence	No
Robinson, 2003	3 mos	8-10	52		X	X	X		Changes in BMI and WC	No

Legend: **BM** = behavior modification; **BMI** = body mass index; **NE** = Nutritional education; **PA** = physical activity; **PI** = parent involvement; **SFI** = school-food intervention; **TS** = triceps skin-fold; **SS** = sub-scapular skin fold; **WC** = waist circumference; **WHR** = waist to hip ratio

The above listed studies are as cited from (Bautista-Castano, 2004).

The investigators used a slightly modified version of the Harvard Youth Adolescent Food Frequency Questionnaire (YAQ) and collected information on physical and sedentary activities as well as height and weight measurements and then compared the results between schools with established nutrition programs and those without. The schools with nutrition programs were divided into two groups. The first group consisted of schools that reported having healthy alternative menus. The second included seven schools that were apart of a program that incorporated aspects of each of the CDC recommendations for healthy eating programs called the Annapolis Valley Health Promoting Schools Project (AVHPSP) which included a physical activity component. A brief summary of the results are shown below.

Table 6 Summary of Body Weight, Diet and Activities adapted from (Veugelers & Fitzgerald, 2005).

	No Program	Nutrition Programs	AVHPSP Programs
Overweight %	32.8	34.2	17.9
Obese %	9.9	10.4	4.1
Mean fruit & vegetable servings per day	5.7	5.8	6.7
Calories from fat, %	30.3	30.3	29.4
Overall diet quality Index score	62.3	62.1	64.5
Physical Activity %			
< 3 x per week	21.9	24.6	19.9
4-6 x per week	33.5	32.3	35.4
> 7 x per week	44.5	43.1	44.7
Sedentary Activities %			
<3 hrs per day	49.9	50.6	56.6
4-6 hrs per day	29.5	28.5	27.8
>7 hrs per day	20.6	20.9	15.6

The results reveal that there is significant decrease in the number of obese and overweight children in the schools that are a part of the AVHPSP program. Additionally, children attending AVHPSP schools consumed more fruits and vegetables, less calories from fat, and reported more physical activity and less sedentary activities. Students

attending schools with alternative health choices with no concerted program had similar outcome measures as those without nutrition programs. The differences did not reach statistical significance, perhaps due to the small ratio of students in the group of interest (3656 no program, 1350 with nutrition program, 133 in AVHPSP). Regardless, the evidence suggests that simply having healthy choice availability without an integrated education program to promote the importance of healthy choices is ineffective and a waste of resources. This evaluation was helpful, in that the results showed the prevalence obesity and overweight was less in schools where a smaller percentage of children participated did not meet the minimum requirements for activity.

THE PREVENTION AND TREATMENT OF CHILDHOOD OBESITY:

Wilson et al based their review of the Cochrane review on prevention, but excluded all programs that were not randomized controlled trials with at least 20 participants. In their review they grouped some 35 programs based on intervention level (school or family), or target behavior (behavior modification). They identified the program, number of participants, duration and stated if there was a statistical difference between groups. In some cases it was not clear what outcome measures were used, but it was always stated if there was a significant difference. The tables that follow were adapted from the text summaries of selected programs from their review. There are a number of programs that showed a reduction in prevalence of overweight among participants, but no statistical difference between intervention groups. This is more evidence to support the need for better designed studies and evaluation tools to determine effectiveness.

Table 7 School-based Programs adapted from (Wilson, 2003).

Program	N	D	Intervention			Intervention Agent (Outcome Measures)	Success
			HP	PA	MF		
Robinson (1999)	227	7 mos	X			Class room based curriculum decrease sedentary activities. (Time sedentary behavior, BMI, TS, WC, WHR)	Y
Mo-Suwan (1998)	310	30 wks		X		Trained staff encouraged infant school classes to exercise. (Not reported)	N
Sallis (1993)		18 mos		X		Physical Education program using PE and classroom teachers (Not reported)	N
Sahota (2001)	636	1 yr			X	Teacher training, school meals, physical education, playground activities. (BMI, eating behavior)	N
Muller (2001)	297	1 yr			X	Family education on diet and exercise. (BMI)	N
Gortmaker (1999)	1295	18 mos			X	Classroom education encouraging physical activity and diet modification with older children (BMI, time spent in sedentary activity)	Girls Y Boys N
Flores (1995)	43				X	Promotion to increase physical activity and improve attitude toward activity. (BMI, HR)	Girls Y Boys N

Legend: N- number of participants, D – duration, HP- health promotion, PA – physical activity, MF – multifaceted interventions involving two or more of the following: (teacher training, modification of school meals, curriculum changes, physical education, playground activities), BMI – body mass index, TS – tricep-skinfold thickness, waist circumference, waist to hip ratio, **Success** – significant difference from control group, **mos** – months, **wks** – weeks, **yrs** – years

Table 8 Family Based Interventions adapted from (Wilson, 2003).

Program	N	D	Intervention	Comparison groups	Outcome Measures	Success
Stolley (1997)	55	12 wks	HP	Dietary education program	Percentage of daily calories from fat	Y
Epstein (2001)	26 Fam	1 yr	HP	Diet education to obese parents with non obese children encouraging either increase fruits & vegetables or decreased sugar and fat	Prevalence of overweight BMI ?	Parents Y Children N
Nova (2001)	185	1 yrs	HP	Information leaflets versus formal education classes on	Prevalence of overweight BMI ?	Y
Epstein (1984)	53	12 mos	HP & PA	Diet education alone versus combined with exercise	Prevalence of overweight	N Significant decrease for both groups
Epstein (1985)	23	12 mos	HP & PA	Same as above	Same as above	same
Epstein (1985)	35	24 mos	HP & PA	Diet combined with either aerobics, calisthenics, or lifestyle exercise	Percentage overweight	Y (A & C) N (L)**
Epstein (1995)	61	12 mos	HP & PA	Diet combined with exercise or decreased sedentary activities	Weight loss, percentage of overweight	Y Significant decrease for both groups, with decreased sedentary group having greater reduction
Epstein (2000)	90	24 mos	HP & PA	Same as above except hi/low physical activity or hi/low sedentary activity	same	N But there were significant decreases in overweight for both groups

Legend: N- number of participants, **D** – duration, **HP**- health promotion, **PA** – physical activity, **MF** – multifaceted interventions involving two or more of the following: (teacher training, modification of school meals, curriculum changes, physical education, playground activities), **BMI** – body mass index, **TS** – tricep-skinfold thickness, waist circumference, waist to hip ratio, **Success** – significant difference from control group, **mos** – months, **wks** – weeks, **yrs** – years

** Note: 10 year follow-up revealed that lifestyle exercise group and aerobics group had statistically significant reductions in percentage overweight than calisthenics group.

Table 9 Behavior Modification Programs: Parents as change agent adapted from (Wilson, 2003).

Program	N	D	Intervention	Comparison Groups	Outcome Measures	Success
Israel (1995)	33	1 yr	Multi-component behavioral change	WR vs WR + management skills course vs waiting list	Weight	N WR only group having significantly more weight gain
Mellin (1987)	66	15 mos	Multi-component behavioral change	Parental education on support strategies	Weight	Y
Epstein (1994)	39	2 yrs	Behavioral change	Parental demonstration of skill mastery vs education only	weight	Y 6 and 12 mos N 2 year f/u
Golan (1998)	60	1 yr	Behavioral change	Parental responsibility vs child responsibility	Weight	Y Decrease in both Parental control significantly higher

Legend: N- number of participants, **D** – duration, **HP**- health promotion, **PA** – physical activity, **MF** – multifaceted interventions involving two or more of the following: (teacher training, modification of school meals, curriculum changes, physical education, playground activities), **BMI** – body mass index, **TS** – tricep-skinfold thickness, waist circumference, waist to hip ratio, **Success** – significant difference from control group, **mos** – months, **wks** – weeks, **yrs** – years, WR – weight reduction, f/u – follow-up

Table 10 Family-based Behavior Modification Programs, adapted from (Wilson, 2003).

Programs	N	D	Intervention	Comparison Group	Outcome Measures	Success
Drownell (1983)	42	1 yr	Social support diet and exercise	M + C, M/C, C only	Weight	Y M/C lost significantly more weight than other two groups
Kirschenbaum (1984)	40	1 yr	Behavioral treatment groups	P + C, C, control	Weight	Y Both groups lost weight with no statistical difference between intervention groups
Senediak (1985)	45	6 mos	Behavioral program	Rapid onset, gradual onset, control	Weight	Y Significant reduction in weight in both groups, none between groups
Flodmork (1993)	43	1 yr	Behavioral	Conventional vs Family+ conventional	BMI	Y All increased BMI F+C had smaller increase than control
Duffy (1993)	27	6 mos	Behavioral training for P + C	Relaxation vs cognitive self management	Weight	Y No statistical difference between groups
Broot (1997)	93	1 yr	Behavioral modification	Summer camp, single session, group outpatient, inpatient	Weight	Y No statistical difference between groups
Epstein (2000)	67 Fam	24 mos	Behavioral	P+C problem solving, C problem solving, Standard family treatment	BMI	Y Standard treatment had greatest decrease in BMI
Goldfield (2001)	31 Fam	12 mos	Behavioral	Mixed individual and group vs group only	BMI, weight	Y No statistical difference between groups

Legend: N- number of participants or no statistical difference between intervention groups, **D** – duration, **HP**- health promotion, **PA** – physical activity, **MF** – multifaceted interventions involving two or more of the following: (teacher training, modification of school meals, curriculum changes, physical education, playground activities), **BMI** – body mass index, **TS** – tricep-skinfold thickness, waist circumference, waist to hip ratio, **Success** – significant difference from control group, **mos** – months, **wks** – weeks, **yrs** – years, **M** –mother, **C** – child, **M/C**, mother- child separately, **Fam** - families

Table 11 No parental involvement adapted from (Wilson, 2003).

Programs	N	D	Intervention	Comparison Group	Outcome Measures	Success
Warschburger (2001)	197	6 wk	Cognitive behavioral	Behavioral training with diet and exercise, diet and exercise alone	Weight	Y No statistical difference between groups
Freemork, (2001)	29	6 mos	Pharmacological Metformin	Med vs no meds Exercise and diet was not reported	Labs, BMI	Y

Legend: N- number of participants, **D** – duration, **HP**- health promotion, **PA** – physical activity, **MF** – multifaceted interventions involving two or more of the following: (teacher training, modification of school meals, curriculum changes, physical education, playground activities), **BMI** – body mass index, **TS** – tricep-skinfold thickness, waist circumference, waist to hip ratio, **Success** – significant difference from control group, **mos** – months, **wks** – weeks, **yrs** – years

In general, there is insufficient evidence of interventional effectiveness from which to base national guidelines, or form clinical practice. There are a number of factors that contribute to the lack of sufficient evidence, namely small studies, poor design, high drop out rates, and poorly reported data. The authors suggest that this review serves as a base line to use when considering future design. Future studies should be larger, and have good methodological quality and longer duration/ follow-up. Overall, programs that were multifaceted and included diet, exercise, family/parental involvement, and overall behavior modification decreasing sedentary behaviors were successful in sustained weight loss.

A META-ANALYTIC REVIEW OF OBESITY PREVENTION PROGRAMS FOR CHILDREN AND ADOLESCENTS: THE SKINNY ON INTERVENTIONS THAT WORK

Stice et al conducted a meta-analytic review of obesity prevention programs and their effects and investigates, participants, intervention, delivery and design features that have greater effects. They focused exclusively on prevention programs that were evaluated in controlled trials. They found that 13 of 46 programs prevented weight gain. Larger effects were found in children, adolescents, and females. Programs that were brief, solely targeted weight control versus other behaviors, pilot studies, and programs where participants may have self-selected were more effective. They used a multivariate model and both linear and quadratic terms to evaluate components of effectiveness. Surprisingly they did not find any significantly larger effect with mandated improvements in diet and exercise, sedentary behavior reduction, delivery with trained interventionist, or parental involvement. In general the percentage of programs that were had a significant effect on obesity prevention was similar to other prevention programs for other public health problems such as HIV and eating disorders. (Stice et al, 2006).

In this review, they identified four common effects of successful programs. First the programs were relatively intensive, and involved 40hrs of intervention time (range = 3-120hrs). However intensity was not the key to effect because many programs that were equally intensive did not produce weight gain effects, which suggests that certain interventions produce a better return per hour of intervention. Second they noted that only two of the 13 programs that were effective, were conceptualized as obesity prevention programs. Many of the effective programs were described as general health intervention education programs, which suggest that there may be other avenues to prevent obesity through alternative methods. The third feature was that only three had lasting effects over long-term follow-up, which suggest the need for longer follow-up. The fourth feature is that positive effects for weight gain have been replicated in multiple trials for only one intervention. (Stice et al, 2006; Stice & Ragan, 2002 as cited in Stice et al, 2006).

In evaluating the moderators of obesity prevention, they considered the participants, intervention, delivery and design features with the greatest effects. The stats support strongest results for children and adolescents versus pre-adolescents for intervention effects. Older participants are better able to understand and control the variables that effect success, and younger participants that have parental involvement to assist with intervention parameters. Additionally the authors found that gender effect size $r = 0.06$ female versus 0.02 for males suggest that females are more susceptible to interventions focused on weight prevention than male because of the additionally societal pressures for women to conform to certain weight standards. Programs with shorter duration and fewer desired effects statistically were more effective, perhaps due to fewer drop outs and easier desired outcomes. When considering models, the behavioral economics model suggests that some people gain more reinforcement from eating than exercising, making them more susceptible to weight gain. The authors suggest adapting

interventions that would better address the needs of certain subpopulations and help to create a balance between costs in future versus temporary benefit in the present.

In this chapter we have summarized eight review articles of obesity prevention programs that have had number of designs and population bases. The review articles have used multiple, but similar evaluation techniques to determine effectiveness of different interventions. The majority of the programs utilized self reported data, which made evaluation difficult at best. A number of programs stated objectives such as increasing physical activity that were not specifically measured. Lack of proper design and inadequate data collection make determination of program effectiveness difficult to assess. The last article by Stice and colleagues utilized a meta-analytic review method which examined a number of features, modifiers and delivery models. Utilizing this method they were able to objectively refute the effectiveness of features previously thought to be effective. More research is needed to identify effective techniques for combating this increasing problem.

Chapter 5: Discussion and Recommendations

DISCUSSION

The prevalence of overweight/obesity has steadily increased over the past few decades. A number of chronic diseases and health disorders have also increased and are clearly attributed to the increased prevalence of obesity (Landers, 2004). Research statistics indicate that the problem not only affects the adult population, but has become a critical concern in early childhood (Connelly, 2002). Poor and minority children are disproportionately affected (Hedley et al, 2004). The rapid increases in childhood obesity render prevention a public health priority with some leading policy makers ranking childhood obesity as a critical public health threat (Bascetta, 2005). With this in mind, identification of children who are at risk for obesity should serve as an early intervention for some of the complications associated with adult obesity.

As a result of many national and international studies, there is an increased recognition of the causal factors and consequences of obesity. On the basis of a multifactorial etiology of obesity, preventive intervention requires multiple settings and the involvement of family, school and community environments. (Dietz and Gortmaker, 2001 as cited in Maffeis, 2002). Many of these studies have led to the establishment of dietary and physical activity guidelines which have been used in attempts to alleviate or ameliorate nutritional and sedentary contributors (IOM, 2005). In American society, the corporate community (i.e., fast food and other markets of unhealthy foods), schools and local communities are recognizing their roles in confronting the issue by modifying the environment and offering opportunities for more healthy choices. Studies have shown that schools and local communities alone are not enough (Landers, 2004). In order for significant reductions to take effect, the effort must occur at multiple levels including

state and national involvement. We are now in the beginning stages of these types of interventions. In recent years there have been a number of programs initiated to combat the obesity epidemic; however measures of their effectiveness have not been equally as aggressive.

Few models for the prevention of child and adolescent obesity have been tested and generalized conclusions on the effectiveness of these programs cannot be drawn (Campbell et al, 2001). In this project an attempt was made to summarize the reviews of primary and secondary prevention programs geared toward reduction of child and adolescent obesity at the community level. Evaluation of existing programs is difficult primarily due to the inconsistencies in program design and data collection. The need for well-designed studies which examine a range of interventions remains a priority (Campbell et al, 2001). Of the eight published review articles on this subject, only one utilized statistical analysis to evaluate effectiveness of interventions on desired outcomes. Ironically, program factors listed below were previously thought to be effective in obesity prevention but were not supported statistically:

1. Mandated improvements in diet and exercise,
 2. Sedentary behavior reduction
 3. Parental involvement
 4. Intervention delivery by trained professionals versus teachers
- (Stice et al, 2006)

There are a number of possible explanations for these findings, one being titration, a phenomenon in which the desired behavior such as physical activity is increased in one setting, but decreased in another. This suggests that although the intervention itself is helpful, the program should be modified to offset the titration effect (Donnelly et al, 1996, Stice et al, 2006). In designing future programs it will be important to consider the successes and failures of previous programs to avoid wasting precious time and resources.

As the nation moves toward more active approaches to address the obesity epidemic through state and national programs, it is imperative that we capitalize on the successes and failures of previous programs. As with the establishment of many of the early physical fitness guidelines, there will be disagreement and apparent contradictions. Of note, the congressional inquiry on best practices associated with physical activity conducted by the Government Accounting Office (GAO) found that the leading strategy for obesity prevention was physical activity (Bascetta, 2005). Though it may appear so, it did not contradict the IOM's 2005 report that both physical activity and healthy eating behaviors are necessary factors for obesity prevention (Bascetta, 2005). In fact these two investigations are supportive of each other if taken in the context of their design. The GAO was looking for the best practices and found physical activity to be the key factor. The GAO was charged with developing an action plan that would include multiple factors.

RECOMMENDATIONS

Throughout this research a common theme seems apparent; any effort to mediate the prevalence of obesity in our society will require a multi-faceted approach. Based on current knowledge and the limited success of project models, the objective of reducing the prevalence and resultant public health concerns will necessitate actions at many interdisciplinary levels. Increased funding for replication of program models which have shown positive short-term results would be highly recommended. In their meta-analysis Stice et al (2006) made the following recommendations:

1. Given that the majority of programs that have been evaluated did not produce significant weight gain prevention, there should be more follow-up trials of enhanced versions of the programs that produce desired outcomes. Doing so would allow more analysis of the interventions and moderators that produce results.

2. Additionally, programs that were not successful should be used to determine causal factors that should be addressed in future programs. Understanding internal barriers to change and perception will aid in the design for success.
3. Future trials should use random assignment, utilize blinded assessment, and take direct measurements of body fat. Additionally the trials should incorporate procedures to minimize attrition. Doing so would help to clearly assess effectiveness.

It is our belief that if these recommendations are followed in future research trials, the possibility of identifying the right formula for effective obesity prevention will be enhanced. The problem is much more complex than it appears. The key to success is in the identification of necessary behavioral changes and alleviating the resistance to do so. As already stated obesity problem is multifactorial involving food supply, restrictions and opportunities for physical activity, and interactions among families, schools and communities. The effort will require multi-faceted approaches. Although the statistical analyses state otherwise, action at the lowest common denominator, parental involvement, is likely to show promise as an intervention modifier. Parents and individual citizens must invoke their political might to demand legislative assistance to address the factors that are outside the home; specifically recreational options, and subsidies that promote healthy food choices. Future studies (utilizing motivated participants) that identify modifiable behaviors and establish well defined outcome measures will yield results that can be modeled to curb the obesity epidemic.

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Vita

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