

Mount Saint Vincent University
Department of Applied Human Nutrition

**Achieving Healthy Body Weights in the Teenage Years:
Evidence-based Practice Guidelines for Community Nutrition Interventions**

By
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A Thesis
Submitted in partial fulfilment
of the requirements for the degree of
Master of Science in Applied Human Nutrition

October, 2007
Halifax, Nova Scotia

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Abstract

Background: Adolescent obesity has become a significant public health problem. Conservative estimates, based on self-reported data, indicate overweight and obesity rates among Canadian adolescents aged 12 to 17 soared from 14% in 1978/79 to 29% in 2004.

This persistent upward trend has serious long-term implications on the physical and psychological well being of adolescents and accounts for billions of dollars in health care costs. For this reason, prevention has been recognized as a priority health issue. While interventions have begun to target school-aged children and adults in clinical settings, few advances have been made to halt the escalating problem among adolescents. This population has unique needs with increasing independence transitioning into adulthood. Reversing the trend requires comprehensive interventions that mitigate personal, social and environmental barriers to healthy lifestyle choices.

There is currently little consensus on best practices for dietetic adolescent obesity prevention and management. Community strategies are recommended as the most efficacious and feasible way to reach the greatest number of youth and support healthy lifestyle development. Evidence based guidelines are currently not available and are needed to guide nutrition practice in this area.

Methods: A thorough systematic review and evidence analysis yielded 48 prevention and treatment interventions meeting the studies inclusion criteria. The evidence was graded and drafted into recommendations and an algorithm guideline displaying how each recommendation relates to nutrition intervention. A panel of independent, national experts assessed the guidelines for validity, acceptability and applicability with a tool adapted from the AGREE Collaborations Appraisal of Guidelines for Research and Evaluation Instrument. These experts covered different areas of expertise, including community nutrition, public health, adolescent health, academia and endocrinology.

Results: The research findings confirm the need for comprehensive strategies, which include components of nutrition education and physical activity, address social and environmental influences and use schools as delivery vehicles for health promotion and health education. For obesity treatment interventions, promising strategies incorporated diet plans, family involvement and behaviour modification techniques in multidisciplinary interventions. Computer based strategies and peer modelling may also be developmentally appropriate strategies for health promotion health in the adolescent population.

Conclusions: The results of this study indicate several interventions conducted over the past 10 years have had a positive effect in preventing or reducing adolescent obesity over the short and/or long term. The findings support the development of comprehensive, multi-disciplinary obesity prevention and treatment interventions and the use of peer modeling, family based and computer based strategies.

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Chapter 1: Introduction

1.1 Problem Statement

Adolescent obesity has become a significant public health problem in Canada (1).

Conservative estimates, based on self-reported data, indicate overweight and obesity rates among adolescents aged 12 to 17 increased from 14% in 1978/79 to 29% in 2004 (2).

These rates among Canadian youth now rank with the highest in the world (3).

Rapidly rising overweight and obesity rates in a fairly genetically stable population confirm a need for comprehensive interventions that address personal, social and environmental factors that influence individual health behaviour earlier in life (4,5).

Interventions have begun to target children and adults in clinical settings but few advances have been made to halt this escalating problem among adolescents (5).

Immediate action based on the best available evidence is required to prevent and treat obesity among this population (6,7,8,9).

Synthesis documents outlining effective, evidence-based models for prevention and treatment that address the unique needs of adolescents in community settings have not been developed. For this reason, guidelines are needed to direct the course of action for intervention programs, validate decisions, provide frameworks for implementation in community settings and guide evaluation efforts (7).

1.2 Relevance of the Study

Obesity has staggering impacts on quality of life and life expectancy (10,11). Obese adolescents often become obese adults and face a high risk for a range of preventable chronic diseases (12,13). In the 1990 Bogalusa community-based heart study of 9167 children and adolescents, 60% of overweight youth reported at least one risk factor for cardiovascular disease (hypertension, hyperlipidemia or impaired glucose tolerance) and over 25% reported two or more (14). Overweight and obese adolescents display abnormal lipid, insulin and blood pressure levels (15,16). The risk of developing cardiovascular disease later in life is higher for overweight adolescents (12,14). Colorectal cancer and gout risk is higher among males and arthritis risk is higher among females who were overweight as adolescents (12). Must and colleagues (12) found that overweight during adolescence was a greater predictor of risk for these chronic health conditions than was overweight during adulthood (12).

While weight reduction can normalize medical status for many health conditions, adolescents currently face high risk levels for chronic diseases which intensify throughout life (17,18,19). As a result of adolescent body weight increases, a future epidemic of obesity related medical conditions is anticipated (17,18,19).

In addition to deterioration of physical health, obese adolescents display impaired psychosocial, emotional, social and school functioning in comparison to adolescents with healthy weights (20,21). Due to negative connotations associated with excess body fat, overweight and obese adolescents experience greater levels of emotional and

psychological stress in response to bullying, verbal insults and teasing by their peers (22,23). Older adolescents are more likely to suffer from physical forms of bullying and to be the perpetrators of bullying towards others (22). Weight stigmatization during adolescence may result in inability to achieve normal and healthy psychological and social development (20,23).

The deterioration of health associated with obesity accounts for billions of dollars in health care costs (24). In 1997, it was estimated that the total direct cost of obesity in Canada was over \$1.8 billion (25). It is now known that obesity related poor health and welfare losses which result in significant indirect costs to the Canadian health care system (26).

Research indicates the longer an individual stays overweight, the more likely their body will adjust to maintain that state (27). Once overweight, it is very unlikely that an adult will return to a normal weight range (2,13,28). For these reasons, prevention and treatment efforts directed at adolescents are critical to improve the immediate and long term physical and psychosocial health of Canadians.

1.3 Purpose and Specific Objectives

The overall goal of this study was to establish evidence-based community nutrition guidelines with a view to developing adolescent eating behaviours consistent with achieving and maintaining healthy body weights.

The specific objectives were:

- 1) to identify community nutrition obesity prevention and treatment strategies aimed at adolescents aged 12 -18 years;
- 2) to apply an evidence-based decision making framework to critically appraise the findings;
- 3) to synthesise potential evidence based intervention guidelines; and
- 4) to verify usefulness through key informant interviews.

The systematic review addressed the following research questions:

1. What elements of community interventions have been successful in achieving either:
 - a) primary or secondary obesity prevention in non-overweight adolescent populations; or
 - b) a weight reduction or stabilization appropriate for growth in overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; and
2. What moderator and mediator variables (including socio-economic status, cultural values, gender, age, food environment, self-efficacy and health knowledge) should be addressed in intervention strategies?

The objectives of the evidence based guidelines were to:

- Provide community nutritionists and public health professionals with recommendations for the development of adolescent obesity prevention and treatment interventions in community or school settings.

1.4 Definitions

Acceptable Macronutrient Distribution Ranges = recommended ranges for percentage of calories that should come from fat, protein and carbohydrates.

Adolescence = a period of development beginning with “the onset of physiologically normal puberty” and ending when “an adult identity and behaviour are accepted.” This “corresponds roughly to the period between the ages of 10 and 19 years, which is consistent with the World Health Organization’s definition of adolescence (29).”

The World Health Organization has further divided adolescence into three developmental stages based on physical, psychological and social changes (29). These stages are classified as:

Early adolescence: 10/13-14 years For the purpose of this study early adolescence is defined as 12-14 years.

Middle adolescence: 14-17 years.

Late adolescence: 17-21 years (variable). For the purpose of this study late adolescence is defined as 17-18 years.

Adolescent obesity BMI cut-offs = International cut off points, obtained by averaging data from Brazil, Great Britain, Hong Kong, Netherlands, Singapore, and United States, for BMI for overweight and obesity by sex for ages 12 to 18 years, defined to pass through a

BMI of 25 and 30 kg/m² at age 18 (30). Table 1 represents adolescent obesity BMI cut-offs.

Table 1
Adolescent BMI cut-offs (30)

Age (years)	Overweight cut-off BMI greater than or equal to:		Obese cut-off BMI greater than or equal to:	
	Boys	Girls	Boys	Girls
12	21.22	21.68	26.02	26.67
12.5	21.56	22.14	26.43	27.24
13	21.91	22.58	26.84	27.76
13.5	22.27	22.98	27.25	28.20
14	22.62	23.34	27.63	28.57
14.5	22.96	23.66	27.98	28.87
15	23.29	23.94	28.30	29.11
15.5	23.60	24.17	28.60	29.29
16	23.90	24.37	28.88	29.43
16.5	24.19	24.54	29.14	29.56
17	24.46	24.70	29.41	29.69
17.5	24.73	24.85	29.70	29.84
18+	25.00	25.00	30.00	30.00

For adolescents, BMI cut-offs are sensitive to the timing of puberty because maturation influences body fat (31). The adolescent overweight and obesity definitions employed in this research are based on CDC BMI-for-age charts, which are recommended by Dietitians of Canada and other associations for use in clinical and community settings (32, 33), and the International Obesity Taskforce (IOTF) criteria for data comparisons.

Body Mass Index (BMI) = Weight in kilograms divided by height in metres squared.

CDC criteria = “BMI reference data using five U.S. national health examination surveys from 1963 to 1994 and five supplementary data sources. The CDC gender- and age-specific BMI references define overweight in children as BMI above the 95th percentile while children between the 85th and 95th percentile as considered to be at risk for overweight. The CDC BMI reference data and cut-off points are recommended for Canadian children except the labels for the weight categories are different; a BMI between the 85th and 95th percentiles indicates a child is overweight while a BMI above the 95th percentile indicates that a child is obese (34).”

Community-based interventions = “Interventions that are implemented within one or more community groups (ad hoc or formal), that promoted change through policy, social marketing, and/or environmental changes, and that targeted members of certain groups or community members at large (34).” For the purpose of this study, schools are included in community settings.

Dietary Reference Intakes = “Dietary Reference Intakes or DRIs is an "umbrella" term for at least four scientifically based nutrient intake reference values, to be used for planning and assessing diets of apparently healthy people. The DRIs include: the Estimated Average Requirement (EAR), the Recommended Dietary Allowance (RDA), the Adequate Intake (AI) and the Tolerable Upper Intake Level (UL) (34).”

Healthy Eating = “A pattern of eating that meets guidelines set out in Canada’s Food Guide, thereby promoting good health and lowering risk of chronic disease (35).”

Intersectoral collaboration = “A recognized relationship between part or parts of different sectors of society which has been formed to take action to prevent obesity in a way that is more effective, efficient or sustainable than might be achieved by any one sector acting alone (36).”

Intervention = “A program designed specifically to alter the physical characteristics or behaviours of a group (35).”

Intervention Intensity = Concentration of intervention sessions per month. (37)

Low = < 1 encounter per month

Medium = 1 encounter per month

High = > 1 encounter per month

Intervention Mode = Intervention allocation type, group or individual.

Mediator variables “signify processes occurring during treatment that explain how and why the intervention is exerting its effects (38).”

Moderator variables “refer to characteristics of a treatment sample that may influence the outcomes of interest, thereby identifying subgroups with greater or lesser chances for positive response (38).”

Nutrition Intervention = “A specific set of activities and associated materials used to address a problem (39).”

Obesity = Excess body fat. “In adolescents = BMI for age \geq 95th percentile (34).”

Overweight = “In children and adolescents = BMI for age \geq 85th percentile and $<$ 95th percentile (34).”

Population Health = “an approach that addresses the entire range of factors that determine health and, by so doing, affects the health of the entire population (40).”

Prevention = “Interventions to prevent populations of adolescents unselected by weight status from becoming obese (41).” For the purpose of this research, prevention includes both primary and secondary.

The U.S. Preventative Services Task Forces defines *primary prevention* measures as “those provided to individuals to prevent the onset of a targeted condition (37).”

The U.S. Preventative Services Task Forces’ Guide to Clinical Preventive Services (2d edition, 1996) describes *secondary prevention* measures as those that “identify and treat asymptomatic persons who have already developed risk factors or preclinical disease but in whom the condition is not clinically apparent (37).”

Physically Active = “Active level of physical activity defined as expending more than 1.5 kcal/kg/day of energy (34).”

Physically Inactive = “Inactive level of physical activity defined as expending less than 1.5 kcal/kg/day of energy (34).”

Treatment = “Interventions targeting obese adolescents, with the objective of preventing worsening of obesity or normalizing body weight (41).”

Chapter 2: Literature Review

2.1 Obesity Etiology

Obesity is a complex disease resulting from multifaceted interactions among genetic, hormonal, metabolic and environmental factors (42). The primary cause is considered to be a long-term energy imbalance resulting from excess energy intake and/ or insufficient physical activity (43,44,45). The recent rises in adolescent obesity rates have been considered to result from any number of factors that influence the energy balance equation (46).

2.1.1 Genetic Factors

Genetics are considered to account for 30% to 70% of the differences in BMI, yet the specific mechanisms involved remain unclear (43, 44,47). Many obesity cases are considered to result from polygenetic mutations combined with a myriad of environmental influences (44). A genetic hypothesis suggests those with specific genotypes may be more susceptible to environmental factors that are conducive to positive energy balance (1). When a genetic predisposition to slow nutrient metabolism and poor distribution of energy expenditure is combined with long term overeating or physical inactivity, the positive energy imbalance results in obesity (43,44,45,47). Genetic factors are also believed to impact individual dietary preferences and energy expenditure (48).

2.1.2 Physical Inactivity

Components of energy expenditure that influence body weight are basal metabolic rate (BMR), the thermic effect of food (TEF) and physical activity (49). In terms of the energy balance equation, the most variable component of energy expenditure is physical activity (48). Some studies suggest lower physical activity rates contribute to rising adolescent obesity rates (13,47).

While physical activity was not significantly associated with overweight or obesity in children aged 6-11, a strong relationship was seen in adolescent boys aged 12-17 (2). Obese adolescents report lower levels of moderate and vigorous physical activity than adolescents with normal weights (48).

The limited data available on activity levels indicates the current generation of adolescents is less active than ever (43). School physical education classes are estimated to contribute to 20-40% of energy expenditure (50). For some, these classes are the only form of moderate or vigorous activity (50). Activity levels appear to peak for students in the tenth grade and then decline steadily, continuing into adulthood (51). Low adolescent activity levels are resulting in an increasingly positive energy balance and are considered a causal factor in the current obesity epidemic (48).

Along with lower activity levels, the current generation of adolescents display an increase in sedentary forms of entertainment, which have been suggested as a contributory factor for obesity development (2). The Canadian Community Health Survey 2004 (CCHS), found a positive correlation between time spent watching TV, playing video games or

using the computer and the likelihood of being overweight or obese among adolescents (2). Statistics report that in 2004, 35% of Canadian adolescents spent more than 30 hours a week in front of a screen (2). The same survey found children who spent more than 2 hours in front of a screen a day were twice as likely to be overweight or obese as those whose “screen time” totalled one hour or less (2).

2.1.3 Dietary Factors

Longitudinal data on Canadian adolescent nutrient intakes are scarce, yet available studies suggest that rising obesity rates may be linked with poor eating habits and unhealthy dietary choices (2,3,52,53,54).

When compared to the Dietary Reference Intakes (DRI) and Canada’s Food Guide, current adolescent diets appear to be high in calories but deficient in several micronutrients (53). The CCHS confirms that, while adolescents are meeting the recommended intake for fat, they may be falling short on fibre and some vitamins and minerals due to insufficient intakes of fruit and vegetables and whole grains (54). Extrapolations from US population studies indicate that low intakes of fruit and vegetables and dairy products and high intakes of less healthy choices may be related to obesity development and future health related co-morbidities among this population (43,52,55,56).

2.1.3.1 Caloric intake and obesity

Historically, adolescent obesity was considered to be the result of excess caloric intake (57). Recent literature generally does not support this notion. The CCHS found that while

caloric intake appears to be the highest during adolescence, it does not appear to have increased since the 1970-1972 Nutrition Canada Survey (54). US National Health and Nutrition Examination Surveys indicate that adolescent energy consumption has increased since the 1970s but only by 95 calories per day (58,59). Some studies report that adolescents who are obese commonly consume fewer total calories than those who fall in a normal weight category (45,58). This discrepancy could be due to under-reporting of food intake or decreased energy needs due to lower energy expenditure (43,60). Regardless, despite no or only modest increases in caloric intake, obesity rates are reaching epidemic proportions. For this reason caloric intake is no longer considered a major causal factor (58).

2.1.3.2 Food and Nutrient Intake

Numerous studies have examined the role of specific foods and the distribution of nutrient intake on obesity development. Once parental obesity is taken into account, little clear evidence exists of the effect of diet composition on adolescent obesity (55,61).

Breakfast consumption among adolescents of obese parents has been considered to be one of the strongest protective factors (58). The breakfast meal is a major contributor of whole grains, dairy and fruit. Breakfast consumption has been associated with lower intakes of fat and high calorie snacks throughout the day which is believed to aid in the achievement of a healthy energy balance (43).

Among adolescents surveyed in the CCHS, breakfast accounted for only 16.4% of total calories (54). Some studies report that overweight adolescents commonly skip breakfast

and consume large, high calorie, meals later in the day (43). This poor distribution of energy intake has been considered a possible causal factor for increased adolescent adiposity (61).

The CCHS, reported that children and adolescents, aged 4-18, obtained most of their calories from grain products, closely followed by “other foods,” as defined by Canada’s Food Guide (CFG) food groups (54). Although grain products represented the largest portion of calories, 33% of adolescent females and 6% of adolescent males did not meet the minimum 5 servings daily (54).

Adolescents, aged 14-18, were the largest consumers of all age groups of “other foods” which accounted for over 25% of their total caloric intake (54). As CFG states, “other foods” should be consumed in moderation (62). The CCHS found that snacks accounted for 30% of total calories for adolescent males and 28% for females (54). Snacks were mainly comprised of “other foods,” of which soft drinks were ranked first among the top ten consumed (54).

Research suggests that low intakes of dairy and fruits and vegetables may be inversely related to adiposity in adolescents (2,63,64). The CCHS found 53% of adolescent males and 63% of adolescent females fell short of the recommended five servings of fruit and vegetables a day (54). The same survey found these adolescents were significantly more likely to be obese than those who regularly consumed fruits and vegetables (2). Intake of milk products also declined as children matured into late teens and by 10-16 years of age, 61% of males and 83% of females did not meet the recommended three daily servings (54).

Adolescents overall macronutrient intake falls within an acceptable range, according to the “acceptable macronutrient distribution ranges” established by the Institute of Medicine (IOM) report titled *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids* (54,65). However, 16% of adolescent males and 13% of adolescent females exceed maximum recommended caloric intake from fat (54). Over 25% of this fat comes from the meat and alternates food group with an almost equivalent amount from “other foods” for both children and adolescents (54). The main contributors to fat intake in all age groups were foods such as pizza, sandwiches, submarines, hamburgers and hot dogs, followed by sweet baked goods, such as cake, cookies, and doughnuts (54). Rising fast foods intakes may be negatively impacting the diet quality of adolescents and resulting in energy balance equation disturbances (7, 66). High fat intakes have been a suspected contributor in weight gain (45,67); yet the exact role of dietary fat and other nutrients on obesity development remain unclear.

2.1.4 Environment

The environment consists of a range of physical and social factors within a community that may influence obesity. While data illustrate a clear relation between environment and health exists, it has been difficult to determine which environmental factors have the most influence on obesity development (5).

Modernisation, new technologies, community designs promoting the use of automobiles, inaccessibility of community recreation centres and neighbourhood safety have all contributed to declining activity levels (43,44). This decline has been associated with an

increased dependence on motorized travel yet distinct relationships between physical activity and the built environment remain uncertain (7). Additionally, nutrient poor, sugar-sweetened, high fat food and beverages offered in family, school and community food environments have led to high intakes of energy dense foods (7, 44,68) further influencing the energy balance equation.

The family eating environment has demonstrated a strong influence on establishing food preferences early in life (45). An adolescent who has been repeatedly exposed to high calorie foods can develop a preference for these foods through mechanisms of associative and physiologic conditioning (68). These mechanisms are based on the theory that a child will automatically reject foods when first introduced, except those that are salty or sweet, and must be repeatedly exposed to the same foods before they gain acceptance (68). For this reason, adolescents come to prefer foods that are familiar and present in their family environment (68).

2.1.5 Socio-Economic Status

Socio-economic status is significantly correlated with dietary intake and obesity prevalence in adults (2). While reports are inconsistent, the same relationship exists in children and adolescents but to a lesser degree (2). An inverse relationship between socio-economic status and percent adiposity has been expressed in children and adolescents throughout the world (45). Lower social status, fewer social supports and primary caregiver's single marital status have all been associated with excess food intake and increased weight (45). Long term effects of lower socio-economic status are also apparent (45).

The relationship between parental education level and obesity is more prevalent (2). Children and adolescents from parents with lower levels of education and lower income backgrounds are more likely to become overweight and remain overweight through adulthood (45,69).

2.2 Critical Periods for Obesity Development

Childhood and adolescence are critical periods for obesity development (70,71,72). Parental obesity, high levels of body weight at one year of age, time of adiposity rebound and fat deposition during adolescence are among the main risk factors for obesity development (18,45,70,71,72).

The period of child growth, known as adiposity rebound, which takes place around 4 to 7 years of age, is associated with acceleration in BMI subsequent to decline post infancy (45,70,71,72). It is connected to the establishment of food behaviours and body metabolism (45,70,71) and is significantly correlated to adiposity later in life (45). Children with early maturation, or rebound, and poor autonomous regulation of food intake tend to display increased adiposity during childhood and adulthood (70,72).

During adolescence the quantity of body fat increases in females due to puberty and body fat is redistributed in both genders (70,72). In females, early puberty is associated with an increase in body fat which is a predisposing factor for obesity (70,72). With the mean age of menarche declining, adolescence poses great concern for obesity development in females (72). While body fat typically decreases in males during adolescence, this period is critical for central fat deposition, which may increase risk of obesity related co-

morbidities (70). The persistence of obesity into adulthood has been shown to rise linearly through childhood to adolescence (73). To break the cycle of obesity across the lifespan, it is essential for prevention strategies to target children and adolescents during the critical periods and support healthy development.

2.3 Adolescent Development

Adolescence marks a period of physical transformation whereby an individual matures sexually, increases in height and weight, completes skeletal growth and changes in body composition (74,75,76). Adolescent physical growth is accompanied by substantial advances in psychological and cognitive development (75).

2.3.1 Physical Growth

One of the main characteristics of adolescence is pubertal growth and the accompanying changes in body composition (76). Physical growth during adolescence is determined by individual genetic potential and the influence of independent and inter-related factors, including nutrition, hormones and environment (76). Both genders display a dip in height growth pre-puberty followed by a sudden increase in velocity once puberty has begun (76). During this growth spurt, 15-20% of adult height is gained (75). Half of adult ideal body weight and half of adult bone mass are also accumulated during adolescence (76). Adolescent weights increase by between 7-25 kilograms for females and between 7-30 kilograms for males (76). While the percentage of body fat and fat mass increases in females by about 1.14kg per year, body fat decreases in males at an almost equivalent rate (76). Fat Free Mass (FFM) alternately increases in males at a higher rate for longer

duration resulting in the loss of adipose tissue (76). Changes in fat distribution and deposition from central to peripheral, subcutaneous to visceral and upper body to lower body are also evident (76). These changes in body composition influence adult obesity risk (76).

2.3.2 Psychological Development

In early adolescence, cognitive development is seen through “concrete thinking, egocentrism and impulsive behaviour” (75). Since young adolescents lack problem solving and abstract thinking skills, they are challenged with linking nutrition and health and in overcoming barriers to behaviour change (75). This early stage of adolescence marks a period of preoccupation with physical appearances (77).

By mid-adolescence the majority of physical growth is complete, yet concerns over body image often persist (75). When combined with increasing “emotional autonomy” and “detachment from the family” these concerns can often yield conflict between health and nutrition choices and the need for peer acceptance (75). As adolescents develop problem solving and abstract thinking skills, they become aware of nutrition and future health connections yet the desire for peer acceptance often makes healthy choices difficult (75).

In late adolescence, teens have developed a stronger identity and the pre-occupation with body image has subsided (75). Older adolescents are better able to perceive long term consequences of their actions, manage emotional and social relations and be more consistent with individual beliefs and values (75). By this stage, adolescents are thinking more about their long term health (75).

2.3.3 Adolescent Eating Habits

Adolescent eating habits are influenced by complex interactions between intrapersonal and external factors, including family and peer relationships, body image perception and the food environment (78). Rapid and sudden changes in physical growth and psychological development impact nutrition needs, food habits and autonomy over food choices and yield adolescents vulnerable to malnutrition (79). Dietary patterns during this critical period can furthermore influence eating habits and health outcomes into adulthood (80,81).

Healthy eating habits developed at an early age are thought to prevent or delay the onset of chronic disease (82). With increasing independence and heightened concerns over appearance and peer acceptance, adolescent eating habits are often characterised by irregular eating patterns, eating outside of the home and increased snacking (83). These habits are further influenced by the lack of a sense of urgency to act on long term health in relation to other life-stage concerns, including parental and peer pressure and media (83).

The establishment of healthy habits during adolescence lays the foundations for health behaviours to be maintained into adulthood (84). Health promotion initiatives focussed on establishing health protective behaviours during this period have been shown to result in both immediate and long term improvements in the health of the entire population (84).

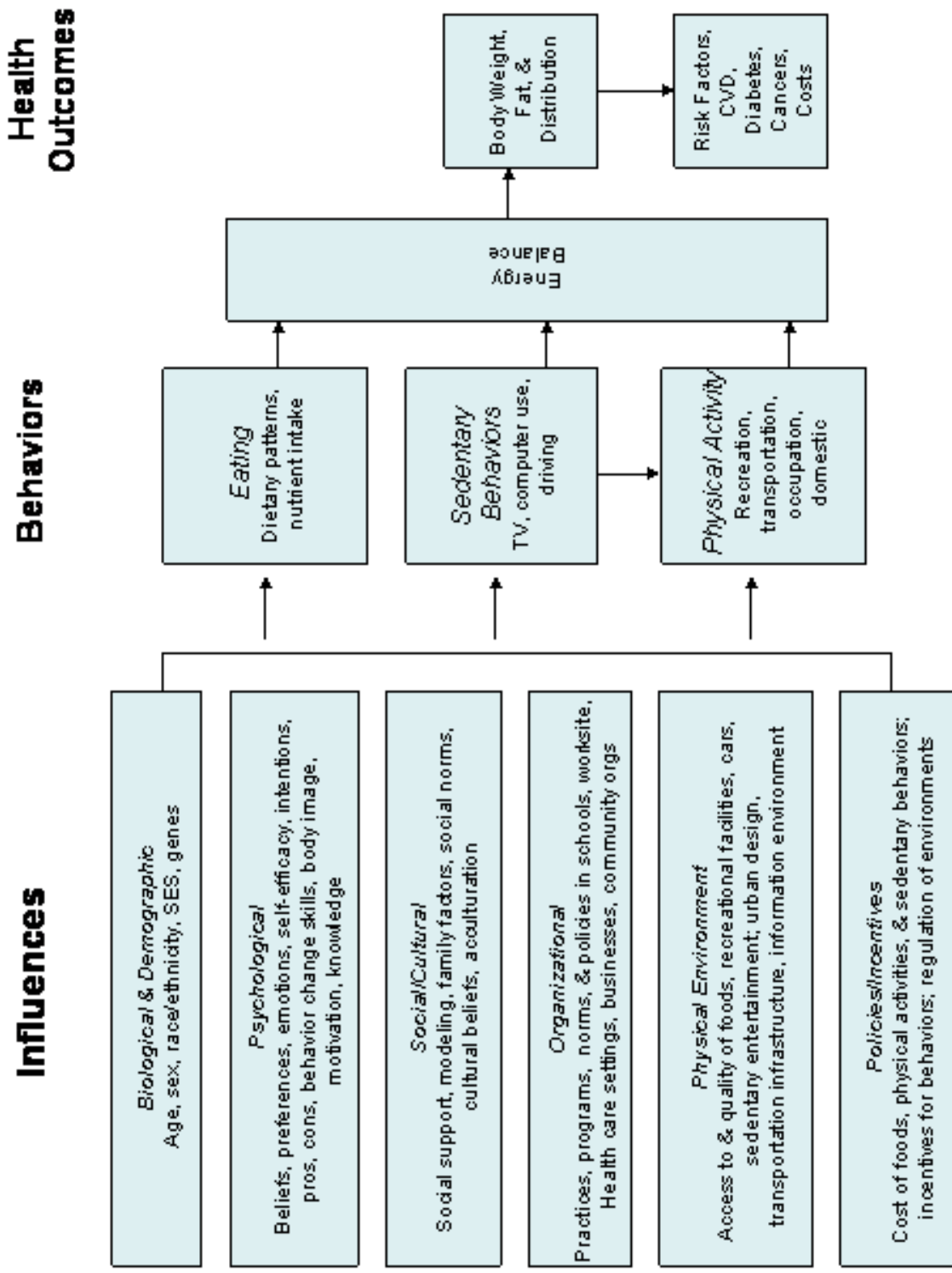
Chapter 3: Theoretical Framework

The ecological model was the theoretical framework used to inform this research. This model addresses multiple levels of influence on obesity development including the relationship between the physical environment and intrapersonal, interpersonal, community and public policy factors (85,86,87).

Intrapersonal factors account for individual knowledge, beliefs, attitude, behaviour change skills, body image, motivation and self-efficacy (85,88). Strategies targeting intrapersonal factors include mass media, social marketing and skill development (85,88). Interpersonal factors include social networks, such as peers, families, teachers, neighbours, social norms and cultural beliefs (85,88). Interventions that enhance social supports and networks address interpersonal factors (85,88). Community factors, include social and health services, community resources, recreational facilities, sedentary entertainment, access to quality food and governmental structures (85,88). These are targeted through mass media, community development and empowerment campaigns (85,88). Policy analysis and political change strategies address public policy, including legislation, taxes and regulations (85).

The ecological model has been considered a promising health theory to understand how to mediate these inter-related and independent variables and influence health related behaviour for obesity prevention (7,48,85,89). It has been conceptually applied to obesity prevention programs with promising results in the past (7,48,85). Figure 1 illustrates how this model relates to obesity (90).

Figure 1: An Ecological Model of Diet, Physical Activity, and Obesity



Developed for the NHLBI Workshop on Predictors of Obesity, Weight Gain, Diet, and Physical Activity, August 4-5, 2004, Bethesda MD

Chapter 4: Methodology

4.1 Research Design

The development of evidence based public health and nutrition guidelines typically involves some combination of the following steps: (1) identifying the topic and research question; (2) establishing an analytic framework for organizing, selecting and evaluating interventions; (3) gathering the evidence; (4) grading and assessing the quality of the evidence; (5) considering expert input; and (6) translating the evidence into recommendations and guidelines (90,91,92).

This study endeavoured to apply a rigorous evidence-based approach in the development of adolescent obesity prevention and treatment recommendations and guidelines following the steps outlined in the evidence synthesis algorithm (Figure 2).

4.2 Methods for Evidence Collection

4.2.1 The Analytic Framework

An analytical framework (Figure 3) guided the evidence collection. This framework identified the complex interactions between multiple levels of influence, including individual, social and environmental factors, on obesity outcomes (91,92). The analytic framework was used to establish the selection criteria (Table 2) and direct intervention evaluations.

Figure 2 Evidence Synthesis Algorithm

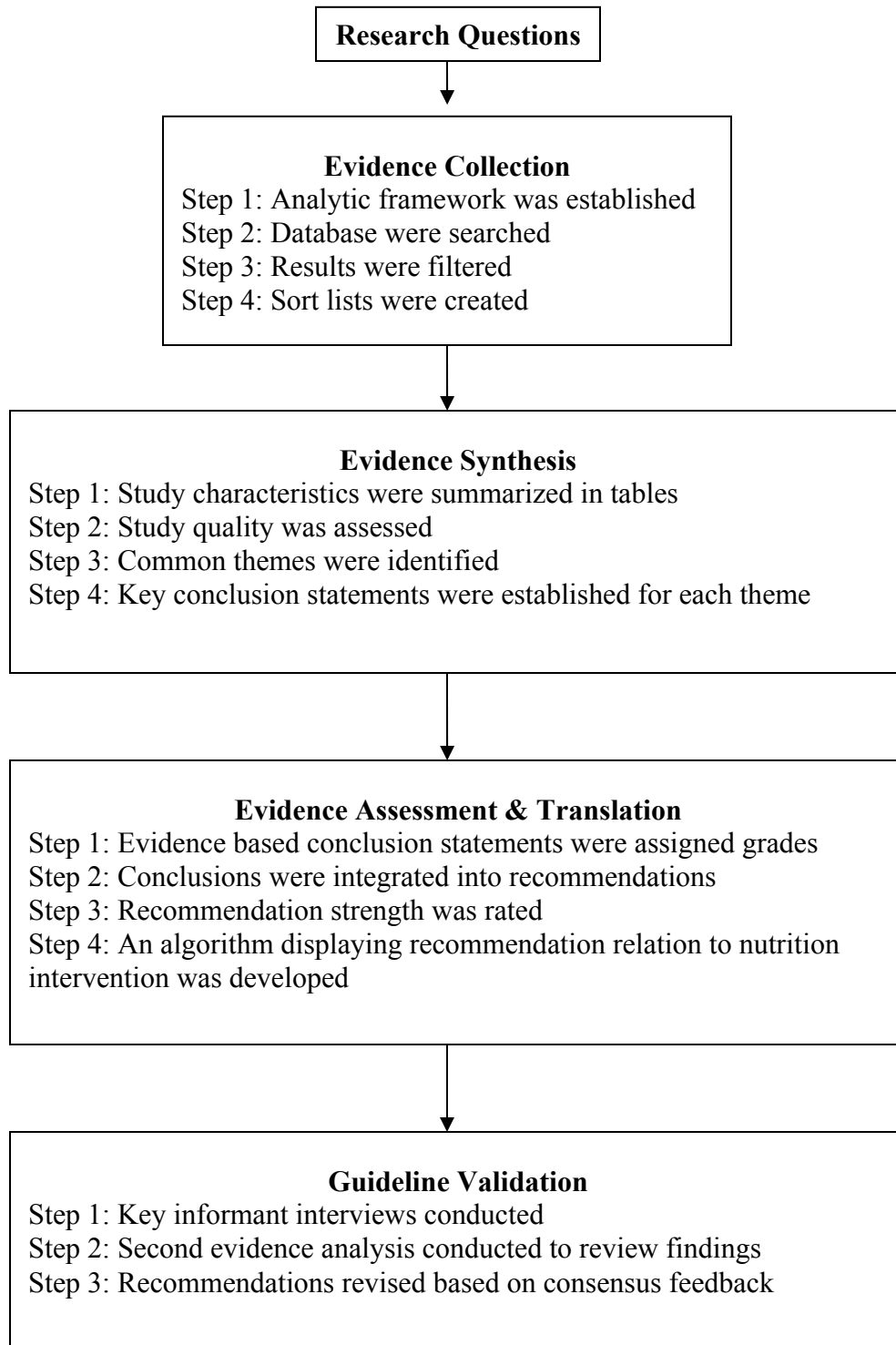
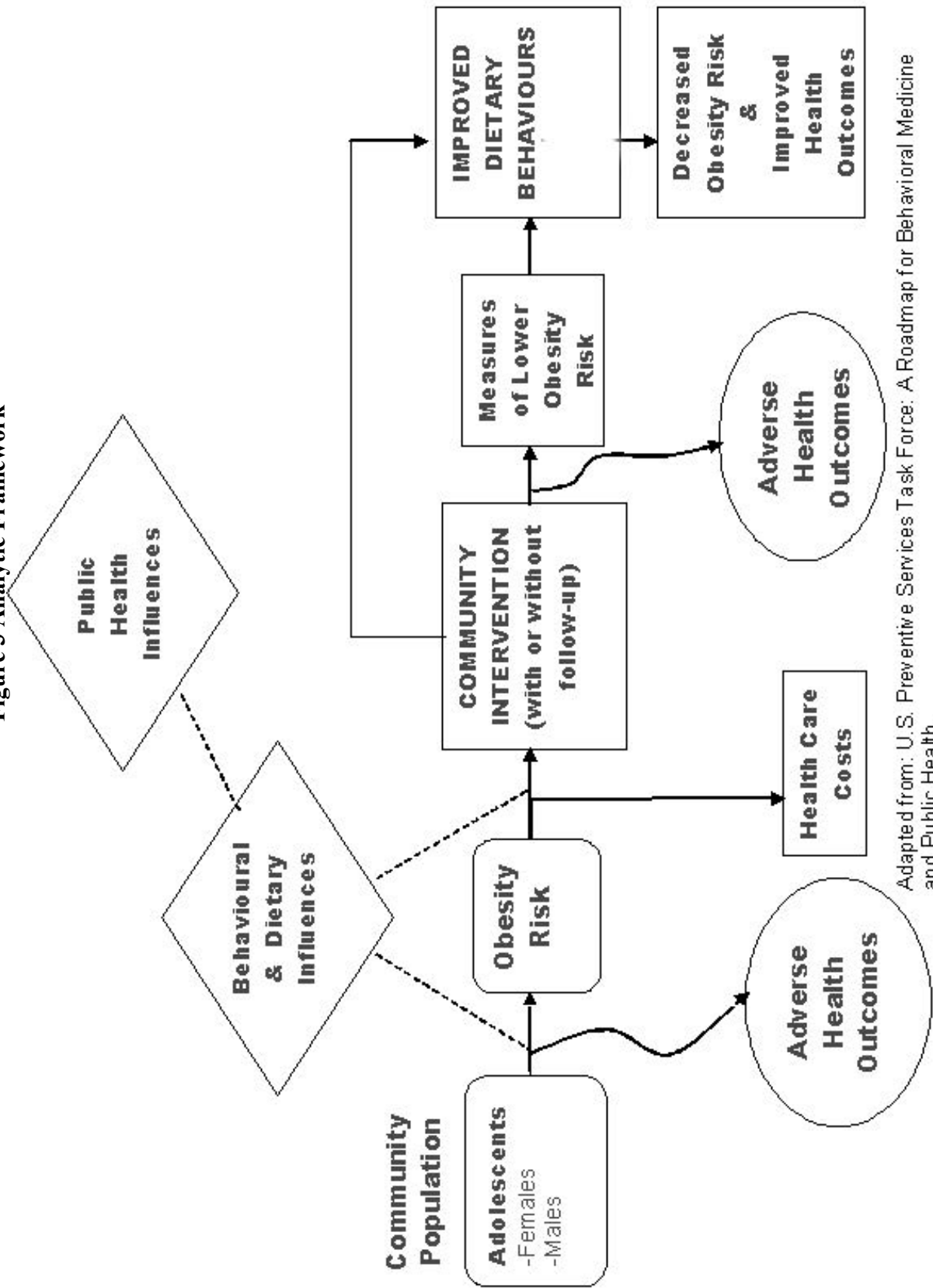


Figure 3 Analytic Framework



Adapted from: U.S. Preventive Services Task Force: A Roadmap for Behavioral Medicine and Public Health.

4.2.2 The Systematic Review

A systematic review was used to identify studies that addressed the research questions proposed in section 1.3. The systematic review involved the following steps for gathering evidence, as recommended by the American Dietetics Association (ADA) evidence analysis team for evidence based guideline development: (1) the strategy for identification and inclusion of articles was planned; (2) the inclusion and exclusion criteria were listed; (3) search words were identified; (4) search databases were identified; (5) the search was conducted; (6) the titles and abstracts of articles were reviewed and filtered; and (7) the remaining articles and full reports were gathered, reviewed and filtered (93).

4.2.2.1 Search Criterion

Studies which addressed one or more of the research questions and met the following inclusion criteria were included in the systematic review. Studies that met the following exclusion criteria were excluded notwithstanding satisfaction of the inclusion criteria.

Table 2
Inclusion and Exclusion Criteria

Criteria	Inclusion Criteria	Exclusion Criteria
Population	Adolescents aged 12 - 18 years: either alone, as part of a family, or among children under 18 years of age.	Subjects under 12 years or 19 years and older
Setting	Community or school	Primary Care
Health Status	Healthy adolescents	Subjects that are pregnant, physically impaired, have a psychiatric disorder, regularly use prescription medications unrelated to obesity complications, or display non-obesity related renal, hepatic, endocrine or pulmonary disorders (apart from asthma) disorders

Nutrition Problems	Primary prevention studies involving normal weight adolescents. Secondary prevention studies involving adolescents at risk of becoming overweight. Treatment studies involving overweight or obese adolescents; with or without obesity related co-morbidities.	Subjects that were pregnant, physically impaired, had a psychiatric disorder, regularly used prescription medications unrelated to obesity complications, or displayed non-obesity related medical conditions including renal, hepatic, endocrine or pulmonary disorders (apart from asthma) disorders
Outcomes Measures	a) Some measure of adiposity (BMI, BMI percentile, % overweight for age, % body fat, waist circumference, triceps skin folds, weight and height), or improved health outcomes b) Dietary behaviours, intake or habits; or change in nutrition related health habits	All other outcome measures. Interventions using obesity medications, surgical measures, or physical activity or reducing sedentary activity as the sole intervention strategy.
Study Design Preference	Randomized Control Trials (RCTs), non-randomized controlled trials, time series, and longitudinal, cohort, cross-sectional and case-control studies of prevention and treatment of obesity programs. These terms were not used in search term combination, but rather manually filtered.	Systematic Reviews
Search Criteria	<i>The Population:</i> Adolescent, teens, youth. <i>The Intervention:</i> Nutrition therapy; diet therapy; community nutrition; program development; health education; public health; prevention; community health; intervention; preventative health services; school-based services; school health. <i>The Outcome:</i> Body Mass Index (BMI); body fat distribution; adiposity; body weight; food habits; dietary habits; health knowledge, attitudes and practice. The above terms were exploded to encompass all related terms. The specific search strategy is noted below.	
Databases	MEDLINE, EMBASE, Cochrane Central, CINAHL, Academic Search Premier, Health Sciences, Health Sciences (SAGE), ERIC	
Years	1996 – December 2006	Prior to January 1996
Publication Limitations	English Language; Electronic	Articles not in English

4.2.2.2 Search Strategy

The search strategy used for MEDLINE and CENTRAL are listed below. These strategies were adapted for other databases.

Search Strategy for MEDLINE

The Population:

1. Adolescent
 - a) Adolescents, Females

- b) Adolescents, Males
- c) Teens
- d) Youth

The Intervention:

- 2. Nutrition Therapy/*methods
 - a) Diet therapy
- 3. Nutrition Physiology/*education
- 4. Program Development
- 5. Health Education
- 6. Public Health/*education OR Public Health/*methods
 - a) Epidemiologic Measurements
 - i. Nutrition Assessment
 - ii. Health Status
 - 1. Nutrition Status
 - b) Epidemiologic Study Characteristics
 - i. Pilot Projects
 - ii. Intervention Studies
 - iii. Epidemiologic Studies
 - 1. Case Control
 - 2. Cohort
 - 3. Cross Sectional
 - c) Public Health Practice
 - i. Primary Prevention
- 7. Community Health Services/*education OR Community Health Services/*methods
 - a) Early Intervention (Education)
 - b) Preventative Health Services
 - c) School-Based Services
 - d) Health, School
- 8. or/#2-#7

The Outcome:

- 9. Body Constitution
 - a) Body Mass Index
 - b) Body Fat Distribution
 - i. Adiposity
 - ii. Body Weight
 - 1. Overweight
 - 2. Obesity
 - 3. Body Weight Changes
- 10. Food Habits
 - a) Dietary Habits
- 11. Health Knowledge, Attitudes, Practice
- 12. or/#9-#11
- 13. and/#1,#8,#12

Search Strategy for Cochrane CENTRAL

1. exp OBESITY/
2. exp Weight Gain/
3. exp Weight Loss/
4. obes\$.af.
5. (weight gain or weight loss).af.
6. (overweight or over weight or overeate\$ or over eat\$).af.
7. weight change\$.af.
8. ((bmi or body mass index) adj2 (gain or loss or change)).af.
9. or/1-8
10. exp OBESITY/dh [Diet Therapy]
11. exp Diet, Fat-Restricted/
12. exp Diet, Reducing/
13. exp Diet Therapy/
14. (diets or diet or dieting).af.
15. (diet\$ adj (modif\$ or therapy or intervention\$ or strateg\$)).af.
16. exp Dietary Fats/
17. (fruit or vegetable\$).af.
18. (high fat\$ or low fat\$ or fatty food\$).af.
19. or/10-18
20. exp Health Promotion/
21. exp Health Education/
22. (health promotion or health education).af.
23. (media intervention\$ or community intervention\$).af.
24. health promoting school\$.af.
25. ((school or community) adj2 program\$).af.
26. ((school or community) adj2 intervention\$).af.
27. (family intervention\$ or parent\$ intervention).af.
28. (parent\$ adj2 (behavio?r or involve\$ or control\$ or attitude\$ or educat\$)).af.
29. or/20-28
30. exp Health Policy/
31. exp Nutrition Policy/
32. (health polic\$ or school polic\$ or food polic\$ or nutrition polic\$).af.
33. or/30-33
34. exp OBESITY/pc [Prevention & Control]
35. 19 or 29 or 33 or 34
36. 9 and 35
37. Animals/
38. exp ADOLESCENT/
39. (teenage\$ or adolescen\$ or youth).af.
40. or/38-39
41. 36 not 37
42. 40 and 41
43. limit 42 to yr=1996-2007

Studies selected were limited to those published in English, dealing with human subjects and involving adolescents. Bibliographies of review articles published since 2000 were also scanned to identify studies of adolescent obesity prevention or treatment interventions. References of relevant articles were searched to find articles missed in the original search.

4.2.2.3 Search Filters

Study selection involved a number of filtering steps. First the title was assessed to determine suitability (92). This was followed by a review of abstracts and finally for those studies that passed both the title and abstract filtering, the full article was retrieved and reviewed (92). Studies that did not involve interventions directed at improving adiposity or dietary intake, habits or behaviours, either independently or as part of comprehensive or multi-disciplinary strategies, or those that met any of the identified exclusion criteria were rejected during the title and abstract screens. Sort lists of excluded articles can be found in Appendix A.

4.3 Methods for Evidence Synthesis

When the body of evidence was retrieved, results were classified based on research design (91,93). The four classifications were: (A) individual or group RCTs; (B) cohort studies; (C) longitudinal studies or case-control studies (non-randomized controlled trials); and (D) non-comparative studies, cross-sectional studies or before-after (pretest/posttest) studies.

4.3.1 Study Characteristic Summaries

Study characteristic tables were completed for each study reporting details about the design, purpose, protocol, outcome measures, data collection methods, results, research conclusions and any reviewer comments. The findings of each study were summarized in brief summary statements, stating the author(s), publication year, outcomes and sample characteristics.

4.3.2 Study Quality Assessments

Studies were evaluated with a pre-validated quality criteria checklist that contained 4 relevance and 10 validity questions (93) (Table 3). Based on the results of the quality checklist, each study was assigned a quality rating of – (poor quality), Ø (neutral quality), or + (high quality).

Table 3: Quality Criteria Checklist

RELEVANCE QUESTIONS	
1. Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group?	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to dietetics practice?	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Is the intervention or procedure feasible? (NA for some epidemiological studies)	<input type="checkbox"/> Yes <input type="checkbox"/> No
<i>If the answers to all of the above relevance questions are “Yes,” the report is eligible for designation with a plus (+) on the Evidence Quality Worksheet, depending on answers to the following validity questions.</i>	
VALIDITY QUESTIONS	
1. Was the <u>research question</u> clearly stated? <ul style="list-style-type: none"> ▪ Was the specific intervention(s) or procedure (independent variable(s)) identified? ▪ Was the outcome(s) (dependent variable(s)) clearly indicated? ▪ Were the target population and setting specified? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Was the <u>selection</u> of study subjects/patients free from bias? <ul style="list-style-type: none"> • Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study? • Were criteria applied equally to all study groups? • Were health, demographics, and other characteristics of subjects described? • Were the subjects/patients a representative sample of the relevant population? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Were <u>study groups comparable</u>? <ul style="list-style-type: none"> • Was the method of assigning subjects/patients to groups described and unbiased? (Method 	<input type="checkbox"/> Yes <input type="checkbox"/> No

<p>of randomization identified if RCT)</p> <ul style="list-style-type: none"> • Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline? • Were concurrent controls used? (Concurrent preferred over historical controls.) • If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis? • If case control study, were potential confounding factors comparable for cases and controls? • If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies. • If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., “gold standard”)? 	
<p>4. Was method of handling <u>withdrawals</u> described?</p> <ul style="list-style-type: none"> • Were follow up methods described and the same for all groups? • Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%) • Were all enrolled subjects/patients (in the original sample) accounted for? • Were reasons for withdrawals similar across groups? • If diagnostic test, was decision to perform reference test not dependent on results of test under study? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>5. Was <u>blinding</u> used to prevent introduction of bias?</p> <ul style="list-style-type: none"> • In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate? • Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.) • In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded? • In case control study, was case definition explicit and case ascertainment not influenced by exposure status? • In diagnostic study, were test results blinded to patient history and other test results? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>6. Were <u>intervention/therapeutic regimens/exposure factor or procedure</u> and any <u>comparison(s)</u> described in detail? Were <u>intervening factors</u> described?</p> <ul style="list-style-type: none"> • In RCT or other intervention trial, were protocols described for all regimens studied? • In observational study, were interventions, study settings, and clinicians/provider described? • Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect? • Was the amount of exposure and, if relevant, subject/patient compliance measured? • Were co-interventions (e.g., ancillary treatments, other therapies) described? • Were extra or unplanned treatments described? • Was the information for 6d, 6e, and 6f assessed the same way for all groups? • In diagnostic study, were details of test administration and replication sufficient? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>7. Were <u>outcomes</u> clearly defined and the <u>measurements</u> valid and reliable?</p> <ul style="list-style-type: none"> • Were primary and secondary endpoints described and relevant to the question? • Were nutrition measures appropriate to question and outcomes of concern? • Was the period of follow-up long enough for important outcome(s) to occur? • Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures? • Was the measurement of effect at an appropriate level of precision? • Were other factors accounted for (measured) that could affect outcomes? • Were the measurements conducted consistently across groups? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>8. Was the <u>statistical analysis</u> appropriate for the study design and type of outcome indicators?</p> <ul style="list-style-type: none"> • Were statistical analyses adequately described the results reported appropriately? • Were correct statistical tests used and assumptions of test not violated? 	<input type="checkbox"/> Yes <input type="checkbox"/> No

<ul style="list-style-type: none"> • Were statistics reported with levels of significance and/or confidence intervals? • Was “intent to treat” analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)? • Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)? • Was clinical significance as well as statistical significance reported? • If negative findings, was a power calculation reported to address type 2 error? 	
9. Are <u>conclusions supported by results</u> with biases and limitations taken into consideration? <ul style="list-style-type: none"> • Is there a discussion of findings? • Are biases and study limitations identified and discussed? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
10. Is bias due to study’s <u>funding or sponsorship</u> unlikely? <ul style="list-style-type: none"> • Were sources of funding and investigators’ affiliations described? • Was there no apparent conflict of interest? 	<input type="checkbox"/> Yes <input type="checkbox"/> No
MINUS/NEGATIVE (-) <i>If most (six or more) of the answers to the above validity questions are “No,” the report should be designated with a minus (-) symbol on the Evidence Quality Worksheet.</i>	
NEUTRAL (O) <i>If the answers to validity criteria to questions 2, 3, 6 and 7 do not indicate that the study is exceptionally strong, the report should be designated with a neutral (O) symbol on the Evidence Quality Worksheet.</i>	
PLUS/POSITIVE (+) <i>If most of the answers to the above validity questions are “Yes” (including criteria 2, 3, 6, 7 and at least one additional “Yes”), the report should be designated with a plus symbol (+) on the Evidence Quality Worksheet.</i>	

4.3.3 Theme Identification

Overview tables, indicating quality rating, sample characteristics, setting and topic relevant comparators were then drafted, for obesity prevention and treatment jointly and separately. Common themes were identified. For each theme a synopsis of the evidence was drafted from the summary statements, comparison factors, methodological statements and outcome impact statements.

4.3.4 Conclusion Statements

The evidence synopses formed the foundation for conclusion statements. These outlined the overall findings based on the available evidence.

4.4 Methods to Assess Evidence Quality and Strength

An evaluation of the evidence based conclusion statements was conducted for strength at each point in the analytic framework, apart from health care costs. Grading guidelines (Table 4), adapted from the ADA (93) and the GRADE working group (94), were used to assess the evidence quality and suitability for community interventions. The conclusion statements were rated according to five defined parameters (design, quality, consistency, quantity and reproducibility) and assigned a final grade between I (minimal flaws, strong evidence) and V (no relevant evidence).

Table 4: Evidence Grading Guidelines

Grade	Study Design	Quality	Consistency	Quantity	Reproducibility
I	Rich body* of high (+) quality RCTs, non-RCTs or case controls	Well-conducted, high quality	Generally consistent / no important inconsistencies	Rich body*	Outcomes relate directly to the research question
II	At least one high quality RCT OR Non-randomized controlled trials or cohort studies	Studies of strong design with minor concerns or studies of weaker design	Consistent with minor exceptions	Several studies**	Minor doubts
III	Prospective cohort; case control OR Non-randomized controlled trials or cohort studies	Studies of weak design or studies with design flaws	Inconsistent findings	Limited number of studies; inadequate samples	Serious doubts about reproducibility and directness due to narrow or different populations, interventions or outcomes of study
IV	Expert opinion only; common practice	Conclusions drawn from usual practice alone	Solely based on expert opinion	No relevant published research studies	Limited to extent of experience
V	No relevant evidence	No relevant evidence	N/A	No relevant evidence; future research need	N/A

*Body of studies = 5 or more. ** Body of studies = 3 or more.

4.5 Methods to Translate the Evidence

Evidence summary sheets were developed to display conclusion statements, a summary of the evidence, the conclusion grade and the evidence sources. The evidence was reviewed and then drafted into evidence based recommendation statements. The recommendations were based entirely on the evidence summaries and assigned a strength linked with strength of evidence (Table 5).

Table 5: Recommendation Strength

Recommendation Strength	
Strong	The recommendations are based on a rich body of high (+) quality studies. Consistent findings in five or more studies. Evidence base is excellent or good (grade I or II). The benefits of the recommendation clearly exceed the harms.
Fair	Recommendations are based on lower quality evidence, with at least one high (+) quality study and consistent findings with minor exceptions. The benefits of the recommendation are perceived to exceed harm. The evidence base is not strong, (grade II or III).
Limited	Little clear evidence exists or the quality of the evidence is not strong (grade II or III). The recommendations are based on studies principally rated as neutral (Ø) quality or a limited number of studies. The findings are inconsistent or serious doubts about reproducibility or implementation feasibility exist.

Finally, the recommendations were translated in an algorithm guideline to display how each recommendation related to nutrition intervention.

4.6 Methods for Guideline Validation

A panel of independent, national experts was selected to act as key informants to review the recommendations for feasibility, plausibility, acceptability, comprehensiveness and accuracy of interpretation of the evidence base supporting the recommendations.

A group of 17 informants was established based on recommendations from colleagues. The experts were identified upon completion of the systematic review and selected purposively to act as influential and prominent experts.

The potential key informants were contacted first with an introductory letter and 2 weeks later with a follow-up phone call. Three of the 17 potential informants declined to participate due to medical leave and work schedule conflicts. Fourteen national experts covering different areas of expertise were included in the key informant interviews. These experts held different titles and positions in the areas of community nutrition, public health, adolescent health, academia, endocrinology and national obesity organizations.

Key informants were mailed an introduction to the research (Appendix B), provided access to supporting data, including the evidence summaries and summary statements on the world-wide web, and supplied with an electronic and hard copy of an evaluation tool (Appendix C) adapted from the AGREE Collaborations Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument (95) to evaluate the guidelines. This tool was selected because it is the only evidence based guideline critical appraisal tool that has been validated (96).

Key informant interview results were summarized in interview summary sheets. Based on expert recommendations a second review of the evidence base was conducted in attempt to gather more detail on specific outcomes pertaining to health benefits and risks and

potential barriers. The second analysis was also used to confirm evidence rankings due to the limitation of only one reviewer.

Consensus feedback from the expert panel was used to revise the recommendations and guidelines and synthesize the final evidence based recommendations.

4.7 Ethical Considerations

The research presented no known risk to key informant interview participants, apart from the inconvenience of time required to evaluate the guidelines. It was approved by the Mount Saint Vincent University, University Research Ethics Board (Appendix D).

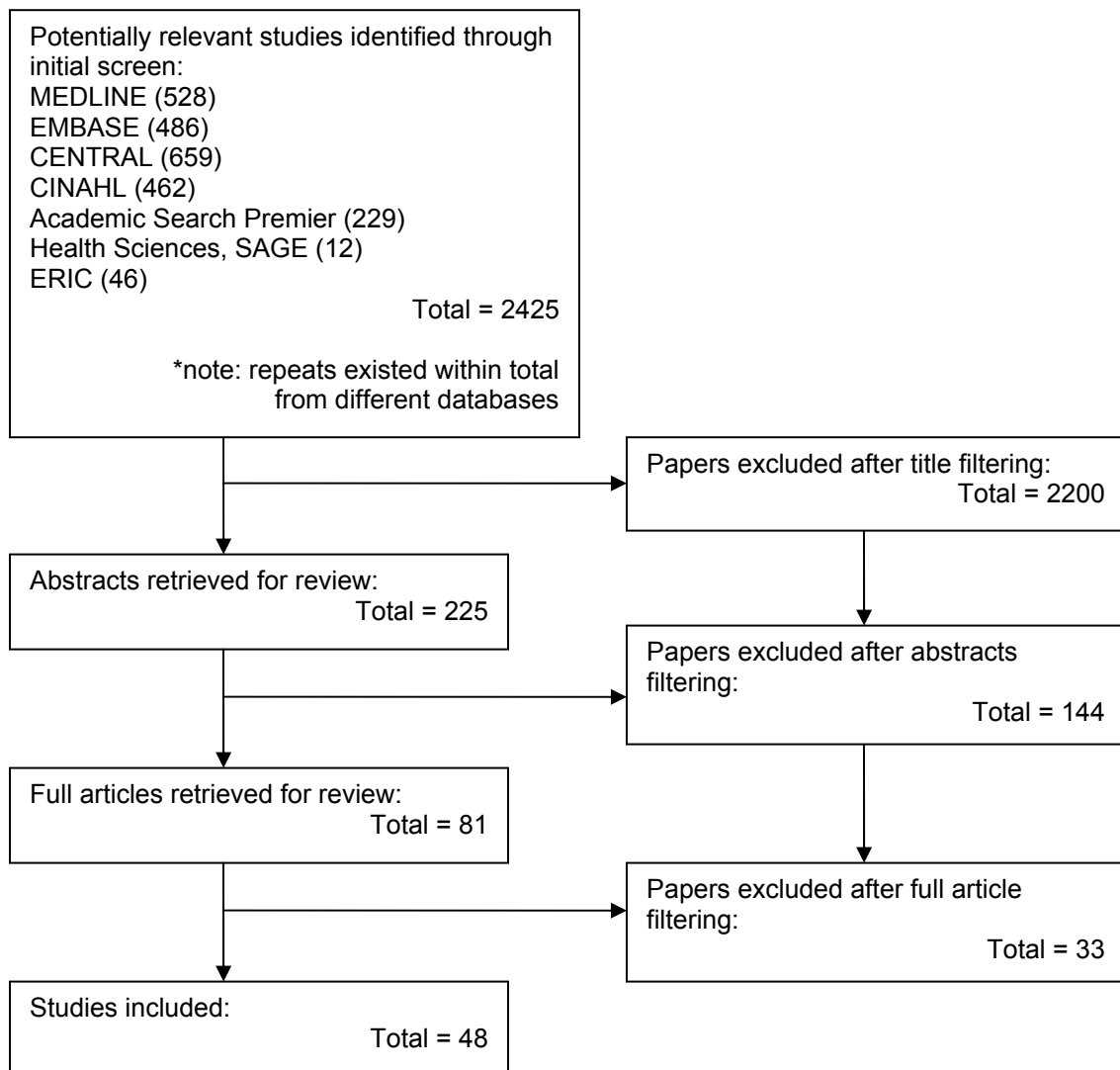
Chapter 5: Results

5.1 Systematic Review Results

5.1.1 Evidence Collection

The initial search from all search databases yielded 2425 hits (MEDLINE 528, EMBASE 486, CENTRAL 659, CINAHL 462, Academic Search Premier 229, Health Sciences SAGE 12, and ERIC 46). After filtering, 48 intervention studies met the inclusion criteria and were not excluded. Figure 4 represents a flow diagram of articles excluded at each filtering stage.

Figure 4: Flow Diagram of Articles Excluded at Each Filtering Stage



5.1.2 Evidence Synthesis and Assessment

5.1.2.1 Evidence Classification

Table 6 represents the results of the evidence classification based on research design.

Table 6: Research Design Classification of Included Studies

Research Design	Total Number of Included Studies	Study Type
Class A	23	23 randomized controlled trials
Class B	0	None
Class C	6	5 nonrandomized controlled trials; 1 longitudinal;
Class D	18	12 pretest/posttest; 5 non-comparative studies; 1 case study; 1 quasi-experimental

5.1.2.2 Study Characteristics

Study characteristic tables and summary statements reporting details of each study can be found in Appendix E and Appendix F, respectively.

5.1.2.3 Study Quality Assessments

A tally sheet was formulated summarizing the quality rating of all the included studies (Appendix G). Most of the studies were either high or neutral quality. The quality rating is also noted in Table 7.

5.1.2.4 Theme Identification

Common themes were identified from the evidence base for obesity prevention and treatment jointly and separately (Table 7).

Table 7: Evidence Theme Identification Table

Author, Year	RATING	Results	SCH	CLAS	COM	FAM	HEP	PA	SA	BEHAV	ENV	POLICY	MEDIA	PREV	FOOD	DIET	PEER	LESS	ETH	IMAGE	FEMALE	COMPU
Agron 2002	D-	+ Δ nut. knowledge + Δ eating behaviour	√			√	√				√	√					√	√	√			
Austin 2005	A+	+ Δ eating behaviour	√	√			√	√	√										√	√	√	
Baxter	C	+ Δ dietary intake/ eating	√		√		√	√			√	√										

Johnson 1997	C +	+ Δ wt with wt maintenance			√	√	√	√	√	√										
Leslie 1999	D -	+ Δ nut. / PA knowledge (insignificant) Ø Δ actual food choices			√		√	√	√	√						√		√		√
Long 2004	A +	+ Δ SE for HE	√	√			√			√										√
Long 2006	D -	+ Δ fat intake Ø Δ F/V intake	√				√													√
Mc- Murray 2002	A 0	+ Δ BP Ø Δ BMI / skinfolds	√	√			√	√	√											
McVey 2004	A 0	+ Δ body image + Δ eating behaviours	√	√			√												√	
Nader 1999	A +	+ Δ PA + Δ dietary knowledge/intentions	√	√			√	√					√							
Nemet 2005	A +	+ Δ wt, body fat + Δ TC, LDL + Δ PA			√	√	√	√								√				
Neu- mark- Sztainer 2003	A +	+ Δ eating patterns + Δ body image + Δ stage of change Ø Δ BMI	√	√		√	√	√	√				√					√		
Nicklas 2000	A +	+ Δ nut. knowledge + Δ F/V intake also seen in control	√			√	√			√		√	√	√						
O'Neil 2002	A +	+ Δ HE knowledge, SE and awareness + Δ F/V intake	√			√	√			√		√	√	√						
Rankins 1999	C	+ Δ HE knowledge	√			√	√			√		√	√	√	√					
Rein- hardt 2002	D 0	+ Δ HE and PA knowledge	√	√			√	√	√											
Res- nicow 2000	A 0	+ Δ dietary intake (insignificant) + Δ nut. knowledge, practices, perceived changes + Δ body fat (small change) + Δ HDL, TC, BP			√		√	√	√					√			√			√
Res- nicow 2005	A +	+ Δ BMI, body fat			√		√	√	√			√						√		√
Rinder- knecht 2004	D 0	Ø Δ SE for HE			√		√	√		√				√				√		
Riten- baugh 2003	C 0	+ Δ Insulin + Δ Soft drink intake	√				√	√	√			√		√	√				√	
Rudolf 2006	D +	+ Δ body weight + Δ self-confidence			√	√	√	√		√										
Sallis 2003	A +	+ Δ PA + Δ BMI for boys Ø Δ fat intake	√			√	√	√	√			√	√					√	√	
Segal	D	+ Δ body wt			√	√	√	√		√	√									

education and physical education or activity. All included diet plans and most were intensive with weekly sessions.

Other common themes that arose included family involvement, food environment and policy change, peer modeling, behavioural approaches and computer based strategies. The evidence summaries (Appendix H) provide specific examples and an evidence synopsis for each of these strategies.

Approximately half of the interventions were offered to specific adolescent populations. The remainder either did not provide population statistics or were directed at primarily Caucasian, middle-class adolescents.

5.1.2.5 Conclusion Statements

Conclusion statements summarizing the overall evidence findings for the identified theme areas are presented in Table 8. The grading guidelines (Table 4) were used to assign each conclusion statement a grade, noted below (Table 8), based on the available evidence (Appendix H).

Table 8: Evidence Conclusion Statements and Conclusion Grades

Prevention and Treatment Interventions
Comprehensive interventions, addressing individual, social and environmental influences on obesity may be associated with improved eating behaviors, nutrition knowledge or dietary intake and reduced adiposity. Grade II
Nutrition education included as a component of comprehensive obesity prevention and treatment interventions may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity. Grade I
Nutrition education combined with physical education in obesity prevention and treatment interventions may be associated with improved eating behaviors, nutrition knowledge and dietary

intake and reduced adiposity. Grade I
Nutrition education combined with physical activity in obesity prevention and treatment interventions may lead to reduced adiposity and improved dietary intake behaviours and knowledge. Grade I
Nutrition education combined with reducing sedentary activity in obesity prevention and treatment interventions may lead to reduced adiposity and improved dietary intake and behaviours. Grade III
Family involvement in adolescent obesity prevention and treatment interventions may lead to positive changes in nutrition knowledge, dietary intake and eating behaviours and reduced adiposity. Grade II
Obesity prevention and treatment interventions using behavioural approaches may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity. Grade II
Obesity prevention and treatment interventions using food preparation and taste testing as behavioural strategies may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity. Grade III
Peer modeling in obesity treatment interventions may be associated with improved eating behaviors, nutrition knowledge, and/or dietary intake and reduced adiposity. Grade II
Obesity prevention strategies, focused on healthy eating, physical activity and overall well-being, rather than on weight may reduce the likelihood of weight stigmatization, poor body image or self-esteem, and negative weight control behaviors. Grade II
Computer based obesity prevention and treatment interventions may be a developmentally appropriate way to improve eating behaviors, nutrition knowledge, and/or dietary intake. Grade II
Obesity prevention and treatment strategies, including components of nutrition education and physical activity may reduce adiposity and risk for obesity related chronic diseases, such as diabetes and heart disease. Grade III
Obesity prevention and treatment interventions made accessible to and empowering adolescents from low socio-economic backgrounds may improve eating behaviors, nutrition knowledge and dietary intake and reduce adiposity among low socio-economic status adolescents. Grade I
Obesity interventions available to multi-ethnic populations may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity. Grade III
Obesity prevention and treatment interventions delivered to female only groups may be more effective in reducing adiposity in females. Grade II
Prevention Interventions
Comprehensive obesity prevention interventions offered in the school setting may be an

effective way to reach a large number of adolescents to promote healthy eating behaviors, nutrition knowledge, or dietary intake. Grade I
Nutrition and physical education implemented within the school curriculum as part of a school-based obesity prevention intervention may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity. Grade II
Altering the school food environment, through changes in school meals and foods offered through vending machines, may be associated with improve eating behaviors, nutrition knowledge, or dietary intake among adolescents and a resultant decrease in adiposity. Grade II
The use of media channels to promote healthy nutrition in the school environment may be associated with improved eating behaviors, nutrition knowledge, and/or dietary intake. Grade III
Treatment Interventions
Comprehensive, multidisciplinary, obesity treatment interventions offered in to adolescents in community settings may be associated with reduced adiposity and improved dietary intake. Grade I
A prescribed diet plan as part of an intensive nutrition-behavioural-exercise obesity treatment intervention may be effective in reducing adiposity and improving nutrition knowledge. Grade I

5.1.2 Evidence Translation

Evidence summaries (Appendix H) were developed to display the conclusion statements, evidence synopsis, conclusion grades and evidence sources. These summaries were then integrated into evidence based recommendation statements. Each recommendation was assigned a strength (Table 5) linked to the strength of the available evidence.

The terms “it is recommended” were used for recommendations with a fair to strong evidence base. For recommendations with a limited to fair evidence base, the terms “it is suggested” were applied.

Table 9 Recommendations

Intervention Strategies for Adolescent Obesity Prevention and Treatment
It is recommended that obesity prevention and treatment interventions consist of a comprehensive approach that addresses dietary habits and physical activity patterns as well as societal and environmental influences. <i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i>

<p>It is recommended that nutrition education, including education on the food guide, healthy food choices and preparation and eating habits, be incorporated in a multi-disciplinary approach to prevent and treat obesity. Nutrition education should be delivered by Registered Dietitians if possible, or by other professionals who have received training, such as health educators, nurses, or school teachers.</p> <p><i>Recommendation strength: Strong</i> <i>Strength of the evidence: Grade I</i></p>
<p>It is suggested that family involvement in obesity prevention and treatment interventions be encouraged. Strategies include family based healthy eating and physical recreation activities, parenting sessions, parent role modeling, family goal setting activities, parent-educator meetings and parental appointments with a dietitian.</p> <p><i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i></p>
<p>It is suggested that peer leadership and role modeling be encouraged in obesity prevention and treatment interventions. This can be achieved through the use of peer leaders and advocates to help teach nutrition and physical activity education or promote healthy eating and a healthy food environment.</p> <p><i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i></p>
<p>Intervention Strategies for Adolescent Obesity Prevention</p>
<p>It is recommended that comprehensive obesity prevention programs be delivered in school settings in order to reach a large number of adolescents to promote healthy eating behaviors, nutrition knowledge, or dietary intake and ensure accessibility by youth of various backgrounds.</p> <p><i>Recommendation strength: Strong</i> <i>Strength of the evidence: Grade I</i></p>
<p>It is recommended that obesity prevention programs adopt a health promotion approach with a focus on healthy eating, physical activity and overall well-being, rather than on weight reduction in order to reduce the likelihood of weight stigmatization, poor body image or self-esteem and negative weight control behaviors.</p> <p><i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i></p>
<p>It is suggested that nutrition education and physical activity be incorporated into the pre-existing classroom curriculum. Teachers should receive training to teach basic nutrition education and opportunities for physical activity should be promoted within the school environment.</p> <p><i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i></p>
<p>It is recommended that obesity prevention interventions be multi-disciplinary including both nutrition education and physical activity.</p> <p><i>Recommendation strength: Strong</i> <i>Strength of the evidence: Grade I</i></p>

<p>It is suggested that school based obesity prevention programs include modifications to create or promote a healthy school food environment. A wide selection of affordable healthy foods should be offered in school cafeterias and vending machines. <i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i></p>
<p>It is suggested that computer based nutrition education strategies, such as nutrient analysis, on-line preparation of healthy foods and sharing recipes, be used as developmentally appropriate strategies for obesity prevention and treatment. While sedentary activity should not be encouraged, computer based nutrition education included in computer education in the school environment may be effective. <i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i></p>
<p>Media marketing should be used to promote nutrition and healthy foods in the school environment. Recommended strategies include public announcements, posters and flyers, school newsletters, visual demonstrations and taste-tests for new foods. <i>Recommendation strength: Limited</i> <i>Strength of the evidence: Grade III</i></p>
<p>Intervention Strategies for Adolescent Obesity Treatment</p>
<p>It is recommended that multi-disciplinary obesity treatment programs be delivered in community settings, such as after-school programs, community or sports centres or churches. <i>Recommendation strength: Strong</i> <i>Strength of the evidence: Grade I</i></p>
<p>It is recommended that obesity treatment interventions be multi-disciplinary including both nutrition education and physical activity. <i>Recommendation strength: Strong</i> <i>Strength of the evidence: Grade I</i></p>
<p>It is recommended that a trained health professional, preferably a Registered Dietitian, prescribe diet plans to obese adolescents in obesity treatment interventions. If a Dietitian is able to assess and monitor an adolescent's nutrition status, a hypo-caloric diet may be suitable. The traffic light system and other food exchange systems prescribed by other trained professionals may be appropriate in absence of a Dietitian. An intensive intervention (with meetings once a month or more) is recommended during the initial treatment phase of at least 3 months. <i>Recommendation strength: Strong</i> <i>Strength of the evidence: Grade I</i></p>
<p>It is recommended that families be directly or indirectly involved in adolescent weight management interventions. This can be achieved through parent-educator sessions and family-based activities. <i>Recommendation strength: Fair</i> <i>Strength of the evidence: Grade II</i></p>
<p>It is suggested that behavioural counseling, addressing topics including self-esteem, goal setting, self-monitoring, motivation, eating behaviours and coping skills, be included as part of a multi-disciplinary approach to obesity treatment. Optimally, these strategies should be delivered by a</p>

<p>psychologist or other trained health educators. <i>Recommendation strength:</i> Fair <i>Strength of the evidence:</i> Grade II</p>
Strategies to Address Obesity Intervention Barriers
<p>It is recommended that obesity prevention and treatment interventions be made accessible to all adolescents, either in school or community settings and offered in low socio-economic neighbourhoods. School based interventions should include empowerment strategies to encourage adolescents to advocate for a healthy school nutrition policy. Efforts should also be made to promote healthy foods at affordable prices both in the school and surrounding community environments; include adolescents, families and communities in policy change advocacy; create health services accessible to all populations and in different languages; and provide low income families with additional resources to access healthy foods. <i>Recommendation strength:</i> Strong <i>Strength of the evidence:</i> Grade I</p>
<p>Obesity prevention and treatment intervention nutrition and physical activity education material should be culturally appropriate and, where possible, provided in various languages to ensure accessibility to multi-ethnic populations. <i>Recommendation strength:</i> Limited <i>Strength of the evidence:</i> Grade III</p>
<p>To reduce adiposity among females, it is suggested that obesity treatment interventions be delivered to female only groups. <i>Recommendation strength:</i> Fair <i>Strength of the evidence:</i> Grade II</p>

The recommendations were displayed in an algorithm guideline (Figure 5).

5.2 Guideline Validation

5.2.1 Key Informant Appraisals

Fourteen experts participated in the key informant interviews for a response rate of 82%.

The interviews followed the structure of the appraisal tool adapted from the AGREE

Instrument (Appendix C). The key informants provided the following ratings on the 11 appraisal instrument questions (Tables 10).

Table 10: Key Informant Appraisal Ratings

Questions:	Rating						Median
	1	2	2.5	3	3.5	4	
1. The overall objectives of the guidelines are specifically described.				3		11	4
2. The research questions covered by the guideline are specifically described.		1		2		11	4

3. The audience to whom the guideline is meant to apply is specifically described.						14	4
4. The target users of the guideline are clearly defined.						14	4
5. Systematic methods were used to search for evidence.				1		13	4
6. The criteria for selecting the evidence are clearly described.				1*		13	4
7. The methods used for formulating the recommendations are clearly described.		1*	1*	1		11	4
8. The health benefits and risks have been considered in formulating recommendations.		2*	1	6	1	4	3
9. There is an explicit link between the recommendations and the supporting evidence.	1*	1*		3		8	4
10. The recommendations are specific and unambiguous.		1*		3(1*)	1	9	4
11. The potential barriers in applying the recommendations have been discussed.	1*	1*		5	1	6	3

*Email response(s): Required further explanation over phone

All key informants who responded via telephone interview felt that systematic methods were used in the evidence search, the criteria for evidence selection was clear and that there was an explicit link between the recommendations and the evidence.

The key informants provided a number of comments, questions and suggestions for change (Table 11), mainly with regards addressing health risks and benefits and intervention barriers.

Table 11: Key Informant Appraisal Comments

Appraisal Question:	Expert Comments:
1. The overall objectives of the guidelines are specifically described.	<p>“The overall objectives were described in detail. This is critical with guidelines.”</p> <p>“There is an inconsistency as to whether the objectives are referring to prevention or treatment.”</p>
2. The research questions covered by the guideline are specifically described.	<p>"There is a need to breakdown prevention and treatment."</p> <p>"The questions need to be better quantified."</p>

3. The audience to whom the guideline is meant to apply is specifically described.	"Good clinical description." "Fairly distinct."
4. The target users of the guideline are clearly defined.	"The target users are clear but should be broader."
5. Systematic methods were used to search for evidence.	"The systematic methods were well described." "The grading guidelines were clear."
6. The criteria for selecting the evidence are clearly described.	"Selection criteria did not indicate adequate length of follow-up. Ideally, studies should follow individuals for a minimum of 3 years."
7. The methods used for formulating the recommendations are clearly described.	"While the methods for formulating recommendations are clearly described, the number of appraisers is a limitation."
8. The health benefits and risks have been considered in formulating recommendations.	"Are there any risks of disordered eating? Are there any indications that overweight children are victimized?" "To avoid risks, obesity prevention should take a vitality approach to eat well, feel good about self and be physically active." "Obesity prevention should take more of a healthy eating approach and be sensitive to self esteem." "Family needs to be considered." "Who is the best person to deliver interventions?" "What kind of behavioural strategies are effective?"
9. There is an explicit link between the recommendations and the supporting evidence.	"Is there any evidence for interventions directed at older or younger adolescents?" "Good summary and supporting documentation." "Each recommendation was linked with evidence sources and appropriately graded."
10. The recommendations are specific and unambiguous.	"The recommendations need to be more specific, with examples." "The themes worked well. The recommendations are brief and concise." "Provide concrete examples of strategies."
11. The potential barriers in applying the recommendations have been discussed.	"The recommendations covered all barriers addressed in the research questions." "It is obviously difficult to include barriers that are not addressed in the evidence." "Personal barriers were not addressed." "What was the evidence on decreasing the cost of healthy foods?" "What resources are needed to address barriers?"

5.2.2 Second Evidence Analysis

A second evidence appraisal confirmed evidence rankings, gathered more detail on specific outcomes pertaining to health benefits and risks and potential barriers and addressed questions posed by experts. Results are identified in Section 5.3.

5.3 Recommendation Revision

Subsequent to key informant interview analysis, expert suggestions and questions were addressed through a second review of the evidence and revisions to the recommendations.

5.3.1 Research Objectives

The original research objectives were modified to provide a more obvious distinction between prevention and treatment, as recommended by three key informants. A public health expert recommended identifying the prevention type as primary or secondary. The research questions were modified to indicate that the systematic review included both.

5.3.2 Target users

While all respondents felt the target users were clearly defined, the majority felt the recommendations and guidelines were applicable to a much larger audience. It was recommended that target audience include community nutritionists, public health nutritionists, public health nurses, public health physicians, community health educators, clinical dietitians, primary health care physicians, school board staff, municipal recreating staff and healthy living coordinators.

5.3.3 Intervention Follow-up and Intensity

Length of follow-up was not included in the original selection criteria. A public health nutritionist expressed concern that adolescents may be successful in losing weight but

have difficulty maintaining weight loss. For this reason, it was recommended that the length of follow-up be reported as well as evidence of long term (one-year) success.

During the second evidence review, these details were extracted. Twenty studies involved interventions with a follow-up greater than or equal to 1 year. Six of these had a follow-up of 2 years, three of 3 years, 2 of 4 years and 1 of 5 years.

Twenty-eight (54%) of the included studies involved short term interventions, with follow-up of less than one year. Table 12 outlines the intervention follow-up of included studies.

Table 12
Intervention Follow-up of Included Studies

<i>Long term studies (follow-up \geq 1 year):</i>	<i>Short term studies (follow-up < 1 year):</i>
Austin 2005: 2 school years	Agron 2002: 9 months
Baxter 1997: 3 years	Carrel 2005: 9 months
Birnbaum 2002: 2 years	Carrel, Meinen 2005: 24 weeks
French 2004: 2 years	Damon 2005: 14 weeks, 10 months
Gortmaker 2000: 2 years	Edwards 2005: One school year
Grey 2004: 1 year	Eliakim 2002: 3, 6 months
Haerens 2006: 2 years	Frable 2004: 12 weeks
Hawley 2006: 1 year	Frenn 2003: < 4 months
Jiang 2005: 2 year	Frenn 2005: After 4 sessions
Johnson 1997: 5 years	Hern 1998: Approximately 4 months
McVey 2004: 1 year	Higgins 2001: 10 months
Nader 1999: 3 years	Horowitz 2004: Unclear
Nemet 2005: 1 year	Jelalian 2006: 4 month, 10 month
Nicklas 2000: 4 years	Jelalian 2002: 6 month
O'Neil 2002: 4 years	Leslie 1999: 10 week
Ritenbaugh 2003: 3 years	Long 2004: 1 month
Rudolf 2006: 1 year	Long 2006: 3 weeks
Sallis 2003: 2 years	McMurray 2002: 8 weeks
Wang 2006: 1.5 years	Neumark-Sztainer 2003: 8 month
Wong et al., 1997: 1 year	Rankins 1999: 6 week
	Reinhardt 2002: 5 weeks
	Resnicow 2000: 6 months

Resnicow 2005: 6 months
Rinderknect 2004: 7 months
Segal 2004: 2 months
Thornburg 2004: Unclear (after 2 units)
White 2005: 6 months
Zang 2006: 8 week

In addition to follow-up duration, intervention intensity was identified during the second review. A majority (80%) of the interventions were high intensity or high intensity for the initial 12 weeks (2.5%). The three low intensity interventions were longer than one year in duration.

5.3.4 Health benefits and risks

Half of the key informants recommended that health risks be described in more detail. The evidence was re-analyzed in attempt to identify additional health risks. Given that chronic disease measures and body image issues were not included as outcome measures for this research, the recommendations were limited by the evidence base.

Interventions that included chronic disease risk measures, such as insulin or cholesterol levels, were addressed in greater detail after the second appraisal. Few interventions reported reduced chronic disease risk as a result of weight reduction or improved dietary intake. Yet, efficacy evidence and details of specific strategies were limited. For this reason, it was recommended that comprehensive health promotion programs include a focus on disease prevention, but further research be conducted in this area.

The recommendations did not specifically address the concern expressed by 4 experts that obesity prevention strategies in the general adolescent population might provoke eating disorders. To avoid this health risk, experts recommended using a vitality or

health promotion approach without a focus on weight. A health promotion approach was supported by the evidence base and was highlighted in the recommendations.

5.3.5 Participant Age

During the second evidence review an attempt was made to address the question of one nutrition professor regarding whether there was any evidence for interventions directed at older or younger adolescents. Most of the studies included in this review were aimed at early to middle adolescence, as outlined in the Table 13. There was insufficient evidence to draw any conclusions.

Table 13
Participant Age Classification in Included Studies

<i>Adolescent Classification</i>	<i>Number of Interventions</i>
Early adolescence: 12-14 years	18
Early and middle adolescence: 12-17 years	18
Middle adolescence: 14-17 years	5
Middle and late adolescence: 14-18 years	2
Late adolescence: 17-18 years	1
All adolescence: 10-18 years	4

5.3.6 Specificity of the Recommendations

After the second evidence appraisal more detail and concrete examples were added for behavioural strategies. A more explicit link between recommendations and prevention and treatment interventions either independently or combined was also established.

5.3.7 Potential Barriers

Many key informants felt that barriers, such as intervention cost, food availability, food security, personal barriers and government policy were not sufficiently addressed in the recommendations. An attempt was made to further address these factors through a second evidence appraisal, but the recommendations were limited by the evidence base. The US

Preventative Service Taskforce suggests that development teams search for economic evaluations for recommended interventions (91). Economic evaluations were not conducted as part of this study. It is acknowledged that resources available for interventions are most often reserved (91).

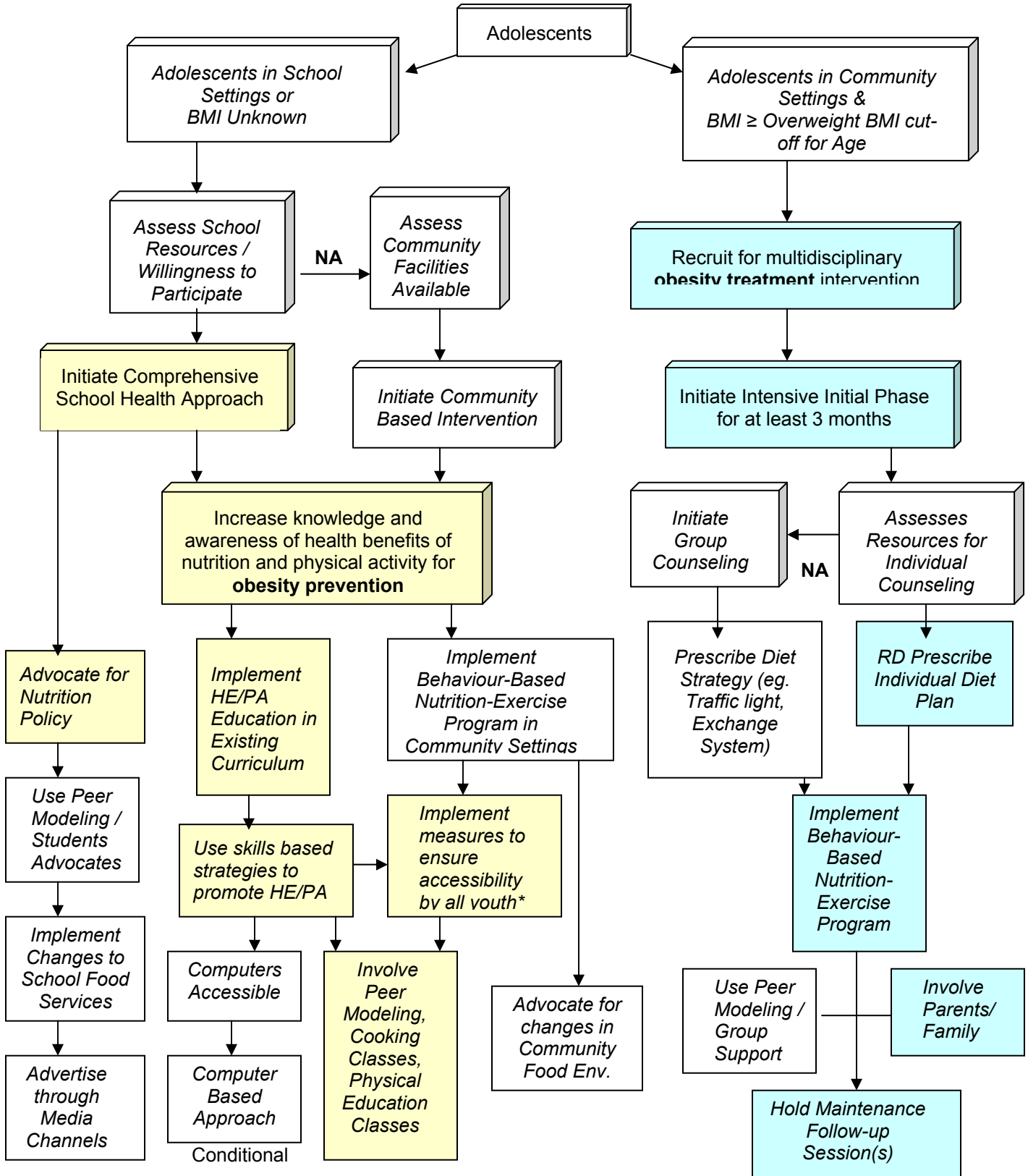
Chapter 6: Discussion

The results of this study demonstrated that there have been many promising adolescent obesity prevention and treatment interventions conducted in school and community settings in the past 10 years. The findings highlight the need to provide schools with the resources required to reach their fullest potential as vehicles for health education and healthy environments. They also render necessary evidence of encouraging, developmentally appropriate population-based strategies, which have been translated into a prevention and treatment algorithm for future community intervention design and implementation (Fig 5).

Previous synthesis research outlining effective, evidence-based obesity prevention and treatment strategies pertaining to adolescents in community settings is lacking. This lacuna is particularly concerning given the rising obesity rates and unique needs of adolescents. The urgency to address rising adolescent obesity rates demands that suitable strategies are identified and implemented in future interventions.

Earlier this year, a panel of Canadian experts addressed major gaps in clinical obesity treatment and prevention knowledge with the release of the *2006 Canadian clinical practice guidelines on the management and prevention of obesity in adults and children* (97). These guidelines provided health professionals a stepwise client-centred assessment and treatment approach for use in daily practice.

Figure 5
Adolescent Obesity Prevention and Treatment Algorithm



Notes: * See recommendations for specific strategies.

NA = not available. HE = healthy eating. PA = physical activity.

Highlighted boxes indicate optimal strategies. Yellow = prevention, Blue = treatment.

The panel recommended health professionals assess client's readiness for behaviour change, identify weight loss barriers and guide lifestyle habit changes through cognitive-behaviour therapy, when available (97). They emphasized a multidisciplinary approach with individualized dietary therapy and physical activity and comprehensive lifestyle modification (97). The authors also acknowledged the importance of population health approaches, centered on increasing healthy options within schools, homes and communities, to prevent and reduce obesity prevalence (97).

The results of the current research support the recommendations of Lau and colleagues with evidence that comprehensive interventions, using strategies from multiple disciplines, focused on nutrition and physical activity behaviour change, are more successful in treating and preventing obesity than interventions with a narrow approach (Evidence: Strong, Grade I).

More importantly, the findings extend the current body of knowledge to community settings by providing evidence of effective population-based strategies appropriate for adolescents. Given the distinct needs of adolescents, health must be promoted through a comprehensive approach in the school environment (Evidence: Strong, Grade I) and combined with treatment of obese adolescents in community settings (Evidence: Strong, Grade I). Within school and community settings, the evidence revealed a number of strategies effective for the adolescent population including a health promotion approach (Evidence: Fair, Grade II); modification to the school food environment (Evidence: Fair, Grade II); computer based strategies (Evidence: Fair, Grade II); peer modelling

(Evidence: Fair, Grade II); and direct family involvement (Evidence: Fair, Grade II).

There was also limited but promising evidence for health promotion through media marketing (Evidence: Limited, Grade III) suggesting a need for further research in this area.

6.1 Guideline Development

In developing the adolescent obesity prevention and treatment community guidelines, a number of steps proved especially useful. First the evidence review was necessary to consider various preventative strategies, determine the range of study designs and establish strength of the supporting evidence. Due to the multifaceted nature of obesity, the ecological model was notably useful in identifying strategies addressing the multiple levels including intrapersonal, community and environment factors, such as population health and health promotion approaches.

Expert opinion was particularly valuable in gaining different perspectives and considering intervention harm and benefits from those with practical experience. This step was also crucial to verify the recommendations with a pre-validated tool for assessing guideline quality. The AGREE Instrument is recommended for guideline appraisal in future synthesis research.

The necessity to provide different recommendations for obesity prevention and treatment for school and community settings also became evident during the evidence synthesis and key informant interviews. Without this division, discrepancies in the strength of certain

intervention strategies (specifically the use of diet plans and behavioural counselling) existed. Consequently, while adolescent obesity prevention and treatment should be coordinated, the recommendations have been made separately.

6.2 Adolescent Obesity Prevention

Schools emerged as the ideal setting for adolescent obesity prevention (Evidence: Strong, Grade I). This result was not surprising in view of the potential advantages for health promotion in this setting, which have been noted by the Institute of Medicine's Committee on Prevention of Obesity in Children and Youth (98) among other experts (99,100) and organizations (101). What is significant about this finding is that adolescent eating habits are highly influenced by social relations and the food environment (78), suggesting that obesity prevention programs in the school environment may be particularly effective during this period when they are developing self-regulatory skills.

Adolescents spend a considerable amount of time in the school environment providing educators and health professionals an ideal opportunity to use a variety of strategies to reach a large number of youth with nutrition and health messages and support health changes by creating healthy environments. While it is clear that individual nutrition education is essential to improve adolescent dietary behaviours, adolescent's health and dietary behaviours are influenced by a wide range of factors. Social and physical environments obviously have a powerful effect on adolescent dietary choices and behaviours and need to be considered in intervention design and implementation.

The findings of Rinderknecht 2004 illustrate that interventions which focus exclusively on improving individual behaviours are unsuccessful in creating lasting changes in adolescent dietary behaviours. The authors implemented an after-school program for 63 Native American youth and used participatory learning activities to expose youth to healthy foods and increase dietary self-efficacy. Although the program engaged adolescents in an examination of environmental influences on healthy eating, it did not make any modifications to the social or physical environments. The authors found that adolescents' preoccupation with social image can undermine dietary self-efficacy when peer support for healthy eating is lacking.

This and other interventions provided evidence that in order to effectively manage the growing adolescent obesity problem, educational strategies need to be integrated with long-term environmental and policy measures to influence behaviour change. Emphasis must be placed on enabling healthy choices by increasing access to nutrition and physical activity and removing social and environmental barriers to health. A comprehensive school approach is especially important for obesity prevention in the adolescent population due to the strong influence of external factors on adolescent health behaviours (Evidence: Fair, Grade II).

The comprehensive interventions included in this study demonstrated that it is possible to alter adolescent's nutrition knowledge, dietary habits and dietary intake through formal and informal education supported by changes in the social and physical environments (Agron 2002, Frenn 2005, French 2004, Birnbaum 2002). Comprehensive school-based interventions were also successful in the long term at reducing obesity prevalence

(Gortmaker 2000) and promoting healthy eating habits (Nicklas 2000). The comprehensive US program entitled “*Gimme 5*” resulted in a 14% increase in fruit and vegetable intake in the intervention group in the first three years (Gortmaker 2000). At the four-year follow up daily fruit and vegetable intake in the intervention group was maintained and the control group had also increased their intake due to school food service changes mandated in all schools by the US Department of Agriculture. The above noted interventions contributed to the evidence supporting the use of comprehensive school health approaches.

In light of the findings, families, teachers, health professionals, communities and government alike need to collaborate towards implementing comprehensive school health programs. Families need to take part in advocating for changes in the school food environment and school nutrition policy. Teachers need to include health education in the school curriculum. Health professionals need to provide education and the necessary resources to teachers and health services within community settings. Additionally, expert opinion and limited supporting evidence highlight the importance of governments in creating healthy public policy. Since most interventions included in this research focused on short term or downstream investments (such as individual behaviours and school food services) rather than upstream investments (environment and public policy), future research focused on policy modification is recommended to support expert opinion.

6.2.1 Specific Strategies of Successful Prevention Interventions

In view of the demonstrated importance of health promotion in the school setting, educators and health professionals need to take advantage of this opportunity to integrate developmentally appropriate nutrition and health education into pre-existing school curriculum and establish healthy environments to reinforce and support health behaviours.

It appears from the intervention studies to date, the ones demonstrating the most success in preventing obesity within the school environment were those which employed a multi-disciplinary approach (Evidence: Strong, Grade I); used a variety of approaches targeting the developmental stage (Evidence: Fair, Grade II); and promoted health throughout the school environment (Evidence: Fair, Grade II). The majority of school-based interventions were framed in terms of health promotion for obesity prevention. Without a direct focus on obesity, this approach appears effective for obesity prevention without adverse negative outcomes, such as the psychological impact of weight stigmatization (Evidence: Fair, Grade II).

6.2.1.1 Combined Nutrition and Physical Education

The most favourable results in terms of obesity prevention and treatment were seen in interventions that combined nutrition education and physical activity (Evidence: Strong, Grade I). The findings demonstrated that increasing school physical activity options resulted in changes in adolescent's physical activity behaviours as well as beneficial effects on body composition and other health risk factors. Combined nutrition education

and physical activity interventions appear to be more effective in preventing and treating obesity than nutrition education alone.

Despite the evidence, many schools have decreased hours devoted to physical education in recent years to focus on examinable curriculum areas. The school setting provides a safe environment where adolescents can be encouraged to engage in regular physical activity. For this and the above noted reasons, schools, with community and government support, need to balance curriculum requirements and opportunities for physical activity. One option may be to hold after school or lunch programs involving physical activity (as was done in the interventions Rinderknecht 2004 and Leslie 1999). Schools may also be more likely to engage in physical activity interventions if the benefits of physical activity and academic achievement are promoted (102).

Most obesity prevention and treatment interventions included in this study advocated for regular physical activity, but not all included a direct form of activity. This study did not examine specific characteristics or strategies used for physical education and activity. Therefore it is recommended that further research be conducted to determine the best duration, intensity and type of physical activity to prevent and treat adolescent obesity. It is also recommended that future research identify the best combination of physical activity and nutrition education.

6.2.1.2 Peer Modeling

Although many interventions used peer modelling as a developmentally appropriate intervention strategy, little evidence of efficacy previously existed. Given that

adolescence is a time when interpersonal skills are developed, adaptive social relationships are formed and identity and self-esteem are established largely in response to peer experiences (23), there is strong rationale for using peer education approaches with adolescents.

Most interventions included in this research which used peer modeling demonstrated that peer leaders significantly increased their nutrition knowledge and made associated changes in dietary intakes (Evidence: Fair, Grade II). The Teens Eating for Energy and Nutrition at School (*TEENS*) program is an example of a successful obesity prevention intervention that used peer leaders as educators (Birnbaum 2002). An evaluation of this program suggests that “peer-led nutrition education programs in schools are feasible and they have high acceptability among peer leaders, students and teachers” (103). Similar efficacy was noted in treatment interventions suggesting peer education approaches may be an effective, developmentally appropriate method for promoting behaviour change among adolescents.

Further research is needed in this area to fully explore the best frequency and mode of peer modeling; yet future interventions should not wait until this research is available rather adolescents should be included in teaching and learning roles in the delivery of intervention material.

6.2.1.3 Computer-Based Approaches

In view of the fact that media exerts a tremendous influence over adolescent’s food decisions, there is vast potential to reach adolescents with nutrition messages through

web and screen-based media. Interactive, computer tailored interventions demonstrated appeal and suitability for adolescent nutrition education and fair evidence of success (Evidence: Fair, Grade II). What is noteworthy about this finding is that media has had a powerful influence on adolescent consumer behaviour (104) suggesting that web-based strategies may prove to be a valuable means of changing adolescent nutrition behaviours.

There are limitations in using visual media in a computer based approach, such as a lack of influence on the availability of healthy food choices for youth and the possibility of increasing sedentary activity. To overcome these challenges, it is suggested that computer-based approaches be used as one component of a comprehensive intervention and integrated into school computer science curriculum where each student has computer access.

6.2.1.4 Environment Modification

The results demonstrating that nutrition education should be supported by efforts to build conditions and environments that encourage healthy lifestyle changes were expected.

It has been reported that adolescents consume one-third of all daily food intake outside of the home and more than half this in the school setting (104). Data suggest the availability of energy dense, nutrient poor foods within the school environment has been considered to negatively impact overall dietary intake by displacing healthy foods (105,106,107).

Over the past two decades, rising adolescent obesity rates have been seen concurrently with a sharp increase in consumptions of energy dense eaten out of the home (2,7). For this reason, it is logical to assume that adolescent's dietary intake has great potential to improve by offering healthy foods in the school environment.

One quarter of the interventions included in this research supported nutrition education with changes in the school food environment. Exemplary interventions included Birnbaum 2002 and Sallis 2003. These interventions made changes in the school food environment, included nutrition education as part of the school curriculum, involved families either indirectly or directly and encouraged physical activity during the school day. Birnbaum 2002 established a school nutrition advisory council to develop policy around the school food environment. Sallis 2003 applied an ecological model addressing both individual and environmental influences and involved school staff and students in policy change efforts. These interventions, among others (French 2004; Haerens 2006; Nicklas 2000; Ritenbaugh 2003), demonstrated that changes in the school food environment support curricular health education in achieving changes in adolescent dietary intakes and eating or reducing obesity prevalence (Evidence: Fair, Grade II).

Intervention success indicates that schools should not only offer healthy foods, but also aim to increase student's awareness and acceptance of healthier options. Simply restricting unhealthy food options has been associated with excess consumption of these foods once available (108). For this reason, strategies to promote healthy foods obviously need to accompany efforts to improve the selection of healthy foods offered in the school food environment. Some of the interventions involving environmental changes used media marketing to promote healthy choices and advocate for healthy school nutrition policy (Agron 2002; French 2004; Nicklas 2000). Media marketing has been successfully

applied to anti-tobacco campaigns (103) and may demonstrate similar success in targeting youth with health messages.

Modifications to the school food environment do not come without challenges. School officials are often reluctant to increase healthy food choices due to fear that changes will adversely impact revenue. While this research did not examine revenue variables, interventions indicating that changes are possible without any long term effect on school food services revenue variables exist (109,110), suggesting modifications to the school food environment are feasible without incurring revenue losses.

6.3 Adolescent Obesity Treatment

The most favourable results in terms of obesity treatment were seen in community rather than school settings (Evidence: Strong, Grade I). In contrast to prevention programs that do not focus on adolescent weights, evidence suggests treatment programs need to be more intensive, multi-disciplinary in nature, include diet plans and involve families.

The findings from the community interventions pointed to the need to tailor programs to diverse community needs. This means taking into account cultural, social and economic factors influencing health. Many of the interventions included in this research conducted community focus groups to determine the issues that were viewed as most important to community members and to gain a better understanding of the potential participant backgrounds. Frable 2006 reported that community assessments were crucial to the intervention success, supporting the case for tailoring programs.

6.3.1 Intervention Intensity

Intensive treatment interventions, ranging from weekly to monthly, proved to be the most effective in achieving weight loss goals. Acknowledging that intensive treatment is resource exhaustive, obesity prevention efforts in the school setting should be combined with more individualized care for obese adolescents. Expert opinion confirms that while interventions need to be more intensive for obese adolescents, obesity prevention interventions that stabilize weight rather than achieving weight reductions are appropriate for overweight adolescents due to future growth.

Although intervention intensity was high, the duration of many interventions included in this review was less than one year. The results indicate that intervention intensity during an initial three month phase may be more important in producing immediate effects for obesity treatment (Evidence: Strong, Grade: I). Stice and colleagues similarly found interventions that were shorter in duration produced significant effects (111).

Regardless of these findings, it is unlikely that short term interventions without follow-up are effective in creating sustainable changes in adolescent health behaviours. None of the short term interventions in this review conducted multi-year follow-ups to determine if health change was maintained. Many of the multi-year interventions were comprehensive, addressing multiple obesity influences, and a majority (80%) resulted in improved dietary intake or behaviours or reduced obesity prevalence. For this reason, to successfully impact on the long-term health of adolescents, it is recommended that an

intensive initial focus on individual behaviours be combined with comprehensive interventions that create supportive environments for physical activity and nutrition behaviour change.

6.3.2 Specific Strategies of Successful Treatment Interventions

Successful treatment interventions were multi-disciplinary, consisted of nutrition education combined with physical activity and used a variety of approaches targeting the developmental stage, such as peer modelling, behavioural strategies and family based approaches. The findings suggest a number of consistent themes between obesity prevention and treatment, including the use of peer models and addressing environmental influences.

6.3.2.1 Diet Plans

The results support the findings of Lau and colleagues (97), that diet plans should be used a part of obesity treatment interventions to achieve weight loss goals (Evidence: Strong, Grade I). A variety of diet plans were used by the included interventions, such as calorie restricted plans, the traffic light diet and the dietary exchange system. Due to the increased energy requirements for growth during adolescence, diet plans need to be nutritionally balanced, established with a trained professional and consider future growth. While diet plans appear to be an integral part of adolescent obesity treatment interventions, this research did not examine the efficacy of individual diet plans. Further research should be conducted to determine the most effective diet plans, as well as the best combination of exercise and dietary modification.

6.3.2.2 Behavioural Strategies

The evidence supported the use of behavioural strategies for nutrition education among adolescents, particularly in obesity treatment (Evidence: Fair, Grade II). The most common behaviour modification techniques utilized in the included interventions were goal setting, self-monitoring and modification of specific eating behaviours. Similar to the findings of Summerbell and colleagues, in a Cochrane review of 18 RCTs designed to prevent obesity (112), this study supports the use of behavioural strategies as an effective obesity management approach.

With increasing independence and autonomy, there is a possibility that adolescent who have not previously developed healthy eating behaviours may make unhealthy food choices (104). It is essential to ensure that adolescents are capable of recognizing and applying healthy eating behaviours to be able to make healthy dietary choices once completely independent in adulthood. Behavioural strategies may aid in developing these skills by allowing adolescents to practice behaviours with the support of families, educators and health professionals.

6.3.2.3 Family-based Approaches

Despite increased pressure from peers and the media during the adolescent years, parents have been reported to remain a very strong influence on what adolescents eat. The family environment influences adolescent food choices based on a number of factors including: parental eating and cooking behaviours; rules regarding eating and meals; family meal patterns; food purchases; parental concerns about nutrition; overall parent-teen relations;

and family cultural and religious factors (113). Given this well established relationship and the results of this study, it is clear that obesity prevention and treatment interventions should consider the family environment and its' influence on adolescent eating behaviour and food choices (Evidence: Fair, Grade II).

Direct family involvement in obesity treatment interventions appears even more important. The included interventions demonstrated that family involvement is important to provide support to adolescents in attaining eating behaviour and food habit change, and also increase family nutrition and physical activity knowledge, allow for parents to model healthy eating behaviours and aid in the creation of a healthy home food environment. These factors have been indicated as important in shaping future eating behaviours (114,115), proving additional support for the inclusion of families in obesity treatment programs.

6.4 Targeting Specific Adolescent Populations

Increased rates of obesity have been reported among adolescents of low socio-economic and ethnically diverse backgrounds (45,116), suggesting a need to target specific adolescent populations, as well as the population as a whole, with prevention or treatment messages. The few studies including adolescents of low socio-economic and ethnically diverse backgrounds suggest that comprehensive approaches, including strategies to promote participation and deliver culturally appropriate material, are effective to ensure accessibility and reduce obesity prevalence or improve eating behaviours in these populations (Evidence: Strong, Grade I). The school is often the most important access

point for students and families. For this reason, it has also been noted and is supported by the research findings that the school setting provides an excellent opportunity to intervene with adolescents who are at risk of developing or already experiencing obesity and related health conditions (99). There is a continued need for future interventions to address barriers, including socio-economic status or ethnicity, and ensure healthy eating and activity options can be accessed by all populations.

Chapter 7 Summation

7.1 Conclusions

Several interventions conducted in the past 10 years have had a positive effect in preventing and reducing adolescent obesity over the short and/or long term. The results demonstrated that schools are the ideal setting for health promotion and disease prevention programs, while community settings are optimal for obesity treatment. Nutrition education combined with physical activity, behaviour based education, environment modification, peer modeling, family involvement and the use of diet plans (for obesity treatment only) displayed evidence of efficacy in attaining positive prevention or treatment outcomes.

The findings point to a need to integrate obesity prevention in schools with treatment of obese adolescents in community settings. In the school setting, prevention efforts should take the form of health promotion supported by school environment modification. Community based obesity treatment can be directed more at individual behaviours including diet plans and a focus on behaviour modification.

In order to achieve long term sustainable changes in health and physical activity behaviours, the evidence indicates individual strategies should be combined with comprehensive approaches addressing social and environmental barriers. A multidisciplinary approach, including nutrition education and physical activity, is essential for success in improving individual behaviours for obesity prevention and treatment. Modification to the school environment is needed to encourage the

development of healthy behaviours and to support health education. Obesity treatment should attempt to address social barriers by encouraging family involvement. Peer modelling and computer based approaches also show promising evidence of efficacy in the adolescent population.

Due to the complex nature of obesity, future interventions must acknowledge the multiple determinants and implement strategies that are comprehensive and address individual, social and environmental factors. A greater commitment to create supportive school and community food environments that encourage healthy individual nutrition and physical activity behaviours is necessary to produce lasting changes in adolescent health.

7.2 Limitations

This study was comprised of a systematic review of the literature and key informant analysis. These methods carry several limitations.

First, the literature searches were intended to be comprehensive, but were not exhaustive. The searches were limited to English publications. The vast majority of studies were electronic publications and manual searches of journals were limited to those referred in other studies.

Second, the evidence was limited to the number of high quality studies currently available. Obesity prevention requires comprehensive interventions and long term follow-up. These are both costly and time consuming. For this reason, high quality studies are scarce (41).

Third, the strength of the recommended practice guidelines was limited by the strength of the evidence available. Some of the studies included in the review may not have been evaluated for effectiveness. Grading guidelines were used in attempt to address this limitation; however, this limited the evidence base.

In addition to the above, there were limitations resulting from the methods used in the systematic review. The US Preventative Services Task Force recommends using 4-10 leaders and 15-20 advisors on a guideline development team because of the multidimensional nature of public health problems (91). A guideline development team ensures that a comprehensive approach is taken, a large knowledge base of interventions is available, vital information is less likely to be overlooked and there is little possibility of appraisal bias (91). Due to the nature of this study, only one guideline development leader was possible. A second evidence appraisal, after advisor (key informant) input was collected, was conducted in attempt to overcome the barriers of this limited perspective.

Moreover, an economic evaluation of the recommended intervention strategies was not conducted. For this reason, assumptions rather than recommendations were made regarding resource availability and requirements.

7.3 Recommendations for Future Research

While the research identifying successful obesity prevention and treatment strategies is mounting, there is still much research needed. The results from this study highlighted a number of areas where future research is recommended.

To ensure production of quality evidence, future research should pay particular attention to qualitative methods assigned to intervention design, reliability of outcome measures, study evaluation, statistical analysis and reporting. In order to determine feasibility of implementation, future research must address the cost effectiveness, resource requirements and transferability of interventions. The current lack of economic data makes it difficult to determine implementation feasibility for promising intervention strategies.

There is also a need for interventions with longer duration and multi-year follow-up. As previously mentioned, many of the interventions in this review did not have a follow-up period long enough to determine whether outcomes persisted past intervention termination.

Future research must focus not only health education but also improving the social and physical environments influencing healthy lifestyle choices. Emphasis should be on population health approaches that apply environmental modifications in conjunction with individual strategies. Evidence on the efficacy of interventions to change environmental

conditions that enable healthy lifestyles is lacking. There is also a need to assess the best way to address minority populations.

While computer based strategies and media marketing appear to be developmentally appropriate for the adolescent population, limited quality evidence exists. Future research is needed to determine effective developmentally appropriate strategies for the various stages of adolescence.

Studies determining the optimal amount of family involvement in both prevention and treatment programs are recommended. Furthermore, research is required to determine the most effective dietary plan for obesity treatment and the best combination of dietary intervention and physical activity.

References for Studies Included in the Systematic Review

Complete Reference	In-Text Citation	Grade	Quality
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Appendix A

**List of Excluded Articles
After Abstract Filtering**

Excluded Articles			
Author	Year	Reason for Exclusion	Title
Luepker et al.	1996	Age	Outcomes of a field trial to improve children's dietary patterns and physical activity (CATCH)
Aranceta Bartina et al.	2006	Study type	The enKid Study
Rodearmel, Wyatt, Barry, Dong, Pan, et al.	2006	Age	A family-based approach to preventing excessive weight gain
Eliakim, Friedland, Kowen, Wolach	2004	Study type	Parentaly obesity and higher pre-intervention BMI reduce the likelihood of a multidisciplinary childhood obesity program to succeed
Amaro et al.	2006	Study type	Kaledo, a new educational board-game, gives nutritional rudiments and encourages healthy eating in children
Chen, Roberts & Barnard	2006	Setting	Effect of a short-term diet and exercise intervention on metabolic syndrome in overweight children
Cole, Waldrop, D'Auria, Garner	2006	Design	An integrative research review: effective school-based childhood overweight interventions
Rodrigues E.M. & Faber Boog M.C.	2006	Study type	Problem-posing as a nutritional education strategy with obese teenagers
Exl-Preysch B.-M., Mulhlemann P., Staluble-Tercier N., et al.	2002	Study type	Preventive nutrition for children. Nutrikid - Nutrition education for children and young people
De Mello, Luft, Meyer	2004	Age / Setting	Individual outpatient care versus group education programs. Which leads to greater change in dietary and physical activity habits in obese children?
Fleming-Moran, Thiagarajah	2005	Review paper	Behavioral interventions and the role of television in the growing obesity epidemic of adolescent obesity
Boon, Clydesdale	2005	Design	A review of childhood and adolescent obesity interventions
Summerbell, Waters, Edmunds, Kelly & Campbell	2005	Design	Interventions for preventing obesity.
Chomitz, Collins, Kim, Kramer, McGowan	2003	Age	Promoting healthy weight among elementary school children via a health report card approach
Ng, Anderson, McQuillen, Yu	2005	Design	School-based obesity and type 2 diabets prevention programs: A public health perspective
Rolland-Cachera, Thibault, Souberbielle, et al.	2004	Site	Massive obesity in adolescents: Dietary interventions and behaviours associated with weight regain at 2y follow-up

Daley A.J., Copeland R.J., Wright N.P., Roalfe A. and Wales J.K.	2006	PA only	Exercise therapy as a treatment for psychopathologic conditions in obese and morbidly obese adolescents: a randomized, controlled trial.
Simon C., Wagner A., Platat C., Arveiler D., et al.	2006	PA only	ICAPS: A multilevel program to improve physical activity in adolescents
Pate R.R., Ward D.S., Saunders R.P., et al.	2005	PA only	Promotion of physical activity among high-school girls: A randomized controlled trial
Kimm S.Y.S., Glynn N.W., Obarzanek E., et al.	2005	Study type	Relation between the changes in physical activity and body-mass index during adolescence: A multicentre longitudinal study
Deforche B., De Bourdeaudhuij I., Tanghe A., Debode P., Hills A.P. and Bouckaert J.	2005	Site	Role of physical activity and eating behaviour in weight control after treatment in severely obese children and adolescents
Chavarro J.E., Peterson K.E., Sobol A.M., et al.	2005	Age	Effects of a school-based obesity-prevention intervention on menarche (United States).
Morris V.	2006	Study design	Community-based programming to treat childhood obesity
González M.J., Miranda-Massari J.R., Ricart C.M. and Guzmán A.M.	2005	Age	Effect of a dietary supplement combination on weight management, adipose tissue, cholesterol and triglycerides in obese children.
Epstein L.H., Roemmich J.N., Paluch R.A., Raynor H.A.	2005	Study type	Influence of changes in sedentary behavior on energy and macronutrient intake in youth.
Winkler G., Noller B., Waibel S. and Wiest M.	2005	Age	BeKi - An initiative for nutrition education in children in the federal state of Baden-Württemberg: Description, experiences, and considerations for an evaluation framework
Morris V.	2006	Study type	Community-based programming to treat childhood obesity
Reinehr T., De Sousa G., Toschke A.M., Andler W.	2006	Age	Long-term follow-up of cardiovascular disease risk factors in children after an obesity intervention
Haby M.M., Vos T., Carter R., Moodie M., Markwick A., et al.	2006	Study type	A new approach to assessing the health benefit from obesity interventions in children and adolescents: The assessing cost-effectiveness in obesity project

Germann J.N., Kirschenbaum D.S., Rich B.H., O'Koon J.C.	2006	Setting	Long-term Evaluation of Multi-disciplinary Treatment of Morbid Obesity in Low-income Minority Adolescents: La Rabida Children's Hospital's FitMatters Program
Pavlovic M.	2005	Study type	Model of childhood obesity primary prevention programme
Zwiauwer K.F.M.	2000	Study type	Prevention and treatment of overweight and obesity in children and adolescents
Story M.	1997	Study type	Promoting healthy eating and ensuring adequate weight gain in pregnant adolescents: Issues and strategies
Maffioletti N.A., De Col A., Agosti F., Ottolini S., et al.	2004	Study type	Effect of a 3-week body mass reduction program on body composition, muscle function and motor performance in pubertal obese boys and girls
Kaplan T.A., Campbell M.H., Moccia-Loos G.	1996	Study type	Effects of a 3-month exercise and nutrition program for childhood obesity on anthropometrics, physical fitness, and serum lipids
Peregrin T.	2001	Age / Study type	Take 10! Classroom-based program fights obesity by getting kids out of their seats.
Fardy P.S., Azzollini A., Tekverk L., et al.	1997	Study type	Physical activity and teenage health. A program to improve cardiovascular fitness, health behavior, and coronary disease risk factors in multiethnic teenagers
Smith A., Coveney J., Carter P., Jolley G., Laris P.	2004	Age	The Eat Well SA project: An evaluation-based case study in building capacity for promoting healthy eating
O'Dea J.A., Abraham S.	2000	Outcome measures	Improving the body image, eating attitudes, and behaviors of young male and female adolescents: A new educational approach that focuses on self-esteem
Dannelly, Kicklighter, Hopkins, Rivers	2005	Setting / Age	Recommendations for nutrition interventions with overweight African-American adolescents and young adults at the Atlanta Job Corps Center.
Zwiauwer K.F.M.	2000	Review paper	Prevention and treatment of overweight and obesity in children and adolescents
Lee S.M.	2005	Study type	Improvements in heart health behaviors and reduction in coronary artery disease risk factors in urban teenaged girls through a school-based intervention: The PATH Program - Commentary
Guldbrandsson K., Bremberg S.	2006	Study type	Two approaches to school health promotion - A focus on health-related behaviours and general competencies. An ecological study of 25 Swedish municipalities
Fardy P.S., Azzollini A., Tekverk L., Agin D., McDermott K.J.	1997	PA only	Physical activity and teenage health. A program to improve cardiovascular fitness, health behavior, and coronary disease risk factors in multiethnic teenagers

Hakanen M., Lagstrom H., Kaitosaari T., et al.	2006	Study type	Development of overweight in an atherosclerosis prevention trial starting in early childhood. The STRIP study
Kaplan T.A., Campbell M.H., Moccia-Loos G.	1996	Study type	Effects of a 3-month exercise and nutrition program for childhood obesity on anthropometrics, physical fitness, and serum lipids
Ebbeling CB; Feldman HA; Osganian SK; et al.	2006	Study type	Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study.
Kubik MY; Lytle LA; Story M	2005	Study type	Schoolwide food practices are associated with body mass index in middle school students.
Germann JN; Kirschenbaum DS; Rich BH; O'Koon JC	2006	Setting	Long-term evaluation of multi-disciplinary treatment of morbid obesity in low-income minority adolescents: La Rabida Children's Hospital's FitMatters program.
Edwards C; Nicholls D; Croker H; et al.	2006	Setting	Family-based behavioural treatment of obesity: acceptability and effectiveness in the UK.
Sothorn MS; Loftin M; Suskind RM; et al.	1999	Study type	The impact of significant weight loss on resting energy expenditure in obese youth.
Ebbeling CB; Feldman HA; Osganian SK; et al.	2006	Study type	Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study.
Jiang JX; Xia XL; Greiner T; Lian GL; Rosenqvist U	2005	Study type	A two year family based behaviour treatment for obese children.
Epstein LH; Gordy CC; Raynor HA; Beddome; Kilanowski; Paluch	2001	Age, study type	Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity.
Patrick; Norman; Calfas; Sallis; Zabinski; Rupp; Cella	2004	Study type	Diet, physical activity, and sedentary behaviors as risk factors for overweight in adolescence.
Gately PJ; Cooke CB; Barth JH; Bewick BM; Radley D; Hill AJ	2005	Setting	Children's residential weight-loss programs can work: a prospective cohort study of short-term outcomes for overweight and obese children.
Kremers; Visscher; Brug; Chin; et al.	2005	Study type	Netherlands research programme weight gain prevention (NHF-NRG): rationale, objectives and strategies.
Neumark- Sztainer D; Story M; Hannan PJ; Rex J	2003	Study type	New Moves: a school-based obesity prevention program for adolescent girls.

Baranowski; Cullen; Nicklas; Thompson	2002	Design	School-based obesity prevention: a blueprint for taming the epidemic.
Bechtel- Blackwell	2002	Population	Computer-assisted self-interview and nutrition education in pregnant teens.
Gately PJ; Cooke CB; Butterly RJ; Mackreth P; Carroll	2000	Setting	The effects of a children's summer camp programme on weight loss, with a 10 month follow-up.
Illuzzi; Cinell	2000	Design	A coordinated school health program approach to adolescent obesity.
Sothorn MS; Loftin M; Suskind RM; Udall JN Jr; Blecker	1999	Study type	The impact of significant weight loss on resting energy expenditure in obese youth.
Pinelli; Elerdini; Faith; Agnello et al.	1999	Setting	Childhood obesity: results of a multicenter study of obesity treatment in Italy.
Sahota; Rudolf; Dixey; Hill ; Barth; Cade	2001	Age	Randomised controlled trial of primary school based intervention to reduce risk factors for obesity.
Stettler N; Zemel BS; Kumanyika S; Stallings	2002	Age	Infant weight gain and childhood overweight status in a multicenter, cohort study.
Epstein LH; Gordy CC; Raynor HA; et al.	2001	Age, study type	Increasing fruit and vegetable intake and decreasing fat and sugar intake in families at risk for childhood obesity.
Patrick; Norman; Calfas; Sallis; Zabinski; Rupp; Cella	2004	Review	Diet, physical activity, and sedentary behaviors as risk factors for overweight in adolescence.
Young; West; Ortiz; Carlson	2004	Setting, Age	A pilot study to determine the feasibility of the low glycemic index diet as a treatment for overweight children in primary care
Warren JM; Henry CJ; Lightowler HJ; Bradshaw SM; Perwaiz S	2003	Age	Evaluation of a pilot school programme aimed at the prevention of obesity in children.
Fitzgibbon; Stolley ; Dyer; VanHorn; KauferChristoffel	2002	Age	A community-based obesity prevention program for minority children: rationale and study design for Hip-Hop to Health Jr.
Goldfield; Epstein; Kilanowski; Paluch; Kogut- Bossler	2001	Study type	Cost-effectiveness of group and mixed family-based treatment for childhood obesity.
Frenn M; Malin S; Bansal N; Delgado et al.	2003	Study type	Addressing health disparities in middle school students' nutrition and exercise.

Goldfield; Epstein; Kilanowski; Paluch; Kogut- Bossler	2001	Study type	Cost-effectiveness of group and mixed family-based treatment for childhood obesity.
Akimoto-Gunther L, Hubler M, Santos M, et al.	2002	Setting / study type	Effects of re-education in eating habits and physical activity on the lipid profile of obese teenagers
Patrick K, Calfas KJ, Norman GJ, et al.	2006	Setting	Randomized controlled trial of a primary care and home-based intervention for physical activity and nutrition behaviors: PACE+ for adolescents.
Caballero, Clay, Davis, Ethelbah, Rock, et al.	2003	Age	Pathways: a school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren.
Sothorn MS; Schumacher H; von Almen TK; Carlisle LK; Udall	2002	Setting	Committed to kids: an integrated, 4-level team approach to weight management in adolescents.
Gottesman MM.	2006	Age	Turn up the heat: the Healthy Eating and Activity Together initiative
Sothorn; Udall; Suskind; Vargas; Blecker	2000	Setting, study type	Weight loss and growth velocity in obese children after very low calorie diet, exercise, and behavior modification.
Edwards B.	2005	Age	Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels.
James; Thomas; Cavan; Kerr	2004	Age	Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial.
Caballero, Clay, Davis, Ethelbah, Rock, et al.	2003	Age	Pathways: a school-based, randomized controlled trial for the prevention of obesity in American Indian schoolchildren.
Beech, Klesges, Kumanyika, Murray et al.	2003	Age	Child- and parent- targeted interventions: the Memphis GEMS pilot study
Patrick, Sallis et al.	2001	Setting	A multicomponent program for nutrition and physical activity change in primary care: PACE+ for adolescents
Veugelers, Fitzgerald	2005	Design	Effectiveness of school programs in preventing childhood obesity: a multilevel comparison
Gittelsohn, Steckler, Johnson et al.	2006	Design	Formative research in school and community-based health programs and studies: "state of the art" and the TAAG approach
Kumanyika SK, Obarzanek E, Robinson TN, Beech BM.	2003	Age	Phase 1 of the Girls health Enrichment Multi-site Studies (GEMS): conclusion.
Luepker RV, Perry CL, McKinlay SM, Nader PR, et al.	1996	Age	Outcomes of a field trial to improve children's dietary patterns and physical activity. The Child and Adolescent Trial for Cardiovascular Health. CATCH collaborative group.

Kumanyika SK, Obarzanek E, Robinson TN, Beech BM.	2003	Age	Phase 1 of the Girls health Enrichment Multi-site Studies (GEMS): conclusion.
Luepker RV, Perry CL, McKinlay SM, Nader PR, et al.	1996	Age	Outcomes of a field trial to improve children's dietary patterns and physical activity. The Child and Adolescent Trial for Cardiovascular Health. CATCH collaborative group.
Gortmaker SL, Cheung LW, Laird N. et al.	1999	Age	Impact of a school-based interdisciplinary intervention on diet and physical activity among urban primary school children: eat well and keep moving.
Gortmaker SL, Cheung LW, Peterson KE, et al.	1999	Age	Impact of a school-based interdisciplinary intervention on diet and physical activity among urban primary school children: eat well and keep moving.
Patrick K, Calfas KJ, Norman GJ, et al.	2006	Setting	Randomized controlled trial of a primary care and home-based intervention for physical activity and nutrition behaviors: PACE+ for adolescents.
Seibold ES, Knafelz K, Grey M.	2003	Study type	A family context of an intervention to prevent type 2 diabetes in high-risk teens.
Saksvig BI, Gittelsohn J, Harris SB, et al.	2005	Age	A pilot school-based healthy eating and physical activity intervention improves diet, food knowledge, and self-efficacy for native Canadian children.
Rodrigues EM, Boog MC.	2006	Setting / study type	Problem-posing as a nutritional education strategy with obese teenagers]
Akimoto-Gunther L, Hubler M, Santos M, et al.	2002	Clinical	Effects of re-education in eating habits and physical activity on the lipid profile of obese teenagers
Gottesman MM.	2006	Age	Turn up the heat: the Healthy Eating and Activity Together initiative
Reinehr T, Kersting M, Wollenhaupt A, et al.	2005	Setting	Evaluation of the training program "OBELDICKS" for obese children and adolescents
Sharma M.	2006	Review	School-based interventions for childhood and adolescent obesity.
Chavarro JE, Peterson KE, Sobol AM, et al.	2005	Outcome measure	Effects of a school-based obesity-prevention intervention on menarche (United States).
Edwards B.	2005	Age	Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels.
Reinehr T, Kersting M, Wollenhaupt A, et al.	2005	Setting	Evaluation of the training program "OBELDICKS" for obese children and adolescents
Pinelli; Elerdini; Faith; Agnello et al.	1999	Age	Childhood obesity: results of a multicenter study of obesity treatment in Italy.

Kirk SF, Harvey EL, McConnon A, et al.	2003	Age	A randomised trial of an Internet weight control resource: the UK Weight Control Trial
Eiben G, Lissner L	2006	Age	Health Hunters--an intervention to prevent overweight and obesity in young high-risk women
Nemet D, Berger-Shemesh E, Wolach B, Eliakim A	2006	Study type	A combined dietary-physical activity intervention affects bone strength in obese children and adolescents.
Braet C, Van Winckel M, Van Leeuwen K	1997	Study type	Follow-up results of different treatment programs for obese children.
Yanagi H, Tanaka M, Hirano C, Tomura S, et al.	1997	Study type	School-based intervention trial for cardiovascular health
Rodearmel SJ, Wyatt HR, Barry et al.	2006	Study type/ setting	A family-based approach to preventing excessive weight gain
Sondike SB, Copperman N, Jacobson MS	2003	Study type	Effects of a low-carbohydrate diet on weight loss and cardiovascular risk factor in overweight adolescents.
Kristal AR, Curry SJ, Shattuck AL, Feng Z, Li S	2000	Age	A randomized trial of a tailored, self-help dietary intervention: the Puget Sound Eating Patterns study.
Balagopal P, George D, Yarandi H, Funanage V, Bayne E	2005	Setting	Reversal of obesity-related hypoadiponectinemia by lifestyle intervention: a controlled, randomized study in obese adolescents
Epstein LH, Roemmich JN, Paluch RA, Raynor HA	2005	Study type	Influence of changes in sedentary behavior on energy and macronutrient intake in youth.
Ebbeling CB, Feldman HA, Osganian SK, et al.	2006	Study type	Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study
McMillan-Price J, Petocz P, Atkinson F, et al.	2006	Setting	Comparison of 4 diets of varying glycemic load on weight loss and cardiovascular risk reduction in overweight and obese young adults: a randomized controlled trial
Rush E, Schulz S, Obolonkin V, Simmons D, Plank L	2006	Study type	Are energy drinks contributing to the obesity epidemic?
van Egmond-Fröhlich A, Bräuer W, Goldschmidt H, et al.		Setting	Effects of a programme for structured outpatient follow-up care after inpatient rehabilitation of obese children and adolescents--a multicentre, randomized study

Matvienko O, Lewis DS, Schafer E	2001	Age	A college nutrition science course as an intervention to prevent weight gain in female college freshmen.
Schwingshandl J, Sudi K, Eibl B, Wallner S, Borkenstein M	1999	Setting	Effect of an individualised training programme during weight reduction on body composition: a randomised trial.
Cameron JW	1999	Age	Self-esteem changes in children enrolled in weight management programs.
Lamerson M	2006	Age	Healthy Kids Program.
Neumark- Sztainer D	2000	Study type	School-based programs for obesity prevention: what do adolescents recommend?
Shepherd LM	2006	Study type	Should we discuss weight and calories in adolescent obesity prevention and weight-management programs? Perspectives of adolescent girls.
Robson PJ	2000	Study type	Tracking intakes in adolescence: the experiences of the Young Hearts Project, Northern Ireland.
Robbins LB	2006	PA only	Girls on the Move program to increase physical activity participation
Brown D	2006	Study type	For your information. Playing to win: video games and the fight against obesity.
Mansfield B	2005	Review	Achieving healthy weights in children and adolescents
O'Dea JA	2005	Review	Improving adolescent eating habits and prevention of child obesity: are we neglecting the crucial role of parents?
Lee SM; Anderson DR	2005	Study type	DataBase: research and evaluation results. [Commentary on] Improvements in heart health behaviors and reduction in coronary artery disease risk factors in urban teenaged girls through a school-based intervention: the PATH Program.
Jerum A	2001	Study type	Evidence-based practice. Effectiveness of interventions to prevent obesity and obesity-related complications in children and adolescents.
Neumark- Sztainer D	2005	Population	Preventing the broad spectrum of weight-related problems: working with parents to help teens achieve a healthy weight and a positive body image.
Savoie M	2005	Setting	Anthropometric and psychosocial changes in obese adolescents enrolled in a weight management program.
Calderon KS	2005	Study type	Obesity-related cardiovascular risk factors: intervention recommendations to decrease adolescent obesity.
Sothorn MS	2002	Setting	Committed to kids: an integrated, 4-level team approach to weight management in adolescents.
Robson PJ	2000	Study type	Tracking intakes in adolescence: the experiences of the Young Hearts Project, Northern Ireland.
Neumark- Sztainer D	2000	Study type	School-based programs for obesity prevention: what do adolescents recommend?
Fardy, Paul S; Azzollini, Ann; Herman, Ariela	2004	Study type	Health-Based Physical Education in Urban High Schools: The PATH Program

O'Dea, Jennifer	2002	Study type	The New Self-Esteem Approach for the Prevention of Body Image and Eating Problems in Children and Adolescents.
Fulton, J.E.; McGuire, M.T.; Caspersen, C.J.; Dietz, W.H	2001	Study type	Interventions for Weight Loss and Weight Gain Prevention Among Youth: Current Issues.
Zephier, E; Himes, J H; Story, M	1999	Study type	Prevalence of overweight and obesity in American Indian school children and adolescents in the Aberdeen area: A population study.
Thomas- Dobersen DA, Butler-Simon N, Fleshner M.	1993	Date	Evaluation of a weight management intervention program in adolescents with insulin-dependent diabetes mellitus.
Haddock, C.K., Shadish, W.R. and Klesges, R.C.	1994	Date	Meta-Analysis–Treatments for childhood and adolescent obesity.

**List of Excluded Articles
After Article Filtering**

Excluded Articles			
Author	Year	Reason for Exclusion	Title
Calderon KS	2005	Study design - Review	Obesity-related cardiovascular risk factors: intervention recommendations to decrease adolescent obesity.
Neumark-Sztainer D	2005	Review paper	Preventing the broad spectrum of weight-related problems: working with parents to help teens achieve a healthy weight and a positive body image.
Edwards C; Nicholls D; Croker H; Van Zyl S; Viner R; Wardle J	2006	Age	Family-based behavioural treatment of obesity: acceptability and effectiveness in the UK.
Gottesman M.M.	2006	Review paper	Turn up the heat: the Healthy Eating and Activity Together initiative.
Peregrin T.	2001	Age	Take 10! Classroom-based program fights obesity by getting kids out of their seats.
Hipsky J., Kirk S.	2002	Clinical	HealthWorks! Weight management program for children and adolescents.
Valverde M.A., Patin R.V., Oliveira et al.	1998	Clinical	Outcomes of obese children and adolescents enrolled in a multidisciplinary health program
Lazzer S., Boirie Y., Poissonnier C., Petit I., et al.	2005	Clinical	Longitudinal changes in activity patterns, physical capacities, energy expenditure, and body composition in severely obese adolescents during a multidisciplinary weight-reduction program

Germann J.N., Kirschenbaum D.S., Rich B.H., O'Koon J.C.	2006	Clinical	Long-term Evaluation of Multi-disciplinary Treatment of Morbid Obesity in Low-income Minority Adolescents: La Rabida Children's Hospital's FitMatters Program
Epstein L.H., Roemmich J.N., Paluch R.A. and Raynor H.A.	2005	No intervention	Influence of changes in sedentary behavior on energy and macronutrient intake in youth.
Seibold, Knafi, Grey	2003	Survey of family context	The family context of an intervention to prevent type 2 diabetes in high-risk teens
Simon, Wagner, DiVita, Rauscher, et al.	2004	PA only	Intervention centred on adolescents' physical activity and sedentary behaviour (ICAPS): Concept and 6 month results
Balagoal, George, Yarandi, Funanage, Bayne	2005	Clinical	Reversal of obesity-related hypoadiponectinemia by lifestyle intervention: A controlled, randomized study in obese adolescents
Dao, Frelut, Oberlin, Peres, Bourgeois, Navarro	2004	Clinical	Effects of a multidisciplinary weight loss intervention on body composition in obese adolescents
Rochon, Klesges, Story, Robinson, et al.	2003	Age: 8-10 years	Common design elements of the Girls Health Enrichment Multi-site Studies (GEMS)
Robbins LB, Gretebeck KA, Kazanis AS, Pender NJ	2006	PA only	Girls on the move program to increase physical activity participation
Wong, Koh, Lee, Fong	1997	Language	Two-year follow-up of a behavioral weight control programme for adolescents in Singapore: predictors of long-term weight loss.
Clocksins, Brian D; Watson, Doris L; Ransdell, Lynda	2003	Review paper	Understanding Youth Obesity and Media Use: Implications for Future Intervention Programs.
Nader P, Sellers D, Johnson C, et al.	1996	Age (third & fifth grade)	The Effect of Adult Participation in a School-Based Family Intervention to Improve Children's Diet and Physical Activity: The Child and Adolescent Trial for Cardiovascular Health
Casazza & Ciccazzo	2006	Review	Improving the dietary patterns of adolescents using a computer based approach
Elizabeth Edmundson, Parcel, Feldman, et al.	1996	Age (Grades 3-5)	The Effects of the Child and Adolescent Trial for Cardiovascular Health upon Psychosocial Determinants of Diet and Physical Activity Behavior
O'Dea J.	2000	Study Outcomes for Eating Disorders	Improving the body image, eating attitudes and behaviours of young male and female adolescents: a new educational approach that focusses on self-esteem.
Kelleher, C.C., Fallen, U.B., McCarthy, E., et al.	1999	Clinical	Feasibility of a lifestyle cardiovascular health promotion programme for 8-15-year-olds in Irish general practice: results of the Galway Health Project.

Windle, Grunbaum, Elliot, Tortolero, et al.	2004	No results yet	Healthy passages: A multilevel, multimethod longitudinal study of adolescent health
Snethen J.A., Broome M.E. and Cashin S.E.	2006	Mainly children 8-12 years	Effective weight loss for overweight children: A meta-analysis of intervention studies
J Hipsky & S Kirk	2002	Outpatient	Healthworks! Weight Management Program for Children and Adolescents
Hopper, C.A., Gruber, M.B., Munoz, et al.	1996	Age: Grade 2-4	School-based cardiovascular exercise and nutrition programs with parent participation.
Fardy, Azzollini, Herman,	2004	PA only	Health-Based Physical Education in Urban High Schools: The PATH Program
Illuzzi S., Cinelli B.	2000	No results	A coordinated school health program approach to adolescent obesity.
Mauriello LM, Driskell MM, Sherman KJ, et al.	2006	Outcome measures	Acceptability of a school-based intervention for the prevention of adolescent obesity.
Singh AS, Chin A Paw MJ, Kremers SP, et al.	2006	No Results	Design of the Dutch Obesity Intervention in Teenagers (NRG-DOiT): systematic development, implementation and evaluation of a school-based intervention aimed at the prevention of excessive weight gain in adolescents.

Appendix B

Key Informant Intervention Research Introduction Package

Purpose and Specific Objectives

The overall goal of this study is to establish evidence-based practice guidelines for community nutrition interventions aimed at developing healthy eating behaviours in Canadian adolescents consistent with achieving and maintaining a healthy body weight.

The objectives of this study are: 1) to identify community nutrition obesity prevention strategies aimed at adolescents aged 12-17 years; 2) to apply an evidence-based decision making framework to critically appraise the findings; 3) to synthesise potential practice based intervention guidelines; and 4) to verify usefulness through key informant interviews. It is intended that the final product will guide Public Health Nutritionists in the development of future community based obesity prevention and treatment programs.

Research Questions

1. What elements of intervention strategies at the community level have been successful in attaining:
 - Healthy eating behaviours or healthy dietary intake among adolescents that can proceed into adulthood; or
 - A statistically significant reduction in weight of overweight adolescents, that may be accompanied by:
 - A reduction in risk factors for cardiovascular disease, stroke, diabetes, gallbladder disease, osteoarthritis, respiratory problems;
 - Weight maintenance or appropriate gain required for growth
2. What barriers (ie. socio-economic status, cultural values, food environment) to behaviour change need to be addressed through intervention strategies?

Definitions

Healthy Eating = “A pattern of eating that meets guidelines set out in Canada’s Food Guide, thereby promoting good health and lowering risk of chronic disease. Measured by the proportion of population age twelve years and over who consume fruits and vegetables more than five times per day.” (Actions Schools! BC, 2005)

Methods for Data Collection / Evidence Selection

Studies which addressed one or more of the research questions and met the following inclusion criteria were included in the review:

Criteria	Inclusion Criteria	Exclusion Criteria
Population	Adolescents aged 12 - 17 years: either alone, as part of a family, or among children under 18 years of age.	18 years or older
Setting	Community or School	Primary Care

Health Status	Healthy adolescents	Subjects that are pregnant, physically impaired, have a psychiatric disorder, regularly use prescription medications unrelated to obesity complications, or display non-obesity related renal, hepatic, endocrinologic or pulmonary disorders (apart from asthma) disorders
Nutrition Problems	Normal weight, overweight, obese or at risk of becoming overweight. With or without obesity related co-morbidities.	Subjects that display non-obesity related medical conditions including renal, hepatic, endocrinologic or pulmonary disorders (apart from asthma) disorders
Outcomes Measures	a) Some measure of adiposity (BMI, BMI percentile, % overweight for age, % body fat or weight and height), or improved health outcomes b) Eating behaviours, dietary intake, dietary habits or change in health habits	All other outcome measures
Study Design Preference	Randomized Control Trials (RCTs), meta-analysis, non-randomized controlled trials, longitudinal, cohort, case-control and time series	Systematic Reviews
Search Criteria	Search terms for evidence selection included: <i>The Population:</i> Adolescent, teens, youth. <i>The Intervention:</i> Nutrition Therapy; diet therapy; program development; health education; public health education, methods or practice; prevention; community health education or methods; intervention; preventative health services; school-based services; school health. <i>The Outcome:</i> Body Mass Index (BMI); body fat distribution; adiposity; body weight; food habits; dietary habits; health knowledge, attitudes and practice.	
Databases	MEDLINE, EMBASE, Cochrane Central, CINAHL, Academic Search Premier, Health Sciences, SAGE, ERIC	
Years	1996 - 2006	Prior to January 1996
Publication Limitations	English Language; Electronic	Articles not in English

Search Filters

Study selection involved a number of filtering steps. First the title was assessed to determine suitability (Cooper & Zlotkin, 2003). This was followed by a review of abstracts and finally for those studies that passed both the title and abstract filtering, the full article was retrieved and reviewed (Cooper & Zlotkin, 2003). Studies that did not involve interventions directed at improving adiposity or dietary intake or dietary habits, either independently or as part of comprehensive or multi-disciplinary strategies, or those that met any of the identified exclusion criteria were rejected during the title and abstract screen. Appendix A represents the articles excluded at each filtering stage.

Methods for Data Analysis

Once the body of evidence was retrieved, results were classified based on research design (ADA, 2003; Briss et al., 2000). The four classifications were (A) Randomized Control Trials (Individuals randomized) or Group Randomized Trials; (B) Cohort Studies; (C) Longitudinal Studies, Case-Control Studies, Time Series; and (D) Non-comparative Studies, Cross-sectional Studies, Before-After Studies.

Evidence analysis worksheets were prepared for each study reporting details about the study design, purpose, inclusion and exclusion criteria, protocol, outcomes measures, data collection methods, results, researcher's conclusions, and any reviewer comments. Studies were evaluated with a pre-validated quality criteria checklist that contained 4 relevance and 10 validity questions (ADA, 2003). Based on the results of the quality checklist, each study was assigned a quality rating of – (poor quality), 0, or + (high quality). The findings of each of study were summarized in brief summary statements, stating the author(s), publication year, outcomes, sample characteristics and any limitations.

An overview table, indicating quality rating, sample characteristics, setting, and topic relevant comparators was prepared. Common themes were identified in the overview table. Conclusion statements were drafted for each theme topic. These outlined the methodological quality, quantity, consistency and findings of the related evidence.

Evidence summaries were created to explain the general findings based of the available evidence. Evidence summary sheets displayed the conclusion statement, a summary of the evidence, the conclusion grade, and the evidence sources.

The summary statements and evidence summary sheets are available at:
http://www.calrudd.com/evidence_summaries.doc

Methods to Assess the Quality and Strength of the Evidence

Evaluation of the evidence was conducted for strength at each point in the analytic framework (Appendix B) and for the intervention as a whole (Cooper & Zlotkin, 2003). Grading guidelines adapted from the ADA (2003), GRADE working group (2004) and Cooper & Zlotkin (2003) were used to assess for methodological quality and the suitability for use in community interventions (Appendix C). The evidence was rated according to five defined parameters (design, quality, consistency, quantity and reproducibility) and assigned a final grade between I (minimal flaws, strong evidence) and V (no relevant evidence).

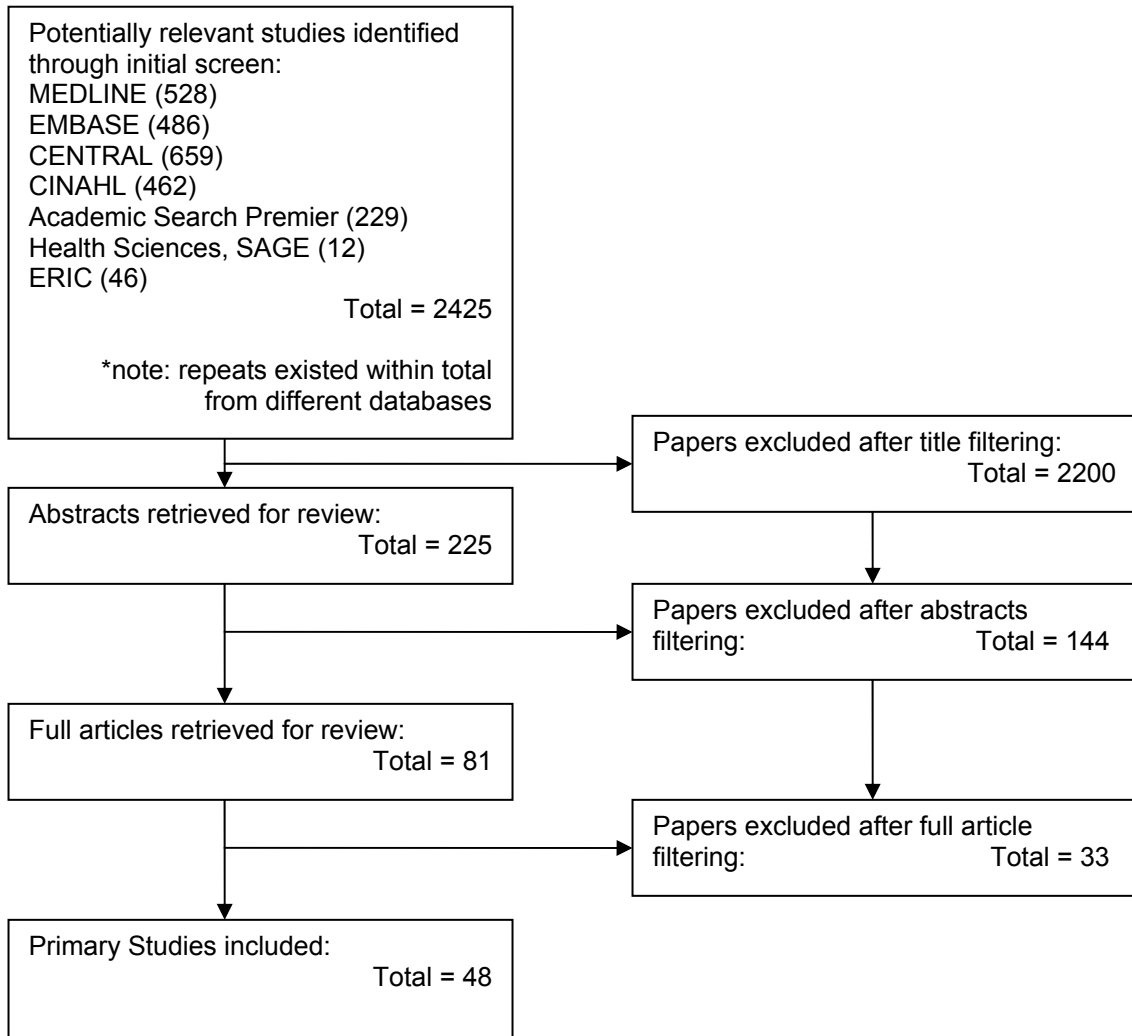
Methods to Translate the Evidence into Guidelines

All relevant and scientifically valid, graded evidence was used to draft recommendation statements (Appendix D). The recommendation and strength were directly linked with the evidence. The recommendations were translated in an algorithm or guideline to display how each recommendation relates to nutrition intervention (Appendix E).

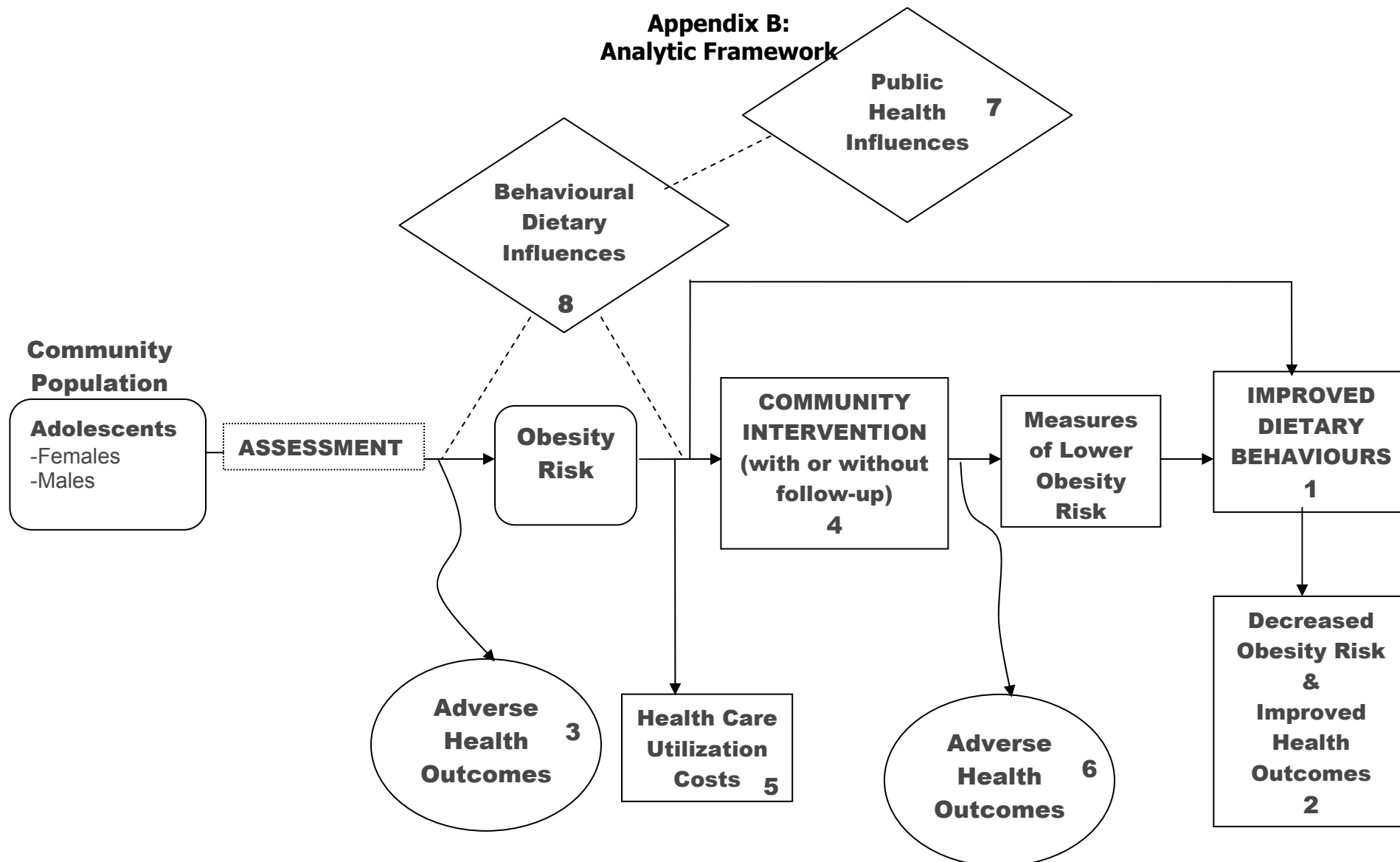
References:

1. Action Schools! BC. Phase 1 (Pilot) Evaluation Report and Recommendations. [cited 4 Mar 2007] Available from: <http://www.healthservices.gov.bc.ca/cpa/publications/actionschoolsreport.pdf>
2. Cooper M & Zlotkin S. An evidence-based approach to the development of national dietary guidelines. *J Am Diet Assoc.* 2002; Vol. 103, No.2: S28-S33.
3. American Dietetics Association. ADA Evidence Analysis Manual, Edition IV. 2003. [cited 20 Apr 2006] Available from: <http://www.adaevidencelibrary.com/category.cfm?cid=7&cat=0&auth=1>
4. Briss P, Zaza S, Pappaioanou M, Fielding J, Wright L, Truman B, Hopkins D, Mullen PD, Thompson R, Woolf S, Carane-Kulis V, Anderson L, Hinman A, McQueen D, Teutsch S & Harris J. Developing an Evidence-Based Guide to Community Preventative Services – Methods. *American Journal of Preventative Medicine.* 2000; 18(1S).
5. Weightman A, Ellis S, Cullum A, Sander L & Turley R. Grading evidence and recommendations for public health interventions: developing and piloting a framework. London: Health Development Agency; 2005. [cited 20 Apr 2006] Available from: <http://www.publichealth.nice.org.uk/page.aspx?o=503422>
6. GRADE working group. Grading quality of evidence and strength of recommendations. *BMJ.* 2004; Vol.328:19.

Appendix A: Summary of Papers Excluded through Search Filters



**Appendix B:
Analytic Framework**



Adapted from: U.S. Preventive Services Task Force: A Roadmap for Behavioral Medicine and Public Health. [cited 20 Apr 2006]. Available from: <http://www.preventiveservices.ahrq.gov/#uspst>

Appendix C: Grading Guidelines

Grade	Study Design	Quality	Consistency	Quantity	Reproducibility
I	Randomized controlled trials (RCTs) or meta-analyses	Well-conducted, high quality	Generally consistent / no important inconsistencies	Rich body	Outcomes relate directly to the research question
II	RCTs Or Non-randomized controlled trials or cohort studies	Studies of strong design with minor concerns or studies of weaker design	Consistent with minor exceptions	Several studies	Minor doubts
III	Prospective cohort; case control Or Non-randomized controlled trials or cohort studies	Studies of weak design or studies with design flaws	Inconsistent findings	Limited number of studies; inadequate samples	Serious doubts about reproducibility and directness due to narrow or different populations, interventions or outcomes of study
IV	Expert Opinion only; common practice	Conclusions drawn from usual practice alone	Solely based on expert opinion	No relevant published research studies	Limited to extent of experience
V	No relevant evidence	No relevant evidence	N/A	No relevant evidence; future research need	N/A

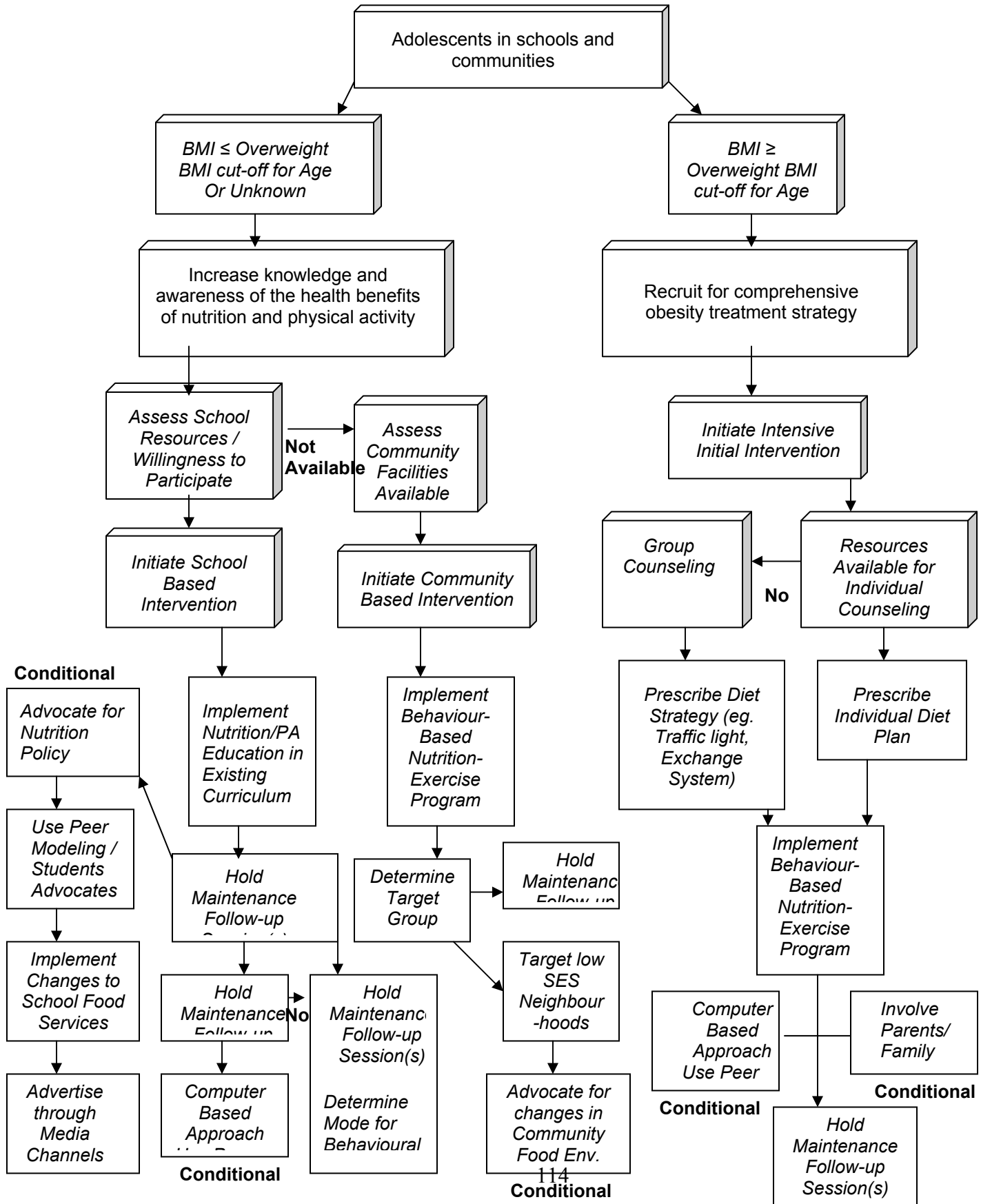
Appendix D: Recommendations

Obesity Prevention Intervention Strategies
<p>School Curriculum</p> <p>Nutrition and physical activity education should be implemented within the school curriculum as part of a comprehensive school-based obesity prevention intervention to improve eating and exercise behaviors and knowledge, and/or dietary intake.</p> <p>Recommendation for use: Fair. If resources and school's willingness to participate exist, schools should be used as the primary venue for obesity prevention programs.</p> <p>Strength of the evidence: Grade II</p>
<p>Comprehensive Components</p> <p>A comprehensive strategy including diet and nutrition education and physical activity should be used in obesity prevention programs. Comprehensive approaches may lead to greater decrease in adiposity.</p> <p>Recommendation for use: Fair</p> <p>Strength of the evidence: Grade II</p>
<p>Nutrition Education</p> <p>Nutrition education should be offered as part of a comprehensive obesity prevention program. Nutrition education (e.g. education on the food guide; healthier food choices, such as low fat foods and fruit and vegetables; healthy eating habits; fast food and eating out; and healthy meal and snack preparation) increases nutrition knowledge which may improve eating behaviours and dietary intake.</p> <p>Recommendation for use: Strong</p> <p>Strength of the evidence: Grade I</p>
<p>Behavioural Strategies</p> <p>Behavioural strategies should be used in obesity prevention interventions. Targeting eating and physical activity behaviours may lead to improved nutrition knowledge and dietary intake and reduced adiposity.</p> <p>Recommendation for use: Fair</p> <p>Strength of the evidence: Grade II</p>
<p>Computer-Based Strategies</p> <p>Computer based strategies can be used as an effective and developmentally appropriate strategy in obesity prevention and treatment interventions. These strategies may improve eating behaviors, nutrition knowledge, and dietary intake among adolescents.</p> <p>Recommendation for use: Fair. If resources exist, computer based strategies may be useful particularly among mid to late adolescence.</p> <p>Strength of the evidence: Grade II</p>
<p>Media Marketing</p> <p>Media channels should be used to promote healthy nutrition in obesity prevention program components and may be associated with improved eating behaviors, nutrition knowledge, and/or dietary intake.</p> <p>Recommendation for use: Limited.</p> <p>Strength of the evidence: Grade III</p> <p>Few studies are currently available supporting the use of media marketing to promote healthy nutrition. Further research is recommended in this area.</p>

<i>Obesity Treatment Intervention Strategies</i>
<p>Multidisciplinary Strategies Adolescent obesity treatment interventions should be multidisciplinary including diet and nutrition education and physical activity. Recommendation for use: Strong Strength of the evidence: Grade I</p>
<p>Intensive Treatment during the Initial Phase Obesity treatment interventions should include an intensive initial treatment phase, involving individual or group therapy. Recommendation for use: Fair Strength of the evidence: Grade II</p>
<p>Prescribed Diet Plans should be administered by a Dietitian Individualized diet plans (eg. calorie restrictions, diabetes exchange system, and traffic light system diets) should be prescribed by a Dietitian in a comprehensive obesity treatment program. Treatment should include individual or group sessions with the Dietitian. Recommendation for use: Strong Strength of the evidence: Grade I</p>
<p>Behavioural Strategies Behavioural strategies (e.g. motivation counseling, self monitoring, goal setting, problem solving, role modeling and peer support) should be used in nutrition education as part of a comprehensive obesity treatment program. Behavioural based nutrition and physical activity education may lead to greater reductions in adiposity. Recommendation for use: Fair Strength of the evidence: Grade II</p>
<p>Family Involvement Parents or families involvement may be associated with improved eating behaviors, nutrition knowledge, and/or dietary intake among adolescents and greater changes in adiposity. Recommendation for use: Fair Strength of the evidence: Grade II</p>
<p>Peer Modeling & Support Peer modeling should be included in obesity treatment interventions. Peer models may be associated with improved eating behaviors, nutrition knowledge, and/or dietary intake among adolescents and greater changes in adiposity. Recommendation for use: Fair Strength of the evidence: Grade II</p>
<i>Addressing Barriers to Intervention</i>
<p>Access and Reach Comprehensive obesity prevention interventions should be offered in school settings to ensure adolescents have equal access to programs and to reach a large number of youth. School based obesity prevention programs may result in improved eating behaviors, nutrition knowledge, and dietary intake. Recommendation for use: Strong</p>

<p>Strength of the evidence: Grade I</p>
<p>Socio-Economic Status Adolescents from low socio-economic backgrounds should be targeted for obesity prevention programs. Interventions involving adolescents from low socio-economic backgrounds may lead to improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity. Recommendation for use: Strong Strength of the evidence: Grade I</p>
<p>Food Environment Altering the school or community food environment, through changes in school meals and foods offered through vending machines, may be associated with improve eating behaviors, nutrition knowledge, or dietary intake among adolescents and a resultant decrease in adiposity. Recommendation for use: Fair. When resources and funding exist, changes should be made to the school or community food environments. Limited evidence supports that schools can continue to make a profit after changes in the school food environment. Strength of the evidence: Grade II</p>
<p>Gender Obesity prevention interventions may be more effective in reducing adiposity when offered to female only groups of adolescents. Recommendation for use: Fair. The results of obesity prevention and treatment programs offered to solely female participants are promising and therefore should be offered whenever feasible. Strength of the evidence: Grade II</p>
<p>Ethnicity Obesity interventions should be offered to multi-ethnic populations. These interventions may be associated with improved eating behaviors, nutrition knowledge and dietary intake and a decrease in adiposity. Recommendation for use: Limited. Few studies are currently available supporting the inclusion of multi-ethnic populations in obesity prevention and treatment programs. Strength of the evidence: Grade III</p>
<p>Addressing Intervention Risks</p>
<p>Body Image and Eating Disordered Behaviours Obesity prevention strategies should focus on healthy eating, physical activity and overall well-being, rather than on weight to reduce the likelihood of weight stigmatization, poor body image or self-esteem, and negative weight control behaviors. Recommendation for use: Fair Strength of the evidence: Grade II</p>

Appendix E: Adolescent Obesity Prevention and Treatment Algorithm



Appendix C

APPRAISAL INSTRUMENT

SCOPE AND PURPOSE

1. The overall objectives of the guidelines are specifically described.

The overall objectives of the guideline should be described in detail and the expected health benefits from the guideline should be specific to the public health problem.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

2. The research questions covered by the guideline are specifically described.

A detailed description of the research questions should be provided for the key recommendations.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

3. The audience to whom the guideline is meant to apply is specifically described.

There should be a clear description of the target population for the guideline. The age range, clinical description and comorbidities should be provided.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

4. The target users of the guideline are clearly defined.

The target users should be clearly defined so that the evaluators can determine if the guideline is relevant to the users.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

RIGOUR OF DEVELOPMENT

5. Systematic methods were used to search for evidence.

Details of the strategy used to search for evidence should be provided, including search terms used, sources consulted and dates of literature covered.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

6. The criteria for selecting the evidence are clearly described.

Criteria for including/ excluding evidence identified should be provided.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

7. The methods used for formulating the recommendations are clearly described.

A description of the methods to formulate the recommendations and arrive at final decisions should be provided.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

8. The health benefits and risks have been considered in formulating recommendations.

The guideline should consider overall health benefits and risks of the recommendations.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

9. There is an explicit link between the recommendations and the supporting evidence.

There should be an explicit link between the recommendations and the evidence on which they are based.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

CLARITY AND PRESENTATION

10. The recommendations are specific and unambiguous.

The guideline should provide a concrete and precise description of which management is appropriate in which situation as permitted by the body of evidence.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

APPLICABILITY

11. The potential barriers in applying the recommendations have been discussed.

Applying the guideline may require system changes which may be a barrier to using them in daily practice. Barriers should be discussed.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

FURTHER COMMENTS

Appendix D



MSVU Ethics Review Application Form

Directions: All proposals submitted for review must have this cover sheet. You must include all relevant supporting documentation in final form (e.g. surveys, interview questions, informed consent forms). To facilitate the referencing of reviewers' comments on the submission, please ensure that the pages are appropriately numbered and that changes made to the proposal are clearly indicated when re-submission is required. Please forward the required number of copies to the Chair, University Review Ethics Board, located in the Research and International Office (RIO).

Note: If you are not sure that your research project requires ethics review, please consult with the Research Office before submitting an application.

The Number of Copies required:

One copy – if the proposal is an Honours Thesis, Directed/Independent Study, or Class Project that has received departmental REB approval and does not exceed minimum risk.
 Three copies – for all other proposals that do not exceed minimum risk.
 Eight copies – for all proposals that exceed minimum risk.

Note – to complete this form click on the shaded box once to begin data entry

General Information

Date: January 8, 2007
 Name of person(s) submitting application: Brenna Rudd
 Title of project: Achieving Healthy Body Weights in the Teenage Years: Evidence-based practice guidelines for community nutrition interventions
 Department(s): Applied Human Nutrition
 E-mail addresses: brenna.rudd@msvu.ca
 Student: Brenna Rudd Supervisor: Dr. Theresa Glanville

Category of Researcher:

Faculty
 Graduate Student - Program of Study/Degree MScAHN
 Please specify: Graduate Project, Thesis or Independent Study? Thesis
 Honours Student
 Other (please specify):

Category of Research:

Minimal Risk - Expedited Review
 Exceeds Minimal Risk
 Re-review

This project is currently under review by:

Or

This project has already been reviewed by (**attach relevant documentation**):

External agency / specify:

MSVU Committee on Research and Publications

Thesis Committee (**NOTE**: A copy of the thesis proposal acceptance must be attached to your ethics application prior to review)

Departmental Research Ethics Board

Third party: (e.g., school board, hospital, etc.)

Specify and attach a copy of the approval (s)

Funding/Sponsorship

Has this project received funding (internal or external): Yes or No

If yes, please indicate the source of funding:

Agreement: I/we have read the MSVU University Research Ethics Board (UREB) Instructions for Completion and Submission of Ethics Protocol Review, the MSVU Senate Policy on Ethical Conduct for Research Involving Humans, and the Tri-Council Policy Statement on the Conduct of Research Involving Humans and agree to comply with the policies and procedures outlined therein. In the case of student research, as Faculty Supervisor, my signature indicates that I have read and approved the application and proposal, deem the project valid and worthwhile, and agree to provide continuing and thorough supervision of the student(s). I/we have read and will make every effort to meet the requirements of the Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans.

Signatures:

For Faculty/Staff Research Projects:

Signature(s) of investigator(s):

Date:

For Students or Thesis Research Projects:

Signature(s) of student investigator(s):

Date:

Signature(s) of Faculty Supervisor(s)

Date:

A. Summary of Proposed Research

Describe the purpose of the research (maximum 500 words). Include enough background information to enable the UREB to understand the rationale for the study. This should be an overview of the proposed research and the purpose of the research: what are you doing and why?

Adolescent obesity has become a significant public health problem in Canada (Katzmarzyk, 2002). Conservative estimates, based on self-reported data, indicate overweight and obesity rates among adolescents aged 12 to 17 soared from 14% in 1978/79 to 29% in 2004 (Shields, 2004).

This persistent upward trend has serious long-term implications for the physical, mental, emotional and social well being of Canadians and accounts for billions of dollars in health care costs (Shields, 2004). Obese adolescents often become obese adults and face a high risk for a range of preventable chronic diseases (Shields, 2004). For this reason, prevention has been recognized as a priority health issue (ADA, 2006). While interventions have begun to target school-aged children and adults in clinical settings, few advances have been made to halt the escalating problem among adolescents (ADA, 2006). This population has unique needs with increasing independence transitioning into adulthood. Reversing the trend requires comprehensive interventions that mitigate personal, social and environmental barriers to healthy lifestyle choices.

There is currently little consensus on best practices for dietetic adolescent obesity prevention and management (Wray & Levy-Milne, 2002). Community strategies are recommended as the most efficacious and feasible way to reach the greatest number of youth and support healthy lifestyle development (ADA, 2006). Evidence based guidelines are currently not available and are needed to guide nutrition practice in this area (ADA, 2006).

The purpose of this research is to develop evidence based practice guidelines for community nutrition interventions aimed at the development of healthy eating behaviours among adolescents consistent with achieving and maintaining a healthy body weight. The research outcomes will direct future community nutrition strategies with the best available evidence for immediate action towards adolescent obesity prevention.

B. Special Considerations

1. If the context of the research is "non-traditional" or specialized in any way (e.g., research in another culture, research with hard-to-access groups), describe the information that the UREB needs to keep in mind when reviewing this application.
2. If the research project is but one component of a larger non-research study (e.g., international development project), describe briefly the larger context of the project.

There are no special considerations with the proposed study.

C. Research Approach or Method

1. Describe your research method. How will you collect the data?
2. Describe/identify your participants.
3. Describe the procedure(s) for recruiting participants.
4. Outline any particular incentives you are using for participation (e.g., payment).
5. Debriefing (if applicable) - Describe debriefing procedures

The proposed study will employ a systematic review and key informant analysis in the

development of evidence-based nutrition practice guidelines. Literature filtering tools proposed by Cooper and Zlotkin (2003) and the ADA (2003) will be used to select appropriate evidence. Once the body of evidence is retrieved, results will be classified, evaluated and critically appraised.

Relevant and scientifically valid evidence will be used to develop comprehensive practice guidelines. The overall conclusions from the graded evidence will be drafted into an algorithm to display how each recommendation relates to nutrition intervention.

A panel of independent, national experts will be selected to act as key informants to review the guidelines for feasibility, plausibility, acceptability, comprehensiveness and accuracy of interpretation of the evidence base supporting the recommendations (Weightman et al., 2005; SIGN, 2003). A minimum of five national experts covering different areas of expertise will be included in the key informant interviews. These experts will hold different titles and positions in the areas of community nutrition, public health, adolescent health, academia, endocrinology, and national obesity organizations. The experts will be identified upon completion of the systematic review and selected purposively to act as influential and prominent experts.

An initial group of informants will be established based on recommendations from colleagues. These potential key informants will be contacted first with an introductory letter and then 2 weeks later with a follow-up phone call, according to the guidelines outlined in the *Key Informant Interview Guide* (Appendix A). They will be asked to recommend additional experts in the field.

Key informants will be provided a tool adapted from the AGREE Collaborations Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument (Appendix B) to evaluate the guidelines. Results will be summarized into interview summary sheets. Key informant interview codes will be developed to compile and analyze the results. These codes will be developed after 3-5 interviews have been conducted and relevant categories become apparent (USAID, 1996). The expert panel evaluations will be used to revise the guidelines and verify usefulness.

D. Third Party Permission

1. If you are using data provided by outside agencies, explain how you will establish agency consent.
2. If data will be collected offsite (e.g., school boards, community agencies, etc.), describe how you will establish consent of third parties. Final approval is contingent upon the researcher's formal confirmation that third party permission has been granted.

Data from outside agencies is not being used. Data will be collected at Mount Saint Vincent University.

E. Research Surveys, Questionnaires, Instruments, Etc.

1. Append of all documents in final form.
2. Indicate the sources of questions (e.g. public domain; developed by the researcher; etc.) and the relationship to the purpose of the study.
3. For instruments under copyright, the onus is on researcher(s) to obtain permission for use.

The key informant interview guide, evaluation tool adapted from AGREE Collaborations Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument, and key informant letter of invitation and consent form are appended.

F. Risks

Minimal risk is defined as: "if potential subjects can reasonably be expected to regard the probability and magnitude of possible harms implied by participation to be no greater than those encountered in everyday life."

1. Specify and describe any potential risks to participants, making special note of situations that exceed minimal risk.
2. If there is the potential to incur risk, outline the safeguards that you will put in place to protect participants.
3. Please pay special attention to situations in which the researcher may have dual relationships with participants (e.g., professors using their own students as participants; counsellors whose clients may also be their research participants).

No known risks.

G. Free and Informed Consent

1. Informed Consent Forms must be placed on departmental letterhead and must address the points below.
2. Written informed consent is normally expected. If you believe written consent is impossible or unwarranted, explain why.
3. These items need to be explicit in the Informed Consent Form. These are:
 - a. The identity of the researcher(s) and contact information, and supervisor information (if applicable);
 - b. An invitation to participate;
 - c. A statement of the research purpose;
 - d. A description of the tasks to be performed and the expected time commitment;
 - e. A description of foreseeable harm and benefits, including limitations to confidentiality
 - f. Confirmation that prospective participants may decline participation or withdraw at any time without penalty;
 - g. *An arm's length* contact in case of questions about the conduct of the research: "If you have questions about how this study is being conducted and wish to speak with someone who is not directly involved in the study, you may contact the Chair of the University Research Ethics Board (UREB) c/o MSVU Research and International Office, at 457-6350 or via e-mail at research@msvu.ca."
4. Please note that the consent of the participants shall not be conditional upon or include any statement to the effect that, by consenting, participants waive any legal rights.
5. If participants are a captive/vulnerable population, participants must be assured that non-participation will not affect their primary care in any way. For example, students must be assured that refusing to respond to a survey will not affect them academically. When it is not clear that potential participants have the capacity to provide informed consent, or if the research participants are from a population recognized as having diminished capacity to provide informed consent (e.g. children, adults with mental disabilities), informed consent must be obtained from an individual who bears responsibility for decisions concerning the well-being of the participant (e.g. parent, guardian, care-giver). When the

participant is able to provide assent for the research (i.e. express their willingness to participate at the time of conducting the research), this should also be sought.

6. If participants are being photographed; videotaped and/or voice recorded, separate letters of consent must be attached to the Informed Consent Form.
7. Researcher(s) should provide a description of the criteria that they will use to judge assent/dissent of a participant in the protocol that they submit for review.
8. Parental consent is required for persons under the age of majority.
 - a. Consent of both the child and the parent(s) are required in research studies where children are minors but are 7 years or older.
 - b. With children under 7, consent of the parent(s) only is necessary for the child's participation in research.
9. Attach the Informed Consent Form(s) to the application.

Please note that if you provide the above information in a *separate* information letter or introduction letter, it must be repeated exactly the same in the Informed Consent Form.

Describe how you will obtain Informed Consent:

An initial group of informants will be established based on recommendations from colleagues. These informants will be contacted first with an introductory letter and then 2 weeks later with a follow up phone call (Appendix C). Informants who agree to participate, will return a signed copy of the consent form in a pre-addressed envelope provided.

Checklist for Informed Consent (On Letterhead)

✓ Introduction
✓ Invitation
✓ Research Purpose
✓ Researcher Identity
✓ Tasks Outlined
✓ Time Commitment
✓ Harms/Benefits
✓ Decline Participation
✓ Withdrawal Anytime
✓ Arm's Length Contact (UREB Chair)
✓ Special Population
✓ Obtaining Consent
✓ Signature area
✓ Special Consent for Audio
✓ Separate Consent for Photographs, Video

H. Privacy, Confidentiality, Anonymity

1. How will anonymity and/or confidentiality be maintained?
 - while collecting data (please identify situations in which confidentiality cannot be guaranteed (e.g. abuse; self-harm; etc);
 - after data collection (i.e. storage, disposal of raw data);
 - on resulting publications.
2. If you are utilizing secondary data, state its original source and confirm that the data does not allow for identification of participants.

Anonymity is guaranteed. Research information will be coded and secured in the privacy of the researcher's home office. Participants' identity will never be disclosed without permission. If quoted in the research report, participants will be identified according to area of expertise (e.g. dietitian, public health nutritionist, professor, endocrinologist, director of obesity network). All key informant interview information will be destroyed at the end of this study, or no later than April 1, 2008.

I. Dissemination of Results

Describe how participants will be informed of the results of the study.

Key informants will be provided with an electronic copy of the research results. A hard copy of the final research thesis will be bound and made available in the Mount Saint Vincent University.

References:

1. Katzmarzyk P. The Canadian Obesity Epidemic: An Historical Perspective. *Obesity Research*. 2002; Vol. 10, No. 7.
2. Shields M. Nutrition: Findings from the Canadian Community Health Survey, Issue no. 1. Measured. *Obesity Overweight Canadian Children and Adolescents*. 2004. Component of Statistics Canada. Catalogue no. 82-620-MWE2005001.
3. American Dietetics Association (ADA) Position of the American Dietetics Association: Individual-, family-, school-, and community-based interventions for pediatric obesity. *JADA*. 2006; Jun; 106(6):925-45.
4. Cooper and Zlotkin. An Evidence Based Approach for the Development of Public Health Nutrition Guidelines: Filtering the Literature. *Canadian Journal of Dietetic Research*. 2003; S64(2).
5. Wray S & Levy-Milne R. Weight management in childhood: Canadian dietitians' practices. *Canadian Journal of Dietetic Practice and Research*. 2002. Vol. 63, Iss. 3;130-133.
6. American Dietetics Association. ADA Evidence Analysis Manual, Edition IV. 2003. [cited 20 Apr 2006] Available from: <http://www.adaevidencelibrary.com/category.cfm?cid=7&cat=0&auth=1>
7. Briss P, Zaza S, Pappaioanou M, Fielding J, Wright L, Truman B, Hopkins D, Mullen PD, Thompson R, Woolf S, Carane-Kulis V, Anderson L, Hinman A, McQueen D, Teutsch S & Harris J. Developing an Evidence-Based Guide to Community Preventative Services – Methods. *American Journal of Preventative Medicine*. 2000; 18(1S).
8. Weightman A, Ellis S, Cullum A, Sander L & Turley R. Grading evidence and recommendations for public health interventions: developing and piloting a framework. London: Health Development Agency; 2005. [cited 20 Apr 2006] Available from: <http://www.publichealth.nice.org.uk/page.aspx?o=503422>.
9. Scottish Intercollegiate Guidelines Network (SIGN). Management of obesity in children and young people. A national clinical guideline. Edinburgh (Scotland): Scottish Intercollegiate Guidelines Network (SIGN). 2003; SIGN publication no. 69.
10. Podrabsky, M. Key Informant Interview Handbook. 2006. [cited 8 Dec 06] Available from: <http://courses.washington.edu/nutr531/HEBD/KIInterviews/KeyInformantInterviewHandbook.pdf>
11. The AGREE Collaboration. Appraisal of Guidelines for Research & Evaluation (AGREE) Instrument. [cited 20 Oct 2006] Available from: www.agreecollaboration.org.

Appendix A: Key Informant Interview Guide

1. Key Informant Selection Process:

An initial group of informants will be established based on recommendations from colleagues. These informants will be contacted first with an introductory letter and then 2 weeks later with a follow-up phone call. These potential key informants will be asked to recommend additional experts in the field.

Key informants will be selected from the following areas of expertise:

- Community nutrition
- Public health
- Adolescent health
- Academia
- Endocrinology
- National obesity organizations

2. Key Informant Interview Script

I. Introductory Letter
See Appendix C: Letter of Invitation.
II. Follow-up Phone Call
<p>Hello,</p> <p>This is Brenna Rudd from Mount Saint Vincent University. A letter was sent to you about participating in my Masters thesis research study on the development of evidence based practice guidelines for the achievement of healthy body weights in the teenage years.</p> <p>Have you had a chance to read this letter? <i>If yes: proceed with script</i> <i>If no: ask "May I tell you more about this research?"</i> <i>If yes: continue with script</i> <i>If no: End here by saying "Thank you for your time. Have a nice day. Goodbye."</i></p> <p>If you choose to participate in this research study, I would like to send you an appraisal tool for the evaluation of the proposed evidence based guidelines for adolescent obesity prevention. Any information you give will be kept confidential.</p> <p>Do you have any questions about this research study or the information I just provided?</p> <p>Are you willing to participate in a review of the proposed guidelines? <i>If yes: proceed with script</i> <i>If no: End here by saying "Thank you for your time. Have a nice day. Goodbye."</i></p>

I will be sending you the proposed evidence based guidelines, all supporting documentation and the guideline appraisal tool within the next week by email and regular mail. You may submit your review by email, regular mail or over a 30 minute telephone interview.

I am hoping to schedule an interview with you in the next 3 weeks. Would you be available for a 30 minute interview on any of the following days and times?

1. mm/dd @ hh:mm – hh:mm
2. mm/dd @ hh:mm – hh:mm
3. mm/dd @ hh:mm – hh:mm
4. mm/dd @ hh:mm – hh:mm

If none of these times are acceptable, is there a time when you will be available?

I will contact you by phone at (XXX)XXX-XXXX on mm/dd @hh:mm. If you need to reschedule, I can be reached by phone at (902)425-1897 or by email at brenna.rudd@msvu.ca. I look forward to talking with you.

Thank you in advance for your participation. Good bye.

III. Interview Introduction

Respondent Code: _____

This is Brenna Rudd from Mount Saint Vincent University. Thank you for taking the time to participate in this interview about the ‘Achieving Healthy Body Weights in the Teenage Years’ research. The interview will take about 30 minutes. Participation is voluntary. You do not have to answer every question, and you can stop the interview at any time. In order to keep your responses anonymous, they will be coded and the link between your name and the code will be kept in a separate, secured location.

This interview will follow the questions outlined in the appraisal tool adapted from the AGREE Collaborations Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument.

Do you have any questions before we continue?

If no: Continue with the Appraisal of Guidelines for Research and Evaluation Instrument.

Upon completion: Excerpts from your review will be analyzed and used in the research. Once the study is completed, you will receive an electronic copy of the results. Thank you for your participation.

Adapted from: Podrabsky, M. Key Informant Interview Handbook. 2006. [cited 8 Dec 06] Available from: <http://courses.washington.edu/nutr531/HEBD/KIInterviews/KeyInformantInterviewHandbook.pdf>

Appendix B: APPRAISAL INSTRUMENT

SCOPE AND PURPOSE

1. The overall objectives of the guidelines are specifically described.

The overall objectives of the guideline should be described in detail and the expected health benefits from the guideline should be specific to the public health problem.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

2. The research questions covered by the guideline are specifically described.

A detailed description of the research questions should be provided for the key recommendations.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

3. The audience to whom the guideline is meant to apply is specifically described.

There should be a clear description of the target population for the guideline. The age range, clinical description and comorbidities should be provided.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

--

4. The target users of the guideline are clearly defined.

The target users should be clearly defined so that the evaluators can determine if the guideline is relevant to the users.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

RIGOUR OF DEVELOPMENT

5. Systematic methods were used to search for evidence.

Details of the strategy used to search for evidence should be provided, including search terms used, sources consulted and dates of literature covered.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

6. The criteria for selecting the evidence are clearly described.

Criteria for including/ excluding evidence identified should be provided and reasons for including or excluding evidence should be clearly stated.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

7. The methods used for formulating the recommendations are clearly described.

A description of the methods to formulate the recommendations and arrive at final decisions should be provided.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

8. The health benefits and risks have been considered in formulating recommendations.

The guideline should consider overall health benefits and risks of the recommendations.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

9. There is an explicit link between the recommendations and the supporting evidence.

There should be an explicit link between the recommendations and the evidence on which they are based.

Strongly Agree

4	3	2	1
---	---	---	---

Strongly Disagree

Comments

CLARITY AND PRESENTATION

10. The recommendations are specific and unambiguous.

The guideline should provide a concrete and precise description of which management is appropriate in which situation as permitted by the body of evidence.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

APPLICABILITY

11. The potential barriers in applying the recommendations have been discussed.

Applying the guideline may require system changes which may be a barrier to using them in daily practice. Changes that may be needed in order to apply the recommendations should be discussed.

Strongly Agree

4

3

2

1

Strongly Disagree

Comments

FURTHER COMMENTS

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The AGREE Collaboration. Appraisal of Guidelines for Research & Evaluation (AGREE)
Instrument. www.agreecollaboration.org

Appendix C:



Letter of Invitation

Brenna Rudd, P.Dt.,
MSc Applied Human Nutrition Candidate,
1472 Tower Road, Suite 526,
Halifax, NS, B3H 4K8
Phone: [REDACTED]

Date

Key Informant Address

RE: Invitation to Participate in Master's Thesis Study, 'Achieving Healthy Body Weights in the Teenage Years: Evidence-Based Practice Guidelines for Community Nutrition Interventions'

Dear:

I am a graduate student in the Department of Applied Human Nutrition at Mount Saint Vincent University. As part of my master's thesis, I am conducting research under the supervision of Dr. Theresa Glanville. The purpose of the study is to establish evidence based practice guidelines for community nutrition interventions aimed at adolescent obesity prevention.

The first part of this study was a systematic review of the literature to identify relevant and scientifically valid evidence for use in the development of comprehensive practice guidelines. The overall conclusions from the graded evidence have been drafted into practice guidelines for community nutrition interventions.

A panel of independent, national experts in the field of adolescent obesity is currently being selected to review the guidelines. You were referred by a colleague as a prominent expert in the field. This letter is being sent to invite you to take part in the review of the proposed evidence based practice guidelines.

Participation would entail reviewing the proposed guidelines for feasibility, plausibility, acceptability, comprehensiveness and accuracy of interpretation of the evidence base

supporting the recommendations. You will be provided an appraisal tool adapted from the AGREE Collaborations Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument to guide the evaluation. This would entail a time commitment of approximately one hour.

There are no known risks from being in this study other than the inconvenience of the time required for you to evaluate the guidelines. You may not benefit directly, however, I hope the research outcomes will help direct health professionals with the best available evidence for immediate action towards adolescent obesity prevention. Once the study is completed, you will receive an electronic copy of the results.

This study has been approved by the Ethics Board at Mount Saint Vincent University. Your participation is completely voluntary. You may withdraw from this study at any time without explanation. If you agree to participate, please return a signed copy of the attached consent form in the envelope provided. You will be contacted within 2 weeks time to confirm participation.

If you have any questions about this study, please contact Brenna Rudd, by phone at (902) 457-6248 or by email at brenna.rudd@msvu.ca, or Dr. Theresa Glanville, by phone at (902) 457-6248 or by email at theresa.glanville@msvu.ca. If you wish to speak with someone who is not directly involved with this study, you may contact the Chair of the University Research Ethics Board, by phone at 902-457-6350 or by e-mail at research@msvu.ca.

Thank you for taking the time to read this letter. Your participation in this study would be greatly appreciated.

Sincerely,

Brenna Rudd, P.Dt.
MScAHN Candidate,
Mount Saint Vincent University

Letter of Informed Consent

In signing this consent form, I agree to participate in the Thesis research study, 'Achieving Healthy Body Weights in the Teenage Years: Evidence-Based Practice Guidelines for Community Nutrition Interventions,' being conducted by Brenna Rudd, under the supervision of Dr. Theresa Glanville.

I understand that participation will entail a time commitment of approximately one hour to review the proposed practice guidelines with an appraisal tool adapted from the AGREE Collaborations Appraisal of Guidelines for Research and Evaluation (AGREE) Instrument. I am aware that excerpts from my written review will be analyzed and used in the research but my anonymity and confidentiality will be preserved at all times. I understand that my identity will never be disclosed without my permission. I understand that the research information I provide will be coded, secured in the privacy of the researcher's home office and destroyed no later than September 1, 2007.

I understand that there are no known risks from being in this study and that I may not benefit directly. I understand that my participation is entirely voluntary and that I may withdraw my permission to participate in this study at any point without explanation.

I am aware that if I have any questions about this study, I am able to contact Brenna Rudd, by phone at [REDACTED] or by email at [REDACTED] or Dr. Theresa Glanville, by phone at (902) 457-6248 or by email at theresa.glanville@msvu.ca. I have been informed that this research activity has met the ethical standards of the University Research Ethics Board at Mount Saint Vincent University. I understand that if I have any questions or concerns about this study and wish to speak with someone who is not directly involved with this study, I may contact the Chair of the University Research Ethics Board, by phone at 902-457-6350 or by e-mail at research@msvu.ca.

By signing this consent form, I am indicating that I fully understand the above information and agree to participate in this study.

Participant's signature

Date

Researcher's signature

Date

One signed copy to be kept by the researcher, one signed copy to the participant.



Excellence • Innovation • Discovery

COPY

University Research Ethics Board

UNIVERSITY RESEARCH ETHICS BOARD

Certificate of Research Ethics Approval

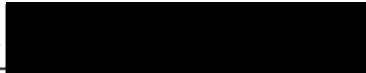
Title of project: *Achieving Healthy Body Weights in the Teenage Years: Evidence-based Practice Guidelines for Community Nutrition Interventions*

Researcher(s): Brenna Rudd
Supervisor (if applicable): Dr. Theresa Glanville
Co-Investigators: N/A

File #: 2006-56

The University Research Ethics Board (UREB) has reviewed the above named proposal and confirms that it respects the *Tri-Council Policy Statement* as outlined in the *MSVU Policies and Procedures: Ethics Review of Research Involving Humans* regarding the ethics of research involving human participants.

This certificate of approval is valid one year from the date of issue. A final report is required within 30 days of expiry. Researchers are reminded that any changes to approved protocol must be reviewed and accepted by the UREB prior to their implementation.


Dr. Elizabeth Bowering, Chair
University Research Ethics Board (UREB)

January 23, 2007
Effective Date

[Expires: January 22, 2008]

Renewal is contingent upon submission to the UREB of a written request for renewal accompanied by a satisfactory annual ethics report thirty days prior to expiry.

Appendix E

Study Characteristic Tables

Study	Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. J Am Diet Assoc; 2002: 102:3 Suppl (S103-105).
Methods	Class (A, B, C, D) Pre-posttest Follow-up: one 9-month academic year Outcome reliability: Student reported surveys Protection against contamination: Not mentioned Unit of allocation: School Unit of analysis: School and individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 220 student advocates Loss to follow-up: not mentioned Setting: School Age range: average age 16 y, grade 10 Gender: 30% males, 70% females SES: low-income high schools Ethnicity: Multi-ethnic
Interventions	10-20 students from participating high schools volunteered as student advocates. The core group was taught 4-6 lessons on healthy eating and physical activity. Student advocates were assisted in addressing policy issues and working with families. Student advocates disseminated The Food on the Run material to schools through the 5-7 school based activities to promote healthy eating and physical activity.
Keywords	<ul style="list-style-type: none"> - School - Low-income - Multi-ethnic - HE/ PA lessons - Policy - Peer model - Families
Outcome Measures	1. Access and promotion of healthy foods in schools 2. Access and promotion of physical activity in schools 3. Healthy eating and physical activity knowledge, attitudes and behaviour of student advocates - self-reporting survey consisted of 42 closed-ended questions: 4 questions related to demographic information, 19 related to PA, 15 pertaining to nutrition and 4 focused on student activity
Results	Intervention successfully increased the number of healthy food and physical activity choices at participating schools Student advocates demonstrated a statistically significant change in knowledge about ($p < .05$) and positive attitudes towards nutrition ($p < .001$). There was also a significant change in healthful eating behavior ($p < .001$).
Result	+ Δ nutrition knowledge
Keywords	+ Δ eating behaviour
Quality	(+, 0, 1)
Study	Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. Arch Pediatr Adolesc Med: 2005; 159(3):225-230.
Methods	Class (A , B, C, D) RCT Follow-up: 2 school years Outcome reliability: Self-reported survey Unit of allocation: School

	Unit of analysis: Individual
Subjects	N (controls baseline) = 226 girls N (interventions baseline) = 254 girls Loss to follow-up: 21 (8%) Setting: School Age range (years): 10 to 14 Gender: Females only SES: not mentioned Ethnicity: Multi-ethnic
Interventions	The Planet Health Intervention promoted healthful nutrition and physical activity and reducing television viewing. The program included 32 classroom lessons and 30 physical activity lessons. The intervention focused exclusively on healthful nutrition and physical activity and reduced television viewing and did not explicitly mention eating disorders, weight control, dieting, body image or overweight.
Keywords	<ul style="list-style-type: none"> - School - Classroom - Female - Multi-ethnic - HE/ PA/↓ SA lessons - Body image measure
Outcome Measures	Self-reported survey data were collected on diet, physical activity, television viewing, dieting, self-induced vomiting, and use of laxatives and diet pills. Anthropometric data was also collected by trained staff.
Results	Girls in intervention schools were less than half as likely to report purging or using diet pills at follow-up compared with girls in control schools (odds ratio, 0.41; 95% CI, 0.22-0.75).
Result Keywords	+ Δ eating behaviour
Quality	(+, 0, -)
Study	Baxter AP, Milner PC, Hawkins S, Leaf M, Simpson C, Wilson KV, Owen T, Higginbottom G, Nicholl J, Cooper N. The impact of heart health promotion on coronary heart disease lifestyle risk factors in schoolchildren: lessons learnt from a community-based project. <i>Public Health</i> . 1997;111(4):231-7.
Methods	Class (A, B, C, D) Non Randomized Control Trial Follow-up: 3 year Outcome reliability: Self-reported questionnaire Unit of allocation: School and community Unit of analysis: Individual
Subjects	N (controls baseline) = 372 N (interventions baseline) = 512 (Grade 7); 512 (Grade 10); Loss to follow-up: 60 (6%) Setting: School Age range (years): 11-14 years Gender (boys/girls): 0.89 (Grade 7); 1.21 (Grade 10) SES: Not mentioned Ethnicity: Not mentioned
Interventions	Three types of policies were implemented in the intervention schools: the Action Health Charter; non-smoking policies; and healthy eating policies. Action Heart workers facilitated general heart health promotion activities and those targeted at individual risk behaviors among school children. Promotion was done through leaflets, posters, and t-shirts. Secondary schools introduced curricular activity on general heart health promotion, healthy eating, smoking, exercise, and

	alcohol consumption. Community based activities were also implemented in the intervention area to promote heart health, low fat milk, and family exercise initiatives.
Keywords	<ul style="list-style-type: none"> - School / community - Policy - Env. - HE/ PA lessons
Outcome Measures	Lifestyle risk factors - smoking, diet and exercise. Assessed using a self-reporting questionnaire.
Results	<ul style="list-style-type: none"> - weak evidence of beneficial changes in the prevalence of low fat milk consumption, low fat spread consumption, and reported exercise in intervention schools - little change in the odds of fat consumption in either control or intervention schools over the 3 year period - wholemeal bread consumption was higher in intervention schools for both 11 and 14y olds
Result	+ Δ dietary intake/ eating behaviours
Keywords	+ Δ PA
Quality	(+, 0, -)
Study	Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.
Methods	<p>Class (A, B, C, D) Randomized Control Trial</p> <p>Follow-up: 2 year</p> <p>Outcome reliability: Self-reported questionnaire</p> <p>Unit of allocation: School</p> <p>Unit of analysis: Individual</p>
Subjects	<p>N (controls baseline) = 8 schools (1755 students)</p> <p>N (interventions baseline) = 8 schools</p> <p>Peer leaders + curriculum + environment: 226</p> <p>Curriculum + environment: 677</p> <p>Environment: 845</p> <p>Loss to follow-up: Not indicated</p> <p>Age range (years): 12-14 years (Middle and Junior high school)</p> <p>Gender (boys/girls): 0.89 (Grade 7); 1.21 (Grade 10)</p> <p>SES: Low SES (at least 20% students received free school lunches)</p> <p>Ethnicity: Not mentioned</p>
Interventions	The Teens Eating for Energy and Nutrition in Schools (TEENS) was a school-based, environmental, classroom and family intervention to increase fruit and vegetable intake and decrease fat intake among low SES adolescents and reduce their future risk of cancer. The intervention was delivered to a group of 7 th grade students over 2 years. It consisted of 10 behavioural based curriculum sessions based on the SCT. Peer leaders helped classroom teachers lead group activities and discussions. Low fat foods were distributed for taste testing. In addition to classroom curriculum, students received "parent packs" with activities and intervention messages for their family. Families received coupons for participation. School food environment changes included promotion of fruit, vegetables and low fat foods and healthy snacks in the schools a la carte lines and vending machines. A school nutrition advisory council (SNAC) was also formed in 6 of the 8 intervention schools to develop policy around the school food environment. Schools were exposed to either 1) control, 2) school environment changes, 3) classroom plus environment interventions or 4) peer leaders plus classroom plus environment changes.

Keywords	<ul style="list-style-type: none"> - School - Classroom - Low SES - Cancer prevention program - Peer modeling - Family involvement - Policy - Behavioural - HE/ PA lessons - Taste testing
Outcome Measures	Students were surveyed to measure usual fruit and vegetable intake and usual food choices using multiple 24 hour recalls. Psychosocial mediators of eating behaviour change were assessed using a questionnaire based on the theory of planned behaviour.
Results	Peer leaders increased fruit and vegetable intake. Students exposed to curriculum plus environmental changes also increased fruit and vegetable intake with borderline significance. Students exposed to only environment changes did not significantly increase fruit and vegetable intake. Peer leaders and students exposed to curriculum plus environmental changes improved usual food choices. Students exposed only to environmental changes improved usual food choices with borderline significance.
Result Keywords	<p>+ Δ fruit and vegetable intake among peer leaders and students exposed to curriculum and environment change</p> <p>0 Δ fruit and vegetable intake among students exposed only to environment change</p> <p>+ Δ usual food choices among peer leaders, students exposed to curriculum and environment change, and students exposed to environment change</p>
Quality	(+, 0, -)
Study	Carrel AL, Clark R, Peterson S, Nemeth B, Sullivan J & Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. Archives of Pediatrics & Adolescent Medicine; 2005; 159 (10): 963-8.
Methods	<p>Class (A, B, C, D) RCT</p> <p>Follow-up: 9 months</p> <p>Outcome reliability: dual energy absorptiometry for body composition</p> <p>Unit of allocation: School</p> <p>Unit of analysis: Individual</p>
Subjects	<p>N (controls baseline) = 23</p> <p>N (interventions baseline) = 27</p> <p>Loss to follow-up: None indicated</p> <p>Setting: School</p> <p>Age range (years): 12-13</p> <p>Gender: 52% female</p> <p>SES: Not indicated</p> <p>Ethnicity: Not indicated</p>
Interventions	Participants were randomized to lifestyle-focused, fitness-oriented gym classes (treatment group) or standard gym classes (control group) for 9 months. The intervention curriculum was personalized to match the students' skill levels and encourage participation. The intervention focused mainly on PA with only a small component of nutrition education. The nutrition education consisted of educational handouts to help develop healthier eating habits. The focus was on the Food Guide Pyramid, recommended servings of food, appropriate portion sizes, healthier food choices, and the benefits of these choices. Lifestyle

	focused activities were encouraged. Skills were taught with the class broken down into small groups. The classes were held 5 times every 2 weeks for 45 minutes and encouraged physical fitness, less self-conscious focus on appearance, and full group participation. The control group participated in the traditional physical education classes.
Keywords	<ul style="list-style-type: none"> - School - Classroom (PE) - PA - HE/ PA lessons <ul style="list-style-type: none"> o Food Guide - DM prevention - Lifestyle change - Behavioural focus
Outcome Measures	Cardiovascular fitness Body composition Fasting insulin and glucose levels
Results	Compared with the control group, the treatment group demonstrated a significantly greater loss of body fat (loss, $-4.1\% \pm 3.4\%$ vs $-1.9\% \pm 2.3\%$; $P = .04$), greater increase in cardiovascular fitness ($\dot{V}O_2\text{max}$, 2.7 ± 2.6 vs 0.4 ± 3.3 mL/kg per minute; $P < .001$), and greater improvement in fasting insulin level (insulin level, -5.1 ± 5.2 vs 3.0 ± 14.3 $\mu\text{IU/mL}$ [-35.4 ± 36.1 vs 20.8 ± 99.3 pmol/L]; $P = .02$).
Result Keywords	+ Δ body fat + Δ PA + Δ Insulin
Quality	(+, 0, -)
Study	Carrel A, Meinen A, Garry C & Storandt R. Effects of nutrition education and exercise in obese children: the Ho-Chunk Youth Fitness Program. WMJ. 2005; 104(5): 44-48.
Methods	Class (A, B, C, D) Pre-posttest Follow-up: 24 weeks Outcome reliability: BIA used to assess body composition; Dietary intake assessed with 24 hour dietary recall Unit of allocation: Unit of analysis:
Subjects	N (controls baseline) = 0 N (interventions baseline) = 38 children and youth Loss to follow-up: Not indicated Setting: School Age range (years): 2 groups - 6-10 years and youth 11-18 years Gender: Not indicated SES: Not indicated Ethnicity: First Nations
Interventions	The program comprised of 24 weeks of twice weekly supervised nutrition and exercise classes. Class time was divided among fitness and nutrition education, with 45 minutes for PA and 30 minutes making a healthy snack. The participants learnt about a variety of fitness and nutrition topics. Nutrition education included: the food guide pyramid, reading food labels, 5-a day fruit and vegetables, the importance of eating breakfast, soda consumption, eating at holidays, and fast food eating behaviors. Incentives were provided for attending class and completing home activities.
Keywords	<ul style="list-style-type: none"> - School - PA

	<ul style="list-style-type: none"> - HE/ PA lessons <ul style="list-style-type: none"> o Food guide o F/V o Breakfast o Eating out - Food preparation <ul style="list-style-type: none"> o Behavioural - Homework
Outcome Measures	Body composition, history and physical exam Dietary intake
Results	Mean fasting plasma insulin decreased after 24 weeks of training. Percent body fat, glucose, and total cholesterol remained unchanged during this time.
Result	0 Δ body fat
Keywords	+ Δ Insulin
Quality	(+, 0, -)
Study	Damon S, Dietrich S & Widhalm K. PRESTO - Prevention Study of Obesity: A project to prevent obesity during childhood and adolescence. Int J Paediatr: 2005; 94:S(448):47-48.
Methods	Class (A, B, C, D) RCT Follow-up: 14 weeks and 10 months Outcome reliability: Questionnaires, food record validity questionable Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 231 N (interventions baseline) = 260 Loss to follow-up: Not indicated Setting: School Age range (years): 10-12 Gender: Not mentioned SES: Not mentioned Ethnicity: Not mentioned
Interventions	The school intervention was performed by a multidisciplinary team. The intervention covered 11 nutrition and health related sessions with 1 hour per week in each class. There was also a physical activity component. A competition about nutrition ideas was used in closing.
Keywords	<ul style="list-style-type: none"> - School - Classroom - PA - HE/ PA lessons
Outcome Measures	Data about nutrition knowledge and eating habits was collected at the beginning of the study through multiple choice questionnaires and a 3-day dietary record. Medical examinations were also conducted. The intervention was followed by a checkup at 14 weeks and 10 months.
Results	The initial poor nutrition knowledge was improved significantly in the intervention group compared with the control. BMI was not improved in overweight children. The project evaluation showed that most pupils and teachers wished to continue the project.
Result	+ Δ nutrition knowledge
Keywords	0 Δ BMI
Quality	(+, 0, -)
Study	Edwards B. Childhood obesity: a school-based approach to increase nutritional

	knowledge and activity levels. <i>Nursing Clinics of North America</i> ; 2005; 40 (4): 661-9.
Methods	Class (A, B, C , D) Nonrandomized control trial Follow-up: One school year Outcome reliability: Height, weight and BMI Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 15 N (interventions baseline) = 28 Loss to follow-up: 15 (54%) Setting: School Age range (years): 12-14 (8 th grade) Gender: Mixed SES: Not indicated Ethnicity: 99% African American
Interventions	The intervention was called Food & Fitness 101. It was held during the physical education class, which met for 1.5 hours every other day for the entire school year. Each class consisted of a warm-up and stretching period, 25 minutes of aerobic activity, and a cool-down period followed by interactive classroom activities designed to increase nutrition education. Incentives were provided to further increase activity levels outside of the classroom. The nutritional activities included calculations of the amount of fat in teaspoons in typical fast food meals. Demonstrations were used to illustrate fat content of those meals. Students were also involved in preparation of healthy snacks that they sampled and served to invited guests and parents. Efforts were made to maximize parental role in the project. Dietary information was sent home on a regular basis. Parents attended special classes in which students presented materials they had learned in the form of skits and role-playing.
Keywords	<ul style="list-style-type: none"> - School - Classroom (PE) - 99% African American - PA - HE lessons - Food preparation - Parent participation
Outcome Measures	Adolescent's height and weight were measured and BMI was calculated with the CDC's Web-based BMI calculator, pre and post intervention.
Results	13 students completed the program. Five students ended up with lower BMIs, for a total weight loss of 33.25 pounds. Three students gained less than 5 lbs; a decrease from gains in previous years. Two students gained a significant amount of weight. Among the 14 control participants, 3 ended up with lower BMIs, for a total weight loss of 6.5lb. Three students gained less than 5lb and two students gained a significant amount of weight during the year.
Result Keywords	+ Δ BMI in some participants (mixed results)
Quality	(+, 0 , -)
Study	Eliakim A, Kaven G, Berger I, Friedland O, Wolach B & Nemet D. The effect of a combined intervention on body mass index and fitness in obese children and adolescents. <i>Eur J Pediatric</i> ; 2002; 161(8):449-454.
Methods	Class (A, B, C , D) Non randomized trial Follow-up: 3 & 6 months Outcome reliability: Height, weight, BMI Unit of allocation: Group

	Unit of analysis: Individual
Subjects	N (controls baseline) = 25 N (interventions baseline) = 3 months: 177; 6 months: 65 Loss to follow-up: 27 subjects (13%) withdrew. Setting: Child Health and Sports Centre Age range (years): 6-16 Gender: 96% female SES: Not mentioned Ethnicity: Multi-ethnic
Interventions	All subjects and their parents were invited to attend four evening lectures (childhood obesity, general nutrition, therapeutic nutritional approach for childhood obesity, and exercise and obesity) at the Child Health and Sports Centre over the 3 month program. The lectures were presented by physicians and dietitians. Participants also attended visits to the dietitian during the 3 or 6 month program. Adolescents attended the first meeting with both parents and then the adolescent and parents met the dietitian separately. The first session involved learning about obesity, receiving information about dietary choices, dietary and cooking habits, understanding motivation for weight loss, and involving the whole family in the weight loss plan. The following appointments were for nutrition education. The participants also received information from worksheets and flyers, and were given a 1200-2000 hypocaloric diet. Subjects participated in a twice weekly 1-hour per session exercise training program. 25 obese children and adolescents followed by an obesity clinic. The control subjects were referred to an outpatient nutritional consultation once every 3 months and were instructed to perform physical activity on their own.
Keywords	- Community - HE/ PA lessons - PA - Diet plan - Parent participation
Outcome Measures	Weight and BMI for age were measured weekly throughout the program. Fitness was assessed using a treadmill.
Results	Following the 3 month intervention, 65% (117 subjects) of the participants lost weight and 74% (133 subjects) reduced BMI. These decreases were statistically significant. There was a statistically significant increase in body weight and BMI in the control subjects after 3 months. The decrease in body weight and BMI for the 65 subjects who continued the intervention for 6 months, was significantly greater compared to subjects who discontinued the program after 3 months. During the 6 months, 37% of the participants (24 subjects) lost weight and 69% (45 subjects) reduced BMI.
Result Keywords	+ Δ BMI
Quality	(+, 0, -)
Study	Frable J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a retrospective critical examination of program evaluation. <i>Prev Chronic Dis</i> ; 2006; 3(3):A98. Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community campus partnership to prevent obesity. <i>Journal of Interprofessional Care</i> , Volume 18, Number 4, November 2004, pp. 447-449(3).
Methods	Class (A, B, C, D) Longitudinal Follow-up: 12 week

	<p>Outcome reliability: Variety of measures used Unit of allocation: Community Unit of analysis: Individual</p>
Subjects	<p>N (controls baseline) = None N (interventions baseline) = 282 Loss to follow-up: Not indicated Setting: Community Age range (years): 46% of participants were younger than 19 years Gender: 72% female SES: below poverty Ethnicity: Multi-ethnic</p>
Interventions	<p>A multi-disciplinary team of university (nursing, nutrition, kinesiology, social work, exercise sciences) and community consultants designed the program. 4 focus groups were held with potential participants to determine class content. More than 160 undergraduate and graduate students from two universities served as educators, exercise leaders, meal preparation and service coordinators, table-talk leaders, child care workers, health screeners, and research assistants. Phase 1 was offered twice in 2003 (summer and fall) and consisted of 12 weekly sessions, prescreening, and post-screening. Participants chose to enroll in the English- or Spanish-language version of phase 1. The intervention consisted of free weekly family meals, table talks, PA and nutrition classes. Culturally acceptable, affordable meals emphasized grains, fruit and vegetables, no added salt and limited fat. Families took home recipes, fresh produce and leftovers.</p>
Keywords	<ul style="list-style-type: none"> - Community - Low SES - Multi-ethnic - Meals - PA - PA/HE lessons - Family
Outcome Measures	<p>Outcome measures were based on national guidelines: <i>Healthy People 2010</i>, <i>Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults</i>, <i>Recommendations to Increase Physical Activity in Communities</i>, and <i>Dietary Guidelines for Americans</i>. Pre and post intervention measures included: health status, blood pressure, weight, height, body fat, BMI, waist/hip ratio, food frequency, 24 hour diet recall, PA patterns, nutrition/exercise knowledge, and participant satisfaction. Participants, 5 years and older, set 2 goals for eating, exercise, or weight management, evaluated post intervention. Program evaluation was determined by interview, direct measurement, and self-report.</p>
Results	<p>The program met stated objectives and extensively engaged students from several health disciplines in service learning. The objectives included:</p> <ol style="list-style-type: none"> 1. Participants will demonstrate a statistically significant improvement in nutrition and exercise knowledge scores. 2. Seventy percent of participants 5 years or older will report dietary improvements from baseline to model component of the 2000 <i>Dietary Guidelines for Americans</i>. 3. Seventy percent of participants will report an increase from self-reported baseline in frequency, intensity, or duration of exercise. 4. Fifty percent of the adolescent and adult participants who are overweight at baseline will show an improvement in weight management. 5. Sixty percent of the participants will complete the program by attending at

	least 8 of the 12 sessions and providing follow-up data.
	6. Seventy percent of the children will report satisfaction with the food served and education sessions.
Result	+ Δ weight management of 50% adolescents
Keywords	
Quality	(+, 0, -)
Study	French S, Story M, Fulkerson J & Hannan P. An Environmental Intervention to Promote Lower-Fat Food Choices in Secondary Schools: Outcomes of the TACOS Study. <i>Amer. J. Pub. Health.</i> 2004; 94(9): 1507-1512.
Methods	Class (A, B, C, D) Randomized Control Trial Follow-up: 2 years Outcome reliability: Some outcomes self-reported Unit of allocation: School Unit of analysis: School and individual
Subjects	N (controls baseline) = 10 schools N (interventions baseline) = 10 schools A random sample of 75 students per school were surveyed Loss to follow-up: Not indicated Setting: School Age range (years): 14-18 (Secondary School) Gender: Mixed SES: On average 9% of students were eligible for free lunch meals Ethnicity: 14% non-white
Interventions	The intervention involved modification of the school food environment and peer promotion of healthy foods. The environmental change comprised of increasing availability of lower-fat foods in a la carte areas by 30% above baseline to an ultimate goal of 50% of products as lower fat options. Peer promotions included highlighting 1 or more of the lower fat foods in a la carte areas and acting as liaisons between food services and students.
Keywords	- School - Environment - HE promotion / media - Peer modeling
Outcome Measures	A la carte sales were measured from electronic cash register sales records. School food service revenues were collected at the end of each school semester. Students were surveyed to measure changes in food choices, perceptions of the school food environment and behavioural intentions.
Results	There were no significant intervention-related differences for lower-fat to higher-fat choices, added fat scores, and fruit and vegetable scores. Students in the intervention school were more likely to perceive that the school offered enough lower-fat options, that the adults at school encouraged them to eat lower-fat options, that their friends bought lower-fat foods, and that it was easier to determine which foods were lower-fat. No significant differences were seen for intentions to buy lower fat foods. No significant differences were seen over time for any of the school food services revenue variables.
Result	+ Δ perceived nutrition knowledge of lower fat foods
Keywords	∅ Δ reported dietary behaviour
Quality	(+, 0, -)
Study	Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. <i>J Pediatr Nurs</i> ; 2003; 18(1):36-45.

Methods	Class (A, B, C, D) Quasi-experimental Follow-up: <4 months (4 classroom and 4 small group sessions) Outcome reliability: variety of questionnaires used Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 57 N (interventions baseline) = 60 Loss to follow-up: Not indicated Setting: School Age range (years): 12-17 Gender: 47% male, 52% female SES: Low SES Ethnicity: Multi-ethnic
Interventions	Students in the intervention group received four classroom interventions with the use of a combined Health Promotion/ Transtheoretical Model to control fat in diet and increase physical activity. All sessions took place in the Family and Consumer Education (FACE) class. Each session lasted 45 minutes and focused on raising consciousness and self-reevaluation, because the majority of students were in the pre-contemplation and contemplation stages. Separate smaller group sessions were held for students in the preparation, action and maintenance stages of change. The intervention was delivered by graduate nursing students. A control group (n = 57) received the usual classroom education.
Keywords	<ul style="list-style-type: none"> - School - Classroom (family and consumer ed) - HE/ PA lessons - Low SES - Multi-ethnic - Stages of change - Behavioural
Outcome Measures	<ul style="list-style-type: none"> - access to healthy foods and availability of low-fat foods - temptation to eat high-fat foods - benefits and barriers to eating a diet with 30% or fewer calories from fat measured with the Decisional Balance Questionnaire - stages of change from the beginning of the school year - percentage dietary fat and frequency of consumption of high- and low-fat foods measured by the Food Habits Questionnaire (FHQ) - physical activity
Results	Posttest percentage fat in food was significantly less for the intervention group as compared with the control group (t = 2.06; df, 115; p = .04).
Result Keywords	+ Δ percentage fat intake
Quality	(+, 0, -)
Study	Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. <i>Appl Nurs Res.</i> 2005; 18(1):13-21.
Methods	Class (A, B, C, D) RCT Follow-up: After 4 sessions Outcome reliability: Multiple questionnaires Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 49 (Diet)

	<p>N (interventions baseline) = 46 (Diet), 40 subjects received more than half of the nutrition modules, 6 received less than half. Loss to follow-up: 23% Setting: School Age range (years): 12-14 Gender: 56% female SES: Low income Ethnicity: Multi-ethnic</p>
Interventions	<p>The intervention was based on the HP/TM. An eight session Blackboard platform delivered Internet approach with four 2- to 3- minute videos was used in 7th grade science class. The intervention was conducted in a computer laboratory where each student had a computer. The students were involved in preparing “on-line” healthy snacks, overcoming barriers to eating healthy foods, discussions of ingredients and sharing recipes, raising awareness of the need for food early in the day, choosing PA, and balancing calories eaten with calories burned. The subjects were asked to respond to 16 radio buttons with HP/TM tailored computer generated feedback and to type 10 discussion board answers for which individualized feedback was given. Each session lasted a class period (40 mins).</p> <p>The control group was comprised of 3 7th grade science classes who had their usual assignments.</p>
Keywords	<ul style="list-style-type: none"> - School - Classroom (science) - Low SES - Multi-ethnic - Computer - HE/ PA lessons
Outcome Measures	<ul style="list-style-type: none"> - percentage dietary fat and frequency of consumption of high- and low-fat foods measured by the Food Habits Questionnaire (FHQ) - physical activity
Results	<p>Those completed more than half the sessions increased exercise, $t(103) = -1.99, p = .05$, and decreased the percentage of dietary fat, $t(87) = 2.73, p = .008$.</p> <p>Subjects ($n = 40$) who received more than half of the nutrition modules decreased percentage of dietary fat from 30.7 to 29.9. The control group had 31.5% dietary fat in the prettest and 31.6% in the posttest.</p> <p>Dietary fat was decreased across all racial groups participating in more than half the sessions.</p>
Result Keywords	+ Δ dietary fat intake
Quality	(+, 0, -)
Study	Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. Archives of pediatrics & adolescent medicine. 1999; 153 (4): 409-18.
Methods	<p>Class (A, B, C, D) RCT Follow-up: 2 school years Outcome reliability: Variable Unit of allocation: School Unit of analysis: Individual</p>
Subjects	N (controls baseline) = 654

	<p>N (interventions baseline) = 641 Loss to follow-up: 18% Setting: School Age range (years): Gender: 48% female SES: Diverse Ethnicity: Multi-ethnic</p>
Interventions	<p>The Planet Health program used concepts from the behavioral choice and social cognitive theories. Students participated in a school-based interdisciplinary intervention over 2 school years. Each intervention school received teacher training workshops, classroom lessons, PE materials, wellness sessions, and fitness funds. Planet Health sessions were included within existing curricula using classroom teachers in 4 major subjects and physical education. The intervention comprised of a total of 16 core lessons each in year 1 and 2. Sessions focused on decreasing television viewing, decreasing consumption of high-fat foods, increasing fruit and vegetable intake, and increasing moderate and vigorous physical activity. Control schools received their usual health curricula and PE classes and none of the Planet Health program.</p>
Keywords	<ul style="list-style-type: none"> - School - Classroom (4 subjects + PE) - HE/ PA/↓SA lessons - PA
Outcome Measures	<p>Height, weight and triceps skinfolds were measured. Dietary intake, television viewing and PA were measured with an optically scannable Food and Activity Survey. Assessment of intake of fruits and vegetables, percentage of energy from fat and saturated fat, and total energy intake was made using the Youth Food Frequency Questionnaire, which was adapted and validated for ethnically and socio-economically diverse youth. Self-reports of weight-loss behavior were adapted from national surveillance indicators.</p>
Results	<p>The prevalence of obesity among girls in intervention schools was reduced compared with controls, controlling for baseline obesity (odds ratio, 0.47; 95% confidence interval, 0.24-0.93; $P = .03$), with no differences found among boys. There was greater remission of obesity among intervention girls vs control girls (odds ratio, 2.16; 95% confidence interval, 1.07-4.35; $P = .04$). The intervention reduced television hours among both girls and boys, and increased fruit and vegetable consumption and resulted in a smaller increment in total energy intake among girls. Reductions in television viewing predicted obesity change and mediated the intervention effect. Among girls, each hour of reduction in television viewing predicted reduced obesity prevalence (odds ratio, 0.85; 95% confidence interval, 0.75-0.97; $P = .02$).</p>
Result Keywords	<p>+ Δ obesity prevalence among girls \emptyset Δ obesity prevalence among boys + Δ fruit/ vegetable intake; energy intake</p>
Quality	<p>(+, 0, -)</p>
Study	<p>Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. Evidence Based Nursing; 2000: 3:13.</p>
Methods	<p>Class (A, B, C, D) RCT Follow-up: 2 school years Outcome reliability: Tricep skinfold dependent on the assessor</p>

	Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) & N (interventions baseline) = 1560 (distribution not indicated) Loss to follow-up: 18% Setting: School Age range (years): 11-12 Gender: 48% female SES: Not indicated Ethnicity: 69% white
Interventions	5 schools were allocated to the Planet Health programme, which consisted of teacher training workshops, classroom lessons, physical education materials, wellness sessions, and fitness funds. The programme included 32 (16/y) lessons focused on television viewing, activity, and diet provided across 4 subjects: language arts, mathematics, science, and social studies. Teaching methods encouraged active student participation. 5 schools were allocated to the usual health and physical education curricula (control schools). Classroom curriculum included increasing fruit and vegetable intake, decreasing fat intake, being active and reducing screen time.
Keywords	<ul style="list-style-type: none"> - School - Classroom (language arts, mathematics, science, and social studies) - HE/ PA/ JSA lessons <ul style="list-style-type: none"> o F/V, fat intakes - PA - Behavioural
Outcome Measures	BMI Tricep skinfold
Results	Analysis was by intention to treat. The prevalence of obesity decreased for girls in the intervention schools (odds ratio [OR] 0.47, 95% CI 0.24 to 0.93, p=0.03) but not for boys (OR 0.85, CI 0.52 to 1.39, p=0.48). Girls in the intervention schools also had a higher rate of remission of obesity (OR 2.16, CI 1.07 to 4.35, p=0.04). Television and video viewing decreased for girls (0.58 h reduction, p=0.001) and boys (0.4 h reduction, p<0.001) in the intervention schools compared with the control schools. Regression analysis found that each hour of reduction in television viewing among girls in the intervention schools was independently associated with a reduction of obesity prevalence (OR 0.85, CI 0.75 to 0.97, p=0.02) and with increased remission of obesity (OR 1.92, CI 1.37 to 2.70, p=0.002). Girls in the intervention schools ate an average of 0.32 more servings of fruit and vegetables each day (p=0.003) and consumed 575 less kJ/day of total energy (p=0.05) than girls in the control schools. The groups did not differ for moderate or vigorous activity levels or total percentage of energy from fat.
Result Keywords	+ Δ obesity prevalence among girls Ø Δ obesity prevalence among boys + Δ fruit/ vegetable intake; energy intake
Quality	(+, 0, -)
Study	Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. J Sch Health. 2004 Jan;74(1):10-5.
Methods	Class (A, B, C, D) RCT Follow-up: 12 month Outcome reliability: Height, weight reliable Unit of allocation: School, Family





	Unit of analysis: Individual
Subjects	N (controls baseline) = 19 N (interventions baseline) = 22 Loss to follow-up: Not indicated Setting: School Age range (years): 11-14 Gender: 36.4% male SES: Not indicated Ethnicity: Multi-ethnic
Interventions	The program was designed to be family centred, culturally sensitive and interactive. It focused on slowing weight gain and improving glucose metabolism, through nutrition, PA and CST for 16 weeks. Classes were provided weekly, lasting 45 min. A brief nutrition assessment was completed with each student and evaluated by the registered dietitian to elicit information regarding previous diets, food consumption habits, dining styles, and daily activities. A non-diet approach taught participants to incorporate a pattern of regular meals with a dietary goal of nutritious and satisfying meals that decreased portion size. Creation of weekly goals with assistance from the registered dietitian supported participants in taking small steps toward success. Participants and their parents were encouraged to attend the weekly classes, which used culturally appropriate materials for Hispanic and African American families. Classes included "Multi-Cultural Pyramids," "Dining Out in The Fast Food Lane," "Basics To Building Better School Lunches," and the "Supermarket Tour," which assisted families in creating appealing ethnic meals while reinforcing reasonable portion sizes.
Keywords	<ul style="list-style-type: none"> - School - Family - Multi-ethnic - DM prevention - HE/ PA lessons <ul style="list-style-type: none"> o Regular meals, portion size - PA - Behavioural
Outcome Measures	BMI Weight Central adiposity Dietary intake, knowledge and self-efficacy
Results	<p>BMI (kg/m²): At follow-up: Intervention: 35.9 (SD 6.8) Comparison: 37.8 (SD 7.7)</p> <p>Weight (lb): At follow-up: Intervention: 214.6 (SD 49.1) (97.3 [SD 22.3] kg) Comparison: 230.3 (SD 58.8) (104.5 [SD 26.7] kg)</p> <p>Central adiposity (inches): At follow-up: Intervention: 44.5 (SD 6.7) (113.0 [SD 17.0] cm) Comparison: 46.8 (SD 7.0) (118.9 [SD 17.8] cm) There was no statistically significant difference between groups in change from baseline to 12-month follow-up.</p> <p>No statistically significant difference in terms of usual food choices, dietary knowledge, dietary self-efficacy, or intake of energy, carbohydrate and saturated fat was shown between groups at follow-up.</p>
Result	Ø Δ weight/BMI from baseline

Keywords	Ø Δ usual food choices, dietary knowledge, SE or intake
Quality	(+, 0, -)
Study	Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. <i>Obesity</i> ; 2006: 14:847-854.
Methods	Class (A, B, C, D) RCT Follow-up: 2 year Outcome reliability: BMI Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 756 N (interventions baseline) = 1226 Loss to follow-up: 150 at end of 1 st year, 336 at end of 2 nd Setting: School Age range (years): 13.04 (SD 0.79) Gender: 40% female SES: 68% low SES Ethnicity: Not indicated
Interventions	This school based intervention program aimed at promoting healthy food and physical activity through the creation of a physically active lifestyle with a healthy diet. A workgroup was created in each of the intervention sites and received guidelines on how to address the intervention topics. Physical activity was addressed by increasing PA to at least 60 minutes per day through additional opportunities to be active during school breaks and classroom hours. An average of an additional 4.7 hours of physical activities was introduced to intervention schools in addition to extra resources, the promotion of physical activity in the classroom. The food intervention focused on behavioral changes to increase fruit, vegetable and water, and reduce soft drink and fat intakes. These were supported by environmental changes including offering fruit and vegetables at very low prices, offering fruit as dessert during lunch break, promoting water intake with the supply of free water bottles, and information, in the form of posters and folders, on the benefits and health consequences of dietary choices. In the classroom, 2 hours were spent on the promotion of healthy eating at the personal level. A computer tailored intervention was provided during 1 hour, with tailored feedback and fat and fruit advice. Teachers were encouraged to organize additional healthy eating activities, games and competitions as suggested in the intervention manual. In five of the intervention schools efforts were made to involve parents, through interactive meetings on healthy food, physical activity and the relationship with overweight and health. Health and nutrition information was published in the school newspaper; parents received information folders and a free CD with the adult computer-tailored intervention for fat intake and PA to complete at home. Parents were also asked to support their child to create a healthier lifestyle.
Keywords	- School - Low SES - HE/ PA lessons o F/V, water, soft drink, fat intake - PA

	<ul style="list-style-type: none"> - Parent participation - Computer - Environment - Behavioural
Outcome Measures	Weight Height BMI
Results	In girls, BMI and BMI z-score increased significantly less in the intervention with parental support group compared with the control group ($p < 0.05$) or the intervention-alone group ($p = 0.05$). In boys, no significant positive intervention effects were found.
Result	+ Δ weight/BMI in girls
Keywords	\emptyset Δ weight/BMI boys
Quality	(+, 0, -)

Study	Hawley SR, Beckman H & Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. J Community Health Nurs; 2006: Vol. 23 (2), pp. 69-80.
Methods	Class (A, B, C, D) Pre-posttest Follow-up: 12 months Outcome reliability: self-reported Unit of allocation: School, Family Unit of analysis: Individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 65; 25 families Loss to follow-up: 11/25 Setting: School Age range (years): 11-13 Gender: Not indicated SES: 8% from single parent families Ethnicity: Not indicated
Interventions	<p>The project included 2 studies over 12 months. Study 1 was designed to raise community awareness of obesity in youth, assess the scope of the problem within a 3 county area, evaluate risk factors and how they may pertain to rural community interventions, and establish a multi-agency network of concerned professionals. Study 2 implemented a community-based obesity prevention program for sixth graders in Hesston, a town of 3,500 people in Harvey County.</p> <p>The Pilot Community Prevention Program consisted of two components: delivery of a 5-session middle school classroom program over a 6-week period and implementation of a community event to promote PA and nutrition.</p> <p>The program consisted of five 40 minute sessions during physical education classes for all sixth grade students. The sessions took place over 6 weeks and consisted of adventure/ experiential games and tasks. All students were provided a Family Field Guide that included guidelines for getting started, changing behaviors, charting and monitoring goals, and having fun working toward health goals, as well as information about health basics, nutrition and fitness. Health related recreational incentives were provided to students who participated.</p>
Keywords	<ul style="list-style-type: none"> - School / community - Classroom (PE) - Family - HE/ PA lessons

	- Behavioural
Outcome Measures	Self-reported PA Eating behaviours measured from total kcal and fat grams from 24h recall Weight, Height
Results	<p>There were no significant changes in students' individual health attitudes and behaviors from intervention pretest and posttest. Significant changes did occur among families across the 6-week intervention. Families saw the goal of healthy eating as significantly more important after the intervention ($z = -2.00, p < .05$) based on a 7-point Likert-type scale to gauge self-efficacy. Families as a whole significantly increased their level of PA, from a mean of 1.44 METs at pretest to a mean of 7.56 METs at posttest. Families did not show a significant improvement in their knowledge of nutrition and goal setting or in their view of the importance of being physically active.</p> <p>Over the course of the intervention, there was a shift in the families' readiness for change in the areas of exercise and nutrition.</p> <p>The lack of impact on students' may have been due to the more advanced understanding of the importance of good nutrition and fitness they students displayed pretest.</p>
Result Keywords	Ø Δ health behaviours among adolescents + Δ health behaviours among families
Quality	(+, 0, -)
Study	Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. <i>Pediatr Nurs.</i> 1998; 24: 127–132.
Methods	Class (A, B, C, D) Quasi-experimental Follow-up: 3 seasonal periods Outcome reliability: Weight, height reliable; 24h recall questionable Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 10 N (interventions baseline) = 13 Loss to follow-up: None indicated Setting: School (biology class) Age range (years): 14-17 Gender: 10 males, 13 females SES: Not indicated Ethnicity: 87% Caucasian
Interventions	Education was provided about total serum cholesterol levels; HDL; LDL; fast food information; "Heart Healthy and Heart Hurting Foods;" sedentary activities; and light, moderate, and vigorous exercise. The content was taught over 20-30-minute periods in three curricular sections covering cholesterol, nutrition, and exercise. Handouts were provided to reinforce the content delivered.
Keywords	<ul style="list-style-type: none"> - School - Classroom - Heart Health Promotion - Family - HE/ PA/ ↓SA lessons
Outcome Measures	Serum cholesterol Dietary intake (fat content) measured through 24h dietary recall Physical activity measured through 7 day exercise recall Blood pressure Weight and height

Results	No significant differences were seen for either total serum cholesterol levels or dietary fat intake between the intervention and control groups.
Result	Ø Δ serum cholesterol
Keywords	Ø Δ dietary fat intake
Quality	(+, 0, )
Study	Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. Can J Pub Health. 2001; 92(6):448-452.
Methods	Class (A, B, C, ) Pre/ post-test Follow-up: 10 months Outcome reliability: Self-reported Unit of allocation: Group Unit of analysis: Individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 43 Loss to follow-up: Not indicated Setting: Community Age range (years): 10-15 Gender: Female SES: Low SES Ethnicity: Not indicated
Interventions	The intervention consisted of a 80 contact hours through weekly recreation program that included physical, social and developmental recreation, including initiative/ cooperative games, videos and bake sales. Issues such as health habits, physical activity and empowerment were included. Healthy snack preparation and planning skills included in each session.
Keywords	- Community - Low SES - Female - HE/ PA lessons - PA - Body Image - Food preparation - Behavioural
Outcome Measures	Psycho-social constructs Health knowledge and behaviours assessed with a health habits survey and a qualitative assessment
Results	Health behaviours remained stable over the duration of the intervention. No changes were seen for healthy eating, physical activity or smoking. 91% of participants reported during the qualitative evaluation that the intervention helped them eat well and be physically active.
Result	+ Δ reported dietary intake
Keywords	
Quality	(+, 0, )
Study	Horowitz M, Shilts MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. J. Nutr. Educ. Behav. 2004 36:1 (43-44).
Methods	Class (A, B, C, ) Non comparative study Follow-up: Not indicated (after 9 lessons) Outcome reliability: Self-reported Unit of allocation: School Unit of analysis: Individual

Subjects	N (controls baseline) = 0 N (interventions baseline) = 34 Loss to follow-up: Not indicated Setting: School Age range (years): 11-15 Gender: Not indicated SES: Not indicated Ethnicity: Not indicated
Interventions	The EatFit intervention is based on the social cognitive theory and has 3 components: 1) Workbook: Each student receives a copy of the 20 page magazine style workbook. 2) Web-based assessment: A personalized assessment program allows students to enter a 24-hour diet record and provides dietary feedback, goal setting, and a contract. 3) Classroom curriculum for the teacher/ leader: the curriculum includes 9 experiential lessons that teach skills, provide goal performance feedback, practice behaviors, and motivate. The topics include dietary and PA goal setting, reading food labels, eating at fast food outlets, learning the physical activities and understanding the influence of media.
Keywords	- School - Classroom - Computer - Behavioural - HE/ PA/ ↓SA lessons o Label reading, fast food
Outcome Measures	Dietary and PA behaviours
Results	Students made positive changes in dietary behaviors (41%), dietary self-efficacy (29%), physical activity behaviors (56%), and physical activity self-efficacy (26%). Student self-assessments indicated 74% made on lasting improvement in dietary behaviors and 79% made one lasting change in PA behaviors.
Result	+ Δ dietary behaviours & SE
Keywords	+ Δ PA behaviours & SE
Quality	(+, 0, -)
Study	Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. <i>International journal of obesity</i> ; 2006: VL30(1): 31-9.
Methods	Class (A, B, C, D) Nonrandomized control trial Follow-up: 4 month, 10 month Outcome reliability: BMI Unit of allocation: Group Unit of analysis: Individual
Subjects	N (controls baseline) = 13 N (interventions baseline) = 76 Loss to follow-up: 18% Setting: Community Age range (years): 13-16 Gender: Mixed SES: Middle SES Ethnicity: 79% Caucasian

Interventions	<p>Adolescents were randomly assigned to one of two treatment conditions: cognitive-behavioral group treatment with 'adventure therapy' similar to Outward Bound (cognitive-behavioral treatment with peer-enhanced adventure therapy (CBT + PEAT)) or cognitive-behavioral group treatment with aerobic exercise (CBT+EXER). Both group-based interventions included 16 weekly sessions, with parents and adolescents attending separate concurrent meetings, followed by 4 monthly maintenance sessions. Adolescents were prescribed a balanced deficit diet based on the dietary exchange system and asked to gradually increase PA to a minimum of 30 minutes daily for 5 days a week. In addition to weekly meetings, adolescents attended bi-weekly dyad meetings with the participating parent. Adolescents who lost ½ pound weekly were entered into a raffle for a small prize.</p> <p>Cognitive behavioral weight loss intervention was standard across both group conditions, and included topics such as self-monitoring, motivation for weight loss, goal setting, the importance of PA, use of parent-teen contracts to support nutrition and PA goals, social influences on diet and exercise, the relationship between stress and eating, and relapse preventions. Nutrition topics included the exchange system, portion control, dietary fat, and health snack choices. These were presented by a dietitian. All adolescents participated in 30 minutes of on-site PA. In addition to the CBT, adolescents participated in either supervised 60 minutes of PA or a session of peer-based intervention, held separately. The peer-enhanced adventure therapy consisted of both physical and mental challenges aimed at developing social skills, problem solving and self-confidence.</p>
Keywords	<ul style="list-style-type: none"> - Community - HE/PA lessons - PA - Behavioural - Peer modeling
Outcome Measures	Weight, Height, BMI Self-perception
Results	Adolescents assigned to both treatment conditions demonstrated significant weight loss over time, $F = 29.06$, $df = 2, 53$, $P < 0.01$. Average weight loss did not differ significantly between groups (-5.31 kg for CBT + PEAT and -3.20 kg for CBT + EXER) at the end of treatment. There was a significant difference in the percentage of participants maintaining a minimum 4.5 kg (10 pounds) weight loss (35% in the CBT + PEAT condition vs 12% in the CBT+EXER condition, $P = 0.042$) 10 months from randomization. Older adolescents randomized to CBT + PEAT demonstrated more than four times the weight loss of older adolescents assigned to CBT + EXER ($M = -7.86$ kg vs $M = -1.72$ kg) at the end of treatment.
Result	+ Δ weight
Keywords	+ Δ weight – lasting over time
Quality	(+, 0, -)
Study	Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for overweight adolescents: Some preliminary findings. <i>J Clin Psychol Med Settings</i> . 2002; 9(1):15-23.
Methods	<p>Class (A, B, C, D) Pre-posttest Follow-up: 6 month Outcome reliability: Height, weight Unit of allocation: Group Unit of analysis: Individual</p>

Subjects	N (controls baseline) = 0 N (interventions baseline) = 16 Loss to follow-up: 1 Setting: Community Age range (years): 13-16 Gender: 11 female, 5 male SES: Not indicated Ethnicity: Not indicated
Interventions	Adolescents and their parents attended separate weekly group meetings over 16 weeks. Each group session lasted 60 minutes, was focused on behavioral weight management and was led by a psychologist. A dietitian attended session periodically to present nutrition information. Adolescents set weekly dietary and physical activity goals. The nutrition plan was based on the dietary exchange system. Foods were organized in six groups: starch, fruit, milk, vegetable, meat and other proteins, and fat. Participants were instructed to follow a 1400 calorie per day diet. Parent sessions addressed strategies for supporting healthier eating and physical activity patterns for the entire family. Adolescents also participated in a 90-minute peer skills training intervention during a second evening weekly. The curriculum consisted of 16 activities, beginning with a warm up, followed by the primary group challenge and group members setting personal goals for the week. Group activities consisted of both mental and physical challenges. Following the 16-week active intervention, adolescents and parents returned for 4 monthly, 60-minute, weight management related maintenance sessions.
Keywords	<ul style="list-style-type: none"> - Community - Family - HE/ PA lessons - PA - Diet plan <ul style="list-style-type: none"> o Dietary exchange system o Hypocaloric - Behavioural
Outcome Measures	Height, Weight BMI Self perception
Results	<p>Participants lost an average of 14.72lb over the course of the intervention, approximately 14% decrease in percent overweight. 14 participants were available for follow-up after 6 months. There was a significant effect for time for both absolute weight loss and percent overweight. For the 14 participants, the average weight loss during the 16-week intervention was 15.46 (decrease of 15.12% percent overweight); with an additional 2.27lb (additional decrease of 5.56% percent overweight) lost from the end of the intervention to the 6-month follow up.</p> <p>Significant improvements over time were observed in self worth, as well as dimensions of physical appearance, and romantic appeal.</p>
Result Keywords	+ Δ weight + Δ weight – lasting over 6 month F/U + Δ body image
Quality	(+, 0, -)
Study	Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. Arch Dis Child; 2005: Vol. 90 (12), pp. 1235-8.

Methods	<p>Class (A, B, C, D) RCT Follow-up: 2 year Outcome reliability: reliable Unit of allocation: School, Family Unit of analysis: Individual</p>
Subjects	<p>N (controls baseline) = 39 N (interventions baseline) = 36 Loss to follow-up: 3 from intervention group, 4 from control Setting: School Age range (years): 12-15 Gender: 61% male SES: Not indicated Ethnicity: Chinese</p>
Interventions	<p>The treatment group participated in a family based behavioural treatment program for two years. A detailed dietary modification plan was implemented in each treatment group family. A "traffic light" food item list was given to the children to help decrease energy intake and promote a balanced diet: "red light" foods were those high in fat or calories; "green light" foods were low in fat and calories; and "yellow light" foods were intermediate. In the treatment group the children and their parents were informed about the daily calorie requirements, based on the Chinese recommended daily allowance. We also gave the Chinese food composition tables to each family, so they could calculate the calorie intake of their child every day and compare with the calorie requirements. In order to avoid the feeling of hunger and limit the calorie intake, some dietary behaviours were suggested to the family, including eating slowly, having soup before meals, eating green light foods first, brushing teeth immediately after each meal, and having meals without staple foods for supper. What the child ate every day was recorded in the diary. The researchers checked the diary at home visits and evaluated the dietary intake. Dietary suggestions were given to the family after each evaluation. Exercise for 20–30 minutes per day for four days per week (three weekdays and one day on weekends) was advised. The children were asked to choose from running, playing football, climbing stairs, and using a skipping rope.</p>
Keywords	<ul style="list-style-type: none"> - School - Family - Chinese ethnicity - HE/ PA lessons - Diet plan <ul style="list-style-type: none"> o Traffic light diet - PA plan - Behavioural
Outcome Measures	<p>Height, weight Blood pressure Cholesterol TG level</p>
Results	<p>BMI was significantly reduced in the treatment group but not in the control group. Total cholesterol decreased 5.5% and triglycerides 9.7% in the treatment group. There was a significant correlation between change in BMI and change in triglycerides. There were no significant changes in plasma lipids in the controls. Blood pressure values also decreased significantly in the treatment, but not the control group.</p> <p>Height Mean change Intervention: +8.2 (SD 4.3) Control: +8.0 (SD 3.9) There was a similar increase in height in both groups.</p>

	BMI: Mean change Intervention: -2.6 (SD 1.6) Control: -0.1 (SD 1.1) Weight (kg) Mean change Intervention: -0.3 (SD 4.3) Control: +5.5 (SD 3.5)
Result	+ Δ BMI
Keywords	+ Δ BP, TG & Total cholesterol + Δ body image
Quality	(+, 0, -)
Study	Johnson WG, Hinkle LK, Carr RE, Anderson DA, Lemmon CR, Engler LB & Bergeron KC. Dietary and exercise interventions for juvenile obesity: long term effect of behavioral and public health models. <i>Obes Res</i> : 1997; 5(3):257-261.
Methods	Class (A, B, C, D) Non randomized control trial Follow-up: 9 weeks, 15 weeks, 5 years Outcome reliability: Measured by trained staff Unit of allocation: Group, Family Unit of analysis: Individual
Subjects	N (controls baseline - INFO) = 9 N (interventions baseline – EN and NE) = 19 Loss to follow-up: 6 participants from each group were followed for 5 years Setting: School Age range (years): 8-17 Gender: 72% female SES: Not indicated Ethnicity: Not indicated
Interventions	This study investigated the influence of nutrition and exercise interventions within cognitive/behavioral and public health formats on weight and blood lipid profiles in obese children. Three conditions were compared over 16 sessions: nutrition and eating-habit change followed by exercise (NE), exercise followed by nutrition and eating-habit change (EN), and an information control (INFO). NE and EN were presented in a cognitive/ behavioral framework which focused on the development of self-regulation whereas the INFO condition received the same material in a public health/educational model.
Keywords	- Community - HE/ PA lessons - PA - Family involvement - Behavioural
Outcome Measures	Body weight Blood lipids
Results	A significant, but modest, change in weight and blood lipids was seen for NE and EN participants. These changes were maintained at a five-year follow-up. INFO participants displayed stable weight and blood lipids during the course of the program, and most remained morbidly obese at follow-up. Improved nutrition, increased physical activity and fitness were significantly correlated with weight and lipid reductions.
Result Keywords	+ Δ body weight participants receiving both nutrition and eating-habit change and exercise + Δ nutrition habits of NE and EN
Quality	(+, 0, -)

Study	Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. J. Am. Diet. Assoc. 1999 99:8 (967-970).
Methods	Class (A, B, C, D) Non comparative study Follow-up: 10 week Outcome reliability: self-reported Unit of allocation: School, Family Unit of analysis: Individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 19 Loss to follow-up: Not indicated Setting: School Age range (years): 11-13 Gender: Females SES: Not indicated Ethnicity: African American, Latina
Interventions	<p>The study involved separate focus groups with middle school girls and mothers. Three focus groups were conducted with the girls and two with their mothers.</p> <p>The first focus group with the girls was to establish a rapport, to identify eating and PA patterns, and to obtain an impression of the girls' daily schedules. The second focus group focused on attitudes towards sports and athletic role models, specific barriers to and incentives for healthful eating and regular PA, and reactions to a prototype intervention.</p> <p>The findings from the focus group formed the basis for the creation of the Culver City Youth Health Center Teen Activity Project (TAP).</p> <p>TAP was offered as a 10-week elective class (for girls only) as part of the Culver City Middle School's After School Program. The class met 3 days a week for 3 sessions. Each class consisted of a 20 to 30 minute discussion or activity about nutrition, fitness and /or body image, followed by a 30 to 40 minute hip-hop aerobic dance and strength training with light free weights. Healthful tasty snacks were provided at every class.</p> <p>All TAP classes were led by African-American or Latina peer leaders and a young, energetic registered dietitian, with a background in fitness. The peer leaders served as influential role models; made the TAP classes more attractive to middle school girls; and gained a sense of pride and heightened self-esteem as they became recognized in the community as nutrition and fitness leaders.</p> <p>The information, skills and healthful behaviors were also reinforced at school and home. A food and nutrition committee of students, parents and nutrition professionals, was developed to advocate for changes in school foodservices. Parents and teachers were invited to participate in TAP night sessions once a week.</p>
Keywords	<ul style="list-style-type: none"> - After-School - Females - African American, Latina ethnicity - HE/ PA lessons - PA - Peer modeling - Behavioural

Outcome Measures	Dietary habits
Results	A majority of the girls reported poor dietary habits. Skipping meals, particularly breakfast, was reported as a preferred way to control body weight. High fat and high sugar foods were common food choices. The TAP program participants showed improved knowledge about fitness and healthful food choices and demonstrated improved skills in choosing low-fat and high fibre foods. However there were few changes in the girls' actual foods choices. No statistically significant changes were detected.
Result Keywords	+ Δ nutrition and PA knowledge (not significant) \emptyset Δ actual food choices
Quality	(+, 0, -)
Study	Long JD & Stevens KR. Using technology to promote self-efficacy for healthy eating in adolescents. J Nurs Scholarsh. 2004;36(2):134-9.
Methods	Class (A, B, C, D) RCT Follow-up: 1 month Outcome reliability: Questionnaires (pre-validated) Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 58 N (interventions baseline) = 63 Loss to follow-up: None mentioned Setting: School Age range (years): 12-16 Gender: 52% female, 48% male SES: Not indicated Ethnicity: Multi-ethnic
Interventions	The intervention consisted of a combination of 5 hours of Web-based instruction and 10 hours of classroom curriculum, compared to nutrition education embedded in the standard school curriculum during a 1-month period. The Web-based nutrition education was divided into 3 modules a) "Treasure Hunt: A Quest for the Golden Orb," b) Sampler: "Ruby's Café." And c) "WebQuest: Diet and Life-Long Health." Each module was instructionally designed with interactive questions specifically tailored to adolescents. Answers to questions were discovered by students as they explored at their own pace, interacted with peers, and linked to WWW health education sites that used a gaming approach to nutrition education. The classroom curriculum was provided by 4 science teachers. It was behaviorally oriented, activity based, and designed to provide students with the knowledge, skills and attitudes to enable them to adopt eating behaviors that reduce health risks. Participants in control schools received the usual nutrition education embedded in their curriculum.
Keywords	- School - Classroom - Computer - HE lessons - Behavioural
Outcome Measures	Self-efficacy for healthy eating Usual food choices Dietary knowledge Fruit and vegetable intake
Results	The intervention group had significantly higher scores for SE for fruits and vegetables, SE for lower fat, usual food choices, and dietary knowledge of fat

	compared to the control group. No difference was found between groups in food consumption. Self-efficacy was significantly associated with dietary knowledge of lower fat, usual food choices, and was inversely associated with lower-fat consumption in the hypothesized model of eating behavior. The intervention was tailored to the social and developmental preferences of adolescents and effectively increased SE for HE. The mediating role of SE in the hypothesized model of adolescent eating behavior warrants further investigation.
Result	+ Δ SE for HE related to dietary knowledge
Keywords	
Quality	(+, 0, -)
Study	Long J, Armstrong M, Shriver B, LaNell H, Luker S, Nash A & Blevins W. Pilot using world wide web to prevent diabetes in adolescents. Clin Nurs Res; 2006: 15(1):67-79.
Methods	Class (A, B, C, D) Pre-posttest Follow-up: 3 weeks Outcome reliability: BMI, self-assessment Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 21 Loss to follow-up: Not indicated Setting: School Age range (years): 12-16 Gender: 57% male SES: Not indicated Ethnicity: Multi-ethnic
Interventions	Participants received 5 hours of Web-based nutrition education delivered in the school's computer classroom for 45 minutes before school began over a 3 week period. The intervention consisted of an educational web site tailored to the social and developmental preferences of adolescents. The web site used an "edutainment" approach blending learning and entertainment. Educational activities consisted of information on fruits, vegetables and fat intake, nutrition games and dietary self-assessment measures.
Keywords	- School (before school) - Computer - HE lessons o F/V and fat intake o Dietary self-assessment
Outcome Measures	BMI Family history for DM 24h dietary recalls and structured interviews
Results	A significant difference in pre and post intervention fat intake as measured through the dietary assessment was found. No significant difference was found in fruit and vegetable scores by either measure.
Result	+ Δ fat intake
Keywords	\emptyset Δ F/V intake
Quality	(+, 0, -)
Study	McMurray RG, Harrell JS, Bangdiwala SI, Bradley CB, Deng S & Levine A. A school-based intervention can reduce body fat and blood pressure in young adolescents. The Journal of adolescent health; 2002: 31(2): 125-32.
Methods	Class (A, B, C, D) RCT

	<p>Follow-up: 8 weeks Outcome reliability: BMI, weight, height Unit of allocation: School Unit of analysis: Individual</p>
Subjects	<p>N (controls baseline) = 247 N (interventions baseline) = Exo:319, Edo:266, EE: 308 Loss to follow-up: Not indicated Setting: School Age range (years): 11-14 Gender: 630 females, 510 males SES: Not indicated Ethnicity: 64% Caucasian, 36% multi-ethnic</p>
Interventions	<p>Youth were randomly assigned by school into four treatment groups: exercise only (ExO), education only (EdO), exercise and education combined (EE), and control group. The ExO group received 30 minutes of aerobic exercise 3 days a week for 8 weeks. The EdO group received a “knowledge program” that was developed by a state-certified health educator and taught by the regular classroom teacher. The program consisted of information on nutrition, smoking, and exercise, and used existing health curricula materials. The materials were presented in two class periods per week for 8 weeks. The EE group received both programs. The control group received neither exercise nor education.</p>
Keywords	<ul style="list-style-type: none"> - School - Classroom - HE / PA lessons - PA
Outcome Measures	<p>Height, Weight BMI Skinfold thickness Blood pressure</p>
Results	<p>Systolic and diastolic blood pressures increased more in the control group than in the intervention groups ($p = .001$). The BMI did not change significantly ($p = .709$), but the sum of skinfolds increased less in subjects in the exercise intervention groups than the education only or control groups ($p = .0001$). The small increase in (p)VO₂max of the combined exercise and education group was significantly greater than the education only group ($p = .0001$).</p>
Result Keywords	<p>+ Δ BP \emptyset Δ BMI \emptyset Δ Skinfolds</p>
Quality	<p>(+, 0, -)</p>
Study	<p>McVey GL, Davis R, Tweed S & Shaw BF. Evaluation of a school-based program designed to improve body image satisfaction, global self-esteem, and eating attitudes and behaviors: a replication study. The International journal of eating disorders; 2004: 36(1):1-11.</p>
Methods	<p>Class (A, B, C, D) RCT Follow-up: 6 month and 12 month Outcome reliability: Questionnaire Unit of allocation: School Unit of analysis: Individual</p>
Subjects	<p>N (controls baseline) = 76 N (interventions baseline) = 182 Loss to follow-up: Not indicated Setting: School classroom Age range (years): 11-13</p>

	Gender: Female SES: Not indicated Ethnicity: Multi-ethnic, majority Caucasian
Interventions	The student intervention, entitled “Every Body is Somebody,” was disseminated through classroom activities, group discussions, and slide and video presentations in 6 weekly 50 minute sessions. Topics included media influences, enhancing self-esteem and body image, body size acceptance, healthy living and stress management.
Keywords	- School - Classroom - HE lessons - Body image
Outcome Measures	Body image satisfaction Dieting attitudes Eating behaviours
Results	The intervention group had significantly higher scores on body image satisfaction and global self-esteem and in reducing dieting attitude scores at post intervention only. The gains were not maintained at the 12-month follow-up.
Result	+ Δ body image
Keywords	+ Δ eating behaviours
Quality	(+, 0, -)
Study	Nader PR, Stone EJ, Lytle LA, Perry CL, Osganian SK, Kelder S, Webber LS, Elder JP, Montgomery D, Feldman HA, Wu M, Johnson C, Parcel GS & Luepker RV. Three-year maintenance of improved diet and physical activity: the CATCH cohort. Child and Adolescent Trial for Cardiovascular Health. Archives of pediatrics & adolescent medicine; 1999; 153(7): 695-704.
Methods	Class (A, B, C, D) RCT Follow-up: 3 years Outcome reliability: Unit of allocation: School Unit of analysis: Individual
Subjects	N = 3714 Loss to follow-up: 27% Setting: School Age range (years): Grade 8 Gender: Mixed SES: Not indicated Ethnicity: 69% Caucasian, multi-ethnic
Interventions	The CATCH project's phase I was a feasibility study of 2 schools in each of 4 sites. The CATCH phase II was a 4-center field trial that evaluated the effectiveness of a feasible, elementary school–based cardiovascular health promotion program in 56 intervention schools and 40 control schools during grades 3 through 5. The CATCH phase III (tracking study) was a longitudinal study in which a 3-year follow-up of the CATCH II cohort of students was conducted. The CATCH III was designed to measure eating and activity attitudes and behaviors as well as cardiovascular disease risk factors in the original CATCH II cohort of students during grades 6 through 8 to assess maintenance of intervention effects achieved at the end of CATCH II (grade 5).
Keywords	- School - Classroom - Heart Health promotion - HE/ PA lessons

Outcome Measures	Dietary Intentions BMI Blood pressure Cholesterol
Results	Self-reported daily energy intake from fat at baseline was virtually identical in the control (32.7%) and intervention (32.6%) groups. At grade 5, the intake for controls remained at 32.2%, while the intake for the intervention group declined to 30.3% ($P < .001$). At grade 8, the between-group differential was maintained (31.6% vs 30.6%, $P = .01$). Intervention students maintained significantly higher self-reported daily vigorous activity than control students ($P = .001$), although the difference declined from 13.6 minutes in grade 5 to 11.2, 10.8, and 8.8 minutes in grades 6, 7, and 8, respectively. Significant differences in favor of the intervention students also persisted at grade 8 for dietary knowledge and dietary intentions, but not for social support for physical activity. No impact on smoking behavior or stages of contemplating smoking was detected at grade 8. No significant differences were noted among physiologic indicators of body mass index, blood pressure, or serum lipid and cholesterol levels.
Result	+ Δ PA
Keywords	+ Δ dietary knowledge, dietary intentions
Quality	(+, 0, -)
Study	Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G & Eliakim A. Short- and long-term beneficial effects of a combined dietary-behavioral- physical activity intervention for the treatment of childhood obesity. <i>Pediatrics</i> ; 2005; 115:4 (e443-e449).
Methods	Class (A, B, C, D) RCT Follow-up: 3 month, 1 year Outcome reliability: Skinfold thickness Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 22 N (interventions baseline) = 24 Loss to follow-up: 6 Setting: School Age range (years): 6-16 Gender: Mixed SES: Not indicated Ethnicity: Not indicated
Interventions	Subjects and parents in the intervention group were invited together for a series of 4 evening lectures (on childhood obesity, general nutrition, a therapeutic nutritional approach for childhood obesity, and exercise and childhood obesity) during the 3 months of the program. The lectures were given by the physicians and dietitian of the Child Health and Sports Center. Dietary Intervention The participants met with the dietitian 6 times during the 3-month program. The participants in these meetings differed according to the age of the patients. Pubertal subjects were invited to the first meeting with both parents and then the adolescent and his or her parents met the dietitian separately. The first appointment, which was 45 to 60 minutes long. Subsequent appointments, were 30 to 45 minutes each, and devoted mainly to nutritional education (eg, food pyramid, food choices, food labels, food preparation and cooking, eating habits, regular meals, and controlling environments that stimulate overeating).
Keywords	- School

	<ul style="list-style-type: none"> - Family - HE/ PA lessons - Diet plan <ul style="list-style-type: none"> o Food guide, regular meals, food preparation
Outcome Measures	BMI Body fat from skinfold tests Cholesterol Fitness
Results	At 3 months, there were significant differences in changes in body weight (-2.8 ± 2.3 kg vs 1.2 ± 2.2 kg), BMI (-1.7 ± 1.1 kg/m ² vs -0.2 ± 1.0 kg/m ²), body fat percentage (from skinfold tests; $-3.3 \pm 2.6\%$ vs $1.4 \pm 4.7\%$), serum total cholesterol level (-24.6 ± 15.1 mg/dL vs 0.8 ± 18.7 mg/dL), low-density lipoprotein cholesterol level (-23.3 ± 15.2 mg/dL vs -3.7 ± 17.3 mg/dL), and fitness (215 ± 107 seconds vs 50 ± 116 seconds) in the intervention group versus the control group. After a 1-year follow-up period, there were significant differences between the intervention group ($n = 20$) and the control group ($n = 20$) in body weight (0.6 ± 6.0 kg vs 5.3 ± 2.7 kg), BMI (-1.7 ± 2.3 kg/m ² vs 0.6 ± 0.9 kg/m ²), and body fat percentage. There was a significant increase in leisure-time physical activity among the intervention participants, compared with a decrease among the control subjects.
Result Keywords	+ Δ body weight, body fat + Δ Total cholesterol, LDL + Δ PA
Quality	(+, 0, -)
Study	Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. <i>Prev Med</i> ; 2003: Vol. 37 (1), pp. 41-51.
Methods	Class (A, B, C, D) RCT Follow-up: 8 month Outcome reliability: Unit of allocation: Unit of analysis:
Subjects	N (controls baseline) = 112 N (interventions baseline) = 89 Loss to follow-up: 11% Setting: School (PE class) Age range (years): 14-16 Gender: Females SES: Not indicated Ethnicity: Multi-ethnic
Interventions	New Moves was based on the Social Cognitive Theory and aimed to provide a class environment in which larger girls could feel comfortable being physically active. Non-overweight girls were included to avoid weight stigmatization. Participants in the intervention schools received the New Moves program instead of regular coed physical education class for on semester (5 days per week for 16 weeks). Classes included physical activity (4 times per week), nutritional guidance (once every other week), and social support within a supportive (once every other week). The program includes small group and class discussions, role playing, tracking eating patterns and preparing and eating healthy snack and breakfast foods. Nutrition sessions focused on skill building and increasing self-efficacy for long term changes in eating behaviors. The program also included a maintenance component that included weekly lunch meetings, with healthy foods, for 8 weeks following the intervention. A

	<p>minimal parental component was also included with 14 postcards mailed home every 2-3 weeks throughout the intervention and maintenance periods.</p> <p>Participants in control schools received minimal intervention that included written materials on healthy eating and physical activity that were distributed at baseline.</p> <p>The program was implemented by program staff and research team members, including a registered dietitian.</p>
Keywords	<ul style="list-style-type: none"> - School - Multi-ethnic - HE/ PA lessons <ul style="list-style-type: none"> o Healthy snacks, breakfast, eating patterns, food preparation - PA - Parent participation (minimal) - Food preparation
Outcome Measures	<p>BMI</p> <p>Eating patterns</p> <p>Self-perceptions</p>
Results	<p>Participants perceived a positive program impact on their physical activity, eating patterns, and self-image. Girls in the intervention significantly progressed in their stage of behavioral change for physical activity from baseline to follow-up. However, for the majority of outcome variables, differences between intervention and control schools at post-intervention and follow-up were not statistically significant.</p>
Result Keywords	<p>+ Δ eating patterns</p> <p>+ Δ body image</p> <p>+ Δ stage of change</p> <p>Ø Δ BMI</p>
Quality	<p>(+, 0, -)</p>
Study	<p>Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh nutrition concept for students. J Sch Health. 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). Health Educ Behav. 2000 Apr;27(2):201-12.</p>
Methods	<p>Class (A, B, C, D) RCT</p> <p>Follow-up: 4 year</p> <p>Outcome reliability:</p> <p>Unit of allocation: School</p> <p>Unit of analysis: Individual</p>
Subjects	<p>N = 2213</p> <p>Loss to follow-up: 19%</p> <p>Setting: School</p> <p>Age range (years): 13-15</p> <p>Gender: 56% female</p> <p>SES: Not indicated</p> <p>Ethnicity: 84% Euro-American</p>
Interventions	<p>Twelve schools were randomized to intervention or control conditions. Students were followed from 9th to 12th grade. Gimme 5: A Fresh Nutrition Concept for Students (Gimme 5) was a 4-year intervention targeting increased fruit and vegetable consumption by high school students. Interventions were composed of a school-based media campaign, classroom workshops, school meal</p>

	modification, and parental involvement. Media materials included marketing stations, food giveaways, point-of-service signs, posters, table tents, announcements, tips sheets, and contests. The classroom workshops comprised of five 55minute interactive workshops by health educators of trained school personnel. 85 activities highlighting fruits/vegetables in 10 academic subjects were used to introduce the program and increase awareness. Family involvement included parent-teacher events, such as taste-testing, media display, and literature distribution. Materials such as menu planning calendars were also sent to families.
Keywords	<ul style="list-style-type: none"> - School - HE lessons <ul style="list-style-type: none"> o F/V intake - Media - Environment - Family - Taste test
Outcome Measures	Fruit and vegetable intake
Results	At follow-up, fruit and vegetable consumption within the control group also increased, resulting in no significant difference between groups. Intervention group knowledge scores and awareness indicators were significantly higher than those of the control group ($p < 0.0001$).
Result Keywords	+ Δ nutrition knowledge and awareness + Δ F/V intake also seen in control
Quality	(+, 0, -)
Study	O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. Journal of the American Dietetic Association. Volume 102, Issue 3, Supplement 1 , March 2002, Pages S93-S96.
Methods	Class (A, B, C, D) RCT Follow-up: 4 years Outcome reliability: Survey Unit of allocation: School Unit of analysis: Schools (continuous variables), Individual
Subjects	N = 2213 Loss to follow-up: 19% Setting: School Age range (years): 14-18 Gender: Mixed SES: Not indicated Ethnicity: 84% Caucasian
Interventions	Gimme 5 used a multicomponent program. Component 1: School media-marketing campaign - To present a unified campaign, all media channels were coordinated to support monthly themes. The focal point of the monthly promotion was cafeteria display exhibits that were the site of produce giveaways and ethnic menus. Each monthly promotion incorporated nutrition and behavioral messages. Other elements of the media-marketing campaign were table tents, point-of-ser-vice signs, posters, public service announcements (PSA), faculty fruit and vegetable baskets, faculty tip sheets, and student contests. Component 2: Workshops Five 55-minute workshops, including a variety of learning strategies, focused on students as individuals and dealt with issues important to the students. Each workshop included a taste-test.

	<p>Component 3: Fresh Choices The goal of Fresh Choices was to increase the availability, variety, and taste of fruits and vegetables meeting Five A Day serving size and nutrient content in school meals.</p> <p>Component 4: Parental involvement, "Raisin' Teens" The objective was to increase the availability and variety of fruits and vegetables served in the home. Gimme 5 staff conducted taste-tests of Gimme 5 recipes, media displays, and activities at parent-teacher organization meetings. Colorful brochures were mailed to parents. The brochures featured tips for purchasing fruits and vegetables, recipes, and nutrition information on the fruits and vegetables being promoted in the school.</p>
Keywords	<ul style="list-style-type: none"> - School - HE lessons <ul style="list-style-type: none"> o F/V intake - Media - Family - Taste test
Outcome Measures	Fruit and vegetable intake
Results	<p>Gimme 5 was somewhat successful in meeting the 3 primary outcomes of the study. Knowledge scores of the intervention cohort were significantly higher when compared with baseline and at follow-up ($P < .0001$) and when compared with controls ($P < .05$).</p> <p>Self-efficacy increased in both groups, possibly reflecting a maturing process. With regard to stages of change, control and intervention distributions at follow-up differed significantly ($P < .0001$ and $P < .01$, respectively) from their baseline distributions and also from each other ($P < .0001$). The intervention group also demonstrated increased awareness. The reported daily servings of fruit and vegetables usually consumed increased by 14% (+.35 servings) from 1994 to 1996 in the intervention group, compared with the control group; although this was smaller than the targeted 0.75 servings, it was significant (linear trend; $P < .001$) and remained stable throughout the program.</p>
Result	+ Δ HE knowledge, SE and awareness
Keywords	+ Δ F/V intake
Quality	(+, 0, -)
Study	Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. J Nutr Educ. 1999; 31(1):14–20.
Methods	<p>Class (A, B, C, D) Pre-posttest</p> <p>Follow-up: 6 week</p> <p>Outcome reliability: Multiple choice test</p> <p>Unit of allocation: School</p> <p>Unit of analysis: Individual</p>
Subjects	<p>N = 448</p> <p>N (controls baseline) = 1 school</p> <p>N (interventions baseline) = 4 schools</p> <p>Loss to follow-up: 19</p> <p>Setting: School</p> <p>Age range (years): 11-15</p> <p>Gender: 164 males, 177 females</p> <p>SES: Not indicated</p> <p>Ethnicity: (Black:White): 0.6:1</p>
Interventions	A 6-week curriculum, "Live!": Eat Less Fat and More Fiber, was tested in the

food and consumer sciences classes of four middle schools in Tallahassee, Florida. The curriculum, composed of five lesson units, focused on building a knowledge base for the prevention of nutrition-related chronic diseases and also included a segment that emphasized the development of low-fat and high-fiber cooking skills.

Behavioral change activities were designed to influence group norms in the classroom, school cafeteria, family, and community. In the classroom, the low-fat, high-- fiber (LFHF) goals that students set were constantly reinforced through (a) weekly LFHF goal reporting, (b) eight LFHF food preparation labs with taste testing, (c) interactive review of each of the five LFHF lesson units, (d) individual diet and disease research reports, and (e) three teacher-led LFHF food demonstrations and an LFHF recipe modification lab. Students publicly committed to achieve their LFHF goal by stating goals orally in the classroom and by entering into classroom competitions (slogans, messages, posters, and cookbooks), which were assigned as homework to reinforce LFHF goals. Family members who set LFHF goals and participated in LFHF homework competitions served as social role models and promoted LFHF eating as a family norm. Active cognitive processing (ACP) activities included students in assessing their own and family members' LFHF dietary practices, in comparing their findings to recommended standards, and in comprehending through research reports how diet-related chronic diseases affect vital organs. Students took the role of teachers in homework assignments whereby parents were taught by students how to (a) interpret LFHF diet assessments in order to set goals to improve their diets and (b) assist with slogan, message, poster, and cookbook development contests that promote goal achievement. Confidence and motivation were meant to be enhanced by learning to prepare tasty LFHF foods. Personal and peer competition was the source of continuous motivation for the interactive "Jeopardy" game, which was the basis for unit reviews. A diet and chronic disease research report focused on loss of vital functions and death associated with diet-related chronic diseases.

Keywords	<ul style="list-style-type: none"> - School - HE lessons <ul style="list-style-type: none"> o Fat, fibre intake - Media - Peer modeling - Behavioural - Family - Food preparation
Outcome Measures	Knowledge of reduced fat eating and cooking
Results	Results of pre- and post-tests, based on the eight study variables, showed that the "Live!" curriculum significantly ($p < .05$) increased knowledge about reduced-fat cooking among children ($n = 266$) in the four test schools, but that this knowledge remained unchanged in the control school children ($n = 75$). In addition, significant ($p < .05$) gain scores were obtained for at least four of the lesson units in three of the four test schools. Interestingly, certain "Live!" lesson units tended to produce higher knowledge gain scores among black ($n = 194$) than among white ($n = 147$) students. The researchers concluded that the "Live!" curriculum is effective in educating adolescents in this study sample about the prevention of nutrition-related diseases.
Result	+ Δ HE knowledge
Keywords	
Quality	(+, 0, -)

Study	Reinhardt W & Brevard P. Integrating the Food Guide Pyramid and Physical Activity Pyramid for Positive Dietary and Physical Activity Behaviors in Adolescents. <i>Journal of the American Dietetic Association</i> ; 2002:102(3), S1: S96-S99.
Methods	Class (A, B, C, D) Pre-posttest Follow-up: 5 week Outcome reliability: Questionnaires Unit of allocation: School Unit of analysis: Individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 192 Loss to follow-up: Not indicated Setting: School Age range (years):12-13 Gender: 54% male SES: Not indicated Ethnicity: Not indicated
Interventions	All students were required to enroll in a combined health and physical education curriculum. The curriculum for the intervention program was developed to integrate practical life skills concerning nutrition and physical activity habits while meeting the state's current Standards of Learning created by the Department of Education. The integrated curriculum used the USDA's Food Guide Pyramid and the Physical Activity Pyramid. 18 lessons were delivered to students over 5 weeks: 2 introductory lessons; 2 lessons for each of 6 corresponding groups of the 2 pyramids; 1 lesson regarding food labeling, body image, and weight management; and 1 review lesson. All lessons were approximately 30 to 40 minutes in length and were taught by the school's health and physical education teachers following weekly training sessions.
Keywords	<ul style="list-style-type: none"> - School - Classroom - HE / PA lessons <ul style="list-style-type: none"> o Food Guide - PA
Outcome Measures	Nutrition knowledge Physical activity knowledge
Results	There was a statistically significant increase in mean pre-intervention (20±6) and post-intervention (27±6) nutrition knowledge scores ($P=.000$; 95% confidence interval [CI] = 6; 8)— a 17% increase in the total points possible (n=167). There was also a statistically significant increase in mean pre-intervention (19±6) and post-intervention (26±7) physical activity knowledge scores ($P=.000$; 95% CI = 6; 8), a 19% increase in the total points possible (n=162). Additional data suggest that some minimal behavior changes did occur.
Result Keywords	+ Δ HE and PA knowledge
Quality	(+, 0 , -)
Study	Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. <i>Health Educ Behav</i> 2000 27:5 (616-631).
Methods	Class (A , B, C, D) RCT Follow-up: 6 months Outcome reliability: DXA not as specific

	Unit of allocation: Group Unit of analysis: Individual
Subjects	N = 57 N (Controls) = 31 - low attenders N (Interventions) = 26 – high attenders Loss to follow-up: Not indicated Setting: Community (housing development) Age range (years): 11-17 Gender: Females SES: Low SES Ethnicity: Multi-ethnic
Interventions	Based on SCT. Program was conducted in two, 6 month cycles over 2 years. For the first 4 months, sessions were held twice weekly for about 2 hours. For the final 2 months, sessions were held weekly. Each session comprised of 1) an interactive educational activity, 2) 30-60 minutes of PA, and 3) preparation and tasting of low-fat, portion-controlled meals.
Keywords	<ul style="list-style-type: none"> - Community - Females - Low SES - Multi-ethnic - HE / PA lessons <ul style="list-style-type: none"> o Low fat, portion control - PA - Food preparation
Outcome Measures	Weight Body fat BP Cholesterol
Results	High attenders (n=26) showed more favorable 6-month posttest values for most outcomes compared with low attenders (n=31). High attenders reported substantially lower total kcal, slightly lower percentage of energy from fat, and lower cholesterol and sodium intake posttest compared with the low attenders. None of these differences achieved statistical significance. The effects showed statistical significance only for nutrition knowledge, low-fat practices, perceived changes in low-fat practices, and perceived social support. High attenders showed a small decrease in body fat (measured by skin fold and DXA) and an increase in HDL. Low attenders showed a slight increase in the adiposity measures and reduced HDL. Both groups showed a decline in total cholesterol and BP.
Result Keywords	+ Δ dietary intake - total kcal, fat, sodium (not statistically different) + Δ nutrition knowledge, practices and perceived changes in practices + Δ body fat (small change) + Δ HDL, TC, BP
Quality	(+, 0, -)
Study	Resnicow K Taylor R, Baskin M & McCarthy F. Results of Go Girls: A Weight Control Program for Overweight African American Adolescent Females. Obesity Research. 2005; 13:10 (1739-1748).
Methods	Class (A, B, C, D) RCT Follow-up: 6 month Outcome reliability: BMI reliable Unit of allocation: Church group

	Unit of analysis: Individual
Subjects	N = 147 Loss to follow-up: 24 Setting: Church Age range (years): 12-16 Gender: Female SES: Middle SES Ethnicity: African American
Interventions	Prior to intervention, researchers conducted focus group interviews with middle-income families to identify potential intervention themes. Two interventions were delivered: 1) high intensity (24-26 sessions offered weekly over 6 months, where parents were invited to every other session) comprising of group behavioral sessions including an experiential component, interactive behavioral activity and 30 minutes of PA; and 2) moderate intensity (6 sessions). The latter was the comparison group.
Keywords	<ul style="list-style-type: none"> - Community - Females - African American - HE / PA lessons - PA - Behavioural
Outcome Measures	Adiposity estimated by BMI Percentage of body fat, waist and hip measures, BP, measures of serum lipids, insulin and glucose and cardiovascular fitness
Results	At 6 month follow up, the net difference between the high and moderate intensity groups was 0.5 BMI units. This was not statistically significant. There was no significant difference in secondary outcomes. Girls in the high intensity group who attended more than ¾ of the sessions had significantly lower BMI and percentage of body fat relative to those in the high intensity group who attended fewer sessions. Findings at one year mirrored those at 6 months.
Result Keywords	+ Δ BMI, body fat
Quality	(+, 0, -)
Study	Rinderknecht K & Smith C. Social cognitive theory in an after-school nutrition intervention for urban Native American youth. J Nutr Educ Behav; 2004; 36(6):298-304.
Methods	Class (A, B, C, D) Pre-posttest Follow-up: 7 month Outcome reliability: 24h dietary recall Unit of allocation: Group Unit of analysis: Individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 154 Loss to follow-up: Not indicated Setting: After school program Age range (years): 11-18 and 5-10 Gender: Mixed SES: Not indicated Ethnicity: Native American
Interventions	A new nutrition component was added to an already established after school program. Researchers taught 1, 30-60 minute monthly lesson to each age group over the course of 1 school year. Lessons focused on improving self-efficacy by exposing youth to more healthful foods, providing opportunities for

	the youth to successfully choose the more healthful alternates (taste-testing), discussing ways to achieve balance through healthful eating and physical activity, and conducting participative learning activities with peer groups, allowing modeling opportunities. Specifically lessons focused on choosing fruits instead of candy, drinking water or juice instead of soda, replacing some higher-fat foods with lower-fat foods, choosing skim or 1% milk, choosing vegetables as more healthful snacks, and review ways to make more healthful ways to stay in balance. The lessons focused on everyday experiences the youth encounter. Researchers were on site weekly to review lessons and provide verbal reinforcements to youth.
Keywords	<ul style="list-style-type: none"> - After-School - Native American - HE / PA lessons <ul style="list-style-type: none"> o Low fat, F/V, healthy snacks, balance - Taste test / exposure - Behavioural
Outcome Measures	Self-efficacy questionnaire Height and weight BMI 24-hour dietary recall
Results	Adolescents exhibited moderate levels of dietary self-efficacy at baseline with no variation by BMI. The intervention did not significantly improve dietary self-efficacy in adolescents. 39 adolescents completed the study by attending at least ¾ of the classes and completing the pre and post-intervention surveys. A significant increase in fat and sugar consumption was identified from baseline to post-intervention. Multiple comparisons showed that boys significantly increased their intake.
Result Keywords	Ø Δ SE for HE
Quality	(+, 0, -)
Study	Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. <i>Prev Med</i> : 2003; 36(3):309-19.
Methods	Class (A, B, C, D) Nonrandomized Trial Follow-up: 3 year Outcome reliability: BS reliable Unit of allocation: School Unit of analysis: School, Individual
Subjects	N (controls baseline) = 37 (Anglo group) N (interventions baseline) = 199 Loss to follow-up: Not indicated Setting: School Age range (years): 16-17 Gender: Mixed SES: Not indicated Ethnicity: Zuni Pueblo
Interventions	The Zuni high school diabetes prevention program included an educational component targeting decreased consumption of sugared beverages, knowledge of diabetes risk factors, and a youth-oriented fitness center. The project converted a school classroom was turned into a supervised fitness facility. The project replaced all regular soft drinks in vending machines with “diet” beverages, provided water coolers throughout the school, offered only healthful

	snacks, increased fruit and vegetables and decreased fat in school lunches, and advertised with student posters throughout the school. Knowledge and attitudes about diabetes were addressed through curriculum introduced to a 9-week segment of the required physical education class.
Keywords	<ul style="list-style-type: none"> - School - Zuni Pueblo Native American - DM prevention - HE / PA lessons <ul style="list-style-type: none"> o Healthy snack, sugared beverages, F/V and fat intake - PA - Environment - Promotion
Outcome Measures	Fasting blood sugar Soft drink intake
Results	At baseline, fasting and 30-min plasma insulin levels were significantly elevated for Zuni youth; they showed significant steady declines for both males and females throughout the study (P = 0.06 to P = 0.000 for trends using quantile regression). By Year 3, values for Zuni males (n = 29) equaled Anglo comparison values, while Zuni female (n = 26) values had declined but were still higher than Anglo comparison values. By year 3 of the intervention, the 400 students were consuming virtually no sugared soft drinks at school. This was down from 800, 12oz cans/week/400 students.
Result	+ Δ Insulin
Keywords	+ Δ Soft drink intake
Quality	(+, 0, -)
Study	Rudolf M, Christie D, McElhone S, Sahota P, Dixey R, Walker J & Wellings C. WATCH IT: a community based programme for obese children and adolescents. Arch Dis Child; 2006: Vol. 91 (9), pp. 736-9.
Methods	Class (A, B, C, D) Pre-posttest Follow-up: 12 month Outcome reliability: Questionnaire reliability questionnaire Unit of allocation: Group Unit of analysis: Individual
Subjects	N = 94 Loss to follow-up: 14 Setting: Community Age range (years): Gender: 49 girls, 45 boys SES: Not indicated Ethnicity: Not indicated
Interventions	WATCH IT was set up following a survey of views of patients and parents referred for obesity to a regional endocrinology clinic and community paediatric dietetic service. The program was held in sports or community centres between 3:30-6:30pm, 4 times a week. It consisted of three components: 1) Frequent individual appointments (30 minutes, initially weekly) for the young person and parent for encouragement, support, and motivational counseling, using the (Healthy Eating Lifestyle Programme) HELP manual to guide content delivery 2) Group activity sessions lasting one hour 3) Group parenting sessions, once the individual appointments reduced in

	frequency. Families attended for 3 months with an option to renew for a year. The program was staffed by part time health trainers, who received ongoing support and supervision from a team leader (weekly), a dietician, a psychologist (monthly), and a paediatrician (periodically).
Keywords	<ul style="list-style-type: none"> - Community - Family - HE / PA lessons - Behavioural counseling - Promotion
Outcome Measures	BMI SD score at entry to the program, with that at 3 and 6 months. Eating behaviour and activity measured through a questionnaire developed for the study and used to measure lifestyle changes.
Results	There was a significant reduction in overweight at 6 months (Δ BMI SD -0.07), especially for teenagers (Δ BMI SD -0.13) and girls (Δ BMI SD -0.07). Qualitative research indicated significant appreciation of the service, with reported increase in self-confidence and friendships, and reduction in self-harm.
Result Keywords	+ Δ body weight + Δ self-confidence, self-harm
Quality	(+, 0, -)
Study	Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003: 24(3):209-17.
Methods	Class (A, B, C, D) RCT Follow-up: 2 years Outcome reliability: Data collected at 2 random times Unit of allocation: School Unit of analysis: School and Individual
Subjects	N = 48 schools N (interventions baseline) = 1678 student-parent pairs Loss to follow-up: 243 student parent pairs Setting: School Age range (years): Grades 6 – 8 (12-14) Gender: 49% female SES: 39.5% of students received free school meals Ethnicity: 44.5% were non-Caucasian
Interventions	An ecological model of health behavior was applied to the intervention. Twenty-four middle schools were randomly assigned to intervention or control conditions. Over 2 years, physical activity interventions were designed to increase PA in physical education classes and throughout the school day. Nutrition interventions were designed to provide and market low-fat foods at school food sources, including cafeteria breakfasts and lunches, a la carte sources, school stores, and bag lunches. Changes were made in the purchasing, preparation and serving practices to decrease fat content of foods available; low-fat items were substituted offered; school nutrition policies were implemented; ideas for healthy lunch bags were printed in schools' parent newsletters; healthy lunch bag raffles were held; and low fat foods were promoted with signs. School staff and students were involved in policy change efforts.
Keywords	<ul style="list-style-type: none"> - School - 39.5% low SES - Multi-ethnic

	<ul style="list-style-type: none"> - HE / PA lessons <ul style="list-style-type: none"> o LF - PA - Environmental - Parent participation - Promotion - Policy
Outcome Measures	Fat intake measured through fat content of bag lunches and school meals and student surveys BMI Physical Activity
Results	A significant intervention effect was seen for PA for the total group and boys, but not girls. The intervention was not effective for total fat ($p < 0.91$) or saturated fat ($p < 0.79$). Survey data indicated that the interventions reduced report BMI for boys.
Result Keywords	+ Δ PA + Δ BMI for boys \emptyset Δ fat intake
Quality	(+, 0, -)
Study	Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. J Am Diet Assoc; 2004: 104:8 Suppl 2 (A32).
Methods	Class (A, B, C, D) Pre-posttest Follow-up: 2 months Outcome reliability: Trained recorders for anthropometric measures, questionnaires validity not described Protection against contamination: Not mentioned Unit of allocation: Group, Individual, Family Unit of analysis: Group and individual
Subjects	N (controls baseline) = 0 N (interventions baseline) = 30 children and adolescents Loss to follow-up: 11/30 Setting: School Age range: Adolescents – 11-16years; children – 6-10 years Gender: Mixed SES: Not indicated Ethnicity: Not indicated
Interventions	The program used a variety of family therapy and cognitive, behavioural, affective, and interactional techniques. Adolescents were encouraged to make small, sustainable lifestyle, physical activity and healthy eating changes. Eating behaviours such as regular eating and eating in response to hunger were targeted. Increasing physical activity and decreasing sedentary activity were encouraged.
Keywords	<ul style="list-style-type: none"> - Community - Family - HE / PA/ \downarrowSA lessons <ul style="list-style-type: none"> o Regular eating, hunger/satiety - Behavioural
Outcome Measures	Pre and post anthropometric data and questionnaires were collected to compare data. Weight, waist and hip circumference, and triceps skinfold thickness were assessed. T test was used to compare variables.
Results	Weight, waist and hip circumference, and triceps skinfold thickness were significantly decreased over the 2 month period. Significant differences were

	observed in participants' nutrition knowledge, diet habits, and body image at the end of the intervention. Subjects increased self-awareness about their dietary habits and life styles; and became more knowledgeable about the necessity of eating healthy foods and exercising daily. All subjects reduced BMI, body size and percent body fat and increased body image. A 1987 RCT of 66 subjects involved in the SHAPEDOWN program found participants significantly decreased weight after 3 months and one year and improved weight related behaviours.
Result	+ Δ body weight
Keywords	+ Δ nutrition knowledge + Δ diet habits, body image
Quality	(+, 0, -)

Study	Thornburg R & Hill K. Using Internet Assessment Tools for Health and Physical Education Instruction. TechTrends: Linking Research & Practice to Improve Learning; 2004: 48(6):53-55.
Methods	Class (A, B, C, D) Non-comparative study Follow-up: After 2 units Outcome reliability: Self-reported Unit of allocation: School Unit of analysis: Individual student
Subjects	N = 27 schools Loss to follow-up: Not indicated Setting: Schools Age range (years): Middle school students (13-15) Gender: Mixed SES: Not indicated Ethnicity: Not indicated
Interventions	Web-based lessons were administered by a pre-service physical education teacher as part of a fitness unit. Each student had his or her own computer in the school's computer lab. Copies of lesson worksheets guided students through the web-sites. The web-sites provided nutrition analyses, estimated calorie needs and displayed locus of control scores. Students also used search engines and assigned sites to research nutrition and PA related topics. Students were instructed to research various PAs and ways they may improve their own dietary and PA habits, and the reasons why those health components are important. Students completed 2 web-based units guided by teachers.
Keywords	- School - Classroom (PE) - Computer - HE / PA lessons - Interactive
Outcome Measures	Nutrition habits evaluated through a Technology and Wellness survey
Results	20 students reported being surprised with the amount of "junk food" they ate. 25 students appeared to understand the concept that an imbalance in calories consumed versus calories expended would result in weigh gain/loss. 80% of students enjoyed doing lessons on the computer. 55% of students stated that doing the web-based nutrition assignment encouraged them to think more about their nutrition habits.
Result	+ Δ nutrition knowledge
Keywords	+ Δ nutrition habits
Quality	(+, 0,)

Study	Wang Y, Tussing L, Odoms-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. <i>Eur J Clin Nut</i> ; 2006: 60:1 (92-103).
Methods	Class (A, B, C, D) RCT Follow-up: 1.5 years Outcome reliability: Pre-validated tools Unit of allocation: School, Community Unit of analysis: Individual
Subjects	N (controls baseline) = Not indicated N (interventions baseline) = 249 Loss to follow-up: Not indicated Setting: School and community Age range (years): 9-14 Gender: 105 boys, 144 girls SES: Not indicated Ethnicity: African American
Interventions	The core theoretical model used for the intervention was the Social Cognitive Theory and the Theory of Triadic Influence model. The intervention was guided by preliminary findings based on focus group discussion and baseline data. It was scheduled to last approximately 1.5 years. Three intervention programs were tested: a) School environment enrichment (SEE), b) community support and environment modification, and c) family support program (FSP). The intervention focus was to increase childrens' and families' consumption of fruit and vegetables, reduce dietary fat intake and engage children in more PA. a) SEE intervention included display of posters, flyers and signs with information on healthy eating; health related messages broadcast on the school-wide intercom, twice per week; increases in physical education; monthly health classes using a series of fun and interactive activities (using a modified version of the Planet Health curriculum) to education about nutrition and PA; improvement in school food service; and school health fairs and campaigns, such as '5-a-day.' b) Partnerships were built with local grocery stores and the school corner store to help promote fruit and vegetable intake with students' families and improve offerings of healthy foods. c) The FSP focused on increasing fruit and vegetable consumption and reducing TV viewing time. Culturally appropriate recipes were distributed to families and the researchers worked with sponsor stores to make fruits and vegetables more accessible. The control schools were not provided with the intervention materials until the study was complete.
Keywords	- School / community - Classroom - African American - Family - Environment - Promotion / media - HE / PA/ ↓SA lessons o F/V intake
Outcome Measures	- BMI and eating behavior were measured through a questions adapted from the Youth Risk Behavior Surveillance System and the CATCH study

	<p>questionnaires</p> <ul style="list-style-type: none"> - Mothers were also surveyed about their own weight status and the feeding behaviors and allowances of children - A family food inventory survey was also conducted.
Results	<p>Baseline data indicate a high prevalence of overweight (43% in boys and 41% in girls) and a number of problems in these children's physical activity and eating patterns. Only 26% reported spending > or = 20 min engaged in vigorous-moderate exercise in > or = 5 days over the past 7 days; 29% reported spending > or = 5 h each day watching TV, playing video games, or using computer. They also consumed too many fried foods and soft drinks. On average, 55% consumed fried foods > or = 2 times/day over the past 7 days; regarding soft drinks, 70% reported consuming > or = 2 times/day.</p> <p>One year post-intervention, the intervention group has smaller BMI, WC and TST than control, by 1.1 Kg/m², 1.3 cm, 3.1 mm, respectively (p<0.05).</p>
Result	+ Δ BMI, WC
Keywords	
Quality	(+, 0, -)
Study	White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. <i>Obes Res</i> ; 2005: Vol. 12 (7), pp. 1050-9.
Methods	<p>Class (A, B, C, D) RCT</p> <p>Follow-up: 6 months</p> <p>Outcome reliability: multiple measures</p> <p>Unit of allocation: Community, family</p> <p>Unit of analysis: Individual, family</p>
Subjects	<p>N (controls baseline) = 29</p> <p>N (interventions baseline) = 28</p> <p>Loss to follow-up: 5 from intervention group, 2 from control</p> <p>Setting: Community, family</p> <p>Age range (years): 11-15</p> <p>Gender: Female</p> <p>SES: Not indicated</p> <p>Ethnicity: African-American</p>
Interventions	<p>The primary components of the study were communicated using a locked Web site created specifically for the Health Improvements Programme for teens (HIP-Teens) intervention program. At the study outset, participants were provided with a personal computer for the home and were given free Internet access. On a weekly basis, participants accessed new material, focused on weight loss, including information regarding nutrition, physical activity, and healthy food choices. Web site content was assessed for readability on a sixth grade reading level. In addition, several study consultants worked to generate Web site content that was culturally and geographically specific, while interesting for adolescents. As such, supplemental links and pages were included that focused on recipes, hobbies and activities, and "health and beauty tips," as well as the inclusion of "chat rooms" for study participants. Participants and their parents also attended focus groups in which they provided feedback as to the readability and interest level of the Web site content.</p> <p>The project consisted of two primary conditions. The behavioral condition incorporated behavior modification techniques and heavy emphasis on e-mail communication with a case manager who had at least graduate-level clinical</p>


	<p>psychology training specializing in weight management. Specific weekly topics in the behavioral condition included: self-monitoring, goal setting for eating and physical activity, problem solving, behavioral contracting, and relapse prevention. The control condition was primarily educational in nature and provided basic information about nutrition and physical activity. Participants in the control condition logged in to a separate Web site and were managed by a registered dietitian. In the control condition, topics included lessons pertaining to serving sizes, the food guide pyramid, hidden calories, and understanding food labels.</p> <p>Comparison: Participants also received a computer and free Internet access. They accessed a control version of the HIP-Teens website and their programme was primarily educational involving basic information about nutrition and PA.</p>
Keywords	<ul style="list-style-type: none"> - Community - African American - Female - Computer - Family - HE / PA lessons - Behaviour
Outcome Measures	<ul style="list-style-type: none"> - Body fat measured using the DXA procedure - Dietary self-efficacy measured using the Child Dietary Self-Efficacy Scale (CDSS) - Program adherence assessed using the frequency of "hits" on the Internet site and completion of weekly quizzes was used as a secondary measure of adherence for participants in the behavioral group - Dietary intake measured through the Multipass 24-Hour Recall and Food Frequency Questionnaire (FFQ)
Results	<p>BMI (kg/m²): Adolescents: There was a significant difference ($p < 0.01$) between the change in the intervention group (-0.24 [SD 1.38]) and the comparison group (+0.71 [SD 1.19]).</p> <p>Weight (kg): Adolescents: There was a significant difference ($p = 0.03$) between the change in the intervention group (+0.55 [SD 3.26]) and the comparison group (+2.40 [SD 2.86]).</p> <p>% Body fat (DEXA): Adolescents: There was a significant difference ($p = 0.02$) between the change in the intervention group (-1.04 [SD 2.00]) and the comparison group (+0.38 [SD 2.95]). This effect remained significant when a regression analysis was conducted taking into consideration baseline adiposity.</p> <p>Website visits: Both children and parents in the intervention group visited the website significantly more times over the 6 months than those in the control group</p>
Result	+ Δ BMI
Keywords	+ Δ Body fat
Quality	(+, 0, -)
Study	Williamson DA, Martin PD, White MA, Newton R, Walden H, York-Crowe E, Alfonso A, Gordon S, Ryan D. Efficacy of an internet-based behavioral weight loss program for overweight adolescent African-American girls. <i>Eating and weight disorders</i> ; 2005;10(3):193-203.
Methods	Class (A, B, C, D) RCT

	<p>Follow-up: 6 months Outcome reliability: DEXA not as specific as other body fat measures Unit of allocation: Family Unit of analysis: Individual</p>
Subjects	<p>N (controls baseline) = 29 N (interventions baseline) = 28 Loss to follow-up: 5 from intervention group, 2 from control Setting: Community, family Age range (years): 11-15 Gender: Female SES: Not indicated Ethnicity: African-American</p>
Interventions	<p>African-American girls were randomly assigned to an interactive behavioral home based internet program or an internet health education program, the control condition. The behavioral intervention included internet counseling and was highly interactive. The control intervention was a passive (non-interactive) educational program. Parents were also participants in the study. Participants in both treatment groups met in face-to-face sessions on four occasions over the first 12 weeks of a 6-month intervention.</p> <p>Intervention: Six months of interactive BT plus nutrition education via the Internet. Lifestyle nutrition and PA habits were targeted.</p> <p>Control: Six months of passive education on nutrition and exercise delivered via the Internet.</p>
Keywords	<ul style="list-style-type: none"> - Community - African American - Female - Computer - Family - HE / PA lessons - Behaviour
Outcome Measures	BMI, body weight, body composition, dietary intake, and weight loss behaviors
Results	<p>Compared to the control condition, adolescents in the behavioral treatment lost more body fat (group difference =1.6% body fat) and parents lost significantly more body weight (group difference =2.1 kg). Utilization of the behavioral website by adolescents and parents was associated with positive outcome. Dietary fat intake was lowered for adolescents and parents in the behavioral treatment group.</p> <p>BMI (mean change): Adolescents: Intervention: -0.19 (SE 0.24) Control: +0.65 (SE 0.23) There was a statistically significant difference between groups in the change from baseline to follow-up ($p < 0.05$).</p> <p>% Body fat (DEXA): Adolescents: Intervention: -1.12 (SE 0.47) Control: 0.43 (SE 0.47) There was a statistically significant difference between groups in the change from baseline to follow-up ($p < 0.05$).</p>

Result	+ Δ BMI
Keywords	+ Δ Body fat
Quality	(+, 0, -)

Study	Wong, Koh, Lee, Fong. Two-year follow-up of a behavioral weight control programme for adolescents in Singapore: predictors of long-term weight loss. <i>Ann Acad Med Singapore</i> . 1997;26:147-53.
Methods	Class (A, B, C, D) Non-randomized control trial Follow-up: One year Outcome reliability: Weight self reported after initial 8 weeks of programme Unit of allocation: Group Unit of analysis: Individual
Subjects	N = 167 Loss to follow-up: 32.9% Setting: Healthy lifestyle center Age range (years): 15-21 (Mean 17.5) Gender: Mixed SES: Not indicated Ethnicity: Chinese
Interventions	<p>The weight control programme, using a combined strategy of behaviour modification, nutrition education and exercise, was implemented by the first author and a team of doctors and nurses from the healthy lifestyle center in the institute after attending a course on obesity management conducted by the Food and Nutrition Department of the Ministry of Health. Students were free to choose individual counseling or group therapy. The programme consisted of an initial treatment phase and a maintenance phase. The initial 8-week phase comprising 4 weekly sessions and 2 fortnightly booster problem-solving sessions stressed on developing the student's skills to change their eating habits and physical activity pattern. Students were encouraged to make their own decisions to make gradual changes to their diet and exercise by using self-monitoring of weight, diet and physical activity; making healthier food choices in reducing fat intake when eating out; cognitive restructuring; setting realistic goals; stimulus control; and reinforcement. They were also taught how to manage stress and resist peer pressure. Pamphlets produced by the Training and Health Education Department and the Food and Nutrition Department were distributed to all students.</p> <p>The maintenance phase consisted of two problem-solving sessions held a month apart. During these sessions, students discussed ways to incorporate increased physical activity in their daily routine and cope with temptations to eat, stress and examinations. As attendance was poor due to student's lack of time and their preference for self-help written materials, we subsequently maintained contact with them by phone and mail. Individualised messages were mailed to the students 6 months and a year after the initial treatment phase to disseminate practical tips on weight loss that had been used effectively by their peers. Congratulatory messages were also sent to those who were able to maintain weight loss from our monitoring, and they were encouraged to share their experiences with their peers.</p> <p>At the same time, the institute implemented new policies and made some environmental changes to foster healthier lifestyle practices. Students were encouraged to participate in sports; more water coolers were installed; and food low in fat and caloric content were coded green to help students make healthier choices. Prizes were also given to the top three students who would maintain their weight loss for a year.</p>
Keywords	- Community

	<ul style="list-style-type: none"> - HE / PA lessons <ul style="list-style-type: none"> o Low fat, kcal content, water - Behavioural
Outcome Measures	<p>Height, weight</p> <p>Dietary habits and intake measured through weekly FFQ and a 3 day food record</p> <p>Knowledge of complications of obesity</p> <p>Exercise frequency</p> <p>Social support</p>
Results	<p>“Of these 112 students, 71.4% lost weight compared to 60% in a comparison group of 86 obese students not in the programme. About one-third (29.5%) had achieved normal weight [body mass index (BMI) < 25] with a mean weight loss of 3.3 kg among boys and 2.3 kg among girls. A stepwise multiple linear regression to determine the best combination of variables predictive of weight loss found three variables to be significantly associated with long-term weight loss: percent of weight loss in the initial 8-week intervention period; increase in exercise or physical activity following intervention, and income. These 3 variables accounted jointly for 59.5% of the variance in weight loss in males and 48% of weight loss in females.”</p> <p>Mean weight loss from 8-week follow-up to 2-year follow-up was significant in total intervention sample, females and males; the number of students in the intervention group with BMI < 25 was 29.5% after the intervention; variables predictive of weight loss were percent of weight loss in the initial 8-week intervention program; increase in exercise of physical activity following intervention, and income</p> <p>At 2-year follow-up, a higher percentage (71.4%) of the students in the weight control programme had lost weight compared to 60% of those not in the weight control programme, although the difference was not statistically significant (P = 0.114). 10.7% of students in the weight control programme regained all the weight lost during the initial 8-week treatment phase. The other 17.9% did not lose weight at all or gained additional weight.</p> <p>The overall mean BMI has decreased from 27.5 at baseline to 26.4 at 2-year follow-up with 29.5% having achieved normal weight (BMI <25, p<0.005). The mean weight loss at 2-year follow-up was 2.9 kg with more weight loss in males (3.3kg) than females (2.3kg)”</p>
Result	+ Δ body weight
Keywords	+ Δ BMI
Quality	(+, 0, -)
Study	Zang S. Go girls go: approaching obesity through an adolescent peer support group. Nurse Practitioner World News; 2006: 11(1): 19-20.
Methods	<p>Class (A, B, C, D) Non-comparative study</p> <p>Follow-up: 8 week</p> <p>Outcome reliability: Self-reported data</p> <p>Unit of allocation: Group</p> <p>Unit of analysis: Individual</p>
Subjects	<p>N = 8 girls and 3 mothers</p> <p>Loss to follow-up: Not indicated</p> <p>Setting: Church</p> <p>Age range (years): 11-16</p> <p>Gender: Female</p> <p>SES: Not indicated</p> <p>Ethnicity: Not indicated</p>

Interventions	An 8 week intervention was held at the Berean Baptist Church. Individual behaviour modification plans and guidelines for breakfast, lunch, dinner and snacks were provided to each participant and parents. Topics for the 8-week peer group sessions included: individual goal setting; motivation; food alternates and substitutions; sharing food discoveries; eating out; helping other kids your age to get them started on healthy eating; and reasons for poor dietary habits. Each participant received an exercise video presenting 7 different 20-minute exercise sessions.
Keywords	<ul style="list-style-type: none"> - Community - Female - Parent participation (minimal) - HE lessons <ul style="list-style-type: none"> o Eating out, food alternates - Behavioural
Outcome Measures	A 24 hour food recall and food questionnaire was administered before participants began the program. Weight and blood pressure were measured weekly.
Results	<p>The greatest individual weight loss was 12 pounds in 8 weeks. Other participants lost between 3-5 pounds. Some did not lose any but did not gain any either.</p> <p>Participants responded positively to the program. The peer group sessions help participants develop strategies to deal with barriers to healthy eating.</p> <p>Two month after the program had ended, the adolescents had lost more weigh and retained the information they had learned.</p>
Result Keywords	+ Δ body weight
Quality	(+, 0, )

***NOTE:** Some of the information contained in the evidence analysis worksheets was reported verbatim from the referenced source.

Appendix F

Summary Statements

Agron et al. (2002) studied the impact of a high-school based program advocating for additional healthful food and physical activity options at school on nutrition behaviours of 220 high school students. They found that training students as advocates to promote changes in the school food environment through education on the basics of nutrition and physical activity yielded positive changes in nutrition knowledge and attitudes and healthy eating behaviour. The authors concluded that a school based, student driven, nutrition and physical activity program involving environmental change was successful in improving low socio-economic status adolescent nutrition behaviors.

Austin et al. (2005) examined the effect of a school based intervention exclusively focused on healthful nutrition and physical activity and reduced television viewing, rather than weight, on disordered weight-control behaviors. This intervention comprised of 32 classroom lessons and 30 physical activity lessons, during which weight status and obesity were not explicitly addressed. The intervention was shown to reduce obesity in girls, avoid weight stigmatization, and prevent new cases of disordered weight control behavior among girls.

Baxter et al. (1997) found that a large community based heart health program among 1636 grade 7 and 10 students led to positive changes in low fat milk and low fat spread consumption and exercise levels. While the actual intervention components were not described in detail, the program included school based healthy eating, exercise and heart health curricula and community based heart health promotion.

Birnbaum et al. (2002) studied the impact of a school-based, environmental, classroom and family intervention to increase fruit and vegetable intake and decrease fat intake among low SES adolescents in efforts to reduce future cancer risk. The multi-component intervention included 10 behavioural based classroom sessions, peer leadership, coupons for families, and school environment changes. The authors found a positive change in fruit and vegetable intake among peer leaders and students exposed to both classroom sessions and environment change, but not among those only exposed to environment change. Positive changes in usual food choices were seen among all students.

Carrel et al. (2005) found that 50 overweight middle school children involved in a school based fitness program displayed a greater loss of body fat than those students in the regular gym class. The program consisted of a lifestyle focused, fitness oriented gym class, with a small component of nutrition education held over the school year. No dietary outcomes were measured.

Carrel, Meinen et al. (2005) found no significant change in percent body fat but a decrease in fasting insulin in 38 children and youth enrolled in a 24 week nutrition and exercise class. The class included 30 minutes of physical activity, basic nutrition education and a healthy snack preparation.

Damon et al. (2005) studied the impact of a school based intervention offered by a multidisciplinary team on the nutrition knowledge of 260 10-12 year olds. The intervention consisted of 11 one hour nutrition and health related sessions, in addition to physical education. The authors found improved nutrition knowledge in the program participants, based on a 3 day dietary record.

Edwards (2005) found that a 'Food & Fitness' intervention offered during an 8th grade physical education class produced mixed results on the weight and BMI of students enrolled in the intervention. The intervention included aerobic activity, nutrition education activities and healthy snacks. Only 13 out of 42 students completed the intervention and limited information is presented on the results.

Eliakim et al. (2002) studied the impact of a combined nutrition-behavioural-exercise intervention on the weight and BMI of 204 children and adolescents. The intervention included group lectures on general nutrition, obesity and exercise, individual nutrition education with dietitian prescribed diet plans and physical activity. The authors found that 65% of subjects lost weight and 75% decreased BMI after the 3 month intervention. However, the intervention required extensive resources and followed an outpatient counseling approach which may not be feasible in some community settings.

Frale et al. (2006) studied the impact of a community intervention involving 12 weekly sessions on healthy eating, physical activity and weight management practices among 282 community members. The program met the stated objectives to improve nutrition knowledge, dietary intake, and weight management. However, the intervention was not specific to the adolescent population and limited intervention details or results were available.

French et al. (2004) examined the impact of an intervention involving modification to the secondary school food environment, using peer promotion of healthy foods, on the intake of lower-fat food choices among 75 students aged 14-18 years. The authors found that students in the intervention schools had better perceived nutrition knowledge of lower fat foods, but no significant difference in dietary behaviours was noted.

Frenn et al. (2003) found that among 182 students, ranging from 12-17 years, a classroom intervention to control dietary fat intake and increase physical activity significantly decreased fat intake of the intervention group compared with the control. The authors concluded that interventions tailored to students' stage of change can result in significant eating behaviour change and that adolescents in the action and maintenance stages can successfully act as peer role models.

Frenn et al. (2005) examined the effect of an 8 session video and computer delivered intervention to increase physical activity and decrease fat among 178 low-income, culturally diverse, 7th grade students. They found that subjects who completed more than half of the nutrition modules decreased dietary fat intake. The authors concluded that interactive, computer tailored interventions may be appropriate for adolescent nutrition education.

Gortmaker et al (1999) studied 1295 ethnically diverse grade 6-7 students enrolled in a school based health education program focused on increasing fruit and vegetable and decreasing high fat food intake, and increasing physical activity. Among the participants, the authors found a reduced prevalence of obesity among girls but not boys. This was associated with lower total caloric intakes and to a lesser degree increased fruit and vegetable intake. The findings indicate that behaviour based health education offered within the school curricula has potential to reduce adolescent obesity among girls.

Gortmaker et al. (2000) studied 1560 grade 6-7 students to determine the impact of 32 health behavior lessons focused on diet and activity, implemented within pre-existing school curricula, on obesity, activity levels and dietary intake. They found that the prevalence of obesity decreased, total caloric intake decreased and intake of fruits and vegetables increased for girls in the intervention schools. The findings for dietary intake are, however, based on self-reported data.

Grey et al. (2004) evaluated the effects on BMI, weight and adiposity of a school based nutrition education and physical activity program, involving nutrition assessments, goal setting evaluated by a dietitian, and weekly coping skills training classes focused on a non-diet approach to healthy eating. They found that although the intervention group had a lower BMI, weight and central adiposity at follow-up, there were no statistically significant differences between the intervention and control groups. The authors concluded that a school based approach using coping skills training may be effective for adolescent nutrition and health education. However, the intervention followed an outpatient nutrition counseling approach which may not be feasible in some school or community settings.

Haerens et al (2006) found that 2840 among 8th grade students from 15 schools, a physical activity and healthy food computer tailored intervention combined with environmental change and parental support decreased adiposity in girls, but not in boys.

Hawley et al. (2006) found no significant changes in health attitudes and behaviors in 65 middle school students enrolled in a school and community based program involving 5 education sessions to promote physical activity and nutrition through experiential games and tasks and family education material. Based on self-reported behavior and intakes, the goal of healthy eating was viewed as significantly more important among families post intervention. The authors concluded that involving families can provide additional support to students engaging in healthy eating behaviors.

Hern and Gates (1998) examined the effect of an education program about heart healthy eating and exercise on 23 adolescents, ages 14 to 17 years. They found no significant difference for dietary fat intake between intervention and control groups. They provided limited information on the intervention and dietary assessment measures.

Higgins & Reed (2001) found that a weekly recreation program for girls, aged 10-15, focusing on health habits, empowerment and physical activity, resulted in a positive change in self-reported dietary intake among the 43 participants.

Horowitz et al. (2004) found that the EatFit intervention resulted in positive changes in dietary and physical activity behaviors and self-efficacy among 34 middle school students. The intervention included a workbook, web-based assessment, and classroom curriculum on diet and physical activity. However, the outcome measures were self-reported and statistical analysis was not identified. The findings point to the potential for web and classroom based nutrition education to impact adolescent dietary behaviors.

Jelalian et al (2006) studied the influence of adding a peer-based ‘adventure therapy’ to a standard cognitive behavioral weight control program for 76 adolescents, aged 13-16 years. They found that both the treatment conditions resulted in significant weight loss but not difference between the conditions. The authors found that adding a peer based component the weight control programs may be most effective for older adolescents.

Jelalian and Mehlenbeck (2002) found significant weight loss among 16 adolescents, aged 13-16 years, enrolled in a peer based intervention involving group behavioral sessions and dietitian led nutrition education and diet plans based on the dietary exchange system. The intervention required more individualized care, which may not be feasible for all community intervention sites.

Jiang et al. (2005) found that a family based behavioral treatment including detailed dietary modifications, a “traffic light” food system and physical activity, led to a significant reduction in BMI among 36 children (mean age 13 years). The authors concluded that the inclusion of families in behavioral interventions may help in treating adolescent obesity.

Johnson et al. (1997) studied the impact of nutrition education and exercise presented to 19 children and adolescents, aged 8-17 years, in a cognitive/ behavioral framework focused on the development of self-regulation. The authors found a positive change in body weight and nutrition habits among participants receiving nutrition education and exercise.

Leslie et al. (1999) found that a 10 week elective class about nutrition, fitness and body image, reinforced by advocacy for changes in school foodservices, improved knowledge about fitness and healthful food choices and improved skills in choosing low-fat and high fibre foods. The authors found that a girl’s only class offered in the school curricula provides an appealing opportunity for adolescents to engage in healthy eating and activity education and behaviors.

Long et al. (2006) studied the effect of an interactive web-based nutrition education program delivered in school classrooms for 45 minutes before school for a 3 week period among 21 students, aged 12-16 years. They found a significant difference in post

intervention fat intake but no difference in fruit and vegetable scores. Data was gathered through a 24 hour recall which may have questionable reliability.

Long and Stevens (2004) found that a web-based instruction combined with 10 hours of classroom curriculum focused on the development of healthy eating knowledge and skills, significantly improved self-efficacy for fruit and vegetable intake and lower fat foods, overall food choices and dietary knowledge of fat among 121 adolescents, aged 12-16 years. The computer based method was developmentally appropriate and peer interaction made the nutrition education enjoyable for adolescents.

McMurray et al. (2002) studied the effect of a school based weight control program on the blood pressure and body fat of 1140 early adolescents. The program evaluated three intervention conditions 1) 30 minutes of aerobic exercise 3 days a week, 2) education on nutrition, smoking and exercise, or 3) exercise and education. The authors found no change in BMI between groups, but a smaller increase in sum of skinfolds in the exercise group. The authors concluded that the combination of exercise and education may have the greatest impact on skinfolds, but exercise was the more important determinant. Limited information was provided on the intervention component.

McVey et al. (2004) found decreased negative dieting behaviors and improved body image satisfaction among 258 grade 6-8 girls exposed to 6 weekly 50 minute sessions on healthy living and body image acceptance. The authors noted that school based health promotion strategies are safe and effective in promoting positive body image and that a universal school program provides wider access to information.

Nader et al. (1999) assessed the impact of a cardiovascular health promotion program on the dietary intake of 3714 grade 6,7 and 8 students. They found that dietary knowledge and intentions were more favorable in the intervention groups 3 years post intervention. The intervention, however, was delivered elementary school years and not described in detail.

Nemet et al. (2005) found significant changes in body weight and body fat percentage in a sample of 54 children (aged 6-16 years) exposed to an intervention involving 4 lectures on nutrition, obesity and exercise and individual nutrition counseling. The intervention required one-on-one counseling by a dietitian which may not be feasible in many community settings.

Neumark-Sztainer et al. (2003) studied the impact of the 'New Moves' intervention, involving physical education, nutritional guidance and social support, focused on increasing self-efficacy, delivered to 201 girls, with a mean age 15.4. They found that the girls progressed in stage of change, but did not statistically change in BMI. The girls only intervention was effective in addressing barriers to physical activity and healthy eating.

Nicklas et al. (1998) studied the effect of a 4 year school-based intervention including a media campaign, school meal modification, classroom workshops, and parental involvement on the fruit and vegetable intake of 2213 9th grade students. They found

increased fruit and vegetable intake in both the control and intervention groups but no significant difference between the groups. The knowledge scores of the intervention subjects were significantly higher. The authors concluded that media marketing is an effective method to deliver health messages and attract adolescent's attention.

O'Neil & Nicklas (2002) studied a multi-component school intervention targeting increased fruit and vegetable intake among high school students. The intervention included media-marketing, tip sheets, contests and fruit and vegetable baskets. They found a 14% increase in fruit and vegetable intake over 2 years and significantly higher nutrition knowledge among students in the intervention schools. The authors concluded that environmental change offers a practical and feasible approach to reach a large sector of the population and target nutrition change.

Rankins et al. (1999) studied the effect of an intervention focused on building knowledge of nutrition related chronic disease and low fat, high fibre cooking offered for 6 weeks in a middle school consumer science class. They found that out of 448 students (mean age 13 years), those in the intervention group displayed significantly increased knowledge of reduced fat cooking and nutrition-related diseases.

Reinhardt and Brevard (2002) found a significant increase in nutrition knowledge scores and physical activity knowledge among 192 7th grade students exposed to an integrated school based nutrition curriculum. The curriculum used the Food Guide Pyramid to promote practical life skills in label reading, body image concerns, and weight management practices. The authors concluded that this type of curriculum can be integrated into core subjects to impact adolescent's health outcomes.

Resnicow et al. (2000) found lower calorie intakes, lower percentage of total energy from fat and lower sodium intakes among high attenders of a group of 57 girls enrolled in a community weight management program held over 6 months. The program included interactive educational activities, physical activity and meal preparation. Experiential activities and social benefits were motivators for participants. The decision to compare high and low attenders was a post hoc decision due to the lack of a control group and the outcomes measures were based on self-reported data.

Resnicow, Taylor et al. (2005) studied the impact of a church based nutrition and physical activity intervention, delivered at both high intensity (24-26 sessions) and moderate intensity (6 sessions), on BMI of 147 girls, age 12-16 years. They found girls in the high intensity group who attended more than $\frac{3}{4}$ of the sessions had significantly lower BMI, but otherwise there was no statistical difference in outcomes. Involving parents in the intervention was reported to have a positive impact on outcomes.

Rinderknecht and Smith (2004) found no change in dietary self-efficacy among youth, aged 11-18 years, from a sample of 154 Native American children exposed to a 7 month intervention. The intervention comprised of one 30-60 minute lesson on improving dietary self-efficacy by exposure to healthy foods, healthy eating and physical activity discussions and learning activities. The authors concluded that the lack of effect

demonstrates a need for intervention programs to be more comprehensive and address environmental and behavioral constraints.

Ritenbaugh et al. (2003) studied the impact of a school-based intervention involving the creation of a school fitness facility and changes in school food services on diabetes risk of 236 Zuni Pueblo high school children (average age 17 years). They found a significant decrease in sugared soft drinks consumption at school by the end of the third year of the students. The researchers used an Anglo group as the control.

Rudolf et al. (2006) found a significant reduction in overweight among 94 children, aged 8-16 years, attending a community based program targeting overweight through individual appointments, following the Healthy Eating Lifestyle Programme model, group activity sessions and parent sessions. The findings support the potential for a program involving group and individual components offered within the community to reduce childhood overweight.

Sallis et al. (2003) found a significant increase in physical activity but no significant change in total fat or saturated fat intake among 1109 students in grades 6-8 involved in a nutrition and physical activity intervention. The intervention comprised of physical education, changes to reduce the fat content of foods offered at school and marketing of healthy low fat eating. The changes across intervention sites were inconsistent and not supported by nutrition education.

Segal et al. (2004) studied the impact of a family based, behavioural weight control program on the eating habits and weights of 30 adolescents and children, aged 11-16 years. The authors reported positive changes in the body weights, nutrition knowledge, diet habits and body image at the end of the 2 month program.

Thornburg and Hill (2004) found that web-based nutrition education intervention, including nutrition analyses and nutrition and activity searches, increased 27 middle school students awareness of their nutrition habits. However, the study involved a small sample, with questionable outcome measures and no statistical analysis.

Wang et al. (2006) studied the impact of a school based healthy eating and activity intervention on the BMI, waist circumference and total skinfold thickness of 450 5-7th grade students. The intervention included school media marketing, nutrition and exercise education, partnerships with local grocery stores to promote fruit and vegetables, and culturally appropriate recipes sent home to families. The authors found a smaller BMI, waist circumference and total skinfold thickness among the intervention group one year post intervention. The findings indicate that school based programs can help prevent obesity.

Wong et al. (1997) found that a higher percentage of the 167 obese students, aged 15-21 years, enrolled in a school based weight control program using a combining strategy of behavior modification, nutrition education and exercise lost weight compared with those in the control group (although this was not statistically different). The outcome measures

were based on self reported data. The findings indicate that an initial intensive approach can help students with behavior modifications which can be effective in maintaining long term weight loss.

White et al. (2004) studied the impact of a web based health promotion program on the BMI, weight and body fat of 57 African American girls between the ages of 11-15 years. The program was offered on a weekly basis, included information on nutrition, weight loss, physical activity and healthy food choices, and involved parental support through focus group sessions. The authors found a significant change in body weight, BMI and body fat among adolescents in the intervention group compared with the control group. The findings support the inclusion of family or parent involvement in weight loss efforts and the efficacy of an internet based approach to promote nutrition and healthier dietary outcomes among adolescent girls.

Zang (2006) found that a community based, group weight management program, offered to 8 adolescent girls, aged 11-16 years, resulted in mixed outcomes on the participant's body weights. The program involved 8 weekly peer group sessions on topics including goal setting, motivation, food alternated and healthy eating. Despite mixed results and a small sample, the author concludes that a peer group approach is a good way to introduce healthy eating and activity to adolescent girls.

Appendix G

Quality Rating Tally Sheets

Author	Resnicow	Resnicow	Damon	Carrel	Davee	Rinder-Knecht	Sallis	Frable	Frable	Grey	William-Son	White	Jiang	Gort-Maker
Year	2000	2005	2005	2005	2005	2004	2003	2006	2004	2004	2005	2004	2005	1999
Relevance Questions														
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Y	Y	Y	Y	Y/N	Y	Y/N	Y/N	Y/N	Y	Y	Y	Y	Y
Validity Questions														
1	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y
3	N	Y	Y	N	Y	N	Y	N	N	Y	Y	Y	Y	Y
4	N	Y	Y	N	N	N	N	N	Y	N	Y	Y	Y	Y
5	N	N	N	N	N	N	N	N	N	Y	N	N	N	N
6	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y
10	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quality Rating	0	+	0	0	-	0	+	0	0	+	+	+	+	+
Sample Size	57	123	491	38	581	63	1434	NA	282	41	57	57	68	1295
Relevance to pop.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Author	Frenn	Frenn	O'Dea	Agron	Wang	Wojcicki	Leslie	Horo- Witz	Rudolf	Hawley	Nicklas	Singh	Kremers	Neumark- Sztainer
Year	2005	2003	2002	2002	2006	2006	1999	2004	2006	2006	1998	2006	2005	2003
Relevance Questions														
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Y	Y	Y	Y / N	Y / N	Y / N	Y	Y	Y	Y	Y	Y	Y	Y
Validity Questions														
1	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y
3	Y	Y	N	N	Y	N	N	N	N	N	Y	Y	Y	Y
4	N	N	N	N	N	N	N	N	Y	N	Y	Y	N	Y
5	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N
6	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
7	Y	Y	N	Y	N	N	N	N	Y	Y	Y	N	Y	Y
8	Y	Y	N	Y	N	N	N	N	Y	N	Y	Y	N	Y
9	Y	Y	N	N	N	N	Y	N	Y	Y	Y	N	N	Y
10	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Quality Rating	+	+	-	-	0	-	-	-	+	0	+	0	0	+
Sample Size	103	117	156	220	450	859	50	34	94	65	2213	500	400	201
Relevance to pop.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Author	Long	Jelalian	McVey	Mc Murray	Nader	Carrel	Thornburg	Edwards	Gortmaker	Zang	Reinhardt	O'neil	Rankins	Long
Year	2004	2006	2004	2002	1999	2005	2004	2005	2000	2006	2002	2002	1999	2006
Relevance Questions														
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Y	Y	Y	Y	Y/N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Validity Questions														
1	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y
2	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y
3	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	N
4	N	Y	N	N	Y	N	N	Y	Y	N	N	N	N	N
5	N	N	N	N	N	N	N	N	N	N	N	N	N	N
6	Y	Y	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y
7	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N
8	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N
9	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	N
10	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quality Rating	+	+	0	0	+	0	-	0	0	-	0	+	+	-
Sample Size	121	76	258	1140	3714	50	27	42	1560	8	192	2213	448	21
Relevance to pop.	Y	Y	Y	Y	Y/N	Y	Y	Y	Y	Y	Y	Y	Y	Y

Author	Jelalian	Eliakim	Haerens	Nemet	Austin	Segal	French	Birnbaum	Higgins	Johnson	Hern	Baxter
Year	2002	2002	2006	2005	2005	2004	2004	2002	2001	1997	1998	1997
Relevance Questions												
1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4	Y/N	Y/N	Y	Y	Y	Y	Y	Y	Y	Y	Y/N	Y/N
Validity Questions												
1	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N
2	Y	N	Y	Y	Y	N	Y	Y	N	Y	N	Y
3	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y
4	Y	Y	Y	Y	Y	N	N	N	N	N	N	N
5	N	N	N	N	N	N	N	N	N	N	N	N
6	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N
7	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y
8	Y	Y	Y	Y	Y	Y	N	Y	N	Y	N	Y
9	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
10	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quality Rating	+	0	+	+	+	0	0	+	-	+	-	0
Sample Size	16	177	2840	54	480	30	20 schools (~750 students)	20 schools 3513 students	43	29	23	1636
Relevance to pop.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Appendix H

Evidence Summary Tables

Obesity Prevention and Treatment Interventions

Comprehensive Interventions Evidence Appraisal		
Questions:		
<p>1. What elements of community interventions have been successful in either:</p> <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; <p>2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?</p>		
Conclusion Statement:		
Comprehensive interventions, addressing individual, social and environmental influences, may be associated with improve eating behaviors, nutrition knowledge, or dietary intake among adolescents and a resultant decrease in adiposity.		
Evidence Summary:		
Of the 49 studies included in this review, 10 were comprehensive. These interventions included nutrition and physical activity education in addition to environmental modifications to improve the selection of healthy choices in schools and/or communities.		
Evidence Synopsis:		
Five studies were rated +, 4 were rated Ø and 1 was rated -. Seven studies were randomized controlled trials, 1 was a pre/posttest and 2 were nonrandomized trials.		
Three intervention studies resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one only in females and one only in males; 3 resulted in improved nutrition knowledge; and 4 resulted in improved dietary intake.		
Conclusion Grade:		
Grade II		
Evidence Sources, Class and Rating:		
Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Baxter AP, Milner PC, Hawkins S, Leaf M, Simpson C, Wilson KV, Owen T, Higginbottom G, Nicholl J, Cooper N. The impact of heart health promotion on coronary heart disease lifestyle risk factors in schoolchildren: lessons learnt from a community-based project. <i>Public Health</i> . 1997;111(4):231-7.	C	0
Bimbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
French S, Story M, Fulkerson J & Hannan P. An Environmental Intervention to Promote Lower-Fat Food Choices in Secondary Schools: Outcomes of the TACOS Study. <i>Amer. J. Pub. Health</i> . 2004; 94(9): 1507-1512.	A	0
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle	A	+

Schools. Obesity; 2006: 14:847-854.		
Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh nutrition concept for students. J Sch Health. 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). Health Educ Behav. 2000 Apr;27(2):201-12.	A	+
O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. Journal of the American Dietetic Association Volume 102, Issue 3, Supplement 1, March 2002, Pages S93-S96.	A	+
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. Prev Med: 2003: 36(3):309-19.	C	0
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003: 24(3):209-17.	A	+
Wang Y, Tussing L, Odums-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nut; 2006: 60:1 (92-103).	A	0

Nutrition Education Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> What elements of community interventions have been successful in either: <ul style="list-style-type: none"> Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Nutrition education included as a component of comprehensive obesity prevention and treatment interventions may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity among adolescents.</p>
<p>Evidence Summary:</p> <p>Forty-seven interventions included a component of nutrition education. Most (88%) were comprised of multi-disciplinary strategies, in which nutrition education was one component. The only study that did not include nutrition education implemented changes in the school food environment (French 2004).</p> <p>Nutrition education topics included the food guide, promotion of low fat foods, calorie balance, healthier food choices and the benefits of these choices, healthy eating habits, 5-a-day fruit and vegetables, eating breakfast, soda consumption, fast food and eating out, individual dietary assessments, fat and sugar content of foods and healthy snack preparation. Many of the studies listed healthy eating or nutrition education as a strategy but did not clearly define the content or intensity.</p> <p>Approximately half (48%) of the nutrition education interventions focused on behavior change through a form of interactive or experiential learning. Adolescents were involved in dietary intake assessments, preparing healthy snacks both live and on computer based programs,</p>

setting healthy nutrition goals and developing and practicing healthy cooking skills.

a) Obesity Prevention

Twenty-nine of the 30 obesity prevention interventions included a component of nutrition education. Nutrition education sessions focused primarily on the topic of healthy eating, promoting fruit and vegetable, low fat, low sugar and healthy snack intakes. The sessions ranged from 4 – 32 classroom lessons.

The high quality RCT, Teens Eating for Energy and Nutrition in Schools (TEENS) intervention was a school-based, environmental, classroom and family intervention delivered to 7th grade students over 2 years (Birnbaum 2002). It consisted of 10 behavioural based curriculum sessions promoting fruit and vegetable intake, low fat foods and healthy snacks. Students exposed to both nutrition education curriculum and school food environment changes increased fruit and vegetable intake with borderline significance and improved usual food choices.

Reinhardt 2002 similarly found that nutrition education resulted in a significant increase in nutrition knowledge scores and physical activity knowledge among 192 7th grade participants of an integrated school based nutrition curriculum. Their intervention used the Food Guide Pyramid to promote practical life skills in label reading, body image concerns and weight management practices.

Conversely, Grey 2004 found that a school based nutrition education and physical activity program, involving nutrition assessments and goal setting evaluated by a dietitian did not result in a statistically significant difference between the intervention and control groups. Yet, the intervention group did show trends towards improved usual food choices and dietary knowledge.

b) Obesity Treatment

All 17 obesity treatment interventions included a component of nutrition education. Nutrition education focused on skill building through activities such as label reading, healthy food preparation and choosing and developing healthy foods and meals.

In a high quality pretest/ posttest trial, Jelalian 2002 studied the impact of group behavioral sessions, dietitian led nutrition education and diet plans based on the dietary exchange system on the weights of 16 adolescents, aged 13-16 years. The authors found that the participants lost an average of 14.73 pounds, which was maintained at 6-month follow-up.

Alternatively, Carrel, Meinen 2005 found no significant change in percent body fat but a decrease in fasting insulin in 38 children and youth enrolled in a 24 week nutrition and exercise class. The class included 30 minutes of physical activity, basic nutrition education and healthy snack preparation.

Evidence Synopsis:

Twenty-two of the 47 studies were rated +, 18 were rated Ø and 7 were rated -. The majority were randomized controlled trials, non randomized controlled trials or pre/posttest studies.

Eighteen interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); 13 interventions resulted improved nutrition knowledge; and 17 interventions resulted in improved dietary intake or eating behaviors (with overlap). Three studies reported no change in dietary intake or nutrition knowledge; and 4 studies reported no change in adiposity. One of the studies that reported no change in adiposity reported decreased fasting insulin levels.

Conclusion Grade:

Grade I

Evidence Sources, Class and Rating:		
Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. <i>Arch Pediatr Adolesc Med</i> : 2005; 159(3):225-230.	A	+
Baxter AP, Milner PC, Hawkins S, Leaf M, Simpson C, Wilson KV, Owen T, Higginbottom G, Nicholl J, Cooper N. The impact of heart health promotion on coronary heart disease lifestyle risk factors in schoolchildren: lessons learnt from a community-based project. <i>Public Health</i> . 1997;111(4):231-7.	C	0
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Carrel AL, Clark R, Peterson S, Nemeth B, Sullivan J & Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. <i>Archives of Pediatrics & Adolescent Medicine</i> ; 2005; 159 (10): 963-8.	A	0
Carrel A, Meinen A, Garry C & Storandt R. Effects of nutrition education and exercise in obese children: the Ho-Chunk Youth Fitness Program. <i>WMJ</i> . 2005; 104(5): 44-48.	D	0
Damon S, Dietrich S & Widhalm K. PRESTO - Prevention Study of Obesity: A project to prevent obesity during childhood and adolescence. <i>Int J Paediatr</i> : 2005; 94:S(448):47-48.	A	0
Edwards B. Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels. <i>Nursing Clinics of North America</i> ; 2005; 40 (4): 661-9.	C	0
Eliakim A, Kaven G, Berger I, Friedland O, Wolach B & Nemet D. The effect of a combined intervention on body mass index and fitness in obese children and adolescents. <i>Eur J Pediatric</i> : 2002; 161(8):449-454.	C	0
Frable J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a retrospective critical examination of program evaluation. <i>Prev Chronic Dis</i> ; 2006; 3(3):A98. Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community campus partnership to prevent obesity. <i>Journal of Interprofessional Care</i> , Volume 18, Number 4, November 2004, pp. 447-449(3).	C	0
Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. <i>J Pediatr Nurs</i> ; 2003; 18(1):36-45.	C	+
Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. <i>Appl Nurs Res</i> : 18(1):13-21.	A	+
Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. <i>Archives of pediatrics & adolescent medicine</i> . 1999; 153 (4): 409-18. Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. <i>Evidence Based Nursing</i> ; 2000: 3:13.	A	+
Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. <i>J Sch Health</i> . 2004 Jan;74(1):10-5.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle	A	+

Schools. Obesity; 2006: 14:847-854.		
Hawley SR, Beckman H & Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. J Community Health Nurs; 2006: Vol. 23 (2), pp. 69-80.	D	0
Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. Pediatr Nurs. 1998; 24: 127-132.	D	-
Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. Can J Pub Health. 2001; 92(6):448-452.	D	-
Horowitz M, Shilts MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. J. Nutr. Educ. Behav. 2004 36:1 (43-44).	D	0
Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. International journal of obesity; 2006: VL30(1): 31-9.	C	+
Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for overweight adolescents: Some preliminary findings. J Clin Psychol Med Settings: 2002; 9(1):15-23.	D	+
Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. Arch Dis Child; 2005: Vol. 90 (12), pp. 1235-8.	A	+
Johnson WG, Hinkle LK, Carr RE, Anderson DA, Lemmon CR, Engler LB & Bergeron KC. Dietary and exercise interventions for juvenile obesity: long term effect of behavioral and public health models. Obes Res: 1997; 5(3):257-261.	C	+
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. J. Am. Diet. Assoc. 1999 99:8 (967-970).	D	-
Long JD & Stevens KR. Using technology to promote self-efficacy for healthy eating in adolescents. J Nurs Scholarsh. 2004;36(2):134-9.	A	+
Long J, Armstrong M, Shriver B, LaNell H, Luker S, Nash A & Blevins W. Pilot using world wide web to prevent diabetes in adolescents. Clin Nurs Res; 2006: 15(1):67-79.	D	-
McMurray RG, Harrell JS, Bangdiwala SI, Bradley CB, Deng S & Levine A. A school-based intervention can reduce body fat and blood pressure in young adolescents. The Journal of adolescent health; 2002: 31(2): 125-32.	A	0
McVey GL, Davis R, Tweed S & Shaw BF. Evaluation of a school-based program designed to improve body image satisfaction, global self-esteem, and eating attitudes and behaviors: a replication study. The International journal of eating disorders; 2004: 36(1):1-11.	A	0
Nader PR, Stone EJ, Lytle LA, Perry CL, Osganian SK, Kelder S, Webber LS, Elder JP, Montgomery D, Feldman HA, Wu M, Johnson C, Parcel GS & Luepker RV. Three-year maintenance of improved diet and physical activity: the CATCH cohort. Child and Adolescent Trial for Cardiovascular Health. Archives of pediatrics & adolescent medicine; 1999: 153(7): 695-704.	A	+
Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G & Eliakim A. Short- and long-term beneficial effects of a combined dietary-behavioral- physical activity intervention for the treatment of childhood obesity. Pediatrics; 2005: 115:4 (e443-e449).	A	+
Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. Prev Med; 2003: Vol. 37 (1), pp. 41-51.	A	+
Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh nutrition concept for students. J Sch Health. 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). Health Educ Behav. 2000 Apr;27(2):201-12.	A	+

O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. Journal of the American Dietetic Association Volume 102, Issue 3, Supplement 1, March 2002, Pages S93-S96.	A	+
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. J Nutr Educ. 1999; 31(1):14-20.	C	+
Reinhardt W & Brevard P. Integrating the Food Guide Pyramid and Physical Activity Pyramid for Positive Dietary and Physical Activity Behaviors in Adolescents. Journal of the American Dietetic Association; 2002:102(3), S1: S96-S99.	D	0
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. Health Educ Behav 2000 27:5 (616-631).	A	0
Resnicow K Taylor R, Baskin M & McCarthy F. Results of Go Girls: A Weight Control Program for Overweight African American Adolescent Females. Obesity Research. 2005; 13:10 (1739-1748).	A	+
Rinderknecht K & Smith C. Social cognitive theory in an after-school nutrition intervention for urban Native American youth. J Nutr Educ Behav; 2004: 36(6):298-304.	D	0
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. Prev Med: 2003: 36(3):309-19.	C	0
Rudolf M, Christie D, McElhone S, Sahota P, Dixey R, Walker J & Wellings C. WATCH IT: a community based programme for obese children and adolescents. Arch Dis Child; 2006: Vol. 91 (9), pp. 736-9.	D	+
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003: 24(3):209-17.	A	+
Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. J Am Diet Assoc; 2004: 104:8 Suppl 2 (A32).	D	0
Thornburg R & Hill K. Using Internet Assessment Tools for Health and Physical Education Instruction. TechTrends: Linking Research & Practice to Improve Learning; 2004: 48(6):53-55.	D	-
Wang Y, Tussing L, Odoms-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nut; 2006: 60:1 (92-103).	A	0
White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. Obes Res; 2005: Vol. 12 (7), pp. 1050-9.	A	+
Wong, Koh, Lee, Fong. Two-year follow-up of a behavioral weight control programme for adolescents in Singapore: predictors of long-term weight loss. Ann Acad Med Singapore. 1997;26:147-53.	C	0
Zang S. Go girls go: approaching obesity through an adolescent peer support group. Nurse Practitioner World News; 2006: 11(1): 19-20.	D	-

Combined Nutrition and Physical Education Evidence Appraisal
Questions:
1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake

- during adolescence; or
- Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions;

2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?

Conclusion Statement:

Nutrition education combined with physical education in obesity prevention and treatment interventions may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity.

Evidence Summary:

Thirty-nine (88%) interventions involving nutrition education also included physical education and/or activity. Some interventions included both physical education and activity.

a) Obesity Prevention

Twenty-four obesity prevention interventions included physical education and 11 included physical activity. Some of these included both.

Planet Health (Gortmaker 2000) was a high quality RCT involving 1295 ethnically diverse early adolescents in 10 schools (5 control schools and 5 intervention schools). This behaviour-based, student-centred intervention promoted physical activity, healthy eating and reducing sedentary activity through classroom curriculum that was delivered by trained teachers. The authors found reduced obesity prevalence among girls from the intervention school at the follow-up. Obesity rates among boys also declined but in both the intervention and control schools. Increased fruit and vegetable consumption and a decreased daily total calorie intake in girls were also reported.

Haerens 2006, conducted a high quality RCT involving a school based intervention aimed at promoting healthy food and physical activity. The intervention aimed to increase physical activity to at least 60 minutes per day through additional activity opportunities during school breaks and classroom hours. The authors reported that BMI increased significantly less in girls in the intervention with parental support group compared with the control group. No significant changes were seen in boys.

Another high quality RCT, the New Moves intervention (Neumark Sztainer 2003) targeted physically inactive girls in grades 9-12. This 16 week behaviour-based intervention comprised of physical activity four times a week and nutrition education and social support sessions every other week. Emphasis was placed on increasing fruit and vegetable intake decreasing fat and sugar intakes. The girls were exposed to healthy food choices through taste testing sessions. They were also invited to attend healthy lunch meetings for 8 weeks after the intervention to encourage maintenance. The authors found that while there was not statistically significant difference in BMI between the intervention and control groups, the girls in the intervention group reported a positive change in eating patterns and progressed in Stages of Change for physical activity.

b) Obesity Treatment

Fifteen obesity treatment interventions included physical education and 12 included physical activity. Some of these included both.

Examples of treatment programs with a combined nutrition education and physical activity approach included a RCT by Carrel 2005. This study randomized 50 overweight middle school adolescents to either a lifestyle-focused, fitness-oriented gym classes (intervention group) or standard gym classes (control group). The treatment group (n=27) showed a significantly

greater loss of body fat (loss, $-4.1\% \pm 3.4\%$ vs $-1.9\% \pm 2.3\%$; $P=.04$), as well as greater improvements in cardiovascular fitness and fasting insulin levels compared to the control group at the end of the 9 month intervention.

The Ho-Chunk Youth Fitness Program (Carrel, Meinen 2005) was a pretest/ posttest trial comprised of 24 weeks of twice weekly supervised nutrition and exercise classes. Class time was divided among fitness and nutrition education, with 45 minutes for physical activity and 30 minutes of a healthy snack preparation. The participants learnt about a variety of fitness and nutrition topics. Nutrition education included: the food guide pyramid, reading food labels, 5-a day fruit and vegetables, the importance of eating breakfast, soda consumption, eating at holidays, and fast food eating behaviors. Incentives were provided for attending class and completing home activities. The authors found that although percent body fat, glucose, and total cholesterol remained unchanged over the duration of the intervention, mean fasting plasma insulin decreased after the 24 week intervention.

In a non-randomized controlled trial, Eliakim 2002 provided a multi-disciplinary intervention to 177 early to middle adolescents and their parents through four evening lectures (childhood obesity, general nutrition, therapeutic nutritional approach for childhood obesity, and exercise and obesity), dietitian visits including a diet plan and twice weekly 1-hour exercise training sessions. Following the 3 month intervention, the authors reported that 65% (117 subjects) of the participants lost weight and 74% (133 subjects) reduced BMI.

Evidence Synopsis:

Seventeen of the 39 studies were rated +, 16 were rated Ø and 6 were rated -. Eighteen studies were randomized controlled trials, 7 were nonrandomized controlled trials, and 13 were pre/posttest trials.

Fifteen intervention studies resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one was in girls only and one was in boys only; six resulted in improved nutrition knowledge; and seven resulted in improved dietary intake. Three studies reported no change in adiposity, two studies reported no change in dietary behaviours, and one reported no change in dietary intake.

Conclusion Grade:

Grade I

Evidence Sources, Class and Rating:

Complete Reference:	Quality Class:	Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. <i>Arch Pediatr Adolesc Med</i> : 2005; 159(3):225-230.	A	+
Baxter AP, Milner PC, Hawkins S, Leaf M, Simpson C, Wilson KV, Owen T, Higginbottom G, Nicholl J, Cooper N. The impact of heart health promotion on coronary heart disease lifestyle risk factors in schoolchildren: lessons learnt from a community-based project. <i>Public Health</i> . 1997;111(4):231-7.	C	0
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Carrel AL, Clark R, Peterson S, Nemeth B, Sullivan J & Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. <i>Archives of Pediatrics & Adolescent Medicine</i> ; 2005; 159 (10): 963-8.	A	0

Carrel A, Meinen A, Garry C & Storandt R. Effects of nutrition education and exercise in obese children: the Ho-Chunk Youth Fitness Program. <i>WMJ</i> . 2005; 104(5): 44-48.	D	0
Damon S, Dietrich S & Widhalm K. PRESTO - Prevention Study of Obesity: A project to prevent obesity during childhood and adolescence. <i>Int J Paediatr</i> ; 2005; 94:S(448):47-48.	A	0
Eliakim A, Kaven G, Berger I, Friedland O, Wolach B & Nemet D. The effect of a combined intervention on body mass index and fitness in obese children and adolescents. <i>Eur J Pediatric</i> ; 2002; 161(8):449-454.	C	0
Frable J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a retrospective critical examination of program evaluation. <i>Prev Chronic Dis</i> ; 2006; 3(3):A98. Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community campus partnership to prevent obesity. <i>Journal of Interprofessional Care</i> , Volume 18, Number 4, November 2004, pp. 447-449(3).	C	0
Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. <i>J Pediatr Nurs</i> ; 2003; 18(1):36-45.	C	+
Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. <i>Appl Nurs Res</i> ; 18(1):13-21.	A	+
Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. <i>Archives of pediatrics & adolescent medicine</i> . 1999; 153 (4): 409-18. Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. <i>Evidence Based Nursing</i> ; 2000: 3:13.	A	+
Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. <i>J Sch Health</i> . 2004 Jan;74(1):10-5.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. <i>Obesity</i> ; 2006: 14:847-854.	A	+
Hawley SR, Beckman H & Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. <i>J Community Health Nurs</i> ; 2006: Vol. 23 (2), pp. 69-80.	D	0
Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. <i>Pediatr Nurs</i> . 1998; 24: 127-132.	D	-
Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. <i>Can J Pub Health</i> . 2001; 92(6):448-452.	D	-
Horowitz M, Shilts MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. <i>J. Nutr. Educ. Behav</i> . 2004 36:1 (43-44).	D	0
Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. <i>International journal of obesity</i> ; 2006: VL30(1): 31-9.	C	+
Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for overweight adolescents: Some preliminary findings. <i>J Clin Psychol Med Settings</i> : 2002; 9(1):15-23.	D	+
Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. <i>Arch Dis Child</i> ; 2005: Vol. 90 (12), pp. 1235-8.	A	+
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. <i>J. Am. Diet. Assoc</i> . 1999 99:8 (967-970).	D	-
McMurray RG, Harrell JS, Bangdiwala SI, Bradley CB, Deng S & Levine A. A	A	0

school-based intervention can reduce body fat and blood pressure in young adolescents. <i>The Journal of adolescent health</i> ; 2002: 31(2): 125-32.		
Nader PR, Stone EJ, Lytle LA, Perry CL, Osganian SK, Kelder S, Webber LS, Elder JP, Montgomery D, Feldman HA, Wu M, Johnson C, Parcel GS & Luepker RV. Three-year maintenance of improved diet and physical activity: the CATCH cohort. <i>Child and Adolescent Trial for Cardiovascular Health. Archives of pediatrics & adolescent medicine</i> ; 1999: 153(7): 695-704.	A	+
Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G & Eliakim A. Short- and long-term beneficial effects of a combined dietary-behavioral- physical activity intervention for the treatment of childhood obesity. <i>Pediatrics</i> ; 2005: 115:4 (e443-e449).	A	+
Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. <i>Prev Med</i> ; 2003: Vol. 37 (1), pp. 41-51.	A	+
Reinhardt W & Brevard P. Integrating the Food Guide Pyramid and Physical Activity Pyramid for Positive Dietary and Physical Activity Behaviors in Adolescents. <i>Journal of the American Dietetic Association</i> ; 2002:102(3), S1: S96-S99.	D	0
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. <i>Health Educ Behav</i> 2000 27:5 (616-631).	A	0
Resnicow K Taylor R, Baskin M & McCarthy F. Results of Go Girls: A Weight Control Program for Overweight African American Adolescent Females. <i>Obesity Research</i> . 2005; 13:10 (1739-1748).	A	+
Rinderknecht K & Smith C. Social cognitive theory in an after-school nutrition intervention for urban Native American youth. <i>J Nutr Educ Behav</i> ; 2004: 36(6):298-304.	D	0
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. <i>Prev Med</i> : 2003: 36(3):309-19.	C	0
Rudolf M, Christie D, McElhone S, Sahota P, Dixey R, Walker J & Wellings C. WATCH IT: a community based programme for obese children and adolescents. <i>Arch Dis Child</i> ; 2006: Vol. 91 (9), pp. 736-9.	D	+
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. <i>Am J Prev Med</i> ; 2003: 24(3):209-17.	A	+
Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. <i>J Am Diet Assoc</i> ; 2004: 104:8 Suppl 2 (A32).	D	0
Thornburg R & Hill K. Using Internet Assessment Tools for Health and Physical Education Instruction. <i>TechTrends: Linking Research & Practice to Improve Learning</i> ; 2004: 48(6):53-55.	D	-
Wang Y, Tussing L, Odoms-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. <i>Eur J Clin Nut</i> ; 2006: 60:1 (92-103).	A	0
White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. <i>Obes Res</i> ; 2005: Vol. 12 (7), pp. 1050-9.	A	+
Wong, Koh, Lee, Fong. Two-year follow-up of a behavioral weight control programme for adolescents in Singapore: predictors of long-term weight loss. <i>Ann Acad Med Singapore</i> . 1997;26:147-53.	C	0

Combined Nutrition Education and Physical Activity

Evidence Appraisal

Questions:

1. What elements of community interventions have been successful in either:
 - Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or
 - Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions;
2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?

Conclusion Statement:

Nutrition education combined with physical activity in obesity prevention and treatment interventions may lead to reduced adiposity and improved dietary intake behaviours and knowledge.

Evidence Summary:

Twenty-four interventions included physical activity. Twelve of these were obesity prevention and twelve were obesity treatment interventions.

Evidence Synopsis:

Twelve studies were randomized controlled trials, seven were non-randomized controlled trials and five were pre/post-test studies. Eleven studies were rated +, 11 were rated Ø, and 2 were rated -.

Twelve studies reported a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), two were in girls only and one was in boys only; three studies reported improved nutrition and physical activity knowledge; one reported improved healthy eating behaviours; and three reported improved dietary intake. Three studies reported no change in adiposity and one study with a very small sample reported mixed results.

Conclusion Grade:

Grade I

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Carrel AL, Clark R, Peterson S, Nemeth B, Sullivan J & Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. Archives of Pediatrics & Adolescent Medicine; 2005; 159 (10): 963-8.	A	0
Carrel A, Meinen A, Garry C & Stordt R. Effects of nutrition education and exercise in obese children: the Ho-Chunk Youth Fitness Program. WMJ. 2005; 104(5): 44-48.	D	0
Damon S, Dietrich S & Widhalm K. PRESTO - Prevention Study of Obesity: A project to prevent obesity during childhood and adolescence. Int J Paediatr; 2005; 94:S(448):47-48.	A	0
Edwards B. Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels. Nursing Clinics of North America; 2005; 40 (4): 661-9.	C	0
Eliakim A, Kaven G, Berger I, Friedland O, Wolach B & Nemet D. The effect of a combined intervention on body mass index and fitness in obese children and adolescents. Eur J Pediatric; 2002; 161(8):449-454.	C	0
Frale J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a	C	0

retrospective critical examination of program evaluation. <i>Prev Chronic Dis</i> ; 2006: 3(3):A98. Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community campus partnership to prevent obesity. <i>Journal of Interprofessional Care</i> , Volume 18, Number 4, November 2004, pp. 447-449(3).		
Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. <i>Archives of pediatrics & adolescent medicine</i> . 1999; 153 (4): 409-18. Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. <i>Evidence Based Nursing</i> ; 2000: 3:13.	A	+
Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. <i>J Sch Health</i> . 2004 Jan;74(1):10-5.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. <i>Obesity</i> ; 2006: 14:847-854.	A	+
Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. <i>Can J Pub Health</i> . 2001; 92(6):448-452.	D	-
Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. <i>International journal of obesity</i> ; 2006: VL30(1): 31-9.	C	+
Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for overweight adolescents: Some preliminary findings. <i>J Clin Psychol Med Settings</i> : 2002; 9(1):15-23.	D	+
Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. <i>Arch Dis Child</i> ; 2005: Vol. 90 (12), pp. 1235-8.	A	+
Johnson WG, Hinkle LK, Carr RE, Anderson DA, Lemmon CR, Engler LB & Bergeron KC. Dietary and exercise interventions for juvenile obesity: long term effect of behavioral and public health models. <i>Obes Res</i> : 1997; 5(3):257-261.	C	+
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. <i>J. Am. Diet. Assoc.</i> 1999 99:8 (967-970).	D	-
McMurray RG, Harrell JS, Bangdiwala SI, Bradley CB, Deng S & Levine A. A school-based intervention can reduce body fat and blood pressure in young adolescents. <i>The Journal of adolescent health</i> ; 2002: 31(2): 125-32.	A	0
Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G & Eliakim A. Short- and long-term beneficial effects of a combined dietary-behavioral- physical activity intervention for the treatment of childhood obesity. <i>Pediatrics</i> ; 2005: 115:4 (e443-e449).	A	+
Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. <i>Prev Med</i> ; 2003: Vol. 37 (1), pp. 41-51.	A	+
Reinhardt W & Brevard P. Integrating the Food Guide Pyramid and Physical Activity Pyramid for Positive Dietary and Physical Activity Behaviors in Adolescents. <i>Journal of the American Dietetic Association</i> ; 2002:102(3), S1: S96-S99.	D	0
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. <i>Health Educ Behav</i> 2000 27:5 (616-631).	A	0
Resnicow K Taylor R, Baskin M & McCarthy F. Results of Go Girls: A Weight Control Program for Overweight African American Adolescent Females. <i>Obesity Research</i> . 2005; 13:10 (1739-1748).	A	+
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC,	C	0

Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. <i>Prev Med</i> : 2003; 36(3):309-19.		
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. <i>Am J Prev Med</i> ; 2003; 24(3):209-17.	A	+
Wong, Koh, Lee, Fong. Two-year follow-up of a behavioral weight control programme for adolescents in Singapore: predictors of long-term weight loss. <i>Ann Acad Med Singapore</i> . 1997;26:147-53.	C	0

Nutrition Education Combined with Decreasing Sedentary Activity Evidence Appraisal		
<p>Questions:</p> <p>1. What elements of community interventions have been successful in either:</p> <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; <p>2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?</p>		
<p>Conclusion Statement:</p> <p>Nutrition education combined with reducing sedentary activity in obesity prevention and treatment interventions may lead to reduced adiposity and improved dietary intake and behaviours.</p>		
<p>Evidence Summary:</p> <p>Seven obesity prevention interventions and one obesity treatment intervention focused on decreasing sedentary activity. None of the studies indicated specific strategies used to reduce sedentary activity.</p> <p>Evidence Synopsis:</p> <p>Four interventions were randomized controlled trials and three were pre/post-test studies. Three studies were rated +, three were rated Ø, and one was rated -.</p> <p>Three studies reported a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one was in girls only; two reported improved healthy eating behaviour; and one reported improved dietary intake. One study reported no change in dietary intake.</p>		
<p>Conclusion Grade:</p> <p>Grade III</p>		
<p>Evidence Sources, Class and Rating:</p>		
Complete Reference:	Class:	Quality Rating:
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. <i>Arch Pediatr Adolesc Med</i> : 2005; 159(3):225-230.	A	+
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth:	A	+

Planet Health. Archives of pediatrics & adolescent medicine. 1999; 153 (4): 409-18. Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. Evidence Based Nursing; 2000: 3:13.		
Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. Pediatr Nurs. 1998; 24: 127–132.	D	-
Horowitz M, Shilts MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. J. Nutr. Educ. Behav. 2004 36:1 (43-44).	D	0
Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. J Am Diet Assoc; 2004: 104:8 Suppl 2 (A32).	D	0
Wang Y, Tussing L, Odoms-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nut; 2006: 60:1 (92-103).	A	0

Family Involvement Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> What elements of community interventions have been successful in either: <ul style="list-style-type: none"> Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Family involvement in adolescent obesity prevention and treatment interventions may lead to positive changes in nutrition knowledge, dietary intake and eating behaviours and reduced adiposity.</p>
<p>Evidence Summary:</p> <p>Twenty-three interventions involved families with varying degrees of intensity. Some interventions were offered through the family environment, while other included family based activities such as distributing culturally appropriate recipes to families, holding group parenting sessions, using family members as role models through inclusion in goal setting activities, parent-teacher meetings and parental appointments with a dietitian.</p> <p style="padding-left: 40px;">a) Obesity Prevention</p> <p>Twelve interventions indirectly involved families in obesity prevention by distributing nutrition education material, hosting student presentations, parent-teacher meetings about school nutrition policy changes and family exercise initiatives.</p> <p>Examples of interventions involving families included the TEENS intervention (Birnbaum 2002), which distributed “parent packs” with activities and intervention messages for students’ families. Families also received healthy food coupons for participation.</p> <p>Healthy Weigh (El camino saludable) was a family based intervention that consisted of free weekly family meals, table talks and physical activity and nutrition classes (Frable 2004). Participants demonstrated a statistically significant improvement in nutrition knowledge scores.</p>

Haerens 2006 attempted to involve parents, through interactive meetings on healthy food, physical activity and the relationship with overweight and health. The authors reported that BMI increased significantly less of girls in the intervention with parental support compared with the control group or the intervention alone.

Hawley 2006, sent provided students' families with a Family Field Guide that included guidelines for getting started, changing behaviors, charting and monitoring goals and having fun working toward health goals, as well as information about health basics, nutrition and fitness. At the end of the 12 month intervention, the authors reported that families saw the goal of healthy eating as significantly more important.

The New Moves intervention (Neumark Sztainer 2003) was a RCT, which aimed to involve families by mailing postcards home every 2-3 weeks to encourage parental support.

b) Obesity Treatment

Eleven obesity treatment interventions were either family based or actively involved families. Jelalian 2006 held 16 weekly sessions, with parents and adolescents attending separate concurrent meetings with the health care team. Another intervention (Wang 2006) worked with sponsor stores to enable families to purchase fruits and vegetables.

Evidence Synopsis:

Eleven of the twenty-three interventions involving families were randomized controlled trials; 5 were non-randomized controlled trials; and 7 were pre/ post-test studies. Twelve studies were rated +, six were rated ∅, and three were rated -.

Thirteen interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one was in girls only. Three interventions resulted in improved nutrition knowledge. One study reported improved healthy eating behaviour and two reported improved dietary intake. One study reported no change in dietary behaviours, among adolescents, but positive changes among families. One study reported no change in dietary intake. One study reported no change in BMI and another reported mixed results among a small sample.

Conclusion Grade:

Grade II

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Birbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Edwards B. Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels. <i>Nursing Clinics of North America</i> ; 2005; 40 (4): 661-9.	C	0
Eliakim A, Kaven G, Berger I, Friedland O, Wolach B & Nemet D. The effect of a combined intervention on body mass index and fitness in obese children and adolescents. <i>Eur J Pediatric</i> : 2002; 161(8):449-454.	C	0
Frable J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a retrospective critical examination of program evaluation. <i>Prev Chronic Dis</i> ; 2006; 3(3):A98.	C	0
Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community		

campus partnership to prevent obesity. Journal of Interprofessional Care, Volume 18, Number 4, November 2004, pp. 447-449(3).		
Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. J Sch Health. 2004 Jan;74(1):10-5.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. Obesity; 2006: 14:847-854.	A	+
Hawley SR, Beckman H & Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. J Community Health Nurs; 2006: Vol. 23 (2), pp. 69-80.	D	0
Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. Pediatr Nurs. 1998; 24: 127–132.	D	-
Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for overweight adolescents: Some preliminary findings. J Clin Psychol Med Settings: 2002; 9(1):15-23.	D	+
Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. Arch Dis Child; 2005: Vol. 90 (12), pp. 1235-8.	A	+
Johnson WG, Hinkle LK, Carr RE, Anderson DA, Lemmon CR, Engler LB & Bergeron KC. Dietary and exercise interventions for juvenile obesity: long term effect of behavioral and public health models. Obes Res: 1997; 5(3):257-261.	C	+
Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G & Eliakim A. Short- and long-term beneficial effects of a combined dietary-behavioral- physical activity intervention for the treatment of childhood obesity. Pediatrics; 2005: 115:4 (e443-e449).	A	+
Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. Prev Med; 2003: Vol. 37 (1), pp. 41-51.	A	+
Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh nutrition concept for students. J Sch Health. 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). Health Educ Behav. 2000 Apr;27(2):201-12.	A	+
O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. Journal of the American Dietetic Association Volume 102, Issue 3, Supplement 1, March 2002, Pages S93-S96.	A	+
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. J Nutr Educ. 1999; 31(1):14–20.	C	+
Rudolf M, Christie D, McElhone S, Sahota P, Dixey R, Walker J & Wellings C. WATCH IT: a community based programme for obese children and adolescents. Arch Dis Child; 2006: Vol. 91 (9), pp. 736-9.	D	+
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003: 24(3):209-17.	A	+
Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. J Am Diet Assoc; 2004: 104:8 Suppl 2 (A32).	D	0
Wang Y, Tussing L, Odums-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nut; 2006: 60:1 (92-103).	A	0
White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan	A	+

DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. <i>Obes Res</i> ; 2005: Vol. 12 (7), pp. 1050-9.		
Zang S. Go girls go: approaching obesity through an adolescent peer support group. <i>Nurse Practitioner World News</i> ; 2006: 11(1): 19-20.	D	-

Behavioural Approaches Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> 1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; 2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement: Obesity prevention and treatment interventions using behavioural approaches may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity.</p>
<p>Evidence Summary: Twenty-three interventions used behavioural, skills based and active learning strategies to promote nutrition behavior change. Three of these exclusively focused on nutrition behaviour change, while the others included behaviour modification as part of a comprehensive approach.</p> <p>Information on actual intervention strategies was limited, but behaviour modification methods included goal setting, label reading, role modeling, peer group sessions, self-monitoring, motivational sessions, healthy cooking habit skill development and practice selecting and making healthy meals or snacks. Twelve interventions used food preparation or taste testing to expose adolescents to new, healthy foods and increase healthy food preparation skills.</p> <p style="text-align: center;">a) Obesity Prevention</p> <p>Thirteen obesity prevention interventions focused on nutrition and physical activity behaviour change. Nine of these used food preparation or taste testing to promote behaviour modification.</p> <p>In the previously mentioned high quality RCT, the Planet Health intervention, Gortmaker 2000 concluded that behaviour based health education, focused on increasing fruit and vegetable and decreasing high fat food intake and increasing physical activity, offered within the school curricula has potential to reduce obesity among adolescent girls.</p> <p>Hawley 2006 found no significant changes in health attitudes and behaviors in 65 middle school students enrolled in a school and community based program involving 5 behaviour based education sessions to promote physical activity and nutrition through experiential games and tasks and family education material.</p> <p style="text-align: center;">b) Obesity Treatment</p> <p>Thirteen obesity treatment interventions used behaviour modification through cognitive behaviour therapy and experiential learning.</p>

The intervention by Eliakim 2002 studied the impact of a combined nutrition-behavioural-exercise intervention on the weight and BMI of 204 children and adolescents. The intervention included dietitian-led, individual, behaviour-based, nutrition education and resulted in significant weight loss among participants.

Jelalian 2006 conducted a cognitive behavioral weight loss intervention, with a non randomized controlled trial design, which included topics of self-monitoring, motivation for weight loss, goal setting, the importance of physical activity, use of parent-teen contracts to support nutrition and activity goals, social influences on diet and exercise, the relationship between stress and eating and relapse preventions. The intervention resulted in significant weight loss in both the treatment and control groups but not difference between groups.

In their pretest/ posttest trial, Segal 2004 studied the impact of a family based, behavioural weight control program on the eating habits and weights of 30 adolescents and children, aged 11-16 years. The intervention comprised of cognitive, behavioural, affective and interactive strategies. These included encouraging adolescents to make small, sustainable lifestyle, physical activity and healthy eating changes. The authors reported positive changes in the body weights, nutrition knowledge, diet habits and body image of participants at the end of the 2 month.

Evidence Synopsis:

Thirteen studies were rated +, 6 were rated Ø and 4 were rated -. About half of the studies were randomized controlled trials, with the remaining studies using non randomized controlled and pre/posttest designs.

Eleven interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); four interventions resulted improved nutrition knowledge; and 4 interventions resulted in improved dietary intake or eating behaviors. Three studies reported no change in dietary intake or eating behaviors; and 1 study reported no change in adiposity.

Conclusion Grade:

Grade II

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Carrel AL, Clark R, Peterson S, Nemeth B, Sullivan J & Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. <i>Archives of Pediatrics & Adolescent Medicine</i> ; 2005: 159 (10): 963-8.	A	0
Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. <i>J Pediatr Nurs</i> ; 2003: 18(1):36-45.	C	+
Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. <i>Archives of pediatrics & adolescent medicine</i> . 1999; 153 (4): 409-18. Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. <i>Evidence Based Nursing</i> ; 2000: 3:13.	A	+
Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. <i>J Sch Health</i> . 2004 Jan;74(1):10-5.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body	A	+

Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. <i>Obesity</i> ; 2006: 14:847-854.		
Hawley SR, Beckman H & Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. <i>J Community Health Nurs</i> ; 2006: Vol. 23 (2), pp. 69-80.	D	0
Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. <i>Can J Pub Health</i> . 2001; 92(6):448-452.	D	-
Horowitz M, Shilts MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. <i>J. Nutr. Educ. Behav</i> . 2004 36:1 (43-44).	D	0
Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. <i>International journal of obesity</i> ; 2006: VL30(1): 31-9.	C	+
Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for overweight adolescents: Some preliminary findings. <i>J Clin Psychol Med Settings</i> : 2002; 9(1):15-23.	D	+
Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. <i>Arch Dis Child</i> ; 2005: Vol. 90 (12): 1235-8.	A	+
Johnson WG, Hinkle LK, Carr RE, Anderson DA, Lemmon CR, Engler LB & Bergeron KC. Dietary and exercise interventions for juvenile obesity: long term effect of behavioral and public health models. <i>Obes Res</i> : 1997; 5(3):257-261.	C	+
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. <i>J. Am. Diet. Assoc</i> . 1999 99:8 (967-970).	D	-
Long JD & Stevens KR. Using technology to promote self-efficacy for healthy eating in adolescents. <i>J Nurs Scholarsh</i> . 2004;36(2):134-9.	A	+
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. <i>J Nutr Educ</i> . 1999; 31(1):14-20.	C	+
Rinderknecht K & Smith C. Social cognitive theory in an after-school nutrition intervention for urban Native American youth. <i>J Nutr Educ Behav</i> ; 2004: 36(6):298-304.	D	0
Rudolf M, Christie D, McElhone S, Sahota P, Dixey R, Walker J & Wellings C. WATCH IT: a community based programme for obese children and adolescents. <i>Arch Dis Child</i> ; 2006: Vol. 91 (9), pp. 736-9.	D	+
Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. <i>J Am Diet Assoc</i> ; 2004: 104:8 Suppl 2 (A32).	D	0
Thornburg R & Hill K. Using Internet Assessment Tools for Health and Physical Education Instruction. <i>TechTrends: Linking Research & Practice to Improve Learning</i> ; 2004: 48(6):53-55.	D	-
White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. <i>Obes Res</i> ; 2005: Vol. 12 (7): 1050-9.	A	+
Wong, Koh, Lee, Fong. Two-year follow-up of a behavioral weight control programme for adolescents in Singapore: predictors of long-term weight loss. <i>Ann Acad Med Singapore</i> . 1997;26:147-53.	C	0
Zang S. Go girls go: approaching obesity through an adolescent peer support group. <i>Nurse Practitioner World News</i> ; 2006: 11(1): 19-20.	D	-

<p>Food Preparation and/or Taste Testing as Behavioural Strategies</p> <p>Evidence Appraisal</p>
<p>Questions:</p>

1. What elements of community interventions have been successful in either:
 - Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or
 - Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions;
2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?

Conclusion Statement:
 Obesity prevention and treatment interventions using food preparation and taste testing as behavioural strategies may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity.

Evidence Summary:
 Twelve interventions used food preparation or taste testing to expose adolescents to new, healthy foods and increase healthy food preparation skills.

Evidence Synopsis:
 Five studies were rated +, 6 were rated Ø and one was rated -. Five studies were randomized controlled trials and the rest were non randomized controlled and pre/posttest designs.

One intervention resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); two interventions resulted improved nutrition knowledge; and six interventions resulted in improved dietary intake or eating behaviors. One small sample study reported mixed results in terms of weight loss. One studies reported no change in eating behaviors and 1 study reported no change in adiposity.

Conclusion Grade:
 Grade III

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Carrel A, Meinen A, Garry C & Storandt R. Effects of nutrition education and exercise in obese children: the Ho-Chunk Youth Fitness Program. <i>WMJ</i> . 2005; 104(5): 44-48.	D	0
Edwards B. Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels. <i>Nursing Clinics of North America</i> ; 2005: 40 (4): 661-9.	C	0
Frable J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a retrospective critical examination of program evaluation. <i>Prev Chronic Dis</i> ; 2006: 3(3):A98. Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community campus partnership to prevent obesity. <i>Journal of Interprofessional Care</i> , Volume 18, Number 4, November 2004, pp. 447-449(3).	C	0
Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. <i>Can J Pub Health</i> . 2001; 92(6):448-452.	D	-
Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. <i>Prev Med</i> ; 2003: Vol. 37 (1), pp. 41-51.	A	+
Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh	A	+

nutrition concept for students. J Sch Health. 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). Health Educ Behav. 2000 Apr;27(2):201-12.		
O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. Journal of the American Dietetic Association Volume 102, Issue 3, Supplement 1, March 2002, Pages S93-S96.	A	+
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. J Nutr Educ. 1999; 31(1):14-20.	C	+
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. Health Educ Behav 2000 27:5 (616-631).	A	0
Rinderknecht K & Smith C. Social cognitive theory in an after-school nutrition intervention for urban Native American youth. J Nutr Educ Behav; 2004: 36(6):298-304.	D	0
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. Prev Med: 2003: 36(3):309-19.	C	0

Peer Modeling Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> 1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; 2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Peer modeling in obesity treatment interventions may be associated with improved eating behaviors, nutrition knowledge, and/or dietary intake among adolescents and changes in adiposity.</p>
<p>Evidence Summary:</p> <p>Seven interventions included peer modeling. Most of these used peer modeling in group sessions. One was based on the Stages of Change model and used those adolescents at a higher level of change to act as role models for those in the (pre)contemplation stages.</p> <p style="padding-left: 40px;">a) Obesity Prevention</p> <p>Five obesity prevention interventions used peer modeling to help teach nutrition and physical activity education.</p> <p>The Teens Eating for Energy and Nutrition in Schools (TEENS) intervention comprised of 10 behavioural based curriculum sessions, in which teachers enlisted the help of peer leaders to lead group activities and discussions (Birnbaum 2002). The authors reported that the peer leaders increased fruit and vegetable intake, while students exposed to curriculum plus environmental changes also increased fruit and vegetable intake with borderline significance and students exposed to only environment changes did not significantly increase fruit and</p>

vegetable intake. Peer leaders and students exposed to curriculum plus environmental changes improved usual food choices.

A pretest posttest trial by Leslie 1999, the Teen Activity Project, offered as a 10-week elective class (for girls only) as part of an After School Program, led by African-American or Latina peer leaders. The authors reported participants showed improved nutrition knowledge and skills in choosing low-fat and high fibre foods.

The TACOs intervention used peer promotion of healthy foods and peer liaisons between food services and students (French 2004). The authors reported that students in the intervention school were more likely to perceive that their friends bought lower-fat foods and that it was easier to determine which foods were lower-fat.

b) Obesity Treatment

Two obesity treatment interventions used peer modeling in conjunction with multi-disciplinary nutrition and exercise approaches.

The Adventure Therapy intervention used cognitive-behavioral group treatment with peer-enhanced 'adventure therapy' compared to cognitive-behavioral group treatment with aerobic exercise (Jelalian 2006). The intervention began with 16 weekly sessions followed by 4 monthly maintenance sessions. Adolescents participated in either supervised physical activity or a peer-enhanced adventure therapy aimed at developing social skills, problem solving and self-confidence. The authors reported that both treatment conditions demonstrated significant weight loss over time. They noted a significant difference in the percentage of participants maintaining a minimum 4.5 kg weight loss after 10 months from randomization. Older adolescents randomized to the peer enhanced adventure therapy group showed more than four times the weight loss of adolescents assigned to activity group.

Evidence Synopsis:

Four of the 6 studies were rated +, one was rated Ø and 2 were rated -. Two studies were randomized controlled trials, three were non-randomized controlled trials and three were pre/posttest studies.

Two interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); four resulted in improved nutrition knowledge and one resulted in improved dietary intake.

Conclusion Grade:

Grade II

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
French S, Story M, Fulkerson J & Hannan P. An Environmental Intervention to Promote Lower-Fat Food Choices in Secondary Schools: Outcomes of the TACOS Study. <i>Amer. J. Pub. Health</i> . 2004; 94(9): 1507-1512.	A	0
Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. <i>International journal of obesity</i> ; 2006: VL30(1): 31-9.	C	+
Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for	D	+

overweight adolescents: Some preliminary findings. J Clin Psychol Med Settings: 2002; 9(1):15-23.		
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. J. Am. Diet. Assoc. 1999 99:8 (967-970).	D	-
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. J Nutr Educ. 1999; 31(1):14-20.	C	+

Body Image Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> 1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; 2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Obesity prevention strategies, focused on healthy eating, physical activity and overall well-being, rather than on weight may reduce the likelihood of weight stigmatization, poor body image or self-esteem, and negative weight control behaviors.</p>
<p>Evidence Summary:</p> <p>Seven interventions included an assessment of body image, self-esteem, eating disorder behaviors or weight stigmatization. Five of these were offered as a health promotion, life-skills, or health education in the school setting.</p> <p>a) Obesity Prevention</p> <p>Five obesity prevention interventions assessed body image, self-esteem, or eating disorder behaviours. All of these interventions used a health promotion approach in which body weight was not discussed, but rather the focus was on healthy eating and active living.</p> <p>An evaluation of students involved in the Planet Health intervention (Austin 2005) revealed that extreme dieting behaviour remained low throughout the obesity prevention intervention with no difference between intervention and control schools.</p> <p>b) Obesity Treatment</p> <p>Two obesity treatment interventions included promotion of a healthy body image and self-esteem. One of these was offered to a group of solely females to avoid weight stigmatization and allow adolescent girls to exercise and discuss their feelings in a non-threatening environment (Resnicow 2005).</p> <p>Evidence Synopsis:</p> <p>One of the 7 studies rated +, 4 were rated Ø and 2 were rated -. Three of these studies were randomized controlled trials and 4 were pre/posttest studies.</p> <p>Five intervention studies resulted in improved body image or self-esteem; and 1 resulted in a reduced prevalence of disordered eating behaviors. One study reported no change in self-esteem or preoccupation with body image among high and low attenders of a nutrition and</p>

physical activity program (Resnicow et al., 2000).		
Conclusion Grade: Grade II		
Evidence Sources, Class and Rating:		
Complete Reference:	Class:	Quality Rating:
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. Arch Pediatr Adolesc Med: 2005; 159(3):225-230.	A	+
Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. Can J Pub Health. 2001; 92(6):448-452.	D	-
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. J. Am. Diet. Assoc. 1999 99:8 (967-970).	D	-
McVey GL, Davis R, Tweed S & Shaw BF. Evaluation of a school-based program designed to improve body image satisfaction, global self-esteem, and eating attitudes and behaviors: a replication study. The International journal of eating disorders; 2004: 36(1):1-11.	A	0
Reinhardt W & Brevard P. Integrating the Food Guide Pyramid and Physical Activity Pyramid for Positive Dietary and Physical Activity Behaviors in Adolescents. Journal of the American Dietetic Association; 2002:102(3), S1: S96-S99.	D	0
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. Health Educ Behav 2000 27:5 (616-631).	A	0
Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. J Am Diet Assoc; 2004: 104:8 Suppl 2 (A32).	D	0

Computer Strategies Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> What elements of community interventions have been successful in either: <ul style="list-style-type: none"> Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Computer based obesity prevention and treatment interventions may be a developmentally appropriate way to improve eating behaviors, nutrition knowledge, and/or dietary intake among adolescents.</p>
<p>Evidence Summary:</p> <p>Seven interventions used a computer based approach to nutrition education. Six of these were school based. Two interventions were exclusively nutrition education, while the others used a multi-disciplinary approach. Most of the computer based interventions offered tailored feedback. Two interventions involved a nutrition assessment based on a dietary record; two took an 'education and entertainment' approach; and one involved on-line preparation of</p>

<p>healthy foods, sharing recipe, and education. Topics included cooking healthy meals, healthy food choices, the food guide and health risks.</p> <p>a) Obesity Prevention Six obesity prevention interventions used a computer based approach. Strategies included students preparing “online” healthy snacks (Frenn 2005), playing web-based health games (Long 2004) and providing tailored dietary feedback to adolescents (Haerens 2006; Horowitz 2004).</p> <p>b) Obesity Treatment Five obesity prevention interventions used a computer based approach. Two interventions were delivered over the internet. One provided low income families with a low cost computer.</p> <p>Evidence Synopsis: Four studies were rated +, 1 was rated Ø and 2 were rated -. Four of the studies were randomized controlled trials and three were pre/posttest studies.</p> <p>Two interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); 1 intervention study resulted improved nutrition knowledge; and 4 intervention studies resulted in improved dietary intake or eating behaviors.</p> <p>Conclusion Grade: Grade II</p> <p>Evidence Sources, Class and Rating:</p>		
Complete Reference:	Class:	Quality Rating:
Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. <i>Appl Nurs Res.</i> 2005; 18(1):13-21.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. <i>Obesity</i> ; 2006: 14:847-854.	A	+
Horowitz M, Shiels MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. <i>J. Nutr. Educ. Behav.</i> 2004 36:1 (43-44).	D	0
Long JD & Stevens KR. Using technology to promote self-efficacy for healthy eating in adolescents. <i>J Nurs Scholarsh.</i> 2004;36(2):134-9.	A	+
Long J, Armstrong M, Shriver B, LaNell H, Luker S, Nash A & Blevins W. Pilot using world wide web to prevent diabetes in adolescents. <i>Clin Nurs Res</i> ; 2006: 15(1):67-79.	D	-
Thornburg R & Hill K. Using Internet Assessment Tools for Health and Physical Education Instruction. <i>TechTrends: Linking Research & Practice to Improve Learning</i> ; 2004: 48(6):53-55.	D	-
White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. <i>Obes Res</i> ; 2005: Vol. 12 (7): 1050-9.	A	+

<p>Disease Prevention Evidence Appraisal</p>
<p>Questions:</p> <p>1. What elements of community interventions have been successful in either:</p> <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or

- Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions;
2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?

Conclusion Statement:

Obesity prevention and treatment strategies, including components of nutrition education and physical activity may reduce adiposity and risk for obesity related chronic diseases, such as diabetes and heart disease.

Evidence Summary:

Of the 48 studies included in this review, 6 interventions focused on achieving healthy body weights or healthy dietary intake to reduce risk for obesity related chronic diseases, such as diabetes and heart disease.

a) Obesity Prevention

An example of a study with a focus on disease prevention was a school-based intervention conducted by Hern 1998. This intervention provided education about total serum cholesterol levels; HDL; LDL; fast food information; "Heart Healthy and Heart Hurting Foods;" sedentary activities; and exercise. The authors reported no significant differences were seen for either total serum cholesterol levels or dietary fat intake between the intervention and control groups at the end of the intervention.

b) Obesity Treatment

A high quality, pre/ posttest obesity treatment intervention by Johnson 1997, reported that of nutrition education and exercise presented to 19 children and adolescents, aged 8-17 years, resulted in a statistically significant reduction in weight as well as lipid profiles. The authors used a cognitive/ behavioral framework to improve nutrition and increased physical activity behaviours.

Two obesity treatment interventions also reported decreased insulin levels after a comprehensive nutrition and exercise intervention (Carrel 2005; Carrel, Meinen 2005).

Evidence Synopsis:

Three of the 6 studies rated +, 2 were rated Ø and 1 was rated -. Four of these studies were randomized controlled trials, 1 was a non-randomised controlled trial and 1 was pre/posttest studies.

Five intervention studies resulted in improved body image or self-esteem; and 1 resulted a reduced prevalence of disordered eating behaviors. One study reported no change in self-esteem or preoccupation with body image among high and low attenders of a nutrition and physical activity program (Resnicow et al., 2000).

Conclusion Grade:

Grade III

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Birbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? Health Education & Behavior. 2002; 29(4):427-443.	A	+
Carrel AL, Clark R, Peterson S, Nemeth B, Sullivan J & Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. Archives of Pediatrics &	A	0

Adolescent Medicine; 2005: 159 (10): 963-8.		
Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary testing of a program to prevent type 2 diabetes among high-risk youth. J Sch Health. 2004 Jan;74(1):10-5.	A	+
Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. Pediatr Nurs. 1998; 24: 127–132.	D	-
Nader PR, Stone EJ, Lytle LA, Perry CL, Osganian SK, Kelder S, Webber LS, Elder JP, Montgomery D, Feldman HA, Wu M, Johnson C, Parcel GS & Luepker RV. Three-year maintenance of improved diet and physical activity: the CATCH cohort. Child and Adolescent Trial for Cardiovascular Health. Archives of pediatrics & adolescent medicine; 1999: 153(7): 695-704.	A	+
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. Prev Med: 2003: 36(3):309-19.	C	0

Participants:

<p>Low Socio-Economic Status Evidence Appraisal</p>
<p>Questions:</p> <ol style="list-style-type: none"> What elements of community interventions have been successful in either: <ul style="list-style-type: none"> Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Obesity prevention and treatment interventions made accessible to and empowering adolescents from low socio-economic backgrounds may improve eating behaviors, nutrition knowledge and dietary intake and reduce adiposity among low socio-economic status adolescents.</p>
<p>Evidence Summary:</p> <p>Eight interventions involved adolescents from low socio-economic backgrounds. Seven of these were prevention and one was a treatment intervention. Only one intervention was in the community setting; the rest were in low socio-economic neighbourhood schools.</p> <p>Intervention strategies used to address barriers experienced by low socio-economic status adolescents included advocating policy change, subsidizing healthy foods in schools and surrounding communities, making health services accessible to all populations and in different languages, sending coupons for healthy foods home to families and making changes to the school food environment.</p> <p>One intervention (Agron 2002) trained students as advocates to promote healthful food and physical activity options at school. The authors concluded that a school based, student driven, nutrition and physical activity program involving environmental change was successful in improving nutrition knowledge and attitudes and healthy eating behaviour of adolescents from low socio-economic backgrounds.</p> <p>Frale 2006 similarly found that a community based intervention involving 12 weekly sessions on healthy eating, physical activity and weight management practices could improve nutrition</p>

<p>knowledge, dietary intake and weight management among participants. The Healthy Weigh (El camino saludable) intervention offered 282 low socio-economic status community members free weekly family meals, based on affordable, healthy foods, from which families took home recipes, fresh produce and leftovers.</p> <p>Evidence Synopsis: Five studies rated +, 2 were rated Ø and 1 was rated -. Five were randomized controlled trials, 2 were nonrandomized controlled trials and 1 was pre/posttest studies.</p> <p>Three intervention studies resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one was among boys only; 1 resulted in improved nutrition knowledge; and 3 resulted in improved dietary intake.</p> <p>Conclusion Grade: Grade I</p> <p>Evidence Sources, Class and Rating:</p>		
Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. J Am Diet Assoc; 2002; 102:3 Suppl (S103-105).	D	-
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? Health Education & Behavior. 2002; 29(4):427-443.	A	+
Frable J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a retrospective critical examination of program evaluation. Prev Chronic Dis; 2006; 3(3):A98. Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community campus partnership to prevent obesity. Journal of Interprofessional Care, Volume 18, Number 4, November 2004, pp. 447-449(3).	C	0
Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. J Pediatr Nurs; 2003; 18(1):36-45.	C	+
Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. Appl Nurs Res. 2005; 18(1):13-21.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. Obesity; 2006; 14:847-854.	A	+
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. Health Educ Behav 2000 27:5 (616-631).	A	0
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003; 24(3):209-17.	A	+

<p>Multi-Ethnic or Non-Caucasian Evidence Appraisal</p>
<p>Questions:</p> <p>1. What elements of community interventions have been successful in either:</p> <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for

growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions;

2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?

Conclusion Statement:
Obesity interventions available to multi-ethnic populations may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity.

Evidence Summary:
Fifteen interventions involved multi-ethnic populations. Three of these were delivered to First Nations adolescents (Rinderknecht 2004; Ritenbaugh 2003; Carrel 2005) and two were delivered solely to African American adolescents (Edwards 2005; Williamson 2005).

Common intervention strategies used to ensure accessibility by multi-ethnic participants included offering programs in different languages and providing culturally acceptable meals, recipes and educational materials for participants and their families.

Evidence Synopsis:
Eight studies rated +, 5 were rated Ø and 2 were rated -. Eight studies were randomized controlled trials, 4 were nonrandomized controlled trials and 3 were pre/posttest studies.

Five intervention studies resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one was only among boys; 2 resulted in improved nutrition knowledge; 1 resulted in improved dietary behaviours and 3 resulted in improved dietary intake. One study reported no change in dietary behaviours. One study reported no change and one reported mixed results in adiposity.

Conclusion Grade:
Grade III

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. <i>Arch Pediatr Adolesc Med</i> : 2005; 159(3):225-230.	A	+
Edwards B. Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels. <i>Nursing Clinics of North America</i> ; 2005; 40 (4): 661-9.	C	0
Frable J, Dart L & Bradley P. Healthy Weigh (El camino saludable) phase 1: a retrospective critical examination of program evaluation. <i>Prev Chronic Dis</i> ; 2006; 3(3):A98. Frable J, Dart L & Bradley P. Healthy Weigh/ El Camino Saludable: A community campus partnership to prevent obesity. <i>Journal of Interprofessional Care</i> , Volume 18, Number 4, November 2004, pp. 447-449(3).	C	0
Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. <i>J Pediatr Nurs</i> ; 2003; 18(1):36-45.	C	+
Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. <i>Appl Nurs Res</i> . 2005; 18(1):13-21.	A	+
Grey M, Berry D, Davidson M, Galasso P, Gustafson E, Melkus G. Preliminary	A	+

testing of a program to prevent type 2 diabetes among high-risk youth. J Sch Health. 2004 Jan;74(1):10-5.		
Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. Arch Dis Child; 2005: Vol. 90 (12): 1235-8.	A	+
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. J. Am. Diet. Assoc. 1999 99:8 (967-970).	D	-
Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. Prev Med; 2003: Vol. 37 (1), pp. 41-51.	A	+
Resnicow K Taylor R, Baskin M & McCarthy F. Results of Go Girls: A Weight Control Program for Overweight African American Adolescent Females. Obesity Research. 2005; 13:10 (1739-1748).	A	+
Rinderknecht K & Smith C. Social cognitive theory in an after-school nutrition intervention for urban Native American youth. J Nutr Educ Behav; 2004: 36(6):298-304.	D	0
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. Prev Med: 2003: 36(3):309-19.	C	0
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003: 24(3):209-17.	A	+
Wang Y, Tussing L, Odoms-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nut; 2006: 60:1 (92-103).	A	0

Female Only Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> 1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; 2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Obesity prevention and treatment interventions delivered to female only groups may be more effective in reducing adiposity in females.</p>
<p>Evidence Summary:</p> <p>Seven interventions involved only female participants. Four of these were treatment and four were prevention interventions. Six were offered in a community setting, while two were school-based interventions.</p> <p>An example of a female only intervention was the GirlPower Project (Higgins 2001). This intervention comprised of a weekly recreation program that included physical, social and developmental recreation, cooperative games and bake sales. It aimed to empower adolescent girls to take action to improve their health habits and physical activity. The authors reported health habits remained stable over the intervention, but the participants reported eating better and being more active.</p>

<p>Evidence Synopsis: Three studies rated +, 3 were rated Ø and 1 was rated -. Four studies were randomized controlled trials and 4 were pre/posttest studies.</p> <p>Three interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); 1 resulted in improved nutrition knowledge; 1 resulted in improved dietary behaviours; and 2 resulted in improved dietary intake.</p> <p>Conclusion Grade: Grade II</p> <p>Evidence Sources, Class and Rating:</p>		
Complete Reference:	Class:	Quality Rating:
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. Arch Pediatr Adolesc Med: 2005; 159(3):225-230.	A	+
Higgins J & Reed N. The GirlPower Project – Recreation, BC Health Goals and Social Capital. Can J Pub Health. 2001; 92(6):448-452.	D	-
Leslie J, Yancy A, McCarthy W, Albert S, Wert C, Miles O & James J. Development and implementation of a school-based nutrition and fitness promotion program for ethnically diverse middle-school girls. J. Am. Diet. Assoc. 1999 99:8 (967-970).	D	-
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. Health Educ Behav 2000 27:5 (616-631).	A	0
Resnicow K Taylor R, Baskin M & McCarthy F. Results of Go Girls: A Weight Control Program for Overweight African American Adolescent Females. Obesity Research. 2005; 13:10 (1739-1748).	A	+
White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. Obes Res; 2005: Vol. 12 (7): 1050-9.	A	+
Zang S. Go girls go: approaching obesity through an adolescent peer support group. Nurse Practitioner World News; 2006: 11(1): 19-20.	D	-

Prevention Interventions

School-based Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> 1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; 2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Comprehensive obesity prevention interventions offered in the school setting may be an effective way to reach a large number of adolescents to promote healthy eating behaviors, nutrition knowledge, or dietary intake.</p>

Evidence Summary:

Of the 48 interventions included in this review, 30 were school-based. Most (86%) of the obesity prevention interventions were school-based. Five were disease prevention programs: diabetes prevention (Grey 2004; Ritenbaugh 2003), cancer prevention (Birnbaum 2002) and heart health promotion (Nader 1999; Hern 1998).

The remaining twenty-six interventions used a health promotion approach to prevent obesity by establishing healthy eating and physical activity behaviours among adolescents. Strategies included nutrition education, physical education and activity, reducing sedentary activity, school food environment change or a combination of the aforementioned strategies.

Seventy-three percent of the school-based interventions were comprised of nutrition education delivered through pre-existing classroom curriculum. Nine of these were offered in physical education classes and another 9 were offered as short sessions to fit within the pre-existing curriculum from health, science, consumer science, computer studies or home economics classes. The Planet Health Program (Gortmaker et al., 2000) was developed to fit within 4 subjects: language arts, mathematics, social studies and science. The interventions ran from 6 weeks to the entire school year and were offered once to three times a week for an average length of one hour.

Twenty studies implemented the intervention material within the existing school curriculum and ten involved modifications in the school environment. One was offered as an elective for girls involved in middle school after school program (Leslie et al., 1999).

Evidence Synopsis:

Thirteen of the 26 school-based prevention studies were rated +, 9 were rated Ø and 4 were rated -. Fifteen studies were randomized controlled trials, 4 were nonrandomized controlled trials, and 7 were pre/posttest trials.

Four intervention studies resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one only in females and one only in males; 9 resulted in improved nutrition knowledge; 4 improved dietary behaviours; and 7 resulted in improved dietary intake. One study reported no change in dietary behaviours.

Conclusion Grade:

Grade I

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. <i>Arch Pediatr Adolesc Med</i> : 2005; 159(3):225-230.	A	+
Baxter AP, Milner PC, Hawkins S, Leaf M, Simpson C, Wilson KV, Owen T, Higginbottom G, Nicholl J, Cooper N. The impact of heart health promotion on coronary heart disease lifestyle risk factors in schoolchildren: lessons learnt from a community-based project. <i>Public Health</i> . 1997;111(4):231-7.	C	0
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Damon S, Dietrich S & Widhalm K. PRESTO - Prevention Study of Obesity: A	A	0

project to prevent obesity during childhood and adolescence. <i>Int J Paediatr</i> ; 2005; 94:S(448):47-48.		
French S, Story M, Fulkerson J & Hannan P. An Environmental Intervention to Promote Lower-Fat Food Choices in Secondary Schools: Outcomes of the TACOS Study. <i>Amer. J. Pub. Health</i> . 2004; 94(9): 1507-1512.	A	0
Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. <i>J Pediatr Nurs</i> ; 2003: 18(1):36-45.	C	+
Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. <i>Appl Nurs Res</i> : 18(1):13-21.	A	+
Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. <i>Archives of pediatrics & adolescent medicine</i> . 1999; 153 (4): 409-18. Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. <i>Evidence Based Nursing</i> ; 2000: 3:13.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. <i>Obesity</i> ; 2006: 14:847-854.	A	+
Hawley SR, Beckman H & Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. <i>J Community Health Nurs</i> ; 2006: Vol. 23 (2), pp. 69-80.	D	0
Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. <i>Pediatr Nurs</i> . 1998; 24: 127-132.	D	-
Horowitz M, Shilts MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. <i>J. Nutr. Educ. Behav</i> . 2004 36:1 (43-44).	D	0
Long JD & Stevens KR. Using technology to promote self-efficacy for healthy eating in adolescents. <i>J Nurs Scholarsh</i> . 2004;36(2):134-9.	A	+
Long J, Armstrong M, Shriver B, LaNeil H, Luker S, Nash A & Blevins W. Pilot using world wide web to prevent diabetes in adolescents. <i>Clin Nurs Res</i> ; 2006: 15(1):67-79.	D	-
McVey GL, Davis R, Tweed S & Shaw BF. Evaluation of a school-based program designed to improve body image satisfaction, global self-esteem, and eating attitudes and behaviors: a replication study. <i>The International journal of eating disorders</i> ; 2004: 36(1):1-11.	A	0
Nader PR, Stone EJ, Lytle LA, Perry CL, Osganian SK, Kelder S, Webber LS, Elder JP, Montgomery D, Feldman HA, Wu M, Johnson C, Parcel GS & Luepker RV. Three-year maintenance of improved diet and physical activity: the CATCH cohort. <i>Child and Adolescent Trial for Cardiovascular Health. Archives of pediatrics & adolescent medicine</i> ; 1999: 153(7): 695-704.	A	+
Neumark-Sztainer D, Story M, Hannan PJ & Rex J. New Moves: a school-based obesity prevention program for adolescent girls. <i>Prev Med</i> ; 2003: Vol. 37 (1), pp. 41-51.	A	+
Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh nutrition concept for students. <i>J Sch Health</i> . 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). <i>Health Educ Behav</i> . 2000 Apr;27(2):201-12.	A	+
O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. <i>Journal of the American Dietetic Association</i> Volume 102, Issue 3, Supplement 1 , March 2002, Pages S93-S96.	A	+
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. <i>J Nutr</i>	C	+

Educ. 1999; 31(1):14–20.		
Reinhardt W & Brevard P. Integrating the Food Guide Pyramid and Physical Activity Pyramid for Positive Dietary and Physical Activity Behaviors in Adolescents. Journal of the American Dietetic Association; 2002:102(3), S1: S96-S99.	D	0
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. Prev Med: 2003: 36(3):309-19.	C	0
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003: 24(3):209-17.	A	+
Thornburg R & Hill K. Using Internet Assessment Tools for Health and Physical Education Instruction. TechTrends: Linking Research & Practice to Improve Learning; 2004: 48(6):53-55.	D	-
Wang Y, Tussing L, Odoms-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nut; 2006: 60:1 (92-103).	A	0

Classroom Curriculum Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> What elements of community interventions have been successful in either: <ul style="list-style-type: none"> Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>Nutrition and physical education implemented within the school curriculum as part of a school-based obesity prevention intervention may be associated with improved eating behaviors, nutrition knowledge and dietary intake and reduced adiposity.</p>
<p>Evidence Summary:</p> <p>Seventy-three percent (22 out of 30) of the school-based interventions comprised of nutrition education delivered through pre-existing classroom curriculum. Seventeen of these were obesity prevention programs.</p> <p>Most interventions were implemented with physical education classes, while 9 of the studies developed short sessions to fit within the pre-existing curriculum from health, science, consumer science, computer studies or home economics classes. The Planet Health Program (Gortmaker et al., 2000) was developed to fit within 4 subjects: language arts, mathematics, social studies and science. The programs ran from 6 weeks to the entire school year and were offered once to three times a week for an average length of one hour. Topics covered included food label reading, healthy food choices, nutrition and disease, dietary fat calculations and goal setting. Some of the programs included opportunities to practice behaviors through interactive activities and computer based methods.</p> <p>Evidence Synopsis:</p> <p>Nine of the 17 curriculum-based school interventions were rated +, 6 were rated Ø and 2 were rated -. Ten studies were randomized controlled trials, 2 were non randomized controlled trials</p>

and 5 were pre/posttest studies.		
Two interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); 6 resulted improved nutrition knowledge; 3 resulted in improved dietary behaviours and 2 resulted in improved dietary intake. Two studies reported no change in dietary intake or behaviours.		
Conclusion Grade: Grade II		
Evidence Sources, Class and Rating:		
Complete Reference:	Class:	Quality Rating:
Austin SB, Field A, Wiecha J, Peterson K & Gortmaker S. The impact of a school based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. <i>Arch Pediatr Adolesc Med</i> : 2005; 159(3):225-230.	A	+
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
Damon S, Dietrich S & Widhalm K. PRESTO - Prevention Study of Obesity: A project to prevent obesity during childhood and adolescence. <i>Int J Paediatr</i> : 2005; 94:S(448):47-48.	A	0
Frenn M, Malin S & Bansal NK. Stage-based interventions for low-fat diet with middle school students. <i>J Pediatr Nurs</i> ; 2003: 18(1):36-45.	C	+
Frenn M, Malin S, Brown R, Greer Y, Fox J, Greer J & Smyczek S. Changing the tide: An Internet/video exercise and low-fat diet intervention with middle-school students. <i>Appl Nurs Res</i> . 2005; 18(1):13-21.	A	+
Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. <i>Archives of pediatrics & adolescent medicine</i> . 1999; 153 (4): 409-18. Gortmaker SL, Peterson K, Wiecha J, Sobal AM, Dixit S, Fox MK, et al. A school-based, interdisciplinary curriculum in grades 6 and 7 reduced obesity in girls. <i>Evidence Based Nursing</i> ; 2000: 3:13.	A	+
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle Schools. <i>Obesity</i> ; 2006: 14:847-854.	A	+
Hawley SR, Beckman H & Bishop T. Development of an obesity prevention and management program for children and adolescents in a rural setting. <i>J Community Health Nurs</i> ; 2006: Vol. 23 (2), pp. 69-80.	D	0
Hern MJ & Gates D. Linking learning with health behaviors of high school adolescents. <i>Pediatr Nurs</i> . 1998; 24: 127–132.	D	-
Horowitz M, Shiels MK & Townsend MS. EatFit: A Goal-Oriented Intervention that Challenges Adolescents to Improve Their Eating and Fitness Choices. <i>J. Nutr. Educ. Behav</i> . 2004 36:1 (43-44).	D	0
Long JD & Stevens KR. Using technology to promote self-efficacy for healthy eating in adolescents. <i>J Nurs Scholarsh</i> . 2004;36(2):134-9.	A	+
McVey GL, Davis R, Tweed S & Shaw BF. Evaluation of a school-based program designed to improve body image satisfaction, global self-esteem, and eating attitudes and behaviors: a replication study. <i>The International journal of eating disorders</i> ; 2004: 36(1):1-11.	A	0
Nader PR, Stone EJ, Lytle LA, Perry CL, Osganian SK, Kelder S, Webber LS, Elder JP, Montgomery D, Feldman HA, Wu M, Johnson C, Parcel GS & Luepker RV. Three-year maintenance of improved diet and physical activity: the CATCH cohort. <i>Child and Adolescent Trial for Cardiovascular Health. Archives of pediatrics & adolescent medicine</i> ; 1999: 153(7): 695-704.	A	+
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M	C	+

& Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. J Nutr Educ. 1999; 31(1):14-20.		
Reinhardt W & Brevard P. Integrating the Food Guide Pyramid and Physical Activity Pyramid for Positive Dietary and Physical Activity Behaviors in Adolescents. Journal of the American Dietetic Association; 2002:102(3), S1: S96-S99.	D	0
Thornburg R & Hill K. Using Internet Assessment Tools for Health and Physical Education Instruction. TechTrends: Linking Research & Practice to Improve Learning; 2004: 48(6):53-55.	D	-
Wang Y, Tussing L, Odoms-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nutr; 2006: 60:1 (92-103).	A	0

Food Environment Change Evidence Appraisal
<p>Questions:</p> <p>1. What elements of community interventions have been successful in either:</p> <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; <p>2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?</p>
<p>Conclusion Statement:</p> <p>Altering the school food environment, through changes in school meals and foods offered through vending machines, may be associated with improve eating behaviors, nutrition knowledge, or dietary intake among adolescents and a resultant decrease in adiposity.</p>
<p>Evidence Summary:</p> <p>Eleven interventions involved modifications to the food environment, 10 of these involved modifications to the school food environment. One of these also included food subsidies on healthy foods within the community food environment. Changes to the school food environment included increasing availability of low fat food items, fruits and vegetables, higher fibre foods, unsweetened beverages and water and general improvement of the selection of healthy choices offered through a la carte meals and vending machines.</p> <p>a) Obesity Prevention</p> <p>Ten interventions involved modifications to the school food environment. Four of these used media marketing strategies to promote healthy foods. Five included changes in the school nutrition policy.</p> <p>Most of the modifications were made to improve the selection of healthy choices offered through a la carte meals and vending machines. Four interventions used media marketing strategies to raise awareness of healthy options. Another four promoted changes in school nutrition policy.</p> <p>In a non-randomized controlled trial, Baxter 1997 implemented healthy eating policies in intervention schools to reinforce curriculum material on general heart health promotion, healthy eating, smoking, exercise and alcohol consumption. The intervention promoted heart health, exercise and healthy eating in through community based activities. The authors reported weak</p>

evidence of positive changes in low fat milk, low fat spread and whole meal bread consumption and improved exercise levels in Grade 7 and 10 students from the intervention schools.

The Teens Eating for Energy and Nutrition in Schools (TEENS) (Birnbaum 2002) was a high quality RCT of a school-based intervention including a component of environmental change promoting increased fruit and vegetable intake and decreased fat intake among low SES adolescents. School food environment changes included promotion of fruit, vegetables and low fat foods and healthy snacks in the schools a la carte lines and vending machines. Low fat foods were distributed for taste testing. The TEENS intervention also established a school nutrition advisory council to develop policy around the school food environment. The authors reported that students exposed only to environment changes did not significantly increase fruit and vegetable intake. Yet, peer leaders and students exposed to curriculum plus environmental changes improved intake.

Another high quality RCT, the TACOs intervention (French 2004) involved modification of the school food environment by increasing availability of lower-fat foods in a la carte areas by 30% above baseline to an ultimate goal of 50% of products as lower fat options. The authors reported no significant differences over time for school food services revenue variables. Students in the intervention schools had better perceived nutrition knowledge of lower fat foods.

b) Obesity Treatment

One obesity treatment intervention aimed to make changes to the community food environment by partnering with grocery stores to increase availability of low cost fruits and vegetables. No studies made changes in the school food environment.

Evidence Synopsis:

Five studies were rated +, 4 were rated Ø and 1 was rated -. Seven studies were randomized controlled trials, 1 was a pre/posttest and 2 were nonrandomized trials.

Three intervention studies resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness), one only in females and one only in males; 3 resulted in improved nutrition knowledge; and 4 resulted in improved dietary intake.

Conclusion Grade:

Grade II

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Agron P, Takada E & Purcell A. California Project LEAN's Food on the Run program: an evaluation of a high school-based student advocacy nutrition and physical activity program. <i>J Am Diet Assoc</i> ; 2002; 102:3 Suppl (S103-105).	D	-
Baxter AP, Milner PC, Hawkins S, Leaf M, Simpson C, Wilson KV, Owen T, Higginbottom G, Nicholl J, Cooper N. The impact of heart health promotion on coronary heart disease lifestyle risk factors in schoolchildren: lessons learnt from a community-based project. <i>Public Health</i> . 1997;111(4):231-7.	C	0
Birnbaum A, Lytle L, Story M, Perry C, Murray D. Are Differences in Exposure to a Multicomponent School-based Intervention Associated with Varying Dietary Outcomes in Adolescents? <i>Health Education & Behavior</i> . 2002; 29(4):427-443.	A	+
French S, Story M, Fulkerson J & Hannan P. An Environmental Intervention to Promote Lower-Fat Food Choices in Secondary Schools: Outcomes of the TACOS Study. <i>Amer. J. Pub. Health</i> . 2004; 94(9): 1507-1512.	A	0
Haerens L, Deforche B, Maes L, Stevens V, Cardon G & De Bourdeaudhuij I. Body Mass Effects of a Physical Activity and Healthy Food Intervention in Middle	A	+

Schools. Obesity; 2006: 14:847-854.		
Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh nutrition concept for students. J Sch Health. 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). Health Educ Behav. 2000 Apr;27(2):201-12.	A	+
O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. Journal of the American Dietetic Association Volume 102, Issue 3, Supplement 1, March 2002, Pages S93-S96.	A	+
Ritenbaugh C, Teufel-Shone NI, Aickin MG, Joe JR, Poirier S, Dillingham DC, Johnson D, Henning S, Cole SM, Cockerham D. A lifestyle intervention improves plasma insulin levels among Native American high school youth. Prev Med: 2003: 36(3):309-19.	C	0
Sallis J, McKenzie T, Conway T, Elder J, Prochaska J, Brown M, Zive M, Marshall S & Alcaraz J. Environmental interventions for eating and physical activity: a randomized controlled trial in middle schools. Am J Prev Med; 2003: 24(3):209-17.	A	+
Wang Y, Tussing L, Odums-Young A, Braunschweig C, Flay B, Hedeker D & Hellison D. Obesity prevention in low socioeconomic status urban African-american adolescents: study design and preliminary findings of the HEALTH-KIDS Study. Eur J Clin Nut; 2006: 60:1 (92-103).	A	0

Media Marketing / Healthy Eating Promotion Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> 1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; 2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>The use of media channels to promote healthy nutrition in the school environment may be associated with improved eating behaviors, nutrition knowledge, and/or dietary intake.</p>
<p>Evidence Summary:</p> <p>Four obesity prevention interventions included media marketing strategies to raise awareness of healthy options. Some of the media channels used were school announcements, point-of service signs, contests, t-shirts and table displays in the cafeteria.</p> <p>The Food on the Run intervention (Agron 2002) involved 220 volunteer student advocates disseminating healthy eating and physical activity education material through the 5-7 school based activities, assisted in addressing school nutrition policy issues and worked with families to promote health. Student advocates created awareness among students and advocated for school nutrition changes. The authors found that a school based, student driven, nutrition and physical activity program using students to promote environmental change was successful in improving healthy food options at school and nutrition knowledge and eating behaviors of student advocates.</p> <p>In the high quality multi-year RCT, Nicklas 2000 found that a school-based intervention including a media campaign, school meal modification, classroom workshops, and parental involvement improved fruit and vegetable knowledge of 2213 9th grade students. The authors</p>

concluded that media marketing is an effective method to deliver health messages and attract adolescent's attention.

Evidence Synopsis:
Three studies were rated + and one was rated Ø. Three studies were randomized controlled trials and one was a non randomized controlled trial.

Two interventions resulted in improved nutrition knowledge and 2 resulted in improved dietary intake.

Conclusion Grade:
Grade III

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
French S, Story M, Fulkerson J & Hannan P. An Environmental Intervention to Promote Lower-Fat Food Choices in Secondary Schools: Outcomes of the TACOS Study. Amer. J. Pub. Health. 2004; 94(9): 1507-1512.	A	0
Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5--a fresh nutrition concept for students. J Sch Health. 1998 Aug;68(6):248-53. & Nicklas TA & O'Neil CE. Process of Conducting a 5-a-Day Intervention with High School Students: Gimme 5 (Louisiana). Health Educ Behav. 2000 Apr;27(2):201-12.	A	+
O'Neil C & Nicklas T. Gimme 5: An Innovative, School-Based Nutrition Intervention for High School Students. Journal of the American Dietetic Association Volume 102, Issue 3, Supplement 1, March 2002, Pages S93-S96.	A	+
Rankins J, Weatherspoon L, Cook L, Reed C, Shuford-Law J, Davis Y, Kissinger M & Ralston P. Influences of a chronic disease risk reduction curriculum called "Live!" on fat and fiber knowledge and attitudes of black and white adolescents. J Nutr Educ. 1999; 31(1):14-20.	C	+

Treatment Interventions

Community Based Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> 1. What elements of community interventions have been successful in either: <ul style="list-style-type: none"> • Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or • Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; 2. What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement: Comprehensive, multidisciplinary, obesity treatment interventions offered in to adolescents in community settings may be associated with reduced adiposity and improved dietary intake.</p>
<p>Evidence Summary: The majority (78%) of treatment interventions were conducted in community settings, including churches, community and sports centres and after-school programs. Four were school based.</p>

In the school based treatment interventions, overweight adolescents recruited through invitation to participate in an exercise based intervention (Carrel 2005); referral from school nurses after an annual health evaluation (Carrel 2005); invitation letters sent home to families of the school's obese students; and enrollment along with students with normal weights (Edwards 2005; McMurray 2002).

All thirteen of the community based treatment interventions included components of nutrition education, 12 included physical education and 7 included physical activity. Nine of the treatment interventions involved families.

Of the five prevention interventions, two were family based (Frable et al., 2004; Grey et al., 2004) and one used peer modeling (Leslie et al., 1999). The prevention interventions were directed at female only (Higgins & Reed, 2001; Leslie et al., 1999), First Nations (Rinderknecht et al., 2004; Grey et al., 2004) and low socio-economic status participants (Frable et al., 2004).

Evidence Synopsis:

Eight studies were rated +, 4 were rated Ø and 1 was rated -. Five studies were randomized controlled trials, 4 were nonrandomized trials and 4 were a pre/posttest.

Twelve intervention studies resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); and 1 resulted in improved dietary intake.

Conclusion Grade:

Grade I

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Eliakim A, Kaven G, Berger I, Friedland O, Wolach B & Nemet D. The effect of a combined intervention on body mass index and fitness in obese children and adolescents. <i>Eur J Pediatric</i> : 2002; 161(8):449-454.	C	0
Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. <i>International journal of obesity</i> ; 2006: VL30(1): 31-9.	C	+
Jelalian E & Mehlenbeck R. Peer-enhanced weight management treatment for overweight adolescents: Some preliminary findings. <i>J Clin Psychol Med Settings</i> : 2002; 9(1):15-23.	D	+
Jiang JX, Xia XL, Greiner T, Lian GL, Rosenqvist U. A two year family based behaviour treatment for obese children. <i>Arch Dis Child</i> ; 2005: Vol. 90 (12): 1235-8.	A	+
Johnson WG, Hinkle LK, Carr RE, Anderson DA, Lemmon CR, Engler LB & Bergeron KC. Dietary and exercise interventions for juvenile obesity: long term effect of behavioral and public health models. <i>Obes Res</i> : 1997; 5(3):257-261.	C	+
Nemet D, Barkan S, Epstein Y, Friedland O, Kowen G & Eliakim A. Short- and long-term beneficial effects of a combined dietary-behavioral- physical activity intervention for the treatment of childhood obesity. <i>Pediatrics</i> ; 2005: 115:4 (e443-e449).	A	+
Resnicow K, Lazarus A, Davis A, Wang D, Slaughter T, Coleman D & Baranowski T. GO GIRLS!: results from a nutrition and physical activity program for low-income, overweight African American adolescent females. <i>Health Educ Behav</i> 2000 27:5 (616-631).	A	0
Resnicow K Taylor R, Baskin M & McCarthy F. Results of Go Girls: A Weight Control Program for Overweight African American Adolescent Females. <i>Obesity Research</i> . 2005; 13:10 (1739-1748).	A	+
Rudolf M, Christie D, McElhone S, Sahota P, Dixey R, Walker J & Wellings C. WATCH IT: a community based programme for obese children and adolescents.	D	+

Arch Dis Child; 2006: Vol. 91 (9), pp. 736-9.		
Segal K, Holmes T, Hollenbeck C, Chasson A. The effectiveness of the Shapedown program, a family-based weight control program for children and adolescents. J Am Diet Assoc; 2004: 104:8 Suppl 2 (A32).	D	0
White MA; Martin PD; Newton RL; Walden HM; York-Crowe EE; Gordon ST; Ryan DH; Williamson DA. Mediators of weight loss in a family-based intervention presented over the internet. Obes Res; 2005: Vol. 12 (7): 1050-9.	A	+
Wong, Koh, Lee, Fong. Two-year follow-up of a behavioral weight control programme for adolescents in Singapore: predictors of long-term weight loss. Ann Acad Med Singapore. 1997;26:147-53.	C	0
Zang S. Go girls go: approaching obesity through an adolescent peer support group. Nurse Practitioner World News; 2006: 11(1): 19-20.	D	-

Diet Plan Evidence Appraisal
<p>Questions:</p> <ol style="list-style-type: none"> What elements of community interventions have been successful in either: <ul style="list-style-type: none"> Preventing obesity by establishing healthy eating behaviours or healthy dietary intake during adolescence; or Treating obesity by achieving a reduction or stabilization in weight appropriate for growth of overweight adolescents that may be accompanied by a reduction in risk factors for obesity related chronic health conditions; What barriers to behaviour change (ie. socio-economic status, cultural values, food environment, self-efficacy) need to be addressed through intervention strategies?
<p>Conclusion Statement:</p> <p>A prescribed diet plan as part of an intensive nutrition-behavioural-exercise obesity treatment intervention may be effective in reducing adiposity and improving nutrition knowledge.</p>
<p>Evidence Summary:</p> <p>Seventeen interventions used a diet plan as part of intensive nutrition-behavioural-exercise obesity treatment interventions.</p> <p style="padding-left: 40px;">a) Obesity Prevention</p> <p>None of the obesity prevention interventions used diet plans.</p> <p style="padding-left: 40px;">b) Obesity treatment</p> <p>Seventeen of the obesity treatment interventions used diet plans to achieve weight loss. Most comprised of a comprehensive approach, with diet plans prescribed by a dietitian or another member of the health care team. Diet plans included calorie restriction, the exchange system, the traffic light system and internet developed personalized plans.</p> <p>All of the interventions involving a prescribed diet plan were intensive. A majority (84%) were 3 months to over a year in length. Eleven interventions directly involved families, either through parent-educator sessions, meetings with a dietitian, or family based activities.</p> <p>Eliakim 2002 used a 1200-2000 hypocaloric diet among 177 adolescents. Jelalian 2006 prescribed adolescents with a balanced deficit diet based on the dietary exchange system where foods were organized in six groups: starch, fruit, milk, vegetable, meat and other proteins and fat.</p> <p>Jiang 2005 provided adolescents with a "traffic light" food item list to help decrease energy intake and promote a balanced diet. "Red light" foods were those high in fat or calories; "green light" foods were low in fat and calories; and "yellow light" foods were intermediate. Dietary</p>

behaviour changes, including eating slowly, having soup before meals, eating green light foods first and having meals without staple foods for supper behaviours were also suggested to the family. At the end of the 2 year intervention the authors reported that BMI was significantly reduced in the treatment group but not in the control group.

Evidence Synopsis:

Eight studies were rated +, 8 were rated Ø and 1 was rated -. Seven studies were randomized controlled trials, 5 were nonrandomized controlled trials and 5 were pre/posttest studies.

Thirteen interventions resulted in a reduced measure of adiposity (body fat, BMI, waist circumference, total skinfold thickness); and one resulted in improved nutrition knowledge. Two studies reported no change in adiposity and one reported mixed results.

Conclusion Grade:

Grade I

Evidence Sources, Class and Rating:

Complete Reference:	Class:	Quality Rating:
Carrel AL, Clark R, Peterson S, Nemeth B, Sullivan J & Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. Archives of Pediatrics & Adolescent Medicine; 2005: 159 (10): 963-8.	A	0
Carrel A, Meinen A, Garry C & Storandt R. Effects of nutrition education and exercise in obese children: the Ho-Chunk Youth Fitness Program. WMJ. 2005; 104(5): 44-48.	D	0
Edwards B. Childhood obesity: a school-based approach to increase nutritional knowledge and activity levels. Nursing Clinics of North America; 2005: 40 (4): 661-9.	C	0
Eliakim A, Kaven G, Berger I, Friedland O, Wolach B & Nemet D. The effect of a combined intervention on body mass index and fitness in obese children and adolescents. Eur J Pediatric; 2002; 161(8):449-454.	C	0
Jelalian E, Mehlenbeck R, Lloyd-Richardson EE, Birmaher V & Wing RR. 'Adventure therapy' combined with cognitive-behavioral treatment for overweight adolescents. International journal of obesity; 2006: VL30(1): 31-9.	C	+
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