ADOLESCENTS AS A VULNERABLE POPULATION FOR
OBESITY, CARDIOVASCULAR DISEASE,
AND TYPE 2 DIABETES

By

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A research manuscript submitted in partial fulfillment of
the requirements for the degree of

MASTER OF NURSING

WASHINGTON STATE UNIVERSITY
Intercollegiate College of Nursing

MAY 2005
To the Faculty of Washington State University:

The members of the Committee appointed to examine the research manuscript of COLETTE A. WILSON find it satisfactory and recommend that it be accepted.

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Abstract

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Obesity, type 2 diabetes mellitus, and cardiovascular disease are significant health
problems for Americans and are reaching epidemic proportions. These health problems have a
major impact not only on the health of Americans, but also take a huge toll on the financial
resources of the nation. Research reporting effective interventions for vulnerable populations,
such as adolescents, are lacking. Multiple factors contribute to obesity and increase the risk of
associated diseases, but a major factor is lifestyle choices. These life-changing decisions are
reached during the adolescent years. Utilizing Bronfenbrenner's Ecologic Theory of
Development to intervene in adolescent health would benefit both individuals and the
community. This crucial period in life is a prime time for lifestyle teaching interventions that
focus on preventing obesity, cardiovascular disease, and type 2 diabetes.
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SECTION ONE

INTRODUCTION

Adolescence is a crucial time for life-long health status decisions. Research tying the vulnerability of adolescents to the increasing trend of obesity in America is lacking. More studies analyzing factors related to obesity, type 2 diabetes mellitus, and cardiovascular disease in this age group should be the focus of health care research. Even more at risk for these health problems are those teenagers in alternative high schools. These adolescents are especially vulnerable because of lower socioeconomic status, lower family education levels, and increased risk behaviors as compared to other teens.

The rates of obesity, type 2 diabetes, and cardiovascular disease in America are reaching an astounding high. This trend is having crippling effects on the health status of the country and changing the face of its health care system. The detrimental effects of these conditions are not only making Americans less healthy, but it is also taking a significant financial toll on the country. Programs addressing obesity and related health problems are becoming more common but few target adolescents. Intervention programs should be targeted early in life, at a time when major life decisions are being made. Teenagers should be emphasized in this research because this age group is not only making health status decisions for today, but also for the future. Of special concern are teens who are the most vulnerable to increased health problems, such as those attending alternative schools. Addressing the obesity epidemic in alternative high school settings should be a focus of health care and research so that vulnerable youth have increased opportunities to make better health decisions that lead to healthier lives.
SECTION TWO

OBESITY IN AMERICANS

Type 2 diabetes mellitus and cardiovascular disease are debilitating illnesses that are increasing in occurrence. These two diseases are closely linked to lifestyle choices and the overweight and obese populations in America. Not only has the prevalence of overweight adults increased dramatically, but so has the incidence of overweight children and adolescents.

The obesity epidemic is growing larger in scale (see Figure 1). In 1999-2002, as many as 64 percent of American adults were overweight (25.0-29.9 Body Mass Index [BMI]). This is a 56 percent increase from the earlier study from 1988 to 1994. Thirty percent of adults were classified as obese (30.0 BMI or greater) in comparison to only 23 percent in 1988-1994 (Hedley et al., 2004). The health status of individuals is closely linked to BMI (U.S. Department of Health and Human Services [DHHS] & U.S. Department of Agriculture [USDA], 2005). Therefore, the population of those with a BMI of 30 or greater and with associated comorbidities is rapidly growing (DHHS & USDA, 2005). Children at greatest risk for a high BMI are those with obese parents (resulting from genetic as well as environmental reasons) and low income families (resulting partially from food insecurity and lowest-cost food options) (Buiten & Metzger, 2000; Drewnowski & Specter, 2004).

The trend (see Table 1 & Figure 2) in childhood and teenage obesity was fairly stable in the 1960s to the 1970s, but in the past three decades the prevalence has increased significantly. The second National Health and Nutrition Examination Survey [NHANES] study from 1976 to 1980 showed the prevalence to have almost doubled in children from the stable baseline of the first study in the 1960s. Even though there is a national focus to reduce the percentage of overweight (classified as greater than 85th percentile of BMI for children) and obese children
(greater than 95th percentile of BMI), the third NHANES (1988-1994) suggests that this rate has not come close to leveling off, but rather has increased even further. The prevalence among children has increased for both sexes from ages six to 19 years, resulting in 16 percent of children in this age bracket being overweight in 1999 to 2002. This number represents a 45 percent increase from the third NHANES in 1988-1994 (U.S. National Center for Health Statistics [NCHS], n.d.).

The destruction that occurs to the body due to cardiovascular disease and type 2 diabetes has historically manifested itself in middle to late adulthood. However, this process is starting earlier in life. Type 2 diabetes used to be referred to as “adult onset,” but almost one-half of new cases of diabetes in children are now due to type 2, representing a large increase in the disease rate for this population (American Diabetes Association, Inc., 2003; Ludwig & Ebbeling, 2001). A study in 2000 showed that the risk of developing type 2 diabetes increased by four percent with every pound of excess body fat (Lytle, 2002). Mortality relating to cardiovascular disease has been associated with obesity, even beginning in childhood (Buiten & Metzger, 2000). The development of arterial lesions associated with arteriosclerosis has been found earlier than previously, as young as three years old (McGill et al., 2000). Children and adolescents are manifesting with so called “adult” diseases largely due to an increased sedentary lifestyle and a decrease in healthy dietary intake. Cardiovascular risk, type 2 diabetes, and insulin resistance are all associated with an increased overweight child population (Robinson, 2000). It follows then that more attention should be paid to lowering the rates of overweight and obese children and adolescents.

National attention on overweight and obese populations has been increasing over the last four decades but until recently the attention has mostly been on adults. The most recent Healthy
People publication has targeted childhood and adolescent weight (U.S. Centers for Disease Control and Prevention et al., 2004). The Healthy People 2010 objective 19.3 targets the reduction of overweight and obesity in 12 to 19 year olds and aims for a six percent reduction from eleven to five percent. This focus on reduction is due to its relationship to problems such as stroke, gallbladder disease, arthritis, cardiovascular disease, sleep disturbances, hypertension, dyslipidemia, problems with breathing, certain cancers, social stigma, discrimination, depression, and lower self-esteem (Hagerty, Schmidt, Bernaix, & Clement, 2004; U.S. Centers for Disease Control and Prevention et al., 2004; U.S. Department of Health and Human Services [DHHS], 2000). The website HealthierUS.gov represents a new program that seeks to centralize the links for health promotion resources for Americans to utilize. It increases awareness of the programs available to U.S. citizens that focus on healthier eating and increased physical activity. Programs like “VERB” and “BAM” (“Body and Mind”) are targeted specifically at children and adolescents (U.S. Executive Office of the President & DHHS, 2005).

Washington State has also focused on the obesity epidemic within the state because more than half of Washington residents are reported to be overweight or obese (Washington State Department of Health [WA DOH], 2003). Only 54.2% of Washington residents meet the nationally recommended amount of physical activity guidelines per week (U.S. National Center for Chronic Disease Prevention and Health Promotion [NCCDPHP], 2005). The Washington State Nutrition and Physical Activity Plan (2003) is an attempt to build supportive communities for weight management. Its purpose is to slow the rate of increase of obese adults, reduce the chronic disease rate, and generally to improve the quality of life for Washingtonians by building supportive environments so that it is easier for people to choose healthy foods and increase their physical activity levels. Children are also included in this plan, though they are not the sole
focus. This plan pulls from many resources to change the experience for Washington residents at different levels, such as for individuals, families, institutions, and communities, and through public policy change (WA DOH, 2003).

Growing amounts of literature concentrate on increasing the awareness of primary care providers about the obesity epidemic. Most literature is focused on treatment and diagnosis of adult complications relating to obesity, but there is a small percentage looking at identification and management of obesity in adolescents. Research demonstrating metabolic complications such as impaired glucose tolerance, insulin resistance, and hyperinsulinemia, as well as psychological sequelae like depression, altered body image, and low self-esteem, are closely related to adolescent obesity. These findings have motivated more research that focuses on adolescents (Hagerty et al., 2004; Grey et al., 2004).

The American Heart Association developed guidelines for primary prevention of cardiovascular disease because it is the leading cause of death and disability for American adults (American Heart Association, 2002). The original publication did not address childhood prevention but it was modified in 2003 to include child-focused prevention goals and recommendations for nutrition, physical activity, and smoking (Kavey et al., 2003). Diabetes is another major problem developing in adolescence that needs more attention by healthcare personnel and research. There should be a greater emphasis for providers to assess for and treat obesity in adolescents due to the impact of their current lifestyle on their present and future health status.
SECTION THREE

SIGNIFICANCE OF OBESITY EPIDEMIC

The current trend in increased weight manifests itself in two ways: medically and financially. There are multiple chronic diseases and problems associated with a higher BMI. This increase in the rate of chronic diseases due to obesity has significantly impacted the overall quality of many people’s lives as well as increased the financial demands on the American healthcare system.

The physiological problem of obesity is an energy imbalance, which is the consequence of a poor diet and the lack of physical activity. More calories are consumed and stored than are consumed and used for energy. In the third NHANES study in 1988-1994, the average intake had increased by 100 to 200 calories per day without a sufficient increase in energy expenditure (Beebe, 2003). Not only do many people take in more calories than needed, but many also do not meet the recommendations for daily intake of specific nutrients. This leads to further health problems. Some diseases and illnesses that are linked to poor nutrition are overweight and obesity, cardiovascular disease, hypertension, dyslipidemia, type 2 diabetes, osteoporosis, orthopedic problems, constipation, diverticular disease, polycystic ovarian syndrome, iron deficiency anemia, oral disease, malnutrition, and some cancers (DHHS & USDA, 2005). Energy imbalance also is affected by the other side of the equation, energy output, which can impact health status as well. Physical inactivity can lead to diseases such as overweight and obesity, cardiovascular disease, hypertension, osteoporosis, diabetes, and some cancers (DHHS & USDA, 2005). With so many health problems that can arise from poor nutrition and physical inactivity, the focus on this energy imbalance should be intense and scrutinizing.
The challenge for health care providers is to identify and treat high-risk people early, whether it be children or adults. The mean age of diagnosis for type 2 diabetes has decreased from 52 to 46.6 years old from 1988 to 2000 (Koopman, Mains, Dia, & Geese, 2005). This could be attributed to either to earlier identification by practitioners or reflect a trend in earlier onset of the disease (Koopman et al., 2005). Obesity, specifically visceral obesity, is an important risk factor for type 2 diabetes, so weight loss programs for high-risk individuals are important. However, implementing effective long-term weight loss programs provides an ongoing challenge (Beebe, 2003). Encouraging people to lose even a modest amount of weight, such as only ten pounds, has benefits for their health status and decrease their risk of associated diseases (DHHS & USDA, 2005). The Diabetes Prevention Program showed that sedentary people that add at least 150 minutes of exercise per week are able to achieve a seven percent weight loss (Beebe, 2003). Nutritional changes could also dramatically change the health status of an individual. The Dietary Guidelines for Americans (2005) estimates that compliance with their recommendations alone could reduce the risk of mortality in adults by nine percent in women and 16 percent in men (DHHS & USDA, 2005). Not only do health education and encouragement of behavioral change for children and adolescents impact a particular child’s health, but the effects of that education transfers over onto family members and increases the likelihood of their own behavioral change (Grey et al., 2004). Supporting behavioral change could make a significant difference in the medical consequences of obesity. However, effective weight management is difficult in an environment that reduces chances for physical activity and encourages intake of nutritionally poor foods (Beebe, 2003).

Behavioral change that complies with nationally recommended nutritional intake and physical activity should start early in life and continue throughout adulthood (DHHS, 2000).
One-quarter to one-half of the adolescents that are overweight are still overweight as adults, due partially to the fact that eating behaviors learned in childhood are solidified in adolescence and carried on into adulthood (Lytle, 2002). Researchers with the Bogalusa Heart Study found that a person's BMI in childhood is a reliable and consistent predictor of heart size in adulthood. A high BMI in childhood is a quality predictor of left ventricular hypertrophy in adulthood. This burden on the heart in childhood, which is carried on to adulthood can, in turn, contribute to a heart attack or heart failure. This study reported that half of the obese adults in the study were also obese as children, supporting the fact that choices made in childhood often decide one's lifestyle decisions for the rest of life. Heart disease begins in childhood and early education and prevention are key to stopping the prevalence of cardiovascular disease (Li, Ulusoy, Chen, & Srinivasan, 2004).

The increase in medical problems relating to obesity also manifests itself in the finances of healthcare. The total costs relating to obesity in the United States in 2000 was estimated at $117 billion, with $61 billion of that as direct medical costs and $56 billion as indirect costs (NCCDPHP, 2003). The upsurge of hospital costs alone is staggering. For obese U.S. children and adolescents alone, the annual inpatient costs have risen from $35 million in 1979-1981 to $127 million in 1997-1999 (NCCDPHP, 2003). For American adults, the treatment costs for obesity are approximately $31 billion, 17% of which is direct medical costs (NCCDPHP, 2003). Even a small weight loss of only ten pounds is estimated to reduce the lifetime medical costs of an overweight individual from between $2,200 to $5,300 (NCCDPHP, 2003). Washington State is also experiencing financial problems due to the soaring obesity-related medical costs. Health care coverage is becoming more difficult to provide at an affordable rate (WA DOH, 2003).
Direct diabetic and cardiac healthcare costs together equal 14.7% of the total U.S. expenditures for healthcare (American Heart Association, 2005). Heart disease is ranked the highest percentage of costs at 8.06%, with hypertension costs at fifth place, 4.24%, and diabetes coming in ninth at 2.37% (American Heart Association, 2005). The estimated cost of cardiovascular disease alone for 2005 is $393.5 billion (American Heart Association, 2005). The expense of treating diabetes is climbing as well. The American Diabetic Association found in 2002 that the cost of expenses relating to diabetes was $132 billion, or one out of every ten healthcare dollars spent in the U.S., with $91.8 billion of that as direct medical costs. They estimate that this figure was low due to intangible costs like pain and suffering and the underreporting because of undiagnosed cases, which could be as many as 5.2 million people. Per capita rates increased from $10,071 in 1997 to $13,243 in 2002, a rise of over 30%. These costs represent 19% of total personal healthcare expenses in the U.S. However, the number of diabetic people adds up to only 4.2% of the total population (American Diabetic Association, Inc., 2003; U.S. Centers for Disease Control and Prevention [CDC], 2003). These costs can be expected to increase significantly when the current group of adolescents reaches adulthood due to the rise in new cases diagnosed, currently at 1.3 million people each year (CDC, 2003; Lytle, 2002). In addition, one-third of cardiovascular disease and obesity-related cancers are attributable to dietary patterns (Lytle, 2002). If Americans complied with national dietary guidelines, the cost of treatment would lower by an estimated $71 billion each year (Lytle, 2002).

The medical and financial sequelae associated with increased obesity in Americans are noteworthy and should be addressed by focusing on the child and adolescent population where the problems often begin. Even though this has been recognized in the literature, program intervention research to determine the best ways to intervene with groups of youth and at-risk
communities of adolescents are lacking. This problem is complicated further by the multiple factors contributing to the obesity epidemic.
SECTION FOUR

CONTRIBUTORS TO THE OBESITY EPIDEMIC

Obesity, and the commonly resulting cardiovascular disease and diabetes, is attributable to multiple factors that make intervention a complicated, but necessary endeavor. Among these factors are genetics, lifestyle choices, and socioeconomic status. Understanding how these factors contribute to the obesity epidemic will help health care providers to understand how best to intervene.

The first major factor is genetics. Adolescent obesity is attributable to genetic factors and metabolic dysfunction. Studies comparing children's weight status associated with their biological parents have shown a higher correlation in comparison to those children's association with their adoptive parents (Hagerty et al., 2004). Higher BMI in childhood is strongly associated with a higher BMI in the parents. If both biological parents are within normal BMI limits, their healthy child has a 14% chance of being overweight. If one parent is obese, then the chance increases to 40%. If both parents are obese, the child has an overwhelming 80% chance of being overweight as well. Also, obese children with a family member (within the first or second degree) that has type 2 diabetes have a 58% chance of developing this illness sometime in their life. Since obesity in both parents is strongly associated with obesity in children, intervention focusing on families is important for the next generation (Hagerty et al., 2004).

Lifestyle choices are the one factor in the obesity epidemic that is most easily changed. Societal influences encouraging decreased physical activity, increased sedentary activities, such as television watching and computer games, and poor nutritional intake are significant factors that can be directly addressed most readily in American youth.
The percentage of youth that do not participate in sufficient physical activity is stunning. A report from the Youth Media Campaign showed that 61.5% of children between the ages of nine and 13 years do not take part in any organized physical exercise outside of school activities and 22.6% of children do not participate in any free-time physical activities (NCCDPHP, 2005). Physical education has also been decreased or completely removed from many school education systems (Hagerty et al., 2004). More than 60% of adults do not participate in sufficient physical exercise and more than a third of high schoolers do not participate in regular physical activity (NCCDPHP, 2003). Children with a healthy BMI are more likely to engage in sufficient vigorous physical activity, as opposed to children with a higher BMI, who are more likely to avoid physical activity and spend more time in sedentary activities, like television watching. This causes the health status of the overweight or obese child to decline even further (Patrick et al., 2004). Screen time activities like television, video games, and computers have also decreased the physical activity time spent by teens (Patrick et al., 2004).

The number of hours the average adolescent spends each day watching television, playing video games, computing, or other similar screen-time sedentary behavior is at a considerable high. Among high school students, 42.8% watch television alone for longer than two hours on an average school day. The percentage of those that spend over five hours a day watching television is at 13.9%. The prevalence of increased hours spent watching television is highest among children with lower grades, those of ethnic and racial minority groups, and in females (Lowry, Wechsler, Galusak, Fulton, & Kann, 2002). Boys average 47 minutes a day playing video games alone (Sturm, 2005). The main recommendation made by this study was that parents should limit their children’s screen-time to two hours a day or less, and encourage other vigorous physical activities (Lowry et al., 2002).
Not only has increased screen-time encouraged a sedentary lifestyle, but it also impacts children especially through commercials. Television watching is often associated with eating snack foods. Calorie-dense, low nutritional value snack foods make up a large portion of television commercials (Sturm, 2005). Large quantities of foods with high fat content are readily available to adolescents for consumption during this low energy output time (Hagerty et al., 2004). The marketing of energy-dense foods has grown and consumer food choices are often driven not by healthy choices, but more by taste, cost, and convenience. The 1997 food retailer advertising costs reached $11 billion, which focused mainly on high sugar and high fat foods. Much of this advertising is targeting children and lower socioeconomic groups (Drewnowski & Specter, 2004). The impact of media influence on adolescents is significant and highly variable based on the current goals of advertising.

Dietary intake is another major opportunity for health intervention. A relationship has been identified between the incidence of obesity and intake of high dietary fat and low number of dairy product servings (Beebe, 2003). Americans in general are not compliant with the Dietary Guidelines for Americans, but adolescents are especially non-compliant. To stay at the same weight, the average, moderately active, adolescent girl would have to regularly consume 2,000 calories a day and a teenage boy would have to take in 2,400 to 2,800 calories a day (DHHS & USDA, 2005). Intake tends to be high in fat, low in fruits and vegetables, and low in calcium-rich foods. Teenagers, often girls, are commonly known to skip meals, specifically breakfast (Story, Neumark-Sztainer, & French, 2002). Increased consumption of caloric, non-nutritive beverages, fast foods, and snack foods by adolescents have been documented (Drewnowski & Specter, 2004). Only 34% of teenage girls and 27% of teenage boys limit their saturated fat intake to the recommended levels and only 36% of girls and 30% of boys fall into the
appropriate category for total fat intake. Adolescents also tend to exceed the recommended level for sodium intake. Teen males often consume double the daily recommended sodium intake and only 29% of girls consume the recommended amount. Low fiber intake, too, is associated with cardiovascular disease and again, most adolescents do not eat enough. Only 22.5% of adolescents consume the recommended two fruits per day and only 46.5% take in at least three servings of vegetables daily (Lytle, 2002). Poor nutritional intake is highly associated with obesity, and adolescents specifically have very poor diets. Appropriately delivered nutritional interventions that teach teens the importance of nutrition and how to eat properly should be an important focus for healthcare efforts.

Socioeconomic status is another factor associated with obesity and poor cardiovascular health. Although obesity rates have been increasing in all ages and populations in America, the highest rates are among the lowest socioeconomic groups and those with lower education levels (see Figure 3) (Drewnowski & Specter, 2004). Children within the lower socioeconomic status groups also are shown to be more likely to be overweight and receive less weight control or dietary advice (O’Dea & Caputi, 2001). One reason for this disparity could be that energy-dense foods, which have higher levels of refined grains, added sugar, and high fat content, are often the lowest-cost choice for the consumer. Poverty and food insecurity are associated with less money spent specifically on food. Another factor is that these accessible energy rich foods with high amounts of sugar and fat are more palatable and are associated with higher caloric intake. The third contributing factor is that poverty and food insecurity are connected with less access to and intake of fresh fruits and vegetables, and in general poorer nutritional intake (Drewnowski & Specter, 2004). Children from low socioeconomic status families are at high risk for developing
obesity through their food choices and this aspect should be addressed specifically by research and health promotion programs.

Adolescents are an at-risk population because so many life changing events occur during this time. This is a pivotal time for youth in which cognitive, biologic, and social changes are occurring. Special challenges and opportunities during the formative teenage years require specific attention by researchers and program developers. Adolescents are making life changing decisions that will affect not only their current health status but also their health in future years (CDC et al., 2004).

Researchers need to take note of the cognitive changes that occur in adolescence so that the teenagers can better understand the programs that are implemented. The teen years are a turbulent time where risk taking behavior and exploration occurs, self-identity and world views are established, and formal, operational thought is solidified in lieu of more concrete thought (Piaget 1969; Piaget, 1973). Defiant and fiercely independent attitudes are commonly expressed during this life changing time (Sturdevant & Spear, 2002). Adolescents are in the developmental stage of formal operations where they form their own ideas and start to comprehend abstract ideas. The psychosocial stage is identity versus role confusion when previous self-doubt dissipates, self-confidence is gained, and adolescents realize that their way of experiencing events is acceptable (Erikson, 1963; Erikson, 1968). At this stage, they need positive role models in peers and adults so that a healthy identity emerges. Their separation from adult role models is defined by their defiant attitude and their peers’ opinions dominate their views.

In nutritional intervention, adolescents can now understand nutritional concepts, make independent food choices, and recognize that there is a conflict between one’s taste preference and health needs. Intervention using a combination of one-on-one sessions as well as group work
is most useful for maximum effectiveness. Using negotiation and reflective thinking techniques are often successful because adolescents are trying to form their own ideas (Sigman-Grant, 2002). Adolescents respond well to encouraging appropriate food choices as a way of asserting independence from parental choices (Sigman-Grant, 2002). However, it is important to include parents, if possible, because parents are often the gatekeepers to food (Hoelscher, Evans, Parcel, & Kelder, 2002). Intervening at this cognitive stage is important as it has the potential of influencing the adolescent’s entire life’s nutritional and physical activity choices.

Adolescence is a nutritionally vulnerable time in life when one must listen to the body’s needs and adapt appropriately. During puberty, the changes to the body are dramatic. Changes include a large skeletal mass increase with approximately half of the adult bone mass being developed, body composition changes with body fat composition dropping to about 12% in men and increase from 16 to 27% in women, sexual maturation, and an increase in height and weight (Stang & Story, 2002). This time is marked by a greater need for nutrients because of a dramatic biological growth. The change in lifestyle that occurs also demands different nutritional intake depending on the activity level of the teen. Nutrient intake must be appropriate for the biologic demands in order for the body to maintain a healthy BMI. Specific needs for proper growth and development are increased protein, calcium, iron, zinc, and vitamins and in general, more caloric energy requirements are needed (Spear, 2002). Biologic and hormonal changes increase the stress and anxiety during this time and intervention should ally these normal worries in order to focus on the other nutritional and fitness needs of their bodies (Hoelscher et al., 2002).

The social changes that are so important during the teenage years are another major factor that one must take into consideration when developing research and health promotion programs involving this age group. The environment in which teens are immersed into can greatly
influence their self-esteem development (Conner, Poyrazli, Ferrer-Wreder, & Maraj Grahame, 2004). Teens move from a family focused realm into more of a peer group focus, so utilizing peer groups is successful when implementing change. Children are spending increased amounts of time away from home, mostly in school and after-school programs. Meal patterns are chaotic and teens are missing more meals at home, instead rapidly eating snacks or skipping the meal entirely (Spear, 2002). Families are spending less time sitting down and eating meals together and households have a significant decrease in the amount of conversation occurring between generations, so the influence from parental nutritional and activity input is less (Sturm, 2005). Encouraging structured family meals, family involvement, and adopting lifestyle fitness choices are ways to change the obesity rates of teens (Buiten & Metzger, 2000).

Acceptance by one's peer group is monumentally important to this group so creating a positive health environment within schools is imperative to successful programs. Obese high school students are often subject to rejection, discrimination, and lower self-esteem. The connection between lower self-esteem and obesity has been documented and is largely due to the pressures put on teens from their peers (Lytle, 2002). An association between lower social status at school and obesity has been shown in adolescents and continued into adulthood (Goodman et al., 2003). Embarrassment about appearance or poor coordination abilities is heightened in individuals with a higher BMI and could deter some from further participation in physical activities (Lytle, 2002).

Often the cognitive demands of school and other obligations, biologic changes like physical growth and puberty, and the complex social demands from peers overshadow the importance of proper nutrition and physical fitness in the eyes of teens. The barriers associated
with eating a proper diet and getting sufficient physical activity seem too high, so health is put aside. Interventions that address this health priority are acutely needed at this time.
SECTION FIVE

TEENS AS A VULNERABLE POPULATION

Of adolescents that are at risk for cardiovascular disease and diabetes relating to obesity, those in alternative high school settings should be a particularly targeted population. Approximately 2.0% (280,000 students) of all high school students are in the nation’s 1,390 alternative high schools. These schools aim at helping students that are at risk for failing or dropping out of the typical high school system due to behavioral, cognitive, or social issues. Often delinquent behaviors are the source of the problem, including drug use, violence, or other illegal activity (Grunbaum et al., 2000). These youths are at a higher risk for health problems because of life circumstances, yet limited information is known about how to intervene with this group for nutritional and physical activity programs.

The students in this setting are often from a lower socioeconomic status and have increased risk behaviors. Low socioeconomic status, defined by eligibility to the free or reduced-price lunch programs, is at a higher rate in an alternative setting than in a typical high school. For example, one alternative high school in a large metropolitan area in Washington State had over half their student body, at 53.1% (222 of 507 students), qualify for either the free or reduced-price lunch programs, with the majority of that being the free lunch program (U.S. National Center for Education Statistics, 2003). The students at alternative high schools are also shown to already have had trouble adequately finishing their education and if they drop out of their alternative school as well, their lower education level places them at a higher risk of obesity and cardiovascular disease. These teens have also been shown to be significantly more likely to be involved in risky behaviors (Connor et al., 2004). Risk behaviors encompass not only tendency for violent behavior but also the tendency for poor nutrition and physical fitness. These students
were shown to have less access to and be less likely to take part in vigorous physical activity regularly than a comparative regular school system cohort (Connor et al., 2004). This large difference in the vulnerability of adolescents that are enrolled in alternative high school settings compared with those in typical settings should make them prime targets for intervention.
SECTION SIX
EXISTING PROGRAMS

A very limited number of programs exist targeting the weight problem during adolescence outside of some information integrated into school instruction. Even fewer focus on high-risk teens such as those at alternative high schools. Community programs exist that target the entire population to increase the physical activity of Americans but those programs often miss teens for their target. “VERB” is one of these programs that has a high success rate but only targets nine- to thirteen-year-olds (Bretthauer-Mueller & Melancon, 2005). “PE2GO” is another successful program available but also targets elementary school children and completely ignores the problem developing at the adolescent level (Martin, Martin, & Martin, 2005).

Nutritional programs are more commonly focused on adolescents but only on small groups of them. “Gimme 5” and “Body Basics” are two nutritionally focused programs that have had a fair amount of success in helping teens reevaluate their diet. “Gimme 5” is an innovative school-based program set out to increase the fruit and vegetable intake of high school student to the recommended five a day (O’Neil & Nicklas, 2002). “Body Basics” is a dietary program concentrating on food, nutrition, growth, body image, and weight control with a large amount of success in Australia. This program could serve as a model of the type of program that could be implemented in American communities, as long as physical activity is emphasized as well (O’Dea, 2002). One example of teenage nutritional and activity level focused intervention program is LEAN’s “Food on the Run.” This is a program in Californian schools encouraging behavioral changes in teenage eating patterns and physical activity levels (Agron, Tadada, & Purcell, 2002). Although the program was successful nutritionally and a significant change occurred with the teens’ knowledge about physical activity, there was no significant change in
their actual activity patterns (Agron, Tadada, & Purcell, 2002). This program will be continued for three more years and is currently being addressed in legislation and policy development (Agron & Berends, 2005).

It is important to implement programs that take into consideration the teen’s wants and needs in order for it to be successful. Adolescent intervention programs are lacking in the U.S. that successfully encourage change in teenage eating and activity behaviors. No programs that particularly target vulnerable adolescents have been described in the available literature found.
SECTION SEVEN
THEORETICAL FRAMEWORK AND NURSING INTERVENTION

The most dominant theory that has been used for working with adolescent populations has been the Social Cognitive Theory. This theory includes a focus on behavioral, personal, and environmental influences (Hoelscher et al., 2002). However, this theory lacks some elements that the review of literature has shown are necessary for reaching adolescents appropriately. Commonly suggested are the educational, behavioral, and motivational pieces, but important is the inclusion of a parent or close support person (Jerum & Masurek Melnyk, 2001). One study mentioned the importance of including three elements relating to obesity - nutrition education, physical activity, and self-efficacy -- in order to make behavioral changes in at-risk youth (Grey et al., 2004). For adolescents especially, integrating all levels of interaction is imperative to a successful program because so much is changing and many supports are needed during these years. Including the individual, family, school, peers, community, and society would produce the best results as so many forces are influencing adolescents (CDC et al., 2004).

Urie Bronfenbrenner’s Ecologic Theory of Development is a model that incorporates multiple forces that influence the individual (see Figure 4). The premise is that the individual interacts on five different levels: the microsystem, the mesosystem, the exosystem, the macrosystem, and the chronosystem. The *microsystem* is the level of daily contact, including the family, school, peers, and possibly neighbors and religious groups. The *mesosystem* includes the interaction of groups in the microsystem which in turn influence the individual. The *exosystem* does not represent daily contact but still impacts the individual. Examples include the extended family, family friends, and the parents’ workplace. The *macrosystem* includes entities that change cultural beliefs, values, and behaviors such as the media, law, and health services. The
last level, the *chronosystem* brings into perspective the time period and the larger environmental or historical events of the time, such as famine, depression, or war. The high impact of obesity at the present time is an example of the chronosystem influence. The five systems and the individual interact with each other and influence the individual (Ball & Bindler, 2003; Bronfenbrenner, 1979). This model uses a holistic approach needed to recognize all the forces influencing children; utilizing it to develop a program would benefit all involved.

Nurses can be leaders in applying Bronfenbrenner’s model directly to prevent and treat obesity in vulnerable teens. Specifically, school nurses and community health nurses would be able to utilize this model to the fullest due to the easy access these nurses have to the multiple systems influencing adolescents. Using the different levels of interaction to target the areas of influence on a teen’s life will help in assessment and intervention of obesity. The application table (see Table 2) assists in asking questions targeted to the different areas of influence and prompts the nurse to intervene on the same level of interaction. More detailed assessment and intervention information is available in *Bright Futures in Practice* nutrition and physical activity editions that can be tailored to the microsystem level of interaction (Patrick, Spear, Holt, & Sofka, 2001; Story, Holt, & Sofka, 2000). Advanced practice nurses, school nurses, and those nurses in community-based clinics should target teens for obesity prevention and early intervention with a special focus on those vulnerable youths in alternative high schools.

Individual attention is important for preventing obesity as each teen is different, but more important is a community-wide approach. Barriers exist for entire communities that need to be addressed before the American society can begin to change the obesity trend. Addressing these obstacles for communities will make a change on national, community, and individual levels. Advanced practice nurses can take the lead in this endeavor and begin to identify and address the
impediments within their own communities and make a change that will impact Americans’ health and improve their quality of life. Using this systems approach will help the advanced practice nurse to make a difference in an individual teen’s life as well as a community level change.
SECTION EIGHT

SUMMARY

Little literature is available tying the increase of obesity and the vulnerability of the teenage years even though these facts are well-documented separately. A dearth of programs to lower the risk of obesity and improve dietary and activity behaviors for teens and an absence of this type of program for vulnerable teens specifically was identified. Nurses must initiate a focus on adolescent obesity so that appropriate interventions can be made for this population. Attention must be paid by healthcare providers as obesity, cardiovascular disease, and type 2 diabetes are escalating in the U.S. today. Intervention programs that specifically target nutrition and physical activity changes for vulnerable adolescents must be implemented. Adolescence is a crucial time for intervention due to the significant changes that occur and its impact on health throughout adulthood. Specifically focusing intervention programs on the teenagers in alternative school settings must be addressed. This population is highly vulnerable to becoming overweight or obese and subsequently developing type 2 diabetes or having a decline in their cardiovascular health. Research programs need to be initiated that incorporate Bronfenbrenner’s model, address adolescent cognitive, biologic, and social characteristics, and recognize the unique vulnerabilities of the alternative high school setting. Advanced practice nurses focusing on community and school health are crucial to implementing change in this population and utilizing the application table for Bronfenbrenner’s model will assist in designing interventions.
REFERENCES


Lowry, R., Wechsler, H., Galuska, D.A., Fulton, J.E., & Kann, L. (2002). Television viewing and its association with overweight, sedentary lifestyle, and insufficient consumption of


Table 1


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NHES = National Health Examination Surveys

NHANES = National Health and Nutrition Examination Survey
Table 2

Application of Bronfenbrenner’s Model for Advanced Practice Nursing Assessment and Intervention at All Levels.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Microsystem</th>
<th>Exosystem</th>
<th>Macrosystem</th>
<th>Chronosystem</th>
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|            | • BMI percentile  
|            | • BP percentile  
|            | • Cardiovascular assessment  
|            | • Results of 24 hour diet recall  
|            | • Amount of exercise each week  
|            | • Amount of sedentary time each day  
|            | • Availability of support person  
|            | • Connection to family, peers, school  
|            | • Knowledge of nutritional requirements and recommendations  
|            | • Knowledge on availability of exercise within community  
|            | • Self-perception of body image and body weight  
|            | • Acceptability  
|            | • Amount of exercise within media attention community  
|            | • Self-perception of exercise, body image and smoking body weight cessation  

| Intervention | Pedometer usage with daily monitoring  
|             | • Weekly food diaries  
|             | • Increase individual access to health information  
|             | • Increase access to daily physical education courses  
|             | • Limit the number of hours each day that soda pop  
|             | • Increase access to daily physical education courses  
|             | • Policy change about child protection laws  
|             | • Media emphasis on proper nutrition, exercise, and  
|             | • Increase teen usage of internet for health information  
|             | • Increasing access to proper nutrition  

|            | • Existence of child protection laws (ie: bike helmet laws, school zone speed limits)  
|            | • Existence of policy supporting access to nutrition and exercise opportunities for low income  
|            | • Percentage of teens on free or reduced lunch program  
|            | • Knowledge of health practitioners to treat obesity in children  
|            | • Amount of media attention on nutrition, exercise, smoking cessation  
|            | • Encouragement in society for kids to be active during free time  
|            | • Percentage of children that access the internet for health information  
|            | • Availability of fresh foods in region  
|            | • Acceptability of using sedentary time as baby-sitter  
|            | • Encouragement in society for kids to be active during free time  
|            | • Increase teen usage of internet for health information  
|            | • Increasing access to proper nutrition  
|            | • Increase teen usage of internet for health information  
|            | • Increasing access to proper nutrition  

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| • Provide support person for exercise/nutrition activities |
| • Increase access to computer programs that monitor intake, exercise, and BMI status |
| • Psychological support for body image disturbances |

| vending machines are turned on |
| • Organize a community run/walk day |
| • Health fair including assessment and intervention activities targeting teens |

| community support for decreasing obesity |
| • Tobacco cessation programs targeting underage smokers |

| through starting food banks and food sharing programs |
| • Decrease acceptability of sedentary behaviors and increasing expectation for active teens |
Figure 1. Percentage of adults who report being obese, * by state (CDC, 2005).

**Obesity Trends* Among U.S. Adults**  
*BRFSS, 1985*  
(*BMI ≥30, or ~30 lbs overweight for 5’4” person*)

Source: Behavioral Risk Factor Surveillance System, CDC.

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**Obesity Trends* Among U.S. Adults**  
*BRFSS, 1990*  
(*BMI ≥30, or ~30 lbs overweight for 5’4” person*)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity Trends* Among U.S. Adults
BRFSS, 1995
(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.

Obesity Trends* Among U.S. Adults
BRFSS, 2000
(*BMI ≥30, or ~ 30 lbs overweight for 5’ 4” person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Obesity* Trends Among U.S. Adults

BRFSS, 2003

(*BMI ≥30, or ~30 lbs overweight for 5'4" person)

Source: Behavioral Risk Factor Surveillance System, CDC.
Figure 2. Prevalence of overweight children and adolescents trend, for selected years 1963-65 through 1999-2002 (NCHS, n.d.).

NHES = National Health Examination Surveys

NHANES = National Health and Nutrition Examination Survey
Figure 3. Obesity as a function of income and education level (Drewnowski & Specter, 2004).
Figure 4. Bronfenbrenner’s ecologic theory of development five interaction levels (Bindler, Bruya, & Lyons. 2004).