Resolution No. 06-2001-151

RESOLUTION OF THE WHITE MOUNTAIN APACHE TRIBE OF THE FORT APACHE INDIAN RESERVATION

WHEREAS, Becky Ethelbah on behalf of Johns Hopkins University, Pathways, has approached the Tribal Council this date with a request that the Tribal Council approve for publication the Pathways manuscript entitled: *"Obesity in American Indian Children: Prevalence, Consequences & Prevention"*; and

WHEREAS, American Indians of all ages and both sexes have a high prevalence of obesity and the Council recognizes that obesity has become a major health problem in American Indians only in the past few generations and is believed to be associated with the relative abundance of high-fat, high-calorie foods and the rapid change from active to sedentary lifestyles; and

WHEREAS, the Tribal Council concludes that it should grant approval to have this manuscript published to encourage effective, educational and environmental interventions to with full participation of the American Indian communities.

BE IT RESOLVED by the Tribal Council of the White Mountain Apache Tribe that it hereby approves the publication of the Pathways Manuscript entitled; *"Obesity in American Indian Children: Prevalence, Consequences & Prevention."*

The foregoing resolution was on June 7, 2001, duly adopted by a vote of EIGHT for and ZERO against by the Tribal Council of the White Mountain Apache Tribe, pursuant to authority vested in it by Article IV, Section 1 (a), (g), (s), (t) and (u) of the Constitution of the Tribe, ratified by the Tribe on September 30, 1993, and approved by the Secretary of the Interior on November 12, 1993, pursuant to Section 16 of the Act of June 18, 1934 (48 Stat. 984).

Dallas Massey, Sr.
Chairman of the Tribal Council

Cyndy Harvey-Burnette
Secretary of the Tribal Council

Obesity in American Indian Children: Prevalence, Consequences, and Prevention

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OL .y is one of the most serious public health problems facing American Indian youth and it has grave implications for immediate and long-term health.

ABSTRACT

Background: American Indians of all ages and both sexes have a high prevalence of obesity. The health risks associated with obesity are numerous and include type 2 diabetes mellitus, hypertension, dyslipidemia, and respiratory problems. Obesity has become a major health problem in American Indians only in the past few generations and it is believed to be associated with the relative abundance of high-fat, high-calorie foods and the rapid change from active to sedentary lifestyles.

Methods: Selected literature review on prevalence of obesity in American Indian children, and health consequences of obesity.

Discussion: Obesity is now one of the most serious public health problems facing American Indian children, and it has grave implications for the immediate and long-term health of American Indian youth. Unless this pattern is reversed, American Indian populations will be burdened by an increased incidence of chronic diseases. Intervention studies are urgently needed in American Indian communities to develop and test effective strategies for obesity prevention and treatment.

Conclusion: To be effective, educational and environmental interventions must be developed with full participation of the American Indian communities.

Key words: obesity, American Indian, prevention, children, diet, physical activity, cardiovascular disease, type 2 diabetes

I' ODUCTION

The health and nutritional status of American Indian children has changed dramatically over the past 30-40 years. Prior to the 1970s, underweight and dietary deficiencies were major health issues affecting large numbers of children (1-4). The findings from the 1969 National Conference on Nutrition, Growth and Development of North American Indian Children indicated that suboptimal nutrition and low weight-for-height were major health problems among American Indian children (1, 3). For example, in a survey of 167 Navajo preschoolers, nearly one-third had weights less than the third percentile (5). Among the Navajos in Lower Greasewood, Arizona, over three-fourths of children had weights and heights less than the 50th percentile (6). In Apache children in Arizona, about 40% had heights below the 10th percentile and 18% had weights below the 10th percentile (2). In all the surveys, growth rates were reported to be well below the national reference. By the late 1970s public health efforts had drastically reduced the prevalence of underweight and growth retardation in American Indian children. Po e changes in nutritional status were attributed to better nutrition, increased food availability, food assistance programs, improved health care, and prevention and treatment of infectious and chronic diseases (2, 5).

Currently, growth retardation and underweight are not problems for the majority of young American Indian children. The 1994 Pediatric Nutrition Surveillance System, conducted by the Centers for Disease Control and Prevention (CDC), included data on 112,586 American Indian children under the age of five years. Less than 2% of the children were considered underweight (weight-for-height < 5th percentile). However, 13% of the young children were considered overweight (weight-for-height > 95th percentile) (7). This indicates that the substantial reduction in pediatric undernutrition has been accompanied by a rapid increase in childhood obesity (4, 8).

Obesity has now emerged as one of the most serious public health problems facing American Indian children and adolescents, and it has grave implications for the immediate and n health of American Indian youth. Unless this trend is reversed, American Indian

populations will be burdened by an increased incidence of chronic diseases, such as type 2 diabetes mellitus, cardiovascular disease (CVD), gallbladder disease, joint diseases, and some cancers (9). This article presents an overview of the prevalence of obesity in American Indian children, the health consequences of obesity, and the urgent need for effective prevention and treatment strategies.

PREVALENCE OF OBESITY

For the United States population prevalence estimates of overweight and obesity are usually derived from nationally representative surveys, such as the National Health and Nutrition Examination Surveys (NHANES) which are conducted on an ongoing basis. However, NHANES does not include in its sampling design American Indians living on reservations.. The most complete health data for American Indians are from Indian Health Service (IHS) sources, which reflect the IHS service population, derived from ambulatory and inpatient data. The IHS service population comprises approximately 60% of all American Indians residing in the United States, primarily on reservations in 35 states. The IHS compiles annual regional and national statistics for its service and user populations (10, 11). Unfortunately, age-specific overweight and obesity prevalence rates are not available through the IHS. Thus, few truly representative surveys of obesity prevalence exist for the American Indian population.

Several recent review articles have summarized the studies on prevalence of obesity in American Indians (8, 12, 13). These reviews indicate that obesity in American Indian communities is widespread, although there is considerable variation across tribes. Obesity rates for American Indian children, adolescents and adults tend to be higher than corresponding rates for the general U.S. population (8, 12, 13). The following section highlights some of the population-based studies on obesity prevalence in American Indian adults and children.

Adults

Studies of American Indian adults, conducted after 1970, indicate a high proportion of obesity (8, 12). Data from the Strong Heart Study show a high prevalence of overweight among American Indian adults aged 45-74 years from several tribes in Arizona, Oklahoma and

N 'South Dakota (14). American Indians in Arizona had the highest prevalence of ov eight, with 75% of the adults being overweight (Body Mass Index (BMI) >27.8 for men and >27.3 for women), followed by 70% of the Indians in Oklahoma and two-thirds of those in the Dakotas. In another study, the prevalence of overweight in Pima Indians in Arizona ranged from 61% to 78% in men aged 20-64 years, and from 81%-87% in women of the same age (15). The Navajo Health and Nutrition Survey (1991-1992) conducted on a representative sample of reservation households found that two thirds of Navajo women (ages 20-59) were overweight (BMI >27.3) and one-third of Navajo men (ages 20-39) and one-half of Navajo men (ages 40-59) were overweight (BMI > 27.8) (16). Among the Navajo, the increase in overweight has been rapid within the past 40-50 years. In 1953, the prevalence of overweight was less than 5% among males and only 15% among females between the ages of 15 and 45 years (17).

Other studies also have shown that obesity is increasing among some American Indian adult populations. The Behavioral Risk Factor Surveillance System, a population-based tel- ne survey, compared trends in BMI for American Indian men and women residing in urban areas and on reservations in the Dakotas, New Mexico, Arizona, Washington and Oregon from 1985-1996 (18). The results showed that among women in all the regions surveyed and men in the Dakotas, average adjusted BMI increased significantly in a linear fashion by 0.1 to 0.2 BMI units each year (about 0.7-1.4 lb) from 1985 to 1996 (18).

Children and Adolescents

There have been several studies on the prevalence of overweight in American Indian children, however, most of these have had relatively small sample sizes. The following studies are particularly noteworthy because of the large number of children included in the sample and inclusion of several reservations. Data from the 1999 CDC Pediatric Nutrition Surveillance System (19) on 30,630 American Indian Children aged 24-59 months showed that 29.3% had a BMI-for-age greater than the 85th percentile and 13.7% had a BMI greater than the 95th percentile. This data indicates that obesity in American Indian children appears to begin early in hi d

In 1990, a national survey on height and weight status of 9,464 American Indian schoolchildren (ages 5-18) living on or near Indian reservations, was conducted by IHS, CDC, and tribal nutrition programs in nine IHS service areas (20). The overall prevalence of overweight in the American Indian children (BMI > 85th percentile of the reference population) was 39% for age and gender based on NHANES II reference data. Findings from the Navajo Health and Nutrition Survey (16)(1991-1992) showed that among 160 adolescents aged 12-19, 35% of the boys and 40% of the girls were overweight (BMI >85th percentile for NHANES II).

A large study on obesity prevalence in American Indian school children was recently conducted through the Aberdeen Area Indian Health Service and involved children from 16 tribes in four Midwestern states (21). Height and weight were measured on 12,559 Indian children ages 5-17 years attending 62 schools on or near reservations in South Dakota, North Dakota, Iowa, and Nebraska. Age-adjusted prevalences of overweight (BMI > 85th percentile for NHANES II) were 39% for boys and 38% for girls. The age-adjusted prevalences of obesity (BMI >95th percentile) for boys and girls were 22% and 18%, respectively. In general, prevalence of overweight and obesity did not markedly differ by age or gender. This study showed that even at the youngest school ages, overweight in American Indian youth was more than twice as likely than for U.S. youth overall, and obesity was more than three times as prevalent.

National surveys have documented a secular trend of increasing overweight in American youth in general during the past 30 years (22). This trend is also evident in American Indian youth. A recent study (23) examined secular changes in prevalence of overweight in Navajo youth in cross-sectional data from 1955-1997. In 1997, about 41% of the 526 Navajo boys and girls, 6-12 years of age, had BMIs ≥85th percentiles of US reference data. Compared with the two previous studies on Navajo youth in 1955 and 1989, the most recent sample had larger weights and BMIs. The estimated rate of secular change in weight was about 1.5 kg per decade in younger boys and girls, and about 3 kg per decade in older boys and girls. The estimated rate of secular change in BMI was about 0.5 - 1.0 units/decade between 1955 and 1997.

HF 'H CONSEQUENCES

The associations between adult obesity and adverse health outcomes, including diabetes, coronary heart disease, cancer and respiratory problems are well documented (9). Many of the prevalent health problems of American Indian adults are related to obesity (24, 25). However, relatively little is known about the immediate consequences of childhood obesity in American Indian youth, such as orthopedic, respiratory, pulmonary, neurological, or psychosocial consequences. A number of studies have examined CVD risk factors and the incidence of type 2 diabetes among overweight Indian youth (26-29). Few studies have examined the long-term effects of child or adolescent obesity on adult mortality and morbidity (30, 31) and none have been done specifically with American Indian youth. The following section briefly reviews health consequences of pediatric obesity in Indian children and adolescents, specifically related to type 2 diabetes, CVD risk factors and psychosocial factors.

Type 2 Diabetes

'abetes mellitus is epidemic among some American Indian populations, and is strongly ssociated with the high prevalence of obesity (24, 32). Diabetes constitutes the major chronic isease problem in many Indian communities. The chronic complications of diabetes include ccelerated development of CVD, end-stage renal disease, loss of visual acuity and limb nputations. All of these complications contribute to the excess morbidity and mortality in dividuals with diabetes (33). Almost all American Indians with diabetes have type 2, which is aracterized by insulin resistance, obesity, a sedentary lifestyle, and sometimes by impaired ulin secretion (28, 34).

The prevalence of type 2 diabetes has been increasing among American Indians (34). ding to this disturbing trend in adults are the recent reports of the emerging problem of type 2 etes in American Indian children and adolescents (33). Until recently, type 2 diabetes was sidered rare in children; however, it is now commonly seen in American Indian children aged nd over (27). It may be that type 2 diabetes among American Indian youth may be the first eq e of the epidemic of pediatric obesity (35).

Except for Pima Indian children, population-based data are not available on incidence rates and prevalence of type 2 diabetes. Most of the available data are based on case reports from diabetes clinic populations. However, it is clear that estimates of this disorder are on the rise, not only among American Indian youth, but also African American and Hispanic youth (33, 35, 36). Fagot-Campagna and colleagues (35) conducted an epidemiologic review on type 2 diabetes among North American children and adolescents. Among 15-19 year old North American Indians, prevalence of type 2 diabetes per 1000 was 50.9 for Pima Indians, 4.5 for all US American Indians, and 2.3 for Canadian Cree and Ojibwa Indians in Manitoba. From 1967-1976 to 1987-1996, prevalence increased 6-fold for Pima Indian adolescents.

Obesity is a hallmark of type 2 diabetes, with up to 85% of children either overweight or obese at diagnosis (33). Other risk factors for pediatric type 2 diabetes include family history of diabetes, intrauterine exposure to diabetes, diet, physical inactivity, and both high and low birth weight (36). A recent analysis found that childhood obesity and intrauterine exposure to diabetes explained most of the increase in diabetes prevalence over time in Pima Indian children (36). Exclusive breastfeeding of infants for at least two months appears to be a protective factor and is associated with a lower rate of type 2 diabetes in Pima Indians up to age 40 (36).

Diabetic Pima Indian children were found to have a very high prevalence of CVD risk factors, including severe obesity (85%), hypercholesterolemia (7%), microalbuminuria (22%), and hypertension (18%) (36). A follow-up study of Pima children with type 2 diabetes conducted when they were between 20-29 years of age showed the median glycosolated hemoglobin was 12%, indicating poor diabetes control, and there was an increase in the number of CVD risk factors. Further, 60% had microalbuminuria and 17% already had macroalbuminuria (36).

The increasing prevalence of type 2 diabetes in American Indian children and adolescents has serious clinical and public health implications because the complications of diabetes are related to the duration of the disease (37). Children who develop type 2 diabetes are at greater risk for earlier development of microvascular (e.g., visual, neurological, and renal impairment) and macrovascular (e.g. hypertension, hyperlipidemia, cardiovascular disease) complications

th : individuals who are diagnosed as adults (28). Bennett (37) estimates that by 35 or 40 ye of age, young people who are diagnosed with type 2 diabetes during childhood may experience serious or end-stage vascular complications. This highlights the urgent need for diabetes and obesity intervention and prevention programs. The characteristics of children and adolescents who develop type 2 diabetes are not completely known or understood. Nevertheless, obesity, diet, sedentary lifestyle, and in utero exposure to diabetes are potentially modifiable factors that are important components in the development of the disease and could be targeted for intervention (28).

Cardiovascular Disease Risk Factors

Cardiovascular disease was not considered a major health problem for American Indians until the latter part of the twentieth century (38, 39) However, IHS data now indicate that CVD is the leading cause of death among American Indians, and it becomes so beginning at age 45, compared with age 65 for the general population (10, 39). Currently, CVD mortality rates appear to creasing, possibly due to the high prevalence of diabetes (38, 39). Analyses from the Strong Heart Study (40) showed that prevalent coronary heart disease among American Indian adults was significantly and independently related to age, diabetes, percentage of body fat, hypertension, smoking, insulin, and low high-density lipoprotein concentrations. Diabetes was the strongest risk factor associated with coronary heart disease.

CDC recently analyzed data from the 1997 Behavioral Risk Factor Surveillance System to characterize the prevalence of risk factors for CVD (hypertension, current cigarette smoking, high cholesterol, obesity and diabetes) in American Indians (41). The findings indicated that 64% of men and 61% of women reported they had one or more CVD risk factors. The prevalence of having one or more CVD risk factors increased with age and varied inversely with level of education. These results may underestimate the true prevalence of CVD risk factors because this is a self-report survey, dependent on participants knowing their risk factor profile; and also the data are collected by telephone. Persons without telephones are more likely to be of lower soc nomic status and to have higher risk of disease (41)

Several studies have shown that overweight white and black children and adolescents are at a substantially increased risk for adverse levels of several CVD risk factors such as blood lipids, insulin, and blood pressure (42-44). The few studies with American Indian youth have found similar results. Among Navajo adolescents aged 12-19 years, BMI was associated with adverse levels of lipids, lipoproteins, blood pressure and glucose, with overweight adolescents having a five fold greater risk for elevated triglyceride levels (>95th percentile) than other adolescents (29). Associations with levels of total/HDL cholesterol and systolic blood pressure were also strong, with correlation coefficients of 0.5 to 0.6. Gilbert and colleagues (45) examined the relationship between blood pressure and anthropometric measures in 481 Navajo males and females aged 13-18 years. Systolic blood pressure and diastolic blood pressure increased significantly with increasing quartiles of BMI for both girls and boys. Another study with 103 Plains Indian children in Oklahoma found that 15-19 year olds in the highest quartile for BMI had higher triglyceride, cholesterol, and LDL cholesterol levels compared with those in the lowest quartiles (26).

Psychosocial Consequences

Reviews of the health risks of child and adolescent obesity have found that the most widespread consequences of childhood obesity are psychosocial, including weight discrimination and stigmatization, body dissatisfaction, and in some studies, poor self-esteem (30, 31). It is believed that these psychosocial consequences result from the societal value placed on thinness as the ideal body form. However, the majority of studies examining psychosocial consequences of obesity have been done with white populations. Therefore, it is unclear if there are any adverse social or psychological effects related to obesity in American Indian youth. Weight attitudes, norms, body image concepts, and standards of attractiveness are believed to be strongly influenced by sociocultural factors. It has been purported that certain cultures may be more accepting and tolerant of a larger body size and less likely to relate to the thin female body image portrayed in the Western media (46, 47).

Studies with American Indian youths, particularly girls, show that youth are dissatisfied w heir weight, worry about being overweight, and commonly use unhealthy weight control methods (48-51). The Indian Adolescent Health Survey, with more than 12,000 youth, found that 50% of adolescent girls reported being dissatisfied with their weight, and 44% were worried about being overweight. Almost half of the girls had been on a weight-loss diet in the past year, and 27% reported they had self-induced vomiting at some time in an attempt to lose weight (51). Girls who felt overweight were more likely to diet compared with those who felt normal weight or underweight. The Minnesota Adolescent Health Survey examined ethnic differences for dieting, binge eating, and weight control methods among adolescent females (52). Prevalence of chronic dieting, self-induced vomiting, laxative use, binge eating, and body pride were similar among American Indian girls and white girls. Davis and Lambert (48) surveyed roughly 2000 Southwestern American Indian fifth graders and found that about two-thirds of all students (59% of girls and 63% of boys) had tried to lose weight. Among overweight students, 82% had atte ted weight loss. Heavier children were also less satisfied with their bodies.

There are few studies documenting the impact of being overweight on the psychosocial well-being of American Indian youth. Data from the Indian Adolescent Health Survey (49) reported that overweight adolescents were concerned and dissatisfied with their weight, but they did not appear to have any negative psychosocial sequelae (suicidal ideation, peer concerns or future job concerns) as a result of being overweight. The findings that many overweight Indian children and adolescents are dieting, dissatisfied with their weight and are engaging in unhealthy weight control behaviors have implications for obesity prevention programs and highlight the need for interventions focusing on healthful weight control behaviors and promoting a healthy self-image.

ONTRIBUTING FACTORS

Obesity is the result of complex interactions between genetic and environmental factors (53). A considerable amount of research on the genetics of obesity has been reported in the past few years. The most recent obesity gene map indicates that there are over 100 genes or marker loci that have the potential to influence obesity (53). While genetic factors are important in the etiology of human obesity, little is known about the role of genetic factors in determining interindividual differences and the response of body mass and body fat stores to chronic alterations in energy balance (53). It is anticipated that major advances will occur in the coming years in the identification of the genetic and molecular causes for susceptibility to obesity and insights as to how genetic and environmental factors interact to produce obesity.

While it is possible that single or multiple gene effects may cause overweight and obesity directly, this does not appear to be the case in the vast majority of people. Rather, it is believed that the genes involved in weight gain increase the susceptibility or risk of an individual to the development of obesity when exposed to an adverse environment (54). The rapid increases in obesity rates in American Indians over recent years suggests that environmental and societal factors are operative in a population that is genetically susceptible to the development of obesity. It has been suggested that the environment contributes substantially to obesity and that the ability to regulate food intake according to energy expenditure is difficult in an environment where food is abundant, high in energy density, inexpensive, and good tasting (55). American Indians developed a high prevalence of obesity only in the past few generations, as tribes shifted from a traditional subsistence lifestyle and a low-fat, high-fiber diet, to a sedentary lifestyle and a Western diet that is high in fat and sugar (8, 24, 25, 56).

The "protective" effects of a traditional lifestyle have been documented in an interesting comparison between the Pima Indians from the Gila River reservation in Arizona and the Pima Indians living in an isolated mountainous region of Northwestern Mexico; these two groups were separated 700-1000 years ago (57). The traditional lifestyle of Mexican Pimas includes a diet lower in animal fats and greater energy expenditure from physical labor compared to the present Pima Indian lifestyle in Arizona (58, 59). Mexican Pimas had an average of 23 hours/week of

ational physical activity (in the past year), whereas the Arizona Pimas had less than 5 hours/week. Fat intake as a percentage of total energy intake was 26% for the Mexican Pimas and 35% for the Arizona Pimas (59). Obesity (BMI>30) was present in only 13% of the Mexican Pimas, whereas 69% of the Arizona Pimas were obese. The prevalence of type 2 diabetes in the Mexican Pimas was only one sixth of that in the Arizona Pima Indians (59). These results suggest that the lower prevalence of obesity and type 2 diabetes in the Mexican Pimas, a population believed to be genetically similar and susceptible to these conditions, is strongly influenced by environmental factors (59).

There are relatively few data on the association between dietary and physical activity patterns to obesity in American Indians (8, 12, 13). Several dietary practices may contribute to obesity, including the wide use of butter, lard, whole milk, fry bread and other fried foods, soft drinks, and low intake of fruits and vegetables (56, 60, 61). Several studies (37, 62-65) have shown that many American Indians, both children and adults, are not physically active on a r basis.

Other factors besides diet and physical activity may also be important in the development of childhood obesity. Exposure to the diabetic environment in utero appears to be an important determinant of both later obesity and type 2 diabetes in childhood and adolescence (36, 66). Infants born to Pima Indian mothers who were diabetic during pregnancy were more likely to become obese during childhood than were their siblings born before the full manifestation of their mother's diabetes (66). It is speculated that a hyperglycemic intrauterine environment may cause fetal adaptation to an excess of fuels or nutrients supplied during gestation, thus mediating later obesity (66).

Several studies have examined metabolic characteristics in the development of obesity, however, currently there is little evidence to support a role of energy expenditure in the development of child obesity (67). It does not appear that energy expenditure or metbolic rate is sig cantly different between American Indian or white children (64, 68).

PR ENTION OF OBESITY: AN ECOLOGICAL APPROACH

To halt the obesity epidemic in American Indian communities will require immediate and ongoing efforts aimed at both prevention and treatment. Prevention of childhood obesity is an important goal, because of the difficulty in successfully treating obesity in children and in adults. Specific modifiable behaviors are associated with obesity, specifically, physical inactivity, overconsumption of energy, and consumption of a high-fat diet (54). Thus, obesity reduction efforts should be focused on increasing physical activity, decreasing physical inactivity (e.g., television watching), and promoting dietary changes, including increasing fruit and vegetables, decreasing fat intake, decreasing sugared beverages and limiting portion sizes of high-calorie foods (54). Intervention efforts should address not only the behaviors of individuals and families but also the multiple social forces in the environment that shape and support such behaviors. Individual-level efforts and educational programs will have limited effectiveness when the environment makes it difficult to follow the recommendations, for example lack of physical activity opportunities in the community or lack of access to an affordable healthful food supply (69, 70). Given the epidemic of obesity in American Indian communities, a more comprehensive approach is needed.

A recent report by the Institute of Medicine (69) recommends that social and behavioral health promotion research and intervention efforts should be based on an ecological model, which focuses not only on the behavior of individuals but also on the social and environmental context in which people live their lives. An ecological model assumes that health and well-being are affected by dynamic interactions between biology, behavior, and the environment. The model addresses change in intrapersonal factors (e.g., characteristics of the individual), interpersonal processes and primary groups (e.g., families), institutional factors (e.g., schools), community factors (e.g., social norms), and public policy (e.g., local regulations and policies). These are all levels of influence which support and maintain behaviors (71, 72). An ecological model assumes that changes in the social environment will produce changes in individuals, and that the support of individuals in the community is essential for implementing environmental changes. Further, an essential component of ecological strategies is active involvement of the target population in

pr n definition, the selection of targets of change, and in specification of appropriate int entions, implementation, and evaluation. The process of using ecological strategies is one of consensus building and community involvement (72). An ecological model is consistent with Native American beliefs that an individual's health and well-being is interrelated to the health of the family, community and the environment (73). An ecological or social environmental perspective provides a promising model for obesity prevention efforts in American Indian communities.

Within this context, efforts to prevent obesity should work towards producing an environment that supports healthy eating and physical activity throughout the entire community. While strategies to address the environmental influences of obesity have not been empirically tested, several approaches have been proposed. Low-income American Indian communities, in particular, need supportive environments with improved access to healthier food choices, and safe, affordable physical activity opportunities. Physical activity opportunities may include ac ble neighborhood centers with facilities for physical activity, community sports and recreation programs, well-maintained playgrounds and recreation fields with adequate equipment, and community trails for hiking, bicycling, and physical fitness. Regular physical education and nutrition education in schools should be a high priority. Healthy eating opportunities should include high quality and affordable fruits and vegetables and lower-fat food choices in grocery stores and trading posts. Healthy foods must be available in fast-food venues, through the school food service, in vending machines and at community events, such as pow wows. The USDA commodity food package while improved over the past 10 years still needs to offer a greater variety of healthful foods.

RESEARCH DIRECTIONS

Many community and school intervention trials for diet and physical activity-related chronic diseases have resulted in null, small or modest effects (74, 75). School-based tobacco use prevention trials have also had disappointing long-term results (76). Baranowski and colleagues (75) e that positive outcomes in chronic disease prevention trials have been weak in

comparison to the resources involved, including substantial funding, multiple years of intervention, large samples, use of state-of-the-art theory, sophisticated statistical models and the expertise of leading health behavior researchers (75). They suggest two major reasons why interventions are not attaining the desired level of change in behavioral outcomes: 1) current theories do not fully predict behavior or behavior change; and 2) interventions are not substantially effecting change in the mediating variables. There is a need for a better theoretical understanding of what factors affect dietary and physical activity behavior change and the psychosocial and biobehavioral mechanisms that influence these behaviors. The use of a polytheoretical approach may enhance the predictiveness of behavior and increase the possible effectiveness of interventions (74, 75). There is also a need for more research on mechanisms that might explain how changes in psychosocial variables could affect outcome behaviors, that is a focus on the mediating variables. Moderated and mediated models will more accurately reflect the nexus of dynamic and modifiable risk and protective factors at the individual and contextual levels (77).

New directions for prevention and behavioral research must include ways to change the macroenvironment and thereby change eating patterns and physical activity (70). Small-scale projects and pilot studies are needed to learn how to measure and intervene on selected environmental variables (70). Differences in access to healthful foods and opportunities for physical activity may be among the factors related to the prevalence of obesity in low-income communities (70). Thus, environmentally focused and community-based research to intervene on these factors is needed.

In addition to a broader environmental perspective for modifying behaviors, more innovative ways to reach and involve families are needed. Strategies for changing the home environment (e.g. reducing television watching, modifying portion sizes or food preparation methods) need to be developed. There is some evidence that tailored messages and stage-based programs may be effective in affecting behavior change; such approaches include motivational interviewing, negotiation skills and personalized tailored interventions (78-80). These

ir ntions have not been attempted in American Indian communities nor have they been utilized in obesity prevention research. Pilot projects should be carried out to determine the practicality and appropriateness of specific intervention strategies. There is also a need for more research on understanding the behavioral risk factors for obesity to help guide interventions. The involvement of American Indians in the design and implementation of community-based intervention programs is critical to program success. The Pathways study offers a model of successful collaboration between researchers and American Indian communities (81).

Currently, there is insufficient information on prevalence rates of obesity among the various American Indian tribes. Surveillance measures need to be developed to document age-specific prevalence rates for overweight and obesity and to track progress in decreasing obesity at a population level.

CONCLUSIONS

Childhood obesity in American Indians is a serious public health problem based on its hig valence, increasing rates over the past few decades, and the associated health risks. All indications are that the current generation of Indian children will face an increased burden of obesity-related chronic diseases, including type 2 diabetes and heart disease at increasingly younger ages, thereby affecting productivity and quality of life for individuals, families and communities, and resulting in burgeoning health care costs.

Obesity is a multi-factorial chronic disease stemming from complex interactions between genes and an environment characterized by positive energy imbalance due to sedentary lifestyles and ready access to an abundance of palatable food. However, dietary and physical activity behavioral risk factors are modifiable and can be targets for change in obesity prevention and treatment efforts. Since treatment of obesity in adults has largely been unsuccessful, the effective prevention of obesity in children is all the more imperative. Currently, little research is available on prevention of child and adolescent obesity. The Pathways study (81) is the largest and most comprehensive prevention study conducted with American Indian children. The behaviorally based multi-component intervention, grounded in Native American values of health and

wellness, and with the active involvement of Native Americans in all aspects of the study, provides a model for future research.

While obesity may appear especially intractable, recent gains achieved among a number of tribes in reducing morbidity and mortality associated with certain conditions and diseases provide testimony and hope to the possibility of reversing the obesity epidemic. Improvements in Indian health since 1973 include decreases in mortality rates of infants, tuberculosis, gastrointestinal disease, accidents, pneumonia, influenza and alcoholism. These changes have resulted from efforts of concerned Indian communities and families who embraced and promoted effective prevention programs (82). These successes should spur similar efforts to combat the obesity and diabetes epidemics.

Acknowledgements:

We would like to express our deepest appreciation and sincere thanks to the students, parents, leaders, school staff/administration, and American Indian communities in the following locations: Gila River Indian Community (Akimel O'odham), Tohono O'odham Nation, Navajo Nation (Dine); Oglala Sioux Tribe (Oglala Lakota), (Rosebud Sioux Tribe (Sicangu Lakota), San Carlos Apache Tribe (Dee') White Mountain Apache Tribe (Dee'), and to all the staff who assisted in the development, implementation, and evaluation of the Pathways study. Funded by Grants (HL-50867; HL-50869; HL-50905; HL-50885; HL-50907) from the National Heart, Lung and Blood Institute.

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