

The epidemic of obesity in American Indian communities and the need for childhood obesity-prevention programs¹⁻³

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ABSTRACT American Indians of all ages and both sexes have a high prevalence of obesity. The high prevalence of diabetes mellitus in American Indians shows the adverse effects that obesity has in these communities. Obesity has become a major health problem in American Indians only in the past 1–2 generations and is believed to be associated with the relative abundance of high-fat foods and the rapid change from active to sedentary lifestyles. Intervention studies are urgently needed in American Indian communities to develop and test effective strategies for weight reduction. The poor success rate of adult obesity treatment programs in the general population points to the need to develop prevention approaches aimed toward children. Because eating and physical activity practices are formed early in life and may be carried into adulthood, prevention programs that encourage increased physical activity and healthful eating habits targeted toward young people need to be developed and tested. To be most effective, interventions must be developed with full participation of the American Indian communities. *Am J Clin Nutr* 1999;69(suppl):747S–54S.

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INTRODUCTION

American Indians comprise diverse groups of people, with 542 federally recognized American Indian tribes in the United States, each with its own traditions and cultural heritage (1). About 1.9 million individuals identified themselves as American Indian or Alaska Native in the 1990 US Census (1). About one-third of American Indians live on reservations or historic trust lands, and ≈50% live in urban areas (2). In general, the American Indian population is youthful, with a median age of 26 y compared with 33 y for the US population as a whole (3).

The overall health status of American Indians has been, and continues to be, poorer than that of the general population by most indicators (3–5). The leading causes of death in American Indians, as in the entire US population, have changed over the past 40 y. Since the early 1950s, the rate of mortality from infectious disease has decreased substantially. But mortality related to behavioral or lifestyle factors has increased, and chronic diseases such as diabetes mellitus, heart disease, and cancer are among the leading causes of death in adults (3–5). These chronic diseases,

diabetes mellitus in particular, are strongly associated with the increasing prevalence of obesity in American Indians (6).

Obesity has been increasing in all US population groups and especially in young people (7–9). Because the prevalence rates of obesity are higher in American Indians, they will probably be disproportionately affected as adults by obesity-related morbidity. Thus, there is a critical need for obesity-prevention programs targeted toward American Indian children. This article presents an overview of the prevalence of obesity in American Indians, the relation of obesity to health outcomes, and potential contributors to obesity. The need for prevention of obesity, for school-based obesity-prevention programs, and for the involvement of American Indians in developing intervention programs for their communities are discussed.

METHODOLOGIC ISSUES

Several issues must be considered when evaluating the health status of American Indians. Caution must be exercised in generalizing data from one location to another because wide variations may exist. Because American Indians living on reservations are excluded from national health and nutrition surveys, such as the National Health and Nutrition Examination Survey (NHANES), national estimates of the prevalence and temporal trends of obesity in American Indians are not available (10). In addition, few data exist on the health or weight status of urban American Indians (2). Data on the prevalence of overweight in American Indians are often limited to studies of specific tribes, many with small sample sizes (10, 11). National data on the prevalence of diabetes and other chronic diseases are also limited (1). Additional limitations to comparisons between studies on prevalence

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of obesity or other health conditions include differences in study designs and sampling methods, definitions of overweight and obesity, and the reference populations to which results are compared. Clearly, a challenge of the coming years will be to design more and stronger studies to enable definition of the scope of health threats facing American Indians and to develop appropriate community-based preventive interventions (2).

PREVALENCE OF OBESITY IN AMERICAN INDIANS

Studies indicate that the prevalence of obesity is widespread in American Indian communities, although there is considerable variation in obesity rates across tribes (10–31). However, all of the studies indicate that obesity rates in American Indian children, adolescents, and adults are higher than the respective US rates for all races combined (11). Selected studies, in ≥ 100 subjects published in 1981–1998 on the prevalence of overweight and obesity in American Indian preschool children, school-age children, and adults are summarized in **Table 1** (11–34).

Adults

There is strong evidence that the prevalence of obesity is high in American Indian adults. A national survey of American Indians living in communities served by the Indian Health Service was conducted as part of the 1987 National Medical Expenditure Survey (11). The prevalence of overweight [body mass index (BMI; in kg/m^2) > 85 th percentile of NHANES II reference population (33)] self-reported by American Indian adults in this survey was 34% for men and 40% for women, higher than the US rates of 24% and 25%, respectively (11). For both men and women the prevalence varied by age, with the highest prevalence occurring between 35 and 64 y of age. The most extensive tribe-specific estimates of obesity in adults are in Pima Indians. Adult Pima Indians have a far greater prevalence of obesity than the US population. The age-specific prevalence of overweight ranged from 61% to 78% in 20–64-y-old men and from 81% to 87% in women of the same age (11, 27).

The Strong Heart Study gathered data on men and women aged 45–74 y in 13 American Indian tribes in Arizona, Oklahoma, and the Dakotas (29, 30). The prevalences of overweight (defined as BMI > 27.8 for men and > 27.3 for women) in Arizona, Oklahoma, and the Dakotas were 67%, 65% and 54%, respectively, for men, and were substantially higher at 80%, 71%, and 66%, respectively, for women. These are considerably higher than the NHANES III (35) all-races rate of 27% and 28% overweight for same-age men and women, respectively (30). Recent findings from the Navajo Health and Nutrition Survey (NHNS) indicated that one-third of men aged 20–39 y and one-half of men aged 40–59 y, but $< 10\%$ of men aged ≥ 60 were overweight. Two-thirds more women in all age groups were overweight (31).

Children and adolescents

As with adults, overweight and obesity rates in American Indian children and adolescents are higher than those in all races combined in the United States (11). In 1990, a national survey of height and weight status of 9464 American Indian schoolchildren (aged 5–18 y) living on or near Indian reservations was conducted by the Indian Health Service, Centers for Disease Control and Prevention, and tribal nutrition programs in 9 Indian Health Service areas of service. Data for height, weight, and BMI of the

schoolchildren were compared with 2 national reference data sets, NHANES II (33) and the Mexican American population in the Hispanic Health and Nutrition Examination Survey (36). Although the 3 populations were similar in height, the American Indian children had significantly higher BMIs for nearly every age and sex group than the reference populations. The overall prevalence of overweight (BMI > 85 th percentile) in the American Indian children was 39% compared with 15% in NHANES II for all races combined and 29% in the Mexican American population of the Hispanic Health and Nutrition Examination Survey. These data indicate that overweight is much more prevalent in American Indian children than in other US children of all ages and both sexes.

At even younger ages the prevalence of obesity is excessive in American Indians. The prevalence rate of overweight American Indian children aged 0–4 y participating in public health programs was 11%, higher than the US all-races rate of 8% (11). Freedman et al (14) found that $\approx 12\%$ of American Indian preschool children in Arizona were above the 95th percentile in weight-for-height and that these children had higher mean age-adjusted BMIs than white, black, or Hispanic preschoolers.

Trend toward increasing obesity

Several studies have reported increases in obesity prevalence during the past 35 y (7–9). In the US, these increases have been observed in white and black adults (7), children (7, 8), and American Indian children (18) and adults (37). Data from NHANES III on whites, blacks, and Hispanics clearly indicate that the proportion of overweight adults, children, and adolescents has increased dramatically during the past decade (7–9, 35). Although NHANES III data are not available for American Indians, other data sources reflect a secular change in the prevalence of overweight (12, 18). Price et al (37) reported a dramatic increase in obesity in Pima Indians born after World War II. Pima children today are also significantly heavier than were children measured at the turn of the century. In 1905, Pima boys who were 165 cm tall weighed an average of 58 kg; in 1981–1988, Pima boys of the same height weighed an average of 69 kg, an increase of ≈ 11 kg (27). A 1989 survey documented increases in height, weight, and obesity rates in Navajo schoolchildren over the past 35 y (18). Compared with data from 1955, mean heights increased 6.1% in boys and 4.4% in girls, whereas mean weights increased 28.8% in boys and 18.7% in girls across all age groups.

RELATION OF OBESITY TO HEALTH OUTCOMES

Many of the health problems of American Indians are related to obesity (6). Although the health implications of obesity are considerable, their magnitude varies greatly among tribal groups. Whereas American Indians are not a homogeneous group with regard to health problems, they have suffered adverse effects from the high prevalence of obesity (6). For the adult US population, the health risks of obesity increase with its severity and reach significance at a BMI > 27 (38). Established obesity-related health risks for adults include type 2 diabetes, hypertension, cardiovascular disease (CVD), hypertriglyceridemia, low HDL cholesterol and endometrial cancer in women, and colorectal cancer in men (39). Obesity may also contribute to high rates of gallstones and adverse pregnancy outcomes in American Indians (2).

Chronic disease risk associated with obesity appears to be higher in people with centralized fat than in those with periph-



TABLE 1

Review of selected studies on the prevalence of overweight and obesity in American Indians, 1981–1998

Population, year, and reference	Age of subjects	Sample size	Percentage overweight or obese		
			Male	Female	Both
	<i>y</i>	<i>n</i>	%		
Preschool children					
American Indian, national, 1988 (11)	<5	54 774	—	—	11.2 ¹
Mescalero Apache, NM, 1988 (12)	1–5	283	—	—	17.3 ¹
American Indian, AZ, 1990 (13)	1–4	622	—	—	12.0 ¹
American Indian, national, 1994 (14)	2–4	23 009	—	—	9.0 ¹
School-age children					
Navajo Indian, NM and AZ, 1988–1990 (19)	14–18	352	25.0 ²	33.0 ²	—
Pueblo Indian, NM, 1988–1993 (17)	9–13	773	—	—	40.4 ²
Navajo Indian, NM, 1988–1993 (17)	9–13	770	—	—	29.1 ²
Navajo Indian, NM and AZ, 1989 (18)	5–17	1969	12.5 ^{2,3}	11.2 ^{2,3}	—
Devils Lake Sioux, ND, 1989 (11)	9–13	105	32.1 ²	30.6 ²	—
Winnebago and Omaha, NE, 1990 (11)	7–17	499	32.7 ²	34.4 ²	—
American Indian, national, 1990 (20)	12–19	11 868	25.0 ^{2,4}	24.2 ^{2,4}	—
American Indian, national, 1990–1991 (15)	5–18	9464	—	—	39.3 ¹
Navajo Health and Nutrition Survey, 1991–1992 (21)	12–19	160	35.0 ²	40.0 ²	—
Winnebago and Omaha, NE, 1992 (16)	3–19	1141	—	—	27.0 ²
Adults					
Pima Indian, AZ, 1981–1988 (27)	20–54	3164	61–78 ²	81–87 ²	—
Pima Indian, AZ, 1981–1988 (27)	≥55	3164	31–53 ²	44–74 ²	—
Cherokee Indian, NC, 1982 (24)	18–27	104	—	59.1 ⁵	—
American Indian, by region, 1985–1988 (22)					
Southwest	≥18	132	30.0 ^{2,4}	28.5 ^{2,4}	—
Plains	≥18	228	27.8 ^{2,4}	35.7 ^{2,4}	—
West	≥18	112	22.7 ^{2,4}	26.8 ^{2,4}	—
Other regions	≥18	220	24.0 ^{2,4}	23.9 ^{2,4}	—
Navajo Indian, NM and AZ, 1986–1987 (26)	20–74	400	42.1 ⁶	54.7 ⁶	—
American Indian, national, 1987 (11)	≥18	6500	33.7 ^{2,4}	40.3 ^{2,4}	—
Zuni Indian, NM, 1987 (28)	20–39	595	33.8	56.2	40.0 ⁷
Zuni Indian, NM, 1987 (28)	40–59	76	55.6	79.2	70.7 ⁷
Alaskan Yup'ik Eskimo, 1987–1988 (23)	≥18	509	34.0 ²	56.0 ²	—
Alaskan Athabascan Indian, 1987–1988 (23)	≥18	107	29.0 ²	55.0 ²	—
Navajo Indian, NM and AZ, 1988 (25)	≥20	250	33.1 ²	50.7 ²	—
Strong Heart Study, 1989–1992 (29, 30)					
Pima, Maricopa/Papago, AZ	45–74	1446	67.0	80.0	75.0 ²
7 Oklahoma tribes, OK	45–74	1449	65.0	71.0	70.0 ²
3 Lakota tribes, ND and SD	45–74	1409	54.0	66.0	62.0 ²
Navajo Health and Nutrition Survey, 1991–1992 (31)	20–39	380	37.0 ²	62.0 ²	—
Navajo Health and Nutrition Survey, 1991–1992 (31)	40–59	233	50.0 ²	69.0 ²	—
Navajo Health and Nutrition Survey, 1991–1992 (31)	≥60	164	9.0 ²	61.0 ²	—

¹Weight-for-height >95th percentile of National Center for Health Statistics (NCHS) reference population (32).²BMI >85th percentile of second National Health and Nutrition Survey (NHANES II) reference population (33).³Weight-for-age >95th percentile of NCHS reference population (33).⁴Self-reported height and weight.⁵Greater than 120th percentile of desirable weight-for-height, NHANES I (34).⁶BMI >85th percentile of NHANES I reference population (34).⁷BMI >27 for males, BMI >26 for females.

eral fat distribution. Abdominal or central obesity is a significant and independent risk factor for CVD, diabetes, impaired glucose tolerance, and hypertension (39). There are few reports on fat distribution in obese American Indians; in these, associations of central obesity have been inconsistent across risk conditions (eg, CVD and type 2 diabetes), sexes, and tribes. In young Pima Indians, waist-to-hip ratio (WHR), a measure of central obesity, was more strongly associated with diabetes than was BMI, which is a measure of overall obesity (27). The Strong Heart Study found that obesity was almost always abdominal (40). Women in all 3 Strong Heart centers with WHRs >0.96 had significantly higher

rates of diabetes than those with WHRs <0.96. A WHR >0.98 was positively associated with diabetes in men from Oklahoma and the Dakotas but was not significantly associated in Arizonan (Pima) men. Compared with diabetes, WHR was a less consistent positive correlate of coronary heart disease, reaching significance only in women in the Dakotas, and was negatively related to coronary heart disease in Arizonan men (as were BMI and percentage of body fat) (40).

The following section briefly reviews the relation of obesity to CVD and diabetes. It is beyond the scope of this paper to address relations with other health risks.

Cardiovascular disease

Obesity is an independent risk factor for heart disease. Although heart disease was rarely noted in American Indians earlier in this century, in the past decade CVD has become the leading cause of death in American Indians (6). Several factors may be responsible for this increase: decreasing incidences of infectious disease, increasing incidences of diabetes mellitus, and increasing incidences of obesity. CVD mortality rates and the prevalence of CVD risk factors, however, vary between American Indian tribes (3, 4). Northern Plains Indians consistently have had rates of CVD that equal or exceed average rates for the United States (4). Some of the southwestern tribes, such as Navajo and Pima, have had low CVD mortality rates. However, studies suggest that the incidence of acute myocardial infarction in these groups is increasing (41, 42).

The Strong Heart Study investigated CVD and its risk factors in American Indians aged 45–74 y in the Dakotas, Oklahoma, and Arizona (30, 40). Analyses showed that the prevalence of coronary heart disease in American Indians was significantly and independently related to percentage of body fat, age, diabetes, hypertension, smoking, and insulin and low HDL-cholesterol concentrations. Diabetes was the strongest risk factor associated with coronary heart disease (40).

Obesity is also a risk factor for hypertension, and hypertension in turn is a risk factor for CVD, especially coronary artery disease, stroke, and peripheral vascular diseases (6). Although several studies have documented an association between hypertension and obesity in American Indian populations, their hypertension rates are relatively low compared with US rates (6, 43). However, some studies indicate that the prevalence of hypertension may be increasing in some tribes (44). Studies also indicate that hypertension and mean blood pressure may be increasing in younger American Indian populations (16, 45). Gilbert et al (19) reported high blood pressure (>90th percentile) in 10% of adolescent Navajo males and 6% of females. There was also a positive relation between body weight and blood pressure. When divided into lower, middle, and upper thirds of BMI, systolic and diastolic blood pressures were positively related with increasing BMI in girls, and systolic blood pressure and BMI were related in boys.

Diabetes

Diabetes mellitus was rarely diagnosed in American Indians until the 1930s, but it is now found in epidemic proportions in American Indian populations and is largely attributable to the increasing prevalence of obesity (1, 29). In most American Indian tribes, diabetes has become a major cause of morbidity and mortality (1, 6). Diabetes is a risk factor for CVD and is also the leading cause of lower extremity amputation and end-stage renal disease (1). The type of diabetes found in American Indian communities is almost exclusively type 2 diabetes. Among Strong Heart Study communities (adults aged 45–74 y), the Pima-Maricopa and Tohono O'odham tribes in Arizona had the highest diabetes rates (65% in men and 72% in women). The prevalence of diabetes in Dakotan (33% in men and 40% in women) and Oklahoman (38% in men and 42% in women) Indians, although lower than those in Arizonan tribes, are much higher than those reported for other US populations (29). The NHNS revealed that diabetes is an even greater health problem than previously realized in Navajo Indians (46). Over 40% of Navajos aged ≥ 45 y were diabetic, although one-third of those were unaware of their condition. In addition, another 18% of

Navajos were glucose intolerant and therefore at high risk for the development of diabetes in the future.

The association of type 2 diabetes with obesity is well known. In the Strong Heart Study the rate of diabetes increased steadily with increasing BMI in both sexes (29). Obesity also relates with parental diabetes, another strong risk factor for diabetes (47). Obesity and parental diabetes increase diabetes incidence rates synergistically, with the highest rates seen in obese individuals with at least one parent with type 1 diabetes. It is estimated that half of all incidences of type 2 diabetes are preventable by obesity control (48).

DETERMINANTS OF OBESITY IN AMERICAN INDIANS

Although the etiology of obesity is multifactorial, both genetics and environment are clearly determinants (49).

Genetic factors

Studies of energy expenditure in Pima Indians suggest that a low metabolic rate may contribute to the aggregation of obesity in families and that a low rate of energy expenditure is a predictor of body weight gain (49, 50). Small decrements in resting metabolic rate can lead to excess accumulation of energy and thus weight gain and obesity. Recent research in Pima Indians has identified polymorphisms in the β -3 adrenergic-receptor gene, which is believed to help regulate resting metabolic rate and lipolysis (51). Individuals with a variant of the gene had lower resting metabolic rates but were no more obese than were those without. Thus, the influences of this gene on low energy expenditure and the development of obesity and type 2 diabetes are not yet clear. A study in 10-y-old Pima children did not find a lower resting metabolic rate, after adjusting for differences in body size and composition, than in white Arizonan children (52). This suggests that environmental factors, eg, high energy intake, low levels of physical activity, or both, may be the major contributors to obesity in Pima children (52).

The "thrifty gene" hypothesis (53) suggests that obesity results from the introduction of a continuous and ample food supply to people who have developed, through evolution, the ability to store energy efficiently, permitting survival through millennia of feast-famine cycles. Historically, for many American Indian tribes, periods of plentiful food alternated with periods of famine. Neel (53) hypothesized that individuals predisposed to diabetes were able to survive by storing surpluses of energy as fat during plentiful periods and using energy more efficiently during times of food scarcity. With dramatic environmental changes, food became more consistently available and lifestyles became more sedentary. The thrifty gene that had been an asset became a liability with the consequential increase in the incidence of obesity. Thus, obesity may be related to a thrifty metabolism (53).

Environmental factors

Although several studies suggest that genetic variables influence propensity toward obesity, behavioral and lifestyle conditions related to diet and physical activity play a critical role in both the manifestation and degree of obesity (54). Most American Indian populations developed obesity only in the past 1–2 generations, when a relative abundance of high-fat foods became available and rapid changes from active to sedentary lifestyles occurred (6). Boyce and Swinburn (55) investigated the compo-



sition of the traditional Pima Indian diet of 100 y ago. Using ethnohistoric literature and traditional recipes, they estimated that the traditional diet consisted of ≈ 70 – 80% carbohydrate, 8 – 12% fat, and 12 – 18% protein; the current Pima diet consists of $\approx 47\%$ carbohydrate, 35% fat, 15% protein, and 3% alcohol (55, 56).

Despite the widespread obesity in American Indians, there is a paucity of data on their dietary and physical activity patterns (10). Several dietary practices that may contribute to obesity have been identified, including the wide use of butter, lard, whole milk, fry bread, and fried meats and vegetables, as well as the generous use of fats in the preparation of beans. Sweets and snacks may account for high energy intakes in some groups (10). Gilbert et al (19) reported that Navajo adolescents consumed sweetened soft drinks at more than twice the national average. In addition, many of the commodity foods that are used widely in American Indian populations are high in fat as well as energy. The NHNS found that, in Navajos, intake of fruit and vegetables was low and intake of fats was high (57). Major factors affecting food choice in the Navajo were cost, availability, and shelf life. Most families have limited cash resources and purchase food on the reservation where selection is limited. Many families shop infrequently and do not have refrigerators; thus, perishable items such as fresh fruit and vegetables must be consumed quickly (57). Decreased physical activity may also contribute to the development of obesity in American Indian children. Fontvieille et al (52) assessed physical activity in Pima Indian and white children living in Arizona and found that the Pima children spent more time watching television and had less involvement in sports than did the white children.

A recent study by Ravussin et al (58) compared the probable impact of the environment on the prevalence of obesity and type 2 diabetes in Pima Indians of Arizona and members of a small population with Pima ancestry (in which separation occurred 700–1000 y ago) living with a more traditional American Indian lifestyle in a remote area of northwestern Mexico. They found that obesity and type 2 diabetes were less prevalent in the Mexican population than in the Arizona Pimas. These findings suggest that, despite a potentially similar genetic predisposition to these conditions, a traditional lifestyle, characterized by a diet including less fat and more complex carbohydrates and by greater energy expenditure in physical activity, may protect against the development of obesity, type 2 diabetes, and CVD risk factors.

Economic factors

Low socioeconomic status is one of the most powerful risk factors for poor health outcomes (2). Low-income populations across all age groups have higher rates of mortality and morbidity from almost all diseases and conditions (4). Higher-than-average rates of obesity have also been linked directly with low-income status. For example, in NHANES II, overweight affected 37% of all adult women below the poverty level compared with 25% of those above the poverty level (2). People in lower-income groups are also more likely to have higher intakes of total fat and lower intakes of fresh fruit and vegetables (2).

American Indians are disadvantaged economically compared with the general US population. The 1990 US Census indicated that 31% of American Indians were living below the poverty level, which is 2.5 times higher than the comparable US all-races figure of 13% (4). In 1990, the median family income of American Indians was \$21750 compared with \$35225 for the total population

(4). About half (51%) of American Indians residing on reservations and trust lands were living below the poverty level in 1989 (59).

Developmental factors

It has been speculated that the increasing rates of diabetes during pregnancy may account for some proportional increase in childhood obesity (18). Sugarman (60) reported that the prevalence of diabetes during pregnancy in Navajo women was about twice that in the general US population. The longitudinal studies of diabetes in the Pima community have revealed that the offspring of women who had diabetes during pregnancy, on average, were more obese, had higher glucose concentrations, and had more cases of diabetes at an earlier age, than the offspring of women who developed diabetes after pregnancy or who remained nondiabetic at follow-up (61). The offspring of diabetic women had higher weights-for-gestational age at birth, and at follow-up had higher weights-for-height than did the offspring of the other 2 groups. Prenatal exposure to the diabetic intrauterine environment appears to have lasting effects on the anthropomorphic and metabolic development of the offspring (61). It is postulated that a hyperglycemic intrauterine environment may cause fetal adaptation to an excess of fuels or nutrients supplied during gestation, thus mediating obesity.

PREVENTION OF OBESITY

The high prevalence of obesity in American Indian adults, coupled with the difficulty in successfully treating adult obesity, points to the urgent need for developing prevention programs aimed toward children. There is little research available on prevention. However, there are several reasons to target children for health behavior interventions. Developmentally, they are at a critical stage for learning health information and skills (ie, it may be easier to establish healthful habits during childhood than later in life, and older elementary schoolchildren are particularly receptive to health education programs that emphasize skills training and family involvement) (62). Obesity during adolescence is a strong predictor of obesity in adulthood (39, 63–65). Furthermore, a recent study found that overweight in adolescence predicted a broad range of adverse health effects that were independent of adult weight after 55 y of follow-up (66).

The literature on obesity prevention has suggested that specific behaviors may be associated with obesity: consumption of a high-fat diet, over-consumption of energy, and physical inactivity (67–69). Both clinical and animal studies support the hypothesis that a diet high in fat facilitates the development of obesity (70–72). Therefore, altering the diet composition to one higher in carbohydrates and lower in fat ($\approx 30\%$ of energy from fat) may be an effective public health approach to prevent obesity (2). Likewise, increasing children's physical activity is critical in considering prevention approaches because physical activity is a major component of total energy expenditure (73). The potential of primary prevention of obesity hinges on helping young people and their families develop new lifestyles and creating supportive environments in which to promote healthful eating and physical activity (69, 74). Relatively few health education interventions directed at preventive health behaviors in American Indians have been reported in the literature, and none specifically on primary prevention of obesity (75).

Developing obesity-prevention programs in American Indian communities presents numerous challenges. Poverty is pervasive in many American Indian communities, and access to a



lower-fat food supply is limited (10). The US Department of Agriculture food distribution program provides high-fat commodity foods such as canned meats, cheese, butter, shortening, and oil to Indian reservations. Although canned vegetables, fruit, fruit juices, and cereal and grain products are also provided, personal preferences and preparation methods often result in diets that are too high in fat (76). The recent proliferation of fast-food restaurants and convenience-food markets on and near reservation communities also encourages the consumption of high-fat foods (10). The lack of community recreational or exercise facilities (eg, YMCAs, health clubs, and parks) and walking, jogging, or biking paths may discourage physical activity. Clearly, the serious economic difficulties and geographic isolation create many challenges for health promotion efforts. Yet we feel there are also many areas of strength on which to build health-behavior change programs, including communities of strong extended family ties and community involvement; a traditional heritage of strength, wellness, and healthful native foods; cultural values of sharing and family cohesion; and a high valuation of children.

School-based obesity-prevention programs

Schools are potentially viable delivery systems for programs aiming to prevent or reduce childhood obesity in American Indian children (77, 78), providing easy access to children and the opportunity for continuous and concentrated contact, cost-effectiveness, and a natural environment in which childhood interventions can take place (75). Because American Indian children on reservations generally eat 2 meals/d in school, the school cafeteria can be a natural avenue for children to learn and practice healthful eating patterns. Obesity-prevention programs can be also be incorporated into other aspects of school, including physical education, classroom curricula, family involvement, and social support from teachers and peers. School-based programs can contribute toward developing policies and shifting social norms for physical activity (increasing energy expenditure) and for healthful eating (balancing energy intake).

Although school-based primary obesity-prevention programs have been few, several school-based weight-control programs for overweight children have had successful results (77, 78). Parcel et al (77) reviewed school-based obesity-prevention or -reduction programs and provided the following 6 guidelines for the development of such programs in schools: 1) interventions should include components directed both at food intake and energy expenditure; 2) the dietary component of interventions should provide for parental involvement and for behavioral and environmental modification; 3) the energy expenditure component should emphasize continuous, lifelong self-management skills and energy-expenditure activities rather than the competitive activities characteristic of many physical education programs in schools; 4) the involvement of food-service personnel in food purchasing and preparation policies is essential; 5) self-monitoring of both diet and exercise appears to be an important skill to be developed in children, for reinforcement and feedback in the learning process; and 6) peers should be involved to help build both a supportive social climate and social standards for diet and exercise.

American Indian involvement in prevention programs

The involvement of American Indians in the design and implementation of community-based intervention programs is crucial

to program success. The success of such programs depends on an understanding and appreciation for cultural differences such as language, history, traditions, and food preferences. Historically, American Indians have been studied and written about by non-Indians, who have often drawn conclusions based on limited contacts and ethnocentric views. This history has naturally resulted in a varying sense of distrust and protectionism by American Indians. In view of this, equality and respect must be the basis on which to build a successful intervention program.


American Indians on the Pathways research team developed the following recommendations that are important to consider in any reservation-based intervention program.

- 1) Develop an early and timely relationship with the governmental structure and processes of the nations involved. It is important to recognize the sovereignty of Indian nations and that research can only be done with their full cooperation and ongoing participation.
- 2) Recruit and hire committed, responsible American Indians to best ensure that the program meets the needs of the tribe or community involved. Communities are more responsive when there is trust and involvement from known and respected American Indians. Persons raised on a reservation, who understand the day-to-day challenges within the communities (eg, economic, resource, family, and distance) and are committed to working with American Indians, are preferred. Because it is difficult for non-Indian researchers to learn about the native culture and values by briefly visiting a reservation or by reading about it, programs staffed by American Indians are more likely to be sensitive to the culture and acceptable to tribal members.
- 3) Recognize that the training, education, and mentoring given to local study staff members will extend beyond the life of the project. These persons can assist their own community members during the project, and they can continue that assistance in future projects. This philosophy will help foster a collaborative relation between academic institutions and American Indian communities and tribal governments.
- 4) Foster open and clear communication with all persons involved rather than a hierarchical method.
- 5) Recognize that cultural sensitivity is critical when working with American Indian people.

Clearly, intervention strategies need to be culturally relevant and sensitive because of the integral role that culture plays in shaping health-related attitudes and behaviors. Essential to the successful development and implementation of research-based intervention programs is a partnership among tribal governments, American Indian organizations, health services, and research communities. There is much to be gained from such partnerships in improving the health of American Indian populations.

SUMMARY

American Indians have a high prevalence of obesity in all age groups and in both sexes. The high prevalence of type 2 diabetes and increasing rates of heart disease in American Indians confirms the adverse effects that obesity has in these communities. It is well established that obesity in adults is difficult to treat. Thus, prevention should be a high priority in obesity research (67, 69). Obesity is increasing in all races in young Americans. Because American Indians have a higher prevalence of obesity, they may be affected disproportionately by obesity-related morbidities.

Because dietary and physical activity practices that are learned at a young age may be carried into adulthood, establishing healthful patterns at an early age is important. Thus, programs should be targeted at youth. To prevent obesity, dual actions are needed in nutrition and physical activity to help youth and their families balance energy intake and expenditure. Schools can play an important role in the prevention of obesity by teaching and modeling healthful behaviors and complementing efforts at home. To be effective, interventions must be culturally sensitive, grounded in cultural traditions and values that promote health and well-being, and developed with full participation of the American Indian communities. 

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