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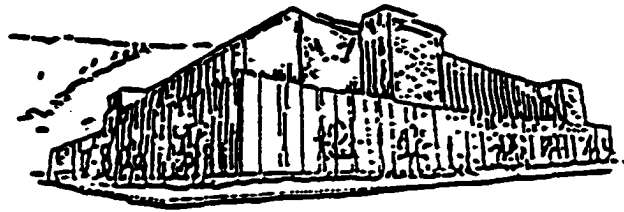
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**Self Reported Physical Activity and Intention to Exercise as Predictors of Health
Outcome in Native American Populations Across Montana.**

by

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B.A., The University of Georgia, 1991

M.A., Northern Arizona University, 1995

presented in partial fulfillment of the requirements

for the degree of

Doctorate of Philosophy

The University of Montana

May 2002

Approved by:



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Self Reported Physical Activity and Intention to Exercise as Predictors of Health Outcome in Native American Populations Across Montana (165 pp.)

Director: Christine Fiore Lerner, Ph.D. *CF*

Obesity and related health problems are on the rise nationally. In Native American people, the incidence of obesity and type 2 diabetes is now of epidemic proportions. There is mounting evidence that the development of obesity related health problems such as diabetes can be significantly delayed through modest lifestyle change. Specifically, a regimen of regular exercise as defined by the CDC and the American College of Sports Medicine appears to provide substantial health protective effects. Nonetheless, nationally the population continues to be sedentary. Older adults, ethnic minorities, and those with lower education and income levels continue to be the least active segments of the population. It is unclear to what extent the public health call for increased physical activity for the promotion of health and prevention of chronic illness has been received by Native Americans residing in reservations. Exercise and healthy diet lifestyle change are notoriously resistant to sustained change. However, exercise promotion interventions have been shown to be more effective when tailored toward the individual's motivation level or "readiness" for exercise adoption. To date, physical activity, readiness for exercise adoption, and their utility in predicting health outcomes in Native American populations have not been examined. Findings provide the first large-scale set of systematic data regarding exercise behavior across Native American communities, and establishes that the predictive relationship between stage of change (SOC) and exercise behavior holds true across the Plains tribes of Montana. Results indicate that those younger than age 45 reported exercise levels consistent with the U.S. population as a whole, while those 45 and older are markedly less active. While less than 1% of the sample reported exercise behavior consistent with the CDC's recommendations, 16% of younger respondents, but only 2% of older respondents met the ACSM recommended level of physical activity. Prevalence rates of sedentary behavior were lower among those younger than age 45 and substantially higher for those 45 and older relative to Caucasian Montanans and the U.S. population as a whole. Rates of overweight and obesity were relatively high at 75% of the sample. Exercise was consistently the best predictor of incidence of health problems. In turn, the best predictor of exercise behavior was SOC for exercise. Implications for the development of efficacious, culturally relevant lifestyle interventions to promote exercise behavior in Native American communities are discussed.

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CHAPTER 1: INTRODUCTION

The past one hundred years have revealed a trend in America toward increasing rates of obesity and associated health problems (Sobal & Stunkard, 1989; Shaw & Jeffery, 1991; Swinburn, Walter, Arroll, Tilyard, & Russell, 1998). Obese individuals are at increased risk of developing coronary heart disease, hypertension, type 2 diabetes, hypercholesterolemia, and some forms of cancer (Van Itallie, 1985; Wing, 1992). Obesity and related chronic health problems, such as type 2 diabetes, have increased dramatically in the last century in Native American populations and are now of epidemic proportions, contributing to premature mortality and morbidity (Broussard, Johnson, Himes, Story, Fichtner, Hauck, Bachman-Carter, Hayes, Frohlich, Gray, Valway, & Gohdes, 1991; Knowler, Pettitt, Savage, & Bennett, 1981).

In Native people obesity is likely the result of an interaction between genetics and lifestyle (Ravussin, 1993). Diet and exercise appear to be the primary lifestyle behaviors linked to health. Exercise in particular appears to be related to reduced risk for obesity related morbidity and mortality (Blackburn, 1995; Krista, LaPorte, Pettitt, Charles, Nelson, Kuller, Bennett, & Knowler, 1993). It has been established that non-Indian physically active individuals have half the risk of coronary heart disease compared to their sedentary counterparts and exercise offers protective effects against type 2 diabetes and colon cancer (Bouchard, Shephard, & Stephens, 1994; Lee, Paffenbarger, & Hsieh, 1991). It has also been established that, despite calls by leading health organizations such as the Centers for Disease Control and Prevention (CDC) and American College of

Sports Medicine, most American adults are inactive or irregularly active (Dishman, 1991). Furthermore, older adults, ethnic minorities, and those with lower education and income levels continue to be the least active segments of the population (Broussard, Johnson, Himes, Story, Fichtner, Hauck, Bachman-Carter, Hayes, Frohlich, Gray, Valway, & Gohdes, 1991; Dishman, 1991; Sobal & Stunkard, 1989). Exercise and healthy diet lifestyle change are notoriously resistant to sustained change (Dishman, 1991; Marcus, Emmons, Simkin-Silverman, Linnan, Taylor, Bock, Roberts, Rossi, and Abrams, 1998). However, exercise promotion interventions have been shown to be more effective when tailored toward the individual's motivation level or "readiness" for exercise adoption (Marcus, et al., 1998). To date, physical activity, readiness for exercise adoption, and their utility in predicting health outcomes in Native American populations have not been examined. The following represents a justification for examining the self-reported level of physical activity, motivation to exercise, and their power to predict health problems in an effort to facilitate the development of efficacious lifestyle interventions to promote health in Native American communities.

Obesity and Related Health Problems in Native American People

In Native peoples, the leading causes of death in descending order are as follows: heart disease, accidents, malignant neoplasms, cerebrovascular diseases, chronic liver

disease/cirrhosis, and type 2 diabetes (Gohdes, Kaufman, and Valway (1993). Of these, heart disease, cerebrovascular disease, and diabetes are strongly associated with obesity.

Evidence suggests that obesity was not commonplace among Native people early in the twentieth century. Geare (1915) published a detailed account of diseases affecting Native American people in the Southwestern United States in the early part of the twentieth century. He did not identify diabetes in this account, and noted, "In these people, pathologic obesity does not exist." In contrast, obesity is now rampant across tribes (Broussard, et al., 1991). A high-fat diet and decreased physical activity have clearly contributed to increasing rates of obesity, which in turn has contributed to an increasing incidence of associated type 2 diabetes, cardiovascular, and cerebrovascular disease (Knowler, Pettitt, Savage, & Bennett, 1981; Knowler, Sadd, Pettitt, Nelson, & Bennett, 1993).

Although nationwide public health efforts targeting risk factors of heart disease and stroke have been successful in reducing rates of mortality in the general population, it remains the leading cause of death in the United States (National Heart Lung and Blood Institute, 1998). Diabetes and its microvascular complications has been the primary focus of chronic disease programs in Indian communities, and very little emphasis has been placed on cardiovascular disease (CVD; Gohdes, 1995). The Strong Heart Study of coronary heart disease (Howard, Lee, Cowan, Fabsitz, Howard, Oopik, Robbins, Savage, Yeh, and Welty, 1995) provided the first systematic source of epidemiological data in

Native American Populations extending outside the Pima tribe. The Strong Heart Study examined CVD risk factors in selected tribes in Arizona, Oklahoma, and North and South Dakota and found high rates of CVD and CVD related mortality rates. These CVD rates exceeded state-wide rates for most age groups, although matched non-Indian subjects from the same geographic region were not directly compared (Lee, Cowan, Welty, Sievers, Howard, Oopik, Wang, Yeh, Devereux, Rhoades, Fabsitz, Go, & Howard, 1998). The Behavioral Risk Factor Surveillance System Survey (BRFSS) from the Centers for Disease Control and Prevention provides the only national source of comparative data on CVD and relevant risk factors (Harwell, Gohdes, Moore, McDowall, Smilie, & Helgerson,, 1999).

Using BRFSS to survey Indian households on or near Montana's seven Indian reservations, Harwell and associates (1999) conducted the only known comparison of the prevalence of CVD and related risk factors in Indian and non-Indian populations from the same geographic region. Younger Native Americans (less than 45 years-old) from across Montana's seven reservations were found to have higher prevalence rates of risk factors associated with CVD, diabetes, and some forms of cancer (Harwell, et al., 1999). The elevated frequencies of CVD risk factors in Native American Montanans have included Body-Mass-Index (BMI) scores greater than or equal to 25 and 30, hypertension, and cigarette use, relative to a comparative non-Indian population. Older Native Americans (older than age 45) also evidence a higher prevalence of the risk factors mentioned above,

as well as a higher frequency of diabetes, myocardial infarction, angina, and CVD compared to older non-Indians (Harwell, et al., 1999). These investigators collected information regarding physical activity; however, they did not analyze or report physical activity levels as a risk factor for CVD across these populations.

While data regarding CVD in Native American communities is limited, there is a relative wealth of information regarding type 2 diabetes. As mentioned above, diabetes has been a focus of concern in Native American communities for years and indeed, data from the Strong Heart Study suggests that diabetes is the *most* important risk factor for CVD among Indians from all tribes (Howard, et al., 1995). The consequences of developing diabetes can be devastating. Among people with type 2 diabetes the risk of heart attack and stroke is twice that the non-diabetic general U.S. population, and the risk of blindness is roughly five times greater in those with diabetes (Huse, Oster, Killen, Lacey, & Colditz, 1989). The rate of tooth loss is 15 times higher in Pima people with type 2 diabetes compared to those without the disease (National Diabetes Information Clearinghouse, 1995). Furthermore, the occurrence of complications such as end-stage renal disease is reportedly 2.8 times more prevalent among Native American people relative to the Caucasian diabetic population (Newman, Marfin, Eggers, & Helgerson, 1990). As previously mentioned, type 2 diabetes is a leading cause of mortality among Native American people. For the above mentioned reasons, and to illuminate the extent

of obesity related health problems in Native American communities, type 2 diabetes will be discussed in further detail.

Type 2 Diabetes in Native American Populations

Type 2 diabetes, a disease characterized by an impaired ability to utilize and ultimately produce insulin, has reached epidemic proportions in Native American communities during the last fifty years (Gohdes, 1995). At present, American Indian people and Pacific Islanders have the highest rates of type 2 diabetes in the world (Bennett-Johnson, 1992). Diabetes is identified as the sixth leading cause of death among Native peoples and this is likely an underestimate, as diabetes contributes to death by heart and cerebrovascular disease. Some have called for a clearer designation of diabetes when the deceased has both diabetes and heart disease (Huse, et al., 1989). Adjusting for age and underreporting of heritage on death certificates, the diabetes-related mortality of Native Americans is 4.3 times that of Caucasian Americans and about twice that of African Americans (Gohdes, 1995; Newman, DeStefano, Valway, German, & Muneta, 1993). In New Mexico, over a thirty year period, Native American deaths attributable to diabetes increased by 550% in women and 249% in men (Carter, Wiggins, Becker, Key, & Samet, 1993). The Pima, who reside in the Southwestern United States region chronicled by Geare (1915) in the beginning of the century, currently have some of the highest rates of both obesity and type 2 diabetes in the world (Bennett, Burch, & Miller,

1971). In Pima, obesity has been shown to amplify the predisposition to type 2 diabetes (Knowler, et al., 1993); however, there is a synergistic interaction between obesity and parental diabetes that seems to be associated with the highest rates of diabetes (Knowler, Pettitt, Lillioja, & Nelson, 1988; Knowler, Pettitt, Savage, & Bennett, 1981). The incidence of type 2 diabetes is significantly lower in non-obese Pima, even among those with diabetic parents (Knowler, McCance, Nagi, & Pettitt, 1993).

Research suggests that high risk of diabetes is associated with being of Native American descent, particularly of high Native American blood quantum (Bennett-Johnson, 1992; Brosseau, Eelkema, Crawford, & Abe, 1979; Gohdes, 1995; Jacobson, de Groot, & Samson, 1995). In addition, those who are obese, have a family member with diabetes, a history of diabetes during pregnancy, and offspring of mothers who had gestational diabetes are at particular risk of developing type 2 diabetes (Pettitt, Nelson, Saad, Bennett, & Knowler, 1993).

Although diabetes has reached epidemic proportions in Native American communities, the preponderance of evidence suggests that diabetes, like obesity, was rare in all tribes prior to 1940 (West, 1974). In fact, the 1900 U.S. Census Bureau report of death rates resulting from diabetes in Native American people revealed only two deaths in a population of 266,760 (Williamson, 1909 as cited in West, 1974). This low diabetes-related death rate translates to approximately one-tenth of that of Caucasian Americans of that time (West, 1974). To a certain extent, this difference may have been attributable to

differences in the rate of testing for diabetes across these populations during this time.

However, Urquhart (1935) performed thousands of urine tests in his work with over four-thousand Eskimo and Indian people in Northwestern Canada and did not identify one case of glucosuria.

Salsbury (1947) reported that in twenty years of service at Gage Memorial Hospital at Granado, Arizona, 25,000 Navajo admissions revealed only five cases of diabetes. In 1940, Joslin was able to find seventy-four diabetic Native Americans in all of Arizona, whereas at present there are thousands (West, 1974). West (1974) reports that, by 1967, Indian Health Service (IHS) established that the rate of diabetes in Native American people had increased to 2.3 times greater than that of Caucasians. Today, Diabetes is a leading cause of death in Native American people.

Why the trend toward diabetes in Native American people? Much effort has been, and continues to be, directed at isolating the genes that predispose Native American people to diabetes (Bogardis, 1993; Knowler, Nelson, Saad, Bennett, & Pettitt, 1993; Knowler, Williams, Pettitt, & Steinberg, 1988), and it appears increasingly safe to conclude that genetics are involved in this epidemic. The risk of diabetes clearly increases with Native American blood quantum (Brosseau, et al., 1979). However, the devastating trend of increasing prevalence of diabetes provides evidence that environmental risk factors are at work, because gene frequencies can not change fast enough to account for these changes in incidence (Knowler, et al., 1993).

Furthermore, the disease has also increased in other populations that have experienced major socioeconomic or migratory changes, often accompanied by increasing obesity and decreasing physical activity (Cohen, 1961; Kawate, Yamakido, Nishimoto, Bennett, Hamman, & Knowler, 1979; Taylor, & Zimmet, 1983; Zimmet, Taft, Guinea, Guthrie, & Thoma, 1977; West, 1974). Changes in the prevalence of obesity across cultures who have experienced rapid westernization supports the "thrifty gene" hypothesis proposed by Neel in 1962. This hypothesis purports that obesity is an expression of a once adaptive "thrifty genotype" that became detrimental with westernization. Specifically, for many cultures, periods of abundant food supply have historically alternated with periods of famine. People who are predisposed to developing diabetes, it is hypothesized, were efficient at storing caloric surplus as fat during abundance, which could later be utilized for survival during periods of famine. Through westernization, and sometimes geographical relocation, food supplies changed from historically traditional lean sources, and became more consistently available and obesity and related health problems ensued (Ravussin, 1993).

The Crow, a tribe of South Central Montana, are a living example of rapid changes from a historical lifestyle of variable food supply and high physical activity to a modern reality of consistent food supply and sedentary lifestyle. Traditionally, the Crow people relied upon bison, elk, antelope, and deer for their primary subsistence. Lowie (1935) writes:

The menace of famine evoked game-charming by men with appropriate supernatural blessings, and stories abound of involuntary fastings, lasting as long as a week, followed by a successful hunt providing an abundance of meat for the tribe (Lowie, 1935, pp.74-75).

Historically, Crow survival necessitated much physical effort. Before the introduction of horses, the Crow roamed on foot over the Yellowstone and Bighorn country, extending toward the sources of the Cheyenne River and Rocky Mountains in search of game (Lowie, 1935, pp. xiv, xv). Bison were chased over cliffs or into corrals. Keeping the animals running in the desired direction involved the laborious erection of two lines of rock piles, with men and women waving robes at animals that tried to escape (Lowie, 1935, pp.72-73).

Crow women, by Lowie's account, worked diligently at drying, preparing and storing meat for periods of famine. Physically, their work was demanding. Crow women prepared hides for shelter and clothing, which involved "infinite scraping with stones and rubbing over a stretched sinew rope" (Lowie, 1935, pp.76). With the forced relocation to reservations, access denied to traditional hunting sites, and the shrinking size of bison herds signaling their possible extinction in the late nineteenth century; no longer able to acquire food in their traditional manner, the Crow were forced to shift to farming in a land of uncertain rainfall and crops. Restrictions and denial of access to traditional hunting and gathering sites which covered enormous geographical areas combined with increasing access to,

cheap, labor-saving devices such as matches replaced the hand-twirled fire-drill, canvas and cotton replaced buffalo hide, and stoves, tables and chairs populated tipi (Lowie, 1935, pp.xv, xvi),

resulted in a new lifestyle requiring less physical exertion for survival and a more consistent food supply.

The preponderance of obesity and related health problems research has been conducted with Native American people of the Southwestern United States, and few studies have assessed the effects of obesity and its health problems among Plains tribes (Acton, Rogers, Campbell, Johnson, & Gohdes, 1993). The Billings area Indian Health Service (IHS) is composed of eight Northern Plains Reservations in Montana and Wyoming. A comprehensive review of all inpatient and outpatient visits across six reservations within the Billings area IHS catchment revealed that rates of diagnosed diabetes across the six reservations were 3.6 times the rates of the U.S. population 17 years of age and older (Acton, et al., 1993).

Furthermore, Acton (1993) ascertained the crude prevalence of selected conditions related to obesity in the Billings IHS service area. These investigators found that 41 percent of IHS clients suffered from hypertension, and 9 percent experienced myocardial infarction.

Given reports that as many as one third of those with type 2 diabetes do not know that they have it (CDC Diabetes Cost-Effectiveness Study Group, 1998), prevalence of the disease in the Billings service area of IHS may be as high as ten times the rate of the

general U.S. population. Furthermore, the study by Acton and associates (1993) reflects clients served prior to 1987. It appears that the prevalence of obesity related diseases is increasing in Native people. For example, crude prevalence estimates of diabetes increased by 360% on the Fort Peck (Souix/Assiniboine) Reservation in the eighteen years between 1969 and 1987 (Acton, et al., 1993). If this trend has continued, prevalence of obesity related diseases in the Billings area may be substantially higher at present.

Indeed, current data from the Behavioral Risk Surveillance Survey (BRFSS) from the Centers for Disease Control and Prevention suggests that 24% of Montanan Native Americans over the age of 44 have been *diagnosed* with type 2 diabetes compared with only 9% of non-Indian Montanans (Harwell, et al., 1999). Type 2 diabetes was the second leading cause of outpatient visits for Crow Service Units in 1997, accounting for 4,575 encounters with health care providers. Crow Service Unit statistics show that diabetes is being diagnosed at very young ages, and the incidence of the disease grows substantially as people enter their early twenties and progress to their sixties. Specifically, in 1997 there were 8 visits by children (ages 5 to 9 years old) for diabetes, 28 by young adolescents (10-14 years), 35 visits by middle- to late-teens (15 to 19 year-olds), 67 by young adults (20 to 24 year olds), 849 by adults (aged 25-44 years), 2,469 by middle-aged adults (45-64 years), and 1,116 visits by older adults (aged 65+ years). These statistics suggest that the incidence of diabetes in Native American people of

Montana increases dramatically during young adulthood and continues to escalate into the early sixties.

Prevention of Type 2 Diabetes in Native American People

Perhaps the best way to prevent the morbidity and mortality associated with type 2 diabetes mellitus is to prevent the disease from establishing itself in the first place.

Presently experts are unclear to what extent type 2 diabetes can be prevented (Knowler, Narayan, Hanson, Nelson, Bennett, Tuomilehto, Scherstein, & Pettitt, 1995). However, the increasing prevalence of type 2 diabetes, and the strong relationship the disease shares with increasing prevalence of obesity within a population suggests that intervening in obesity may prevent the establishment of type 2 diabetes. Evidence is accumulating that the disease onset, at the very least, can be significantly delayed through lifestyle change. Making healthy lifestyle changes may also protect against the development of future diabetic complications. Microvascular complications, such as nerve death in the extremities, begin to develop at the onset of hyperglycemia, while the clock for macrovascular complications, such as heart disease, begins ticking many years and even decades earlier during the prediabetic stage (Hafner, Mykkanen, Festa, Burke, & Stern, 2000).

Many of the risk factors for type 2 diabetes can be delayed by weight loss through physical activity, and diet. Caloric restriction decreases hyperglycemia dramatically

(Savage, Bennion, Flock, Nagulesparan, Mott, Roth, Unger, & Bennett, 1979), lowering fat-intake may facilitate weight loss and prevent diabetes onset (Marshall, Hoag, Shetterly, & Hamman, 1994). As delineated below, there is a growing body of evidence suggesting that exercise in particular is effective in the prevention of diabetes.

Protective Effects of Exercise

A panel of scientists, selected for their research expertise in issues related to the health implications of exercise, was assembled by the Centers for Disease Control and Prevention in 1995. The panel reviewed pertinent physiological, epidemiological, and clinical evidence in order to formulate a “concise public health message” expressing the types and amount of recommended physical activity. The consensus was that “every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week” (Pate, Pratt, Blair, Haskell, Macera, Bouchard, Buchner, Ettinger, Heath, King, Krista, Leon, Marcus, Morris, Paffenbarger, Patrick, Pollock, Rippe, Sallis, & Wilmore, 1995).

Moderate-intensity physical activity was defined as, “3 to 6 METs (work metabolic rate/resting metabolic rate), which is the equivalent of brisk walking at 3 to 4 miles per hour for most healthy adults” (Pate et al. , 1995). The panel emphasized that, based on the most reasonable interpretation of the currently available data, regular moderate physical activity provides substantial health benefits (prevention of chronic

disease in particular), and that intermittent episodes of physical activity, as short as 8 to 10 minutes, accumulating to 30 or more minutes on most days, provide beneficial health and fitness effects. As physical fitness levels increase, age-adjusted all-cause mortality rates decrease significantly in both men and women (Blair, Kohl, Paffenbarger, Clark, Cooper, & Gibbons, 1989). This trend holds even after statistical adjustment for smoking, cholesterol level, systolic blood pressure, fasting blood glucose level, and parental history of coronary heart disease (Blair, et al., 1989).

Research involving Pima tribal members has demonstrated a relationship between physical activity, obesity, and fat distribution (Krista, LaPorte, Pettitt, Charles, Nelson, Kuller, Bennett, & Knowler, 1993). Physical activity was found to be negatively correlated with glucose intolerance, obesity, and central distribution of fat. Furthermore, those with diabetes were less active and reported less leisure physical activity during the teenage years, suggesting that activity may protect against the development of type 2 diabetes both directly and through an influence on obesity and centralized fat distribution (Krista, et al., 1993).

Increasing physical activity appears to improve insulin sensitivity (Bjorntorp, de Jounge, Sjostrom, & Sullivan, 1973; Helmrich, Ragland, Leung, & Paffenbarger, 1991; Krista, LaPorte, Pettitt, Charles, Nelson, Kuller, Bennett, & Knowler, 1993) while also contributing to weight loss. Horton (1986) has shown that deconditioning and physical inactivity are both related to the development of insulin resistance. Encouraging evidence

has emerged from the Finnish Diabetes Prevention Study suggesting that substantial reductions in diabetes incidence can be achieved in middle-aged high risk adults through modest lifestyle change. Specifically, over 500 overweight adults with impaired glucose tolerance (prediabetic) were randomly assigned to a lifestyle intervention or a control group. Intervention group subjects were given detailed guidance in reducing fat intake, increasing fiber in the diet, and moderate exercise (30 minutes daily) with the goal of 5% weight reduction. The intervention group at one year follow-up reported significantly less consumption of fat and sugar, changed quality of fat intake, increased consumption of vegetables, and increased exercise compared with the control group. Although each of the above variable differences were highly significant statistically, changed quality of fat intake and increases in exercise were markedly different across groups. Self-report of increased exercise in the intervention group was more than double that of the control group. At four year follow-up, the intervention group had a 58% lower incidence of type 2 diabetes than did the control group.

In a prospective investigation of the association between physical activity and subsequent incidence of type 2 diabetes in a cohort of 87, 253 women in the United States, women who engaged in vigorous exercise at least once a week had a relative risk (RR) of type 2 diabetes of .84 ($p < .005$). Importantly, these results were found even after adjusting for age, body-mass index, obesity, and family history, suggesting that physical

activity is a promising approach to the primary prevention of the disease (Manson, Rimm, Stampfer, Colditz, Willett, Krolewski, Rosner, Hennekens, & Speizer, 1991).

In a prospective, longitudinal investigation of the relationship between physical activity and type 2 diabetes in a large sample of University of Pennsylvania male alumni, leisure-time physical activity was inversely related to the development of the disease (Helmrich, Ragland, Leung, & Paffenbarger, 1991). In fact, for each 500 kilocalorie increment in energy expenditure, the age adjusted risk of type 2 diabetes decreased by six percent. This association remained after adjusting for obesity, hypertension, and parental history of diabetes. These investigators found that those at highest risk for the development of diabetes (high Body-Mass-Index, history of hypertension, and parental history of diabetes) received the strongest protective effects of physical activity (Helmrich, et al., 1991).

Eriksson and Lindgarde (1991) compared two groups of middle-aged men with impaired glucose tolerance. The members of the intervention group were given physical training, advised to decrease sugar and fat while increasing complex carbohydrates and fiber in their diets, and lose weight if overweight. The comparison group, selected after being ruled out of the intervention due to conditions such as hypertension, alcoholism, and other medical ailments, received standard medical care. The intervention group, but not the comparison group, achieved significant weight loss, most of which was maintained at five-year follow-up. Furthermore, only 11% of the subjects in the

intervention group, compared with 21% of the comparison group, developed diabetes. Thus, in the treated men the incidence of diabetes was .5 times (95% confidence interval 0.3-1.0) that of the men who did not receive treatment. Unfortunately, the groups were not assigned at random, and it is unclear if the groups may have differed at baseline in characteristics important in the etiology of diabetes.

In Da-Qing, China, a randomized clinical trial in Chinese adults with IGT has demonstrated preventive effects of diet and exercise (Pan, Li, Hu, Bennett, & Howard, 1994, as cited in Knowler, et al., 1995). In this trial subjects were randomly assigned to a diet-only intervention group, exercise-only intervention group, a combined diet and exercise group, and a no-treatment control group. Subjects were followed for six years, revealing cumulative incidence rates of diabetes that were lower in each of the three intervention groups (44, 41, and 46% respectively) than in the control group (65%). Of note, the exercise only group had the lowest incidence of diabetes relative to the other intervention groups through the follow-up tracking.

Currently the National Institute of Health (NIH) is evaluating the relative efficacy of type 2 diabetes prevention modalities. The Non-Insulin-Dependant Diabetes Primary Prevention Trial is a large-scale, randomized clinical trial investigating the prevention of type 2 diabetes through lifestyle and pharmacological intervention. Findings will assist in identifying the impact of prevention efforts on the development of type 2 diabetes.

Prevention, or postponement, of type 2 diabetes through lifestyle change has thus received some promising support to date. The Finnish Diabetes Prevention Study has established a “proof of principle.” That is, it has established that it is highly likely that those at risk for developing type 2 diabetes, through modest lifestyle change, can significantly postpone the onset of the disease. However, it remains unclear to what extent the results of the Finnish Diabetes Prevention Study will apply to the diverse population of the United States and the very different cultural and social environment of Native American people residing on or near reservations.

Weight Management

As discussed above, obesity and centralized body fat distribution are clearly related to development of CVD and type 2 diabetes (Hubert, et al., 1983; Knowler, et al., 1981; Knowler, et al., 1993; Ohlson, Larsson, Svardsudd, Welin, Eriksson, Wilhelmsen, Bjorntorp, & Tibblin, 1985; Ravussin, 1993). The incidence of obesity has increased dramatically in the last century in Native American populations (Broussard, et al., 1991; Knowler, et al., 1981; Hall, Hickey, & Young, 1992). As discussed above, the increase in obesity is likely related to an interaction between genetic vulnerability and environmental changes in diet and physical activity levels (Ravussin, 1993).

Foreyt (1995) reviewed the treatment of obesity in minority populations. He writes that poverty and lower levels of education are associated with higher levels of

obesity, and that these factors affect a proportionately higher rate of individuals in minority populations than individuals in the white population. Furthermore, he observes that different minority populations share the same high fat-diet and low-exercise pattern, seem less concerned with weight than the white population, and in general are less likely to perceive themselves as obese than are whites. He found that the limited data that exist suggest that simply applying the commonly used behavioral approaches to minority individuals does not work very well, as evidenced by less weight loss and higher attrition rates.

Successful, sustained, weight loss depends upon lifestyle changes in physical activity and diet (Foreyt & Goodrick, 1994). Obesity occurs when energy intake chronically exceeds energy expenditure. Intake of high-fat foods is most clearly related to the development of obesity. The body automatically expends energy in it's efforts to function optimally. The source of energy expenditure individuals have the most control over is that of physical activity, which can account for up to 20% of required energy (Shaw & Jeffery, 1991).

Physical activity level and it's role in reducing the incidence of CVD and type 2 diabetes in Native American people of the Plains tribes is presently unknown. Efforts to promote diabetes control in the Billings Area Indian Health Service catchment have included diabetic support groups, diabetes camp, educational classes, cooking classes, screening programs, grocery store tours, diabetes education materials at health fairs, pow-

wows, and schools, one-on-one instruction during diabetes clinics, diabetes education during prenatal clinic, orienting health care providers about the Diabetes Standards of Care, a diabetes newsletter, fitness centers, and community aerobic classes (personal communication with the director of diabetes efforts, Kelly Moore, M.D., Billings Area Indian Health Service, 1999). A variety of services have been available on the Crow Reservation, including local fitness centers in 3 of 5 communities, the Community Health Program, which conducts outreach health promotion and education work, outpatient clinics, an inpatient hospital, Nutritional services conducted by Registered Dietitians, and Public Health Nursing. Unfortunately, these services and educationally-based programs and activities, although offered at varying times and places throughout the service units, have demonstrated consistently low attendance rates.

Indeed, population estimates indicate that only 8% to 20% of Americans exercise routinely, and the rate of sedentary living has been estimated between 30% and 59% (Centers for Disease Control, 1990). Dishman (1990) reports that, for the past twenty years, dropout rates from supervised exercise programs around the world have remained at roughly 50%. When people become motivated to begin a physically active lifestyle regimen, it appears that behavioral process strategies (e.g. counterconditioning, reinforcement, stimulus control) are increasingly utilized to increase and maintain the rate of physical activity (Marcus & Simkin, 1993; Marcus, Simkin, Rossi, & Pinto, 1996).

However, for the vast majority of individuals who are not currently interested in exercise, these same behavioral processes are not relevant (Marcus, et al., 1993).

Individuals not currently engaged in healthy behavior choices may not view their behavior as problematic, or alternatively may desire change but be blocked by a multitude of barriers including fear of failure, uncertainty about how to change, and reluctance to accept the struggles of change without the pleasures of the problem behavior. Thus, to maximize effectiveness, interventions to prevent diabetes by facilitating healthy lifestyle change must understand the specific obstacles facing the individual, and address them accordingly, rather than applying broad, non-specific solutions and minimizing the difficulties of initiating and maintaining change. Given that a substantial number of people are not currently motivated to begin increasing the level of their physical activity or alter their diet, a number of experts have recommended the use of the Transtheoretical Model of Change (Prochaska & DiClemente, 1984) in healthy lifestyle interventions (Dishman, 1991; Marcus, Rossi, Selby, Niaura, & Abrams, 1992; Marcus & Simkin, 1993; Marcus, Simkin, Rossi, & Pinto, 1996; Mullan & Markland, 1997).

Transtheoretical Model of Change

Prochaska and DiClemente (1984) have formulated the *Transtheoretical Model of Change* (TMC) which conceptualizes change as progressing through a series of discreet, sequential stages reflecting degrees of motivation to change. The model conceptualizes

change as both static and dynamic, in that an individual can stay in a given stage for long periods of time, or alternatively progress rapidly. Unlike other change models, TMC integrates both intention and overt behavior change. TMC suggests that facilitating the individual's movement to the next stage is the immediate goal, as opposed to assuming that overt change of problematic behavior should be the objective for all people. Research with smokers who were attempting self-change indicated that those who progressed one stage within one month were twice as likely to successfully change within six months compared with those who did not (Prochaska & DiClemente, 1992). That is, even beginning to consider the need to change one's behavior can be instrumental in creating a path to additional factors that will be important in the process. Change is not necessarily steady or incremental according to the TMC, different factors are important at different times, and the change process can be ceased, reversed, or abandoned at any time (Weinstein, Rothman, & Sutton, 1998).

Furthermore, the TMC has demonstrated that people use specific processes or strategies differentially according to their stage of change, and that a mismatch in strategy and stage may result in an increased likelihood of failure to achieve change (DiClemente, 1991; Ockene, Ockene, & Kristellar, 1988; Prochaska, 1991; Prochaska, DiClemente, & Norcross, 1992). The vast majority of research on the TMC has been directed toward understanding change in addictive behaviors. However, people have also been found to progress through stages of change when increasing exercise, mammography screening, radon testing, and healthy diet

Stages of Change

The initial stage of change is termed *precontemplation*, and is characterized by a lack of intention to change the behavior within the next six months. Individuals in this stage are often uninformed about the long-term consequences of their current behavior, avoid thinking about the problems associated with the behavior, feel demoralized about their ability to make changes, and may be defensive in response to social pressures to change (Grimley, Prochaska, Velicer, Blais, & DiClemente, 1994). Addressing behavior to be changed at this stage is usually unfruitful. Resistance to change is the hallmark of precontemplation (Prochaska, DiClemente, & Norcross, 1992). When people in this stage present to therapy it is usually because they are being coerced by others. An individual in the precontemplation stage regarding healthy eating might say, "There is nothing wrong with the way I eat, meat on the bones is a sign of being healthy." In one study of smokers, Prochaska and DiClemente (1992) reported that of those who remained in precontemplation from baseline to one month, only 3% had made an attempt to quit smoking at the six month measurement wave. However, those who moved from precontemplation to the next stage, *contemplation* within the first month, were twice as likely (7%) to have attempted change six months later.

The next stage, *contemplation*, is characterized by an awareness of a problem with the current behavior and seriously thinking about changing it, but not being quite ready to make a commitment to change. People tend to stay in the contemplation stage for prolonged periods of time. Contemplators tend to struggle with the weighing of the pros and cons of the current behavior and the solutions to the problem (Prochaska,

DiClemente, & Norcross, 1992). For the individual contemplating increasing physical activity, there may be a dilemma between short term positive consequences and potential long-term health problems of their current sedentary lifestyle. The individual contemplating a more healthful diet, may be torn between eating foods that taste good, and are less expensive, but result in weight gain and risk of health problems. On discrete measures, contemplators state they intend to change their behaviors within the next six months (Prochaska, DiClemente, & Norcross, 1992). Prochaska and DiClemente (1992) demonstrated that 20% of the smokers in the contemplation stage, who remained in this stage one month later, had attempted to quit smoking within six months. However, of those who progressed within the month to the next stage, *preparation*, 41% had attempted change six months later.

Prochaska (1992) defined the *preparation* stage as characterized by past attempt to change within the previous year and intention to change within the next month. A person in this stage may be making attempts to change behavior, but has not yet reached a specified criterion for change. The individual in preparation to change diet may have cut down on the number of fast food meals consumed each week, but is still occasionally eating them. On discrete measures people in the preparation stage score high on both the contemplation and action scales.

The *action* stage is characterized by a modification in behavior, experiences, and/or environment in order to overcome the problem behavior. Action requires

considerable time and effort and is often noticed by significant others. However, the action stage is also the most vulnerable time for relapse to earlier stages. People are classified as being in action if they have successfully changed for a period of one day to six months. Because action is overt behavior change, people often equate action with change. The danger in conceptualizing change as an all or nothing process is that the prerequisite changes in intention are necessary, and the important efforts required to maintain the changes following action, may be ignored (Prochaska, DiClemente, & Norcross, 1992).

Finally, the *maintenance* stage is characterized by consistently engaging in a new incompatible behavior for more than six months. The individual in the maintenance stage is working to maintain the new behavior and prevent relapse. During relapse, people regress to an earlier stage. The extent to which people regress seems to depend on the demoralizing affects of the lapse. The majority of smoking relapsers (85%), relapse to contemplation or preparation stage and repeat movement toward action (Prochaska & DiClemente, 1986).

Processes of Change

Investigating people who have successfully changed addictive behaviors, Prochaska and DiClemente (1983) have identified processes of change that occur at each stage of change. Behavioral techniques such as stimulus control, counterconditioning,

reinforcement management, self-efficacy (self-liberation), and helping relationships have been processes most frequently used by individuals in the preparation, action, and maintenance stages of change. On the other hand, processes such as consciousness raising, defined as efforts to seek information and understanding about the problem behavior; environmental reevaluation, defined as considering and assessing how the problem affects the physical and social context of the individual; and self-reevaluation, defined as an emotional and cognitive reappraisal of values the individual holds with respect to the current and alternative behavior, have been more frequently employed by those in earlier stages of readiness to change (Prochaska, Norcross, & DiClemente, 1994).

Self-changers (people using self-help methods or simply changing on their own) appear to use the same processes of change that have been at the core of psychotherapy systems (Prochaska & DiClemente, 1984). A common set of change processes has been identified across diverse behaviors such as smoking cessation, weight loss, and dealing with psychological distress (Prochaska, DiClemente, & Norcross, 1992). In a behavioral weight-loss program, the processes used early in treatment were the single best predictor of outcome (Prochaska, Norcross, Fowler, Follick, & Abrams, 1992).

Decisional Balance

When considering change, individuals seem to discriminate between the pros and cons of a decision. The pros and cons of change are independent factors. Therefore, an

individual may be high on one and low on the other, low on both, or high on both. The importance of pros and cons to the individual appear to change across stages. Velicer and associates (1985) demonstrated that smokers in the precontemplation stage rated the pros of smoking high and the cons low. The pros of smoking remained high across the first three stages (precontemplation, contemplation, and preparation), but the gap between pros and cons narrowed as individuals moved through the stages. However, during the action and maintenance stages, the pros and cons are less important as predictors of successful change. The pros and cons are generally in balance during the contemplation stage, making movement to the next stage unlikely. In the preparation stage the cons clearly outweigh the pros, and this imbalance remains in the action and maintenance stages, while decreasing in importance. The relationship between the pros and cons has been replicated across a wide range of behaviors including exercise (Marcus, et al., 1992), sunscreen use (Rossi, 1992), radon gas testing (Rossi, 1992), contraceptive use adoption (Prochaska, et al., 1990), mammography screening (Rakowski, et al., 1992) and dietary fat reduction (Rossi, et al., 1990).

Across twelve different problem behaviors studied (such as sedentary behavior, reducing fat, weight control, smoking, delinquency, lack of radon testing, and mammography screening among others), a relationship between pros and cons during the process of change has emerged (Prochaska, et al., 1994). This relationship between the pros and cons during change have been delineated into the Strong and Weak Principles

of progress or change (Prochaska, 1994). The Strong Principle of Progress states that movement from precontemplation to action involves an increase in the pros of making healthy behavior change by approximately one standard deviation (S.D.). While pros of change are increasing, the Weak Principle of Progress states that progression from precontemplation to action involves a decrease in the cons of healthy lifestyle change by approximately .5 S.D. (Prochaska, 1994). Tracking relative changes in pros and cons of lifestyle change will be informative in evaluating the efficacy of lifestyle interventions.

Self-Efficacy and Temptation

Perceptions of self-efficacy and temptation also appear to vary across stages of change. Self-efficacy refers to one's confidence that one can perform the behaviors necessary to produce desired outcomes. Self-efficacy has been proposed as a mediator between knowledge and action (Bandura, 1982). Of special relevance to lifestyle interventions, choice, effort expenditure, thoughts, emotional reactions, and behavioral performance are all influenced by self-efficacy evaluations (Bandura, 1977; Bandura, Adams, Hardy, & Howells, 1988). Measures of self-efficacy generally assess the individual's confidence in their ability to abstain from the problem behavior across a variety of salient situations. Temptation ratings are included to assess the salience of the situational cues (Grimely, et al., 1994). Self-efficacy and temptation ratings appear to be strongly related to the individual's current stage of change (DiClemente, et al., 1991).

Self-efficacy and temptation seem to interact across stages of change.

Specifically, temptation is high and efficacy low in precontemplation. This gap narrows in contemplation and preparation stages, and is in balance as individuals move into action. During action, self-efficacy evaluations increase dramatically while temptation ratings decrease gradually, and in maintenance temptation ratings reach a low while efficacy peaks and remains high (DiClemente, et al., 1991).

Self-efficacy evaluations appear to be relevant predictors of movement of smokers into action and maintenance, but do not appear relevant for earlier stage movement (Prochaska, et al., 1985). Prediction of stage movement from precontemplation and contemplation stages seems to relate to decision making and cognitive processes of change. Efficacy evaluations appear to reflect effort or coping activity. High smoking abstinence efficacy in precontemplators and contemplators is associated with increased change process activity, and with decreased activity in action and maintenance individuals. That is, early in the change process individuals with confidence in their abilities to make changes engage in more change processes, and as individuals successfully make and maintain change confidence is reflected in less change process activity. Indeed, overconfidence is associated with relapse during the action and maintenance stages of change (Prochaska, Norcross, & DiClemente, 1994). Thus self-efficacy does appear to influence effort on specific change processes, dependent to some extent on stage of change (DiClemente, et al., 1985).

Matching Stage of Change and Intervention Strategy

Treating precontemplators as if they are ready to contemplate in depth the causes of their current behavior may be a mistake. One might imagine that a person at risk for diabetes, who is not engaging in healthy lifestyle choices, may be under frequent fire from concerned others, particularly medical care providers. If the person does not perceive his or her current lifestyle as problematic, or if the rewards for a less healthy lifestyle are greater than the potential adverse, short-term consequences, strategies that place pressure on the individual to change may be premature. That is, one is not likely to benefit from discussing solutions to the problem if one does not perceive that there is a problem.

Medeiros and Prochaska (1993) demonstrated that the premature termination of therapy can be predicted based on a person's pretreatment stage of change, processes of change, and decision making variables. These predictor variables hold promise in that they are all subject to modification through intervention. These authors found that stage of change predicted the course of therapy. Specifically, precontemplators were much more likely to terminate therapy prematurely, contemplators were more likely to continue in therapy, and those in preparation and action were more likely to terminate appropriately upon successful change. Further, precontemplators were more likely to weight the cons of treatment more heavily than the pros, relative to those in other stages.

Perhaps these individuals believed therapy to be unnecessary, aversive, and confrontational (and therefore adversarial). These authors suggest that interventions be guided by the individual's pretreatment stage of change.

Assessing the diabetic person's readiness for change is not a difficult task; there are easy-to-use techniques for doing this. However, the health care provider must be willing to accept that the individual may not be ready for immediate action. If the individual presents with signs of emotional distress and ambivalence, he/she is most likely not in preparation or action. Mismatching readiness for change and strategy for change may account for high rates of attrition and low rates of participation in diabetes education classes (Curry, 1993). Before the individual is ready to take action, prerequisite personal awareness of the importance of the particular lifestyle behavior must be attained. In addition, some people may need to express and deal with their feelings about their risk for diabetes in order to process diabetes relevant information fully. If the health care provider meets periodically with an individual at risk for diabetes and attempts to achieve overt change (action) immediately, despite a patient's early stage of change, the probability of failure will be likely to increase.

From a health care provider's perspective working with an individual with high risk factors for the establishment of obesity related disease, who has not demonstrated a desire to adhere to a healthier lifestyle can be very frustrating, especially because of the sense of urgency that accompanies the development or anticipation of complications

associated with obesity related diseases. A stage model of change provides a different, more attainable set of treatment goals. Success at adhering to one facet of a lifestyle change regimen can be viewed as evidence of potential with other behaviors. Rather than focusing exclusively on overt behavior change, one might note success in tracking movement in covert readiness for overt change.

Goals can be targeted successively. Movement from precontemplation to contemplation should be the goal for those in the earliest stage of readiness, rather than movement from precontemplation to action. Rather than "pushing" for immediate change in the precontemplator, the provider can emphasize change processes of consciousness raising and self-reevaluation to facilitate movement to contemplation. Furthermore, there appears to be a change in the relative weights of the pros and cons of changing as a person progresses through the stages of change. Precontemplators, across problem behaviors, appear to overestimate the cons of treatment/changing and underestimate the pros (Prochaska, et al., 1994). Individuals who are in the contemplation stage tend to feel "stuck" and may benefit from efforts to tip the balance of pros and cons in the direction of change.

People in the preparation stage are feeling ready to take action; however, premature action, launched before developing an adequate plan may result in a relapse to one's previous less healthy lifestyle. Those in action must actively work to maintain their motivation to resist temptations, and continue problem solving about challenges to their

new behavior. An intervention, matched to an individual's stage of change and designed to help an individual be more cognizant of the advantages to a healthy lifestyle, while challenging the perceived disadvantages, problem solving regarding individual, familial, and community obstacles, and doing so in a way that utilizes cultural strengths, may be the most effective way to facilitate change. Indeed, Marcus and associates (1992) have demonstrated that an application of the stages of change model successfully increases exercise adoption in community interventions. By targeting stage movement through a six-week stage matched intervention, these investigators were able to facilitate baseline exercise stage progress in sixty percent of participants.

The Transtheoretical Model and Native American Populations

The TMC has demonstrated that people progress through stages of readiness for change, from initial awareness and contemplation of a need to change into action and maintenance of overt changes. Processes of change are both individual- and other-focused. Native American cultural values tend to be less individual- and more group-oriented (Sutton & Broken Nose, 1996). Johnson and associates (1995) have observed that change efforts in Native American communities may encounter barriers at familial, social, cultural, economic, and environmental levels (Johnson, Anderson, Bastida, Kramer, Williams, & Wong, 1995). One might expect that family, social, and cultural influences may also be powerful agents for the facilitation of change as well.

To date, the TMC has not been utilized to predict physical activity level and health outcome in Native American populations. Daskivich (1997) demonstrated that the TMC is applicable to diabetes care in a Montana Reservation community. Using measures developed to be sensitive to cultural practices and beliefs, processes of change were generally related to stage measures in ways consistent with their relationship to behavioral correlates. Of special interest, these investigators found that traditional cultural beliefs were highly endorsed by those in earlier stages and infrequently endorsed by individuals in action. Furthermore, in a sample of Native Americans of the Wind River Reservation fatalistic beliefs regarding diabetes were more common in those in earlier stages relative to those in action (Calhoun, 1999). Both Daskivich (1997) and Calhoun (1999) found that stage of exercise readiness and self-efficacy was significantly associated with exercise behavior, but accounted for only 5% of the variance in the exercise behavior criterion. However, there was not much variability in this sample, with approximately 80% meeting criterion for “vigorous” exercise. Blood glucose readings were significantly related to both exercise and diet stage of change, as well as a decisional balance favoring pros, as predicted by the model. The process measure revealed differential use of processes by stage and level of glycemic control. A MANOVA revealed a main effect for diet stage across diet self-efficacy, diet decisional balance, as well as diabetes quality of life. In short, preliminary evidence suggests these measures

relate to relevant behavioral correlates and offer utility in tracking lifestyle change in Native American populations.

In a collectivist culture such as that of Native people, one might expect social processes of social support and social liberation to be utilized throughout the change process. However, in the Flathead Reservation sample, those in the contemplation stage used these social processes less, while those making overt changes utilized collectivist strengths more. In contrast, Marcus and Simkin (1993) found, in their non-Native sample, increased use of all processes of change with progression in stage, with the exception of social liberation which was underutilized across stages, perhaps due to the "individual and personal nature of change." Therefore, when working with contemplators in Native populations, using social processes more is indicated.

Behavioral change processes were used more frequently by those making overt changes in their behavior, consistent with findings in non-Native populations (Marcus, et al., 1993; Prochaska & DiClemente, 1992). However, being open and trusting of people who expressed sincere care, both professional and non-professional, was reported equivalently across stages. An intervention that facilitated the use of cultural strengths and beliefs of the Native American community, in the service of change, may be particularly facilitative of lifestyle change. Daskivich (1997) writes,

Poor strategies for use with those in precontemplation include giving expert advice, labeling, blaming, and developing premature focus. Giving expert advice is likely to put the patient into a passive role. A better strategy is to help the patient build their own motivation for change. This

may be of particular importance in a Native American population given the historical context. (Daskivich, 1997. P.106).

Summary

In summary, obesity and related health problems are on the rise nationally. In Native American people, the incidence of obesity and type 2 diabetes is now of epidemic proportions. There is mounting evidence that the development of obesity related health problems such as diabetes can be significantly delayed through modest lifestyle change. Specifically, a regimen of regular exercise as defined by the CDC and the American College of Sports Medicine appears to provide substantial health protective effects. Nonetheless, nationally the population continues to be sedentary. Older adults, ethnic minorities, and those with lower education and income levels continue to be the least active segments of the population (Broussard, Johnson, Himes, Story, Fichtner, Hauck, Bachman-Carter, Hayes, Frohlich, Gray, Valway, & Gohdes, 1991; Dishman, 1991; Sobal & Stunkard, 1989). It is unclear to what extent the message to increase physical exercise has been received by Native Americans residing on reservations.

Exercise and healthy diet lifestyle change are notoriously resistant to sustained change (Dishman, 1991; Marcus, Emmons, Simkin-Silverman, Linnan, Taylor, Bock, Roberts, Rossi, and Abrams, 1998). However, exercise promotion interventions have been shown to be more effective when tailored toward the individual's motivation level or "readiness" for exercise adoption (Marcus, et al., 1998). To date, physical activity,

readiness for exercise adoption, and their utility in predicting health outcomes in Native American populations have not been examined. Examining the self-reported level of physical activity, motivation to exercise, and their power to predict health problems could yield results instrumental in developing efficacious lifestyle interventions to promote health in Native American communities.

Hypothesis

Physical Activity

Exploratory analysis were conducted to determine self-reported levels of physical activity among Native American people residing on reservations across Montana.

Specifically, self-reported activities (two most frequently engaged in activities, frequency and duration past month) were converted to MET values then multiplied by frequency of occasions and duration of activity. Physical activity level was expected to significantly predict health outcome. Specifically, individuals with higher cumulative activity ratings were expected to endorse a significantly lower incidence of poor health outcome (e.g., CVD, Diabetes, etc.).

Transtheoretical Model of Change

Measures derived from the TMC (stage and self-efficacy) were expected to contribute explanatory variance in predicting (a) self-reported physical activity and (b) health outcome. Significant main effects for stage of exercise, self-efficacy for exercise, and physical activity ratings were expected. Self-efficacy for exercise and activity ratings were expected to be significantly higher for those in action and maintenance stages relative to those in precontemplation. TMC measures were expected to have significant positive predictive power regarding health outcome, equivalent to activity ratings.

CHAPTER 2: METHOD

Participants

To be eligible for participation in the survey, respondents were required to be Native American and ≥ 18 years of age, living on or near Montana's seven reservations (Blackfeet, Crow, Flathead, Fort Belknap, Fort Peck, Northern Cheyenne, and Rocky Boy's). The sample was stratified to reflect relative population size across reservations. One Native American adult from each selected household was eligible for participation. A total of 1,000 surveys were completed. Based on 1990 census data of Native American's residing on Montana's seven reservations, a sample size of 1,000 completed interviews reflects approximately 12% of the Native American Households on the seven reservations in Montana. Of households randomly selected to participate, there was a 2% non-response rate (refusal, eligible respondent not available, unable to communicate due to physical/mental impairment, or language barrier).

Measures

Data was collected using the Brief Risk Factor Surveillance Survey (Appendix A). The following background information was collected: age, gender, height (without shoes), weight (without shoes), education, employment status, family history of diabetes, belief in Native American's being able to prevent diabetes, cigarette use and county of residence.

Stages of Change for Exercise Adoption

The following measures, developed by Acton and Fiore (1996) were included: measures of current stage of change (for exercise), confidence to begin regularly exercising, barriers to exercise (open ended), and a belief in the utility of exercise in promoting health and preventing heart disease and diabetes development/progression.

Physical Activity:

Participants responded to a self-report measure of physical activity. Specifically, the frequency and duration of the most frequently engaged in activity was assessed. Broad spectrums of physical activity across domains of recreation, occupational, and domestic work were assessed across a continuum of intensity.

Guidelines for classifying the intensity or METs (working metabolic rate/resting metabolic rate) of activity were used to quantify level of exertion (Ainsworth, Haskell, Leon, Jacobs, Montoye, Sallis, & Paffenbarger, 1992). Meeting recommended activity level was operationally defined as engaging in a minimum of 30 minutes of exercise accumulated across the course of a day, at least five days per week, at an intensity level greater than or equal to 3 to 6 METs as emphasized by the Centers for Disease Control and Prevention (Pate, Pratt, Blair, Haskell, Macera, Bouchard, Buchner, Ettinger, Heath, King, Krista, Leon, Marcus, Morris, Paffenbarger, Patrick, Pollock, Rippe, Sallis, & Wilmore, 1995), or engaging in a minimum of 20 minutes of exercise, at least three days

per week, at a vigorous intensity level defined as greater than or equal to 8 METs as emphasized by the American College of Sports Medicine (ACSM, 1990).

Health Outcome Measures

Respondents reported their subjective evaluation of their health status “in general.” In addition, respondents reported the number of days during the past month in which they were limited from engaging in their usual activities due to physical and/or emotional illness. Visits to a health care provider in the past year, overnight hospitalizations in the past year, and BMI (calculated as weight divided by height squared (kg/m²)) were also collected as an indicator of health. Finally, respondents reported if they had received any of the following diagnoses (all dichotomous): hypertension, heart attack, CHD, stroke, chronic obstructive pulmonary disease, liver disease, leukemia, high blood cholesterol, and diabetes.

Procedures

The methodology of the BRFSS surveys has been described previously (Gentry, Kalsbeek, Hogelin, Forman, Marks, & Trowbridge, 1985). The Montana Department of Health and Human Services (DPHHS), in collaboration with the Billings Area Indian Health Service (IHS) conducted the BRFSS telephone survey of adult Native Americans living on or near Montana’s seven reservations (Blackfeet, Crow, Flathead, Fort Belknap,

Fort Peck, Northern Cheyenne, and Rocky Boy's) from May through July 1999. A random sample of households with three-digit telephone prefixes located on or near the reservations were contacted by trained telephone interviewers.

Statistical Analysis

Descriptive statistics regarding activity level, motivation to exercise, obesity, and chronic illness were analyzed across two age groups: those younger than age 45 (younger group), and those age 45 and older (older group). Chi-Square analyses were utilized to test for significant differences across groups.

Harwell and associates (1999), using the same data set found significantly increased incidence of health problems in those 45 and older relative to those younger than 45 years. To account for the expectation that for those age 45 and older, a higher prevalence of health problems, independent of activity level and stage of change for exercise, would obscure the analyses of the variables of interest (SOC, exercise, beliefs) a preliminary analyses was conducted. MANOVA was performed to determine whether age, gender, and education level, were related to any of the interval or continuous criterion variables: perception of health status, healthcare visits in the past 12 months, BMI, and exercise behavior. Specifically, age and education were considered as potential covariates and gender as the between-subject variable. Chi-Square analyses were

conducted to determine the strength of association between dichotomous outcome variables and age, gender, and education level.

A series of forward binary logistic regression analyses were conducted with dichotomous outcome variables (diabetes, hypertension, CVD, stroke, heart attack, hypertension) with stages of change, physical activity, and belief in exercise as a means to promote health and prevent illness (beliefs) as predictors. The forward method was selected because it allows all predictor variables freedom to vie for explanatory variance in each criterion variable in a sequential manner. That is, it is the method that allows one to ask which variable explains the most variance (all in) in the first step, followed by a second step in which the remaining variables attempt to add explanatory variance to the most predictive variable, followed by a third step, until none of the predictors are able to add power to the prediction model. In this way the question of the relative predictive utility of self-reported exercise level and stages of change for exercise were examined. A series of forward multiple regression analyses regarding continuous outcome variables were conducted to assess the relative predictive power of exercise, stages of change, and beliefs in predicting healthcare visits, perception of health status, and BMI. A forward multiple regression analyses was conducted to assess the relative predictive power of stages of change, beliefs, fatalism regarding diabetes, BMI, age, gender, education, and history of health problems in predicting exercise behavior.

CHAPTER 3: RESULTS

Analysis

All analyses were conducted using SPSS (version 10.0) for Windows. Less than 15% of all data points were missing within each variable relevant to the regression analyses. However, listwise deletion of missing data would have resulted in a 35% reduction in sample size. Twenty-one percent of the missing data was found to occur in the frequency and duration of physical activity cells. Therefore, a mean frequency and duration was calculated for each specific activity and used as a replacement value.

Results were generally supportive of hypothesized findings. Results will be presented as they pertain to the sections that follow.

Descriptive Statistics

One thousand Native American respondents over the age of 18 years-old, from across Montana's seven reservations, completed the BRFSS. Dividing the sample into an older (≥ 45 years) and younger group (<45 years), the sample is slightly more heavily represented by younger, female respondents, and the sample as a whole is fairly well educated, as shown in Table 1 below.

Table 1.

Characteristics of Respondents by Age Group

	<45 years-old	≥45 years-old
Total	598 Mean (SD)	402 Mean (SD)
Age (years)	32.0 (7.8) N(%)	58.1 (10.0) N(%)
Sex		
Male	252 (42)	176 (44)
Female	346 (58)	226 (56)
Highest grade completed		
Grade 1-8	10 (1.7)	32 (8)
Grade 9-11	84 (14)	55 (13.7)
Grade 12 or GED	197 (32.9)	129 (32.1)
College 1-3	219 (36.6)	121 (30.1)
College 4 or more	86 (14.4)	61 (15.2)

The sample was stratified to represent the relative population sizes of the seven reservations, as shown in Table 2 below. Analysis of variance revealed no meaningful differences in exercise behavior, stages of change for exercise (SOC), BMI, or health care utilization during the past 12 months across the 7 reservation samples.

Table 2.

Population and Sample Descriptors.

<u>Reservation</u>	<u>Population</u> 18+ years-old N (% Native American)	<u>Sample</u> Native American Respondents N (% of Sample)
<u>Blackfeet</u>	3,960 (79.2)	234 (23.4)
<u>Crow</u>	2,645 (68.5)	153 (15.3)
<u>Flathead</u>	3,139 (21.3)	185 (18.5)
<u>Fort Belknap</u>	1,292 (90.5)	70 (7.0)
<u>Fort Peck</u>	3,272 (48.4)	195 (19.5)
<u>Northern Cheyenne</u>	1,891 (86.5)	107 (10.7)
<u>Rocky Boy's</u>	800 (94.7)	56 (5.6)

Source: US Department of Commerce, Bureau of the Census, 1990 Census of Population and Housing – Summary Tape File 1A.

Physical Activity

Respondents reported occupational and exercise physical activities, frequency of activity, and duration of time spent engaged in the activity. Physical activity was converted into MET values, then multiplied by frequency and duration of the activity. Table 3 below illustrates the percentage of respondents reporting activity levels at or above those recommended by the CDC across age groups. Those reporting frequency of activity of at least 5 occasions weekly, for a duration of at least 30 minutes, and a MET level of at least 4.0 were classified as meeting the CDC recommended level of exercise.

Both age groups report high levels of moderate-intensity physical activity. However, very few respondents endorsed exercise behavior sufficient to reach the threshold defined by the CDC for optimal health. Respondents less than 45 years of age were significantly more likely to report moderate exercise behavior consistent with the CDC recommendations, and were less likely to report that they do not exercise at all. Indeed, 39% of the older respondents reported not exercising compared with 18% of the younger adults in the sample.

Table 3.

Percentage of Those with Self-Reported Physical Activity Levels At or Above the CDC's Recommended Activity Level

	<45 years-old	≥45 years-old	χ^2	df	Sig.
	N (%)	N (%)			
Total	598	402	54.32	2.1	.000
Exercise - CDC Level	6 (1)	2 (<1)			
Exercise - Below CDC Level	486 (81)	245 (61)			
Exercise Abstainers	106 (18)	155 (39)			

Note: Abstainers = respondents who report that they do not exercise at all.

Deconstructing the variables used to define the CDC threshold, it appears that frequency of exercise (at least 5 times a week) was the CDC criterion rarely endorsed,

while increasing percentages of respondents met the criteria for duration of activity and MET level respectively, as presented in Table 4 below.

Table 4.

Deconstruction of Self-Reported Physical Activity Variables Comprising the CDC's Recommended Activity Level

Total	N (%)		
	1000		
	CDC Level	Below CDC Level	Abstainers
Physical Activity	8 (1)	731 (73)	261 (26)
Frequency	19 (2)	720 (72)	261 (26)
Duration	203 (20)	536 (54)	261 (26)
MET level	465 (47)	274 (27)	261 (26)

The CDC recommendations are intended to broaden the definition of healthful activity level to include moderate activity levels accumulated across brief bouts of activity throughout the day on most days. In contrast, the American College of Sports Medicine (ACSM) has recommended a healthful level of physical activity (ACSM, 1990) characterized by higher intensity (e.g., vigorous), but briefer duration and frequency across the week. Specifically, the ACSM recommends that adults engage in a minimum of 20 minutes of vigorous-intensity physical activity (e.g., jogging or 8.0 METs) at least 3 times a week. As shown in Table 5 below, a minority (11%) of respondents endorse

exercise behavior consistent with recommendations by the ACSM. Younger respondents (<45 years-old) were significantly more likely to report exercising at ACSM levels (16%) relative to older respondents (≥ 45 years-old; 2%).

Table 5.

Percentage of Those with Self-Reported Physical Activity Levels At or Above the ACSM's Recommended Activity Level.

	<45 years-old	≥ 45 years-old	χ^2	df	Sig.
	N (%)	N (%)			
Total	598	402	49.59	2.1	.000
Exercise - ACSM Level	97 (16)	9 (2)			
Exercise - Below ACSM Level	501 (84)	393 (98)			

Note: ACSM = American College of Sports Medicine.

The amount of time spent watching television “yesterday,” and on an average day was assessed as a possible means of assessing sedentary behavior. Less than 1% of respondents reported that they do not own a television, and another 7% reported that they do not watch television. Of the remaining 93% of respondents who reported that they watch television, 55% watched 2 hours or less television the day before the survey ($M = 2.86$, $SD = 2.19$), and 86% watched 4 or fewer hours of television. On an average day

television is watched ($M = 3.28$, $SD = 2.49$) for 1 or 2 hours by 47% of the sample, and an additional 34 % watch for 3 or 4 hours. Neither television watched the previous day nor average television watching was found to be related to exercise behavior ($r = -.013$, $p = .724$), or obesity ($r = -.002$, $p = .952$).

Respondents who reported that they do not exercise regularly were asked to identify *the most important reason* they do not exercise more or exercise at all. Of the respondents who answered this question ($N = 543$), 38% indicated the most important barrier to exercise was “lack of time,” followed by 10% identifying with being too “lazy,” and 8% indicating they were too “tired or exhausted.” Less than 1% of the sample cited the following barriers: diabetes, cancer, safety concerns related to violence, traffic, dogs, or lack of sidewalks; embarrassment/self-consciousness, lack of others to exercise with, lack of skills/knowledge, fear of injury or lack of a convenient place to exercise.

Health Outcome

Analysis of variance (ANOVA) was used to identify differences in health outcome measures. Those 45 years-old and older reported a significantly higher incidence of myocardial infarction ($p < .000$), coronary heart disease ($p < .05$), stroke ($p < .000$), diabetes ($p < .000$), and high blood pressure ($p < .000$). The older group also reported significantly higher BMI ($p < .000$), and their BMI scores were more apt to fall into a range ($p < .000$) that placed them at high risk for developing diabetes and CVD, as shown in Table 6. The

sample as a whole endorsed a high prevalence of weight above levels thought to be healthy. Indeed, 70% of the younger group of respondents and 80% of the older group reported being overweight or obese. Thirty percent of those younger than age 45 and 40% of respondents age 45 and older were found to have BMI values placing them in the obesity range.

Table 6.

Health Outcome Responses by Age Group.

	<45 years-old	≥45 years-old			
Total	(N= 598) N (%)	(N=401) N (%)	F	df	Sig.
Myocardial Infarction	5 (1)	51 (13)	35.66	1.998	.000
CVD	17 (3)	135 (34)	3.97	1.998	.046
Diabetes	27 (4)	95 (24)	51.21	1.998	.000
Stroke	3 (0)	21 (3)	23.37	1.998	.000
Hypertension	89 (15)	168 (42)	84.68	1.998	.000
BMI	(N=582)	(N=386)	12.75	1.966	.000
18 -24.9 (Healthy)	176 (29)	73 (18)			
25-29.9 (Overweight)	226 (38)	160 (40)			
30-34.9 (Obese: Class I)	122 (20)	105 (26)			
35-39.9 (Obese: Class II)	36 (6)	26 (7)			
≥40 (Obese: Class III)	22 (4)	22 (6)			

Transtheoretical Model of Change

As expected, stages of change (SOC) was found to be significantly related to the other TMC variables: confidence in one's ability to begin an exercise regimen;

confidence in one's ability to maintain an exercise regimen; and a belief that exercise improves one's health and prevents or delays the onset of chronic illness' such as CVD and diabetes. Stages of change was also significantly related to body mass index, exercise levels, and exercise behavior consistent with the CDC recommended levels of physical activity for optimal health, as illustrated in Table 7 below. However, although the above mentioned relationships were highly significant, the strength of association between these variables is unclear as, with the exception of BMI and exercise behavior, the remaining variables are discreet with highly limited ability to vary (e.g., 3 levels).

Table 7.

The Relationship of Stages of Change for Exercise and Conceptually Related Variables.

	Stages of Change for Exercise		
	N	r	Sig. (one-tailed)
Exercise Improves Health	928	-.110	.000
Exercise Prevents Illness	912	-.141	.000
Confidence to begin Exercise	261	-.170	.003
Confidence to Maintain Exercise	260	-.104	.047
BMI	919	-.086	.005
Exercise Level	904	.369	.000
CDC Recommended Exercise Level	904	-.426	.000

Values derived from Pearson Correlation

Table 8 below illustrates the frequency of SOC and attitudinal variable (i.e., belief in exercise as a means to prevent illness and promote health, fatalism regarding diabetes) levels by age group. The Table shows that, in general, both young and older respondents believe in the utility of exercise as a means to promote health and prevent illness, are at least considering beginning a regular exercise regimen, and are at least somewhat confident about their ability to begin and maintain this regimen. The most striking

difference in SOC for exercise across respondents 45 and older and those younger than 45 years-old was the relative percentages of the two age groups who were in the precontemplation stage. Specifically, there was almost three times as many respondents reporting they were precontemplators regarding intention to exercise in the older group relative to the younger group (24% and 9% respectively). The younger group also had a higher percentage of respondents endorsing that they were in action or maintenance relative to the older group (44% and 33% respectively).

Table 8 also illustrates that there were significant differences in regards to fatalism about Native American people and diabetes. Specifically, 70% of respondents in the less than 45 years-old age group believe that “Indian people can prevent getting diabetes,” compared with 60% of respondents in the older age group. In both the young and older age groups, 15% of respondents *do not* believe that Indian people can prevent the onset of diabetes, and a fair percentage of respondents are simply unsure (16% in the younger group and 25% in the older group). Fatalistic beliefs regarding diabetes were independent of education level and gender.

There were no significant differences across age groups regarding confidence in ability to begin and maintain a regular exercise regimen, with both groups reporting they are fairly confident. Interestingly, the younger group was more confident about beginning an exercise regimen than they were about maintaining it whereas the older group was equally confident in their ability to begin and maintain a regimen. Both groups generally

agreed that exercise improves health, but the younger group felt more strongly about this than did the older respondents (36% and 28%). However, 5% of the older group reported they do not believe exercise improves health relative to one-half of one percent of the younger group. The groups felt equivalently strong about the utility of exercise as a means to prevent illness, with the exception of 5% of the older group disagreeing.

Table 8.

Frequency of Stages of Change and Attitudinal Variable Levels by Age Group.

	<45 years-old	≥45 years-old		
Total	(N= 598) N (%)	(N=401) N (%)	df	χ^2
SOC	571	378	4.1	42.03**
Precontemplation	49 (9)	89 (24)		
Contemplation	145 (25)	85 (23)		
Preparation	130 (23)	77 (20)		
Action	157 (28)	84 (22)		
Maintainance	90 (16)	43 (11)		
Confidence to Begin Exer.	177	313		NS
Very Confident	68 (38)	30 (34)		
Somewhat Confident	101 (57)	51 (57)		
Not at All Confident	8 (5)	8 (9)		
Confidence To Main. Exer.	178	87		NS
Verv Confident	43 (24)	27 (31)		
Somewhat Confident	123 (69)	50 (58)		
Not at All Confident	12 (7)	10 (12)		
Exercise Improves Health	590	382	2.1	23.20**
Strongly Agree	215 (36)	107 (28)		
Agree	372 (63)	258 (68)		
Disagree	3 (1)	17 (5)		
Strongly Disagree	0 (0)	0 (0)		
Exercise Prevents Illness	583	371	2.1	23.20**
Strongly Agree	207 (36)	126 (34)		
Agree	371 (64)	228 (62)		
Disagree	5 (1)	17 (5)		
Strongly Disagree	0 (0)	0 (0)		
Fatalism Regarding Diabetes	598	402	3.1	15.54**
Yes	88 (15)	59 (15)		
No	416 (70)	240 (60)		
Unsure	93 (16)	102 (25)		

**p<.001.

Regression Analyses

Preliminary Analyses

A multivariate analysis of variance (MANOVA) was conducted to determine whether age ($M = 42.44$, $SD = 15.37$), gender, and education level ($M = 4.41$ (H.S. Grad.), $SD = 1.05$), were related to any of the interval or continuous criterion variables: perception of health status ($M = 2.72$, $SD = 1.16$), healthcare visits in the past 12 months ($M = 5.59$, $SD = 7.89$), BMI ($M = 28.58$, $SD = 5.71$), and exercise behavior ($M = 825.11$, $SD = 1088.58$). Specifically, age and education were considered as potential covariates and gender as the between-subject variable.

All of the above criterion variables were found to be dependant on age: perception of health status, $F(1, 914) = 122.97$, $p < .000$, healthcare visits in the past 12 months, $F(1, 914) = 10.30$, $p = .001$, BMI, $F(1, 914) = 11.16$, $p < .01$, and exercise behavior, $F(1, 914) = 64.36$, $p < .000$. That is, as respondents age increased their perception of health decreased, healthcare visits increased, BMI increased, and exercise behavior decreased. Regarding exercise behavior, respondents age 45 and older reported significantly less exercise frequency, $\chi^2(2, 1) = 57.08$, $p < .000$, duration of exercise, $\chi^2(2, 1) = 76.00$, $p < .000$, and exercise intensity, $\chi^2(2, 1) = 65.16$, $p < .000$.

Perception of health status improved, $F(1, 914) = 22.38$, $p < .000$, as education level increased; while BMI, $F(1, 914) = .17$, $p = .680$, and exercise behavior, $F(1, 914) =$

1.76, $p = .184$ were found to be independent of education. Exercise behavior (M>F), $F(1, 914) = 22.71, p < .000$, and healthcare visits (F>M), $F(1, 914) = 9.34, p = .002$, were found to be dependant on gender, while BMI, $F(1, 914) = .73, p = .392$, was not.

Chi-Square analyses were conducted to determine the strength of association between dichotomous outcome variables and age, gender, and education level. As shown in Table 9 below, analyses demonstrated that diabetes, high cholesterol, MI, CHD, stroke, and hypertension were dependant on education. As education level increases the incidence of each of the above listed health outcomes decreases. Specifically, 29% of respondents with less than a high school level education reported having diabetes compared with 11% of those with at least a high school education. The same pattern held true for MI (14% vs. 6%), CHD (17% vs. 5%), stroke (12% vs. 1%), and hypertension (39% vs. 25%). Age group membership (age ≥ 45 and age < 45) was powerfully associated with all health outcome variables. As age increased poor health outcome increased. MI, CHD, and hypertension were related to respondent's gender (M>F), while diabetes, high cholesterol, and stroke were found to be independent of gender.

Table 9.

Summary of Chi-Square Analyses Determining the Independence of Age, Education, and Gender Variables from Health Outcome Variables.

Demographic Differences Variable	Outcome Variable	N	df	χ^2	
Age	Diabetes	997	1,1	82.96**	O>Y
	High Cholesterol	625	1,1	20.73**	O>Y
	MI	999	1,1	64.05**	O>Y
	CHD	995	1,1	61.97**	O>Y
	Stroke	1000	1,1	22.89**	O>Y
	Hypertension	1000	1,1	94.80**	O>Y
Gender	Diabetes	997	1,1	.69	
	High Cholesterol	625	1,1	.80	
	MI	999	1,1	9.46**	M>F
	CHD	995	1,1	5.62*	M>F
	Stroke	1000	1,1	.09	
	Hypertension	1000	1,1	9.21**	M>F
Education	Diabetes	994	5,1	14.85**	↓HS>HS
	High Cholesterol	622	5,1	17.38**	↓HS>HS
	MI	995	5,1	20.65**	↓HS>HS
	CHD	991	5,1	24.79**	↓HS>HS
	Stroke	996	5,1	24.73**	↓HS>HS
	Hypertension	996	5,1	11.97*	↓HS>HS

Note: Age = continuous, Gender = male and female, Education = highest grade categorized as: zero schooling, less than hs, grades 9-11, hs graduate, college 1-3 years, college graduate or beyond.
 **p<.01. *p<.05.

Regression Analyses

Prediction of Chronic Illness. A series of six forward logistic regression analyses were conducted to examine the relative contributions of age, gender, education, exercise level, SOC for exercise, and belief in exercise as a means to promote health and prevent illness, and a fatalistic belief that Indian people can not prevent the onset of diabetes, in predicting: (a) diabetes, (b) hypertension, (c) history of MI, (d) CHD, (e) history of stroke, and (f) high cholesterol. Variables pertaining to confidence in one's ability to begin and maintain an exercise regimen were not included in the model as their inclusion increased listwise case exclusion from 14% to 73% of the sample.

The hypothesis that exercise behavior and SOC for exercise would contribute explanatory variance to health outcome was mostly not supported. Exercise behavior did contribute significant explanatory variance following age and gender to the prediction of CHD, $\chi^2(1, 3) = 5.78, p = .016$. However, age accounted for most of the explained variance across criterion variables, as shown in Table 10 below. SOC, a belief in exercise as a means of promoting health, fatalism regarding the prevention of diabetes, and education level failed to contribute explanatory variance in the prediction of any of the criterion variables.

Table 10.

Summary of Forward Logistic Regression Analyses for Variables Predicting Poor HealthOutcome.

Dependant Variable	Step	Independent Variable	df	R ² Δ	B	SE B	χ ²
Diabetes	1	Age	1,1	.20**	-.068	.008	93.89**
Hypertens.	1	Age	1,1	.17**	-.055	.006	108.24**
	2	Gender	1,2	.01**	-.446	.167	7.09**
Heart Attack	1	Age	1,1	.26**	-.093	.012	79.67**
	2	Gender	1,2	.04**	-1.283	.346	14.80**
	3	Ex Prevent Illness	1,3	.01*	-.669	.316	4.68*
CHD	1	Age	1,1	.26**	-.092	.012	108.24**
	2	Gender	1,2	.02**	-.738	.320	5.39*
	3	Exercise	1,3	.02**	.001	.000	5.78*
Stroke	1	Age	1,1	.13**	-.070	.015	22.76**
High Chol.	1	Age	1,1	.06**	-.033	.007	21.57**
	2	Ex Prevent Illness	1,2	.02**	.467	.167	5.54*

Note. SOC = stage of change for exercise, Ex Improve Health = a belief that exercise improves one's health, Ex Prevent Illness = a belief that regular exercise can prevent the occurrence and severity of illness.

**p<.01. *p<.05.

Prediction of healthcare visits, perception of health, and BMI. A forward multiple regression analysis was conducted to examine the relative contributions of age, gender, education, exercise level, SOC for exercise, and belief in the utility of exercise in promoting health and preventing illness in predicting: (a) healthcare visits, (b) perception of health status, and (c) BMI. Table 11 below illustrates that while age was the most powerful predictor of BMI and number of visits to a healthcare provider in the past 12 months, it did not influence one's perception of one's health. As hypothesized, both SOC and exercise were predictive of the criterion variables. Also in support of hypothesized findings, SOC was a better predictor of perception of health status and BMI, relative to exercise level. Specifically, SOC, $F(2, 858) = 13.79, p < .000$, contributed more explanatory variance in the prediction of respondent's perception of their health than did exercise behavior. SOC was the only variable to add explanatory variance to age, $F(1, 833) = 12.36, p < .000$, in the prediction of BMI, $F(2, 832) = 8.25, p < .000$. Neither education level nor belief in exercise as a means of preventing illness contributed explanatory variance in the prediction of any of the criterion variables.

Table 11.

Summary of Forward Multiple Regression Analysis for Variables Predicting Healthcare
Visits, Body Mass Index (BMI), and Perception of Health Status (PHS).

Dependant Variable	Step	Independent Variable	df	B	SE B	β	R ² Δ	t
PHS	1	Age	1,859	2.63	.00	.34	.12**	10.69**
	2	SOC	2,858	2.48	.03	-.14	.02**	-4.49**
	3	Exercise	3,857	-8.28	.00	-.08	.01*	-2.26*
	4	Ex Imp Hlth	4,856	.15	.07	.07	.01*	2.10*
Healthcare Visits	1	Age	1,820	6.56	.02	.12	.01**	3.46**
	2	Gender	2,819	1.65	.57	.10	.01**	2.91**
BMI	1	Age	1,833	4.64	.01	.12	.01**	3.52**
	2	SOC	2,832	-.33	.16	-.07	.01**	-2.02*

Note. SOC = stage of change for exercise, PHS = perception of health status, Ex Imp Hlth = a belief that exercise improves one's health, BMI = Body-Mass-Index
**p \leq .01.

The finding that, as we age we are more apt to have health problems was not surprising or interesting as this is generally accepted to be true. Furthermore, the effects of age and gender in predicting the criterion variables were such that the role of the variables of central interest, SOC and exercise level, were obscured. To investigate,

specifically, the influence of SOC and exercise levels in predicting health outcome criterion variables, logistic and multiple regression analyses were again performed, only without including age or gender.

Prediction of Chronic Illness. A series of six forward logistic regression analyses were conducted to examine the relative contributions of exercise level, SOC for exercise, and belief in exercise as a means to promote health and prevent illness in predicting: (a) diabetes, (b) hypertension, (c) history of MI, (d) CHD, (e) history of stroke, and (f) high cholesterol. The hypothesis that exercise behavior and SOC for exercise would contribute explanatory variance to health outcome was supported. Results support the hypothesis that physical activity level is a meaningful predictor of health outcome. Entered with SOC and belief in the utility of exercise to improve health and prevent illness; physical activity level was the best predictor of diabetes, coronary heart disease, BMI, high cholesterol, and perceived health status, and added significant explanatory variance to the prediction of MI, as shown in Table 12 and Table 13 below.

Table 12.

Summary of Forward Logistic Regression Analyses for Variables Predicting Poor HealthOutcome. Excluding Demographics.

Dependant Variable	Step	Independent Variable	df	R ² Δ	B	SE B	χ ²
Diabetes	1	Exercise	1	.04**	.001	.000	17.20**
Hypertens.	1	SOC	1	.01*	.134	.062	4.69*
Heart Attack	1	Ex Improve Health	1	.04**	-1.148	.334	13.06**
	2	Exercise	1	.04**	.001	.000	12.68**
CHD	1	Exercise	1	.05**	.001	.000	16.26**
	2	Ex Improve Health	1	.03**	-.870	.315	8.21**
High Chol.	1	Exercise	1	.02**	.000	.000	7.67**
	2	Ex Prevent Illness	1	.01*	.431	.198	4.77*
	3	Ex Improves Health	1	.01*	-.569	.279	4.23*

Note. SOC = stage of change for exercise, Ex Improve Health = a belief that exercise improves one's health, Ex Prevent Illness = a belief that regular exercise can prevent the occurrence and severity of illness.

**p<.01. *p<.05.

The hypothesis that SOC would add significant explanatory variance in predicting poor health outcome was partially supported. As reported previously, variables pertaining to confidence in one's ability to begin and maintain an exercise regimen were

not entered in the model as their inclusion increased listwise case exclusion from 14% to 73% of the sample. As shown in Tables 12 and 13, SOC was the only significant predictor of hypertension, and added significant explanatory variance in the prediction of one's perception of one's health status. Belief regarding the utility of a regular exercise regimen to promote health was the best predictor of MI and added significant explanatory variance to the prediction of CHD, high cholesterol, and perception of health status. A belief in regular exercise as a means to prevent the onset or severity of illness added explanatory variance in the prediction of high cholesterol. Of note, none of the predictors were able to contribute significant explanatory variance in the prediction of health care visits in the past 12 months.

Table 13.

Summary of Forward Multiple Regression Analysis for Variables Predicting Healthcare Visits, Body Mass Index (BMI), and Perception of Health Status (PHS), Excluding Demographics.

Dependant Variable	Step	Independent Variable	df	B	SE B	β	$R^2 \Delta$	t
Healthcare Visits		NS						
PHS	1	Exercise	1,860	-2.10	.00	-.20	.04**	-5.98**
	2	SOC	1,859	-.12	.03	-.13	.02**	-3.70**
	3	Ex Imp Hlth	1,858	.23	.08	.10	.01**	3.02**
BMI	1	Exercise	1,833	-4.40	.00	-.08	.01**	-2.44**

Note. SOC = stage of change for exercise, PHS = perception of health status, Ex Imp Hlth = a belief that exercise improves one's health, BMI = Body-Mass-Index
 ** $p \leq .01$.

Prediction of Exercise. As self-reported exercise was shown to be the best predictor of health outcome, a forward stepwise regression analysis was performed to determine what variables predicted exercise behavior. Demographic variables of interest including age, gender, and education were entered into the regression analysis along with SOC, belief in exercise as a means to prevent illness and promote health, and BMI. In addition, as the prescription for managing chronic illness invariably includes

recommendations to exercise, variables pertaining to a history of diabetes, hypertension, MI, CHD, and high cholesterol were included.

Table 14.

Summary of Forward Multiple Regression Analysis for Variables Predicting Exercise.

Dependant Variable	Step	Independent Variable	df	B	SE B	β	$R^2 \Delta$	t
Exercise	1	SOC	1, 859	318.97	28.18	.36	.14**	11.32**
	2	Age	2, 858	-15.57	2.29	-.21	.04**	-6.80**
	3	Gender	3,857	-325.81	69.33	-.14	.01**	-4.70**

Note. SOC = stage of change for exercise
 ** $p \leq .01$.

As shown in Table 14 above, the best predictor of exercise behavior was SOC, $F(1, 859) = 128.15$, $p < .000$, which accounted for 14% of the variance in predicting exercise behavior. Age, $F(2, 858) = 90.60$, $p < .000$, and gender, $F(3, 857) = 69.25$, $p < .000$, each added statistically significant explanatory variance to SOC, and the combined variables explained 20% of the variance in exercise behavior.

CHAPTER 4: DISCUSSION

The purpose of this investigation was to answer three broad questions: (1) To what extent has the public health message regarding the health protective effects of increased physical activity been received by Native Americans residing on reservations across Montana? Specifically, is there a belief in exercise as a means to promote health and prevent illness? Exactly how much physical activity are Native Americans across Montana engaging in routinely? And, are self-reported exercise levels predictive of cardiovascular disease, diabetes, obesity, healthcare visits, and perception of health? (2) To what extent are Native Americans in Montana motivated to begin a regular exercise regimen to promote their health and prevent or delay illness? And (3) might the assessment of motivation to exercise improve upon, or perhaps even be a better way to predict health outcome than self-reported activity level?

Results generally supported the hypotheses that higher levels of physical activity predict a lower incidence of poor health outcome. Results partially supported the hypotheses that motivation to exercise (i.e., SOC) is predictive of health outcome. SOC added explanatory variance to three of the five criterion variables predicted by exercise behavior and was a better predictor of hypertension. Furthermore, SOC was found to be the *best* predictor of self-reported exercise behavior. This investigation provides the first large-scale set of systematic data regarding exercise behavior across Native American

communities, and establishes that the predictive relationship between SOC and exercise holds true across the Plains tribes of Montana. The remainder of this discussion will focus on answers to the above questions gleaned from analyses, implications of these findings, limitations on the conclusions that can be drawn from the investigation, and suggestions for future directions.

Exercise Behavior

To what extent has the public health message regarding the health protective effects of increased physical activity been received by Native Americans residing on reservations across Montana? In answer to this first question, it appears that the vast majority (98%) of Native Americans, both young and old, across Montana's seven reservations believe that exercise is instrumental in preventing illness and promoting health. However, the strength of this conviction is questionable. It appears that approximately one-third of the sample holds firm beliefs (i.e. "strongly agree") that regular exercise promotes health and prevents illness, while the remaining two-thirds appear somewhat more tentative in their endorsement of regular exercise (i.e. "agree"). This may explain why, although belief in regular exercise as a means to promote and prevent illness and exercise level were related, they were not predictive of self-reported exercise behavior. Indeed, even respondents who report that they are in the action or maintenance stage of exercise adoption are not entirely convinced that it prevents/delays

illness (only 39% and 42% “strongly agree,” respectively) or promotes health (35% and 38%, respectively).

Exactly how much physical activity are Native Americans across Montana engaging in routinely? It should be noted at the start this survey assessed “physical activity” as activities including traditional exercise behaviors (e.g., basketball, jogging, etc.) as well as laborious activities (e.g. carpentry, mowing the lawn, raking the lawn, shoveling snow, and painting/papering). Most respondents report that they are engaging in regular physical activity, with a sizable minority (26%) stating that they do not exercise at all. This level of inactivity tracks very close to the U.S. population as a whole, where it has been reported that approximately 25% of American adults are sedentary (CDC, 2000). Caucasian Montanans appear to be slightly less sedentary (22%; CDC, 2000). One striking finding relates to the prevalence of sedentary behavior in respondents less than age 45 compared with those 45 years of age and older (Appendix D, p. 161). While females in the older age group are slightly more apt to be sedentary (40% versus 36%), the prevalence of sedentary behavior in across gender is roughly equivalent to sedentary rates in U.S. adults over the age of 65 years (35%; CDC, 2000). However, Native Americans under age 45 years-old were far less likely to be sedentary than respondents in the older group. In fact, across all age groups less than 45 years of age, respondents reported a sedentary lifestyle prevalence rate *lower* than the U.S. population of comparative age (CDC, 2000). As this data is cross-sectional it is unclear whether this

finding represents a trend toward increasing activity levels in future generations or evidence that activity level falls precipitously with age in this population. Another possibility is that there is a greater prevalence of mobility impairments secondary to health conditions such as diabetes (e.g., amputations) among older Native American respondents relative to the U.S. and Montana Caucasian populations. Prevalence of mobility limitation across Montana's reservation communities is unknown, and may be an important barrier to exercise worthy of assessment in future health promotion efforts.

Depending on which standard (CDC or AC SM) is being used to define optimal exercise levels, dramatically differing percentages of respondents meet criteria for recommended physical activity. It appears that less than 1% of respondents reported exercising at a level recommended by the CDC for optimal health. This stands in stark contrast to the U.S. population as a whole where it is estimated that 22% of adults meet CDC recommended levels of exercise (USDHHS, 1999). A closer look at the data suggests that when people are exercising it is with sufficient intensity, but of insufficient *frequency* and duration. Very few respondents exercised with enough frequency (2%) to meet the CDC recommendations, and only 20% exercised for a long enough period of time. However, 55% of respondents reported exercise intensity of at least 4 METs, as per CDC recommendation. It should be noted that the CDC recommendations emphasize that individuals should *accumulate* at least 30 minutes of exercise over the course of the day. That is, one does not have to exercise *continuously* for 30 minutes. This survey did

not assess cumulative activity, but rather continuous activity. Nonetheless, it was the recommendation of exercising at least 5 days a week that resulted in so few respondents meeting the CDC standard.

On the other hand, 11% of respondents reported exercise levels consistent with recommendations by the ACSM. This prevalence is similar to the U.S. population as a whole where it is estimated that 15% of adults meet the ACSM recommended level of exercise (USDHHS, 1999). Specifically, 16% of younger respondents, but only 2% of older respondents, reported exercise levels consistent with recommendations by the ACSM. In summary, older Native Americans in Montana appear to be more sedentary and markedly less active relative to the U.S. population as a whole, while those younger than 45 years-old appear to be slightly less sedentary and more active relative to the average American adult (USDHHS, 1999). Both the younger and older respondents in this sample endorse lifestyle exercise behavior consistent with the CDC recommendations at a markedly lower rate than the U.S. population as a whole.

Again, as this is cross-sectional data, it is not clear whether these findings represent a changing attitude and lifestyle regarding exercise among the younger generations on the reservations in Montana, or if activity level and attitudes on the reservations change as people get older. Contrasting the types of physical activity that are most popular across the older and younger age groups suggests that the older group is much more likely to derive their fitness from less intensive activities. In both groups,

walking is the most popular activity (61% of younger, and 77% of older respondents), followed by gardening (21% and 43%, respectively), and this is consistent with the nation as a whole (USDHHS, 1999). The next most popular activities then diverge between groups: the younger group is more apt to play basketball (15% vs. 1%), lift weights (15% vs. 6%), and bike (10% vs. 6%) than are members of the older group, whereas the older group is more apt to engage in home exercise (11% vs. 5%).

As the two most popular activities across age groups are of moderate intensity (e.g., subthreshold for the ACSM recommendations), exercise promotion efforts may be more effective by emphasizing the CDC recommendations for lifestyle exercise as opposed to ACSM recommendations. An individual assessment of what activities the individual enjoys participating in would be the most appropriate starting place for helping people tailor their behavior for improved health. Providing community level support for more intensive activities for older members of the reservation community may also be facilitative of exercise. The current generation of individuals under the age of 45 years-old may have difficulty maintaining their active lifestyle if there are perceived barriers for older adults to engage in activities such as basketball, weight lifting, or biking.

Traditionally, older Native American adults have been highly respected within the family and community. As an individual ages, it is expected that they have attained wisdom and pass this wisdom to younger generations. Older people within Native American communities are instrumental in instilling value systems within the younger

generations, transmitting cultural history/identity, and providing a model (not necessarily through their own actions) for how to conduct one's life. With diabetes attaining epidemic proportions within the Native American communities, resulting in premature morbidity and mortality, the older generation must feel the weight of responsibility in helping future generations prevent or delay onset of the disease. Indeed, during community meetings on the Crow Reservation, a recurring theme discussed by older members was the need to impart information to the young to prevent the difficulties in health they were experiencing in their older age.

At present, it appears that older Native Americans are not demonstrating, through their actions, that exercise is an important part of healthy living. Prevention efforts have traditionally targeted those at highest risk for developing diabetes and CVD, and this often has resulted in calls for increased focus on children and young adults. While the young are indeed an important group on which to focus health promotion efforts, in a Native American population health promotion targeted to the older generations may also prove to be facilitative of healthy lifestyle for future generations.

Are self-reported exercise levels predictive of cardiovascular disease, diabetes, obesity, healthcare visits, and perception of health? The short answer is absolutely. The best predictor of health problems, obesity, healthcare visits, and perception of health was age. The finding that respondents had more health problems as they got older was not surprising. When age was removed from the model however, exercise was the best

predictor of diabetes, CHD, high cholesterol, perception of health , and obesity.

Although exercise explained, on average, only 4% of the variance, this finding is both statistically and clinically meaningful when the prediction is of a disease that results in premature morbidity and mortality. Furthermore, given the finding that so few older adults were reporting healthful exercise levels, the finding that exercise behavior still was able to explain meaningful variance in health outcome suggests it plays a strong role in health promotion/disease prevention.

It has been established that obesity places people at increased risk for many different chronic health problems including CVD and diabetes. Fully 75% of the total sample was overweight or obese ($BMI \geq 25$), which stands in stark contrast to the 61% national prevalence of overweight and obesity. Thirty-nine percent of the sample reported BMI scores reflecting overweight, and an additional 34% of the sample were classified as obese. In contrast, 35% of the U.S. adult population is overweight and 26% of are obese (USDHHS, 1999). In the adult U.S. population there has been a near doubling of obesity rates from 15% in 1994 to 27% in 1999 (USDHHS, 1999). It is unclear what changes in obesity rates have been occurring among Native American populations in Montana over time, but the present survey findings represent a good marker for future analyses of trends.

Jakicic and associates (1999), conducted an 18-month trial examining the relative utility of accumulated versus continuous activity for achieving and maintaining weight

loss in a sample of overweight women. Although CDC/ACSM recommendations call for an accumulation of at least 60-150 minutes of exercise weekly, these investigators found that initial weight loss gains decayed after 6 months along with exercise behavior, and participant's who were able to maintain their weight loss were exercising about 190 minutes per week. Thus, if the goal is to lose weight and maintain that loss through lifestyle change, the minimum CDC/ACSM recommendations may not be adequate.

Motivation to Exercise

Given knowledge that exercise promotes health and delays/prevents illness, how motivated to exercise are Native Americans from reservation communities across Montana?

In general the vast majority of the sample (86%) is at least thinking about increasing their exercise in the interest of health. Among respondents 45 years and older, almost three times as many people (24%) report they are *not* considering changing their exercise behavior relative to the younger respondents (9%). Forty-four percent of the younger respondents indicated they were exercising regularly, and were content with their current level of exercise compared with one-third of the older respondents (33%). One quarter of younger respondents and one-fifth of older respondents indicated they might make an increase in their exercise behavior within the next month, and another 25% of both groups stated they were contemplating change but were not ready anytime soon. It is interesting to see such a high prevalence of people in the preparation stage of change, as

this is such a brief window of readiness for change (one-month), usually this stage is least frequently endorsed. One possible explanation for this finding is that answering the myriad of health related and exercise specific questions of the BRFSS may have been instrumental in promoting reflection of one's health and health behaviors and increased motivation to change.

The role of exercise behavior in promoting health and preventing illness has been long established. A thorough assessment of self-reported exercise behavior can be cumbersome, time intensive, and historically has been shown to be prone to overestimations (Klesges, Heck, Mellon, Fulliton, Somes, & Hanson, 1990). SOC, on the other hand, is a relatively quick and easy assessment. With SOC, people are not asked to report the details of their physical activity, or lack thereof, and hence there may be more face saving for individuals in reporting that they are at least *thinking* about exercising. Perhaps the central question in this investigation was; *Does motivation to exercise (i.e., SOC) add predictive power to exercise level in the prediction of health problems. perception of one's health status in general (which has consistently been shown to powerfully predict health outcome in large scale epidemiological studies such as the Framingham Heart Study), obesity, or healthcare visits (Please refer to Appendix B for summary of the predictive model)?*

In general, results suggest the answer to this question is a cautious "sometimes." When age was included as a predictor, SOC was a better predictor of obesity and

perception of health status, but it did not contribute meaningful predictions toward any of the other criterion variables. With age excluded from the prediction model, SOC was the only predictor of hypertension, and again contributed 2% explanatory variance in the prediction of health status, but did not contribute otherwise to any of the predictive models. The finding that SOC for exercise, but *not* exercise behavior was predictive of hypertension is an interesting finding, but one that may fit the literature. Exercise is effective in preventing/managing hypertension in some, but not all people (USDHHS, 1999), and the power of exercise to reduce/prevent hypertension may not be as strong as other cardiovascular illnesses. Preliminary evidence suggests that SOC for exercise may be related to improvements in other health related behaviors. Marcus and associates (1999), for example, found that women were much more likely to successfully quit smoking and maintain abstinence 12 months later if they were also exercising. It is possible that SOC for exercise is predictive of hypertension because of its relationship with exercise (which helps *some* people), and other behaviors such as diet and adherence to a medication regimen.

Most importantly, SOC was the *best* predictor of exercise behavior, explaining 14% of the variance. Indeed SOC was a *better* predictor of exercise than was age, gender, education, fatalism, belief in exercise as a means to promote health and prevent illness, obesity, and a history of chronic illness (for which exercise is routinely recommended to

manage). Thus, exercise is the best predictor of health outcome, and SOC in turn, is the most powerful predictor of exercise behavior.

Beliefs regarding the utility of exercise in promoting health and preventing/delaying chronic illnesses, were predictive of cardiovascular-related health (with the exception of hypertension), but did not impact obesity, diabetes, perception of health, frequency of healthcare visits, or (interestingly) exercise behavior. The way in which the survey assessed belief in the health protective effects of exercise was by asking the extent to which one believed that, "Exercise reduces the risk of heart disease, diabetes, and the progression of diabetes." This finding suggests that, although the vast majority of people who participated in this survey believe that CVD and diabetes can be prevented/delayed, even among Native American people, individuals may hold a stronger belief in exercise as a means to promote cardiovascular health. This is supported by the finding that 15% of the sample do not believe that Native American people can prevent themselves from developing diabetes (e.g., fatalism) and an additional 20% reported they were "unsure." By yoking diabetes and cardiovascular disease in this assessment, it is difficult to assess directly beliefs about exercise and diabetes. Despite the fact that one-third of the sample either holds fatalistic beliefs or are uncertain about the power of Native Americans to prevent diabetes, fatalism was not predictive of diabetes or any other health outcome..

Limitations

There is evidence that SOC matched interventions to promote exercise behavior are effective (Marcus, Bock, pinto, Forsyth, Roberts, & Traficante, 1998). However, correct staging must occur before efficacious stage-matched interventions can be delivered. At least two factors may be involved in decreasing the predictive utility of SOC in the present investigation: (1) The current way in which SOC is assessed provides a snapshot of the individuals current motivation without assessment of relapse of exercise adoption (e.g. periods of sedentary behavior and regressions in SOC); and (2) The way SOC was assessed allows for too much subjective interpretation of what defines regular healthy levels of exercise, and allows for increased error in staging due to the wording of the 5 stage statement choices. Each of these factors will be discussed in turn.

The first factor weakening the relationship between activity levels and SOC for exercise is related to the way in which SOC for exercise was assessed in the present study.

In a comparison of eight algorithms of staging intention to exercise, Reed and associates (1997) found that a detailed (longer) definition of “regular exercise” resulted in more conservative staging (i.e., more subjects falling into the precontemplation and contemplation stage) relative to brief definitions. Furthermore, these investigators found that definitions consistent with the CDC’s recommendations (e.g., lifestyle exercise

gathered in short bouts accumulating to 30 minutes at least 5 days a week) resulted in classifying more people in maintenance than did algorithms using the ACSM definition. This comparison yielded recommendations for writing a staging algorithm to include: (1) well defined descriptions of each stage; (2) a complete and clearly defined criterion for regular exercise; (3) the use of measurement criteria that all respondents can understand; and (4) either a true/false or 5 choice format.

These investigators recommended the “LongVig5Choice” algorithm as it resulted in the most reliable and theoretically valid staging of subjects. The LongVig5Choice begins with a long, clear definition consistent with the recommendations of the ACSM, “Exercise includes activities such as brisk walking, jogging, swimming, aerobic dancing, biking, rowing, etc. Activities that are primarily sedentary, such as bowling, or playing golf with a cart, would not be considered exercise. REGULAR EXERCISE = 3 TIMES OR MORE PER WEEK.” Note that this definition provides examples of activities of sufficient intensity for health benefits and activities that are sub threshold. Unfortunately, the creators of this algorithm left out the duration criterion (i.e., at least 20 minutes) from the definition. The definition is then followed by 5 stage choices: (1) Yes, I have been for more than 6 months (maintenance); (2) Yes, I have been for less than 6 months (action); (3) No, but I am planning to start in the next 30 days (preparation); (4) No, but I am planning to start in the next 6 months (contemplation); and (5) No, and I don’t plan to start in the next 6 months (precontemplation). Note that each stage specifies that the

subject either is or is not currently meeting the regular exercise criterion. An additional advantage of this measure is that it begins with the maintenance stage, which may reduce the likelihood of respondents who are currently exercising regularly endorsing precontemplation mistakenly trying to indicate that they are not planning on changing their exercise habits.

In contrast, for the purpose of this investigation exercise was defined two pages prior to the stages items as: "We consider regular exercise to be any physical activity that you perform three times a week for 30 minutes at a time, or 5 times a week for 20 minutes at a time." This definition appears to have been an attempt to incorporate both the CDC and ACSM recommendations in a simplistic, easy to understand manner. However, it appears that the duration criteria were crossed, it should have read three times a week for 20 minutes or five times a week for an accumulation of 30 minutes..." Furthermore, this definition is brief, primarily because it leaves out a description of the intensity criteria, allowing for too much subjective interpretation of what constitutes healthy levels of exercise. This problem is presented by the finding that 32% of those in the action stage and 35% of those in the maintenance stage believe they are exercising to "improve my health," when in fact they are not meeting the recommended exercise levels for meaningful health benefit.

A deconstruction of the ACSM criteria illustrates that 22% of those in action and 12% of those in maintenance SOC are not exercising at least 3 occasions per week; 15%

of those in action and 9% of those in the maintenance SOC do not exercise for at least 20 minutes per occasion; and 83% and 73% of those in action and maintenance, respectively, do not exercise with enough intensity (i.e., 8.0 METs). Reed and associates began their recommended algorithm with examples of activities representing intensity levels sufficient for health benefits. Future investigations of exercise behavior of Native American people in Montana may utilize the data from this study regarding most frequently engaged in activities (in the Spring season) as examples for above and below threshold activities respective to lifestyle exercise (CDC) and vigorous exercise (ACSM) recommendations.

An additional shortcoming of the SOC algorithm used in this investigation involved the staging choices: “(1) I am not thinking about becoming more active or doing more exercise to improve my health (precontemplation); (2) I am thinking about becoming more active or getting more exercise to improve my health, but I haven’t made a change yet (contemplation); (3) I have been thinking about being more active or getting more exercise to improve my health and I will in the next month (preparation); (4) I have become more active and am getting more exercise to improve my health (action); and (5) I have made changes in my exercise and activity level over a year ago and I am keeping to it. (maintenance).” It is conceivable that an individual may be regularly active as defined by the CDC/ACSM recommendations and yet still endorse the statement, “I am thinking about being more active or getting more exercise to improve my health, but I

haven't made a change yet (i.e., contemplation stage)." The same individual could equally endorse the precontemplation or the preparation statement. In this investigation, of those reporting exercise behavior sufficient for ACSM recommendations criteria, 5% endorsed the precontemplation statement, 18% endorsed the contemplation statement, and 22% endorsed the preparation statement. To try to improve the accuracy of SOC respondents are told to endorse the statement that, "describes you the best," but a better means may be to begin the precontemplation, contemplation, and preparation statements with, "I am currently not a regular exerciser but, . . .," or with the five choice wording of the LongVig5Choice algorithm described above.

With SOC for exercise currently assessed by asking respondents if they are thinking of "getting more exercise to improve (their) health," the collection of data regarding motivation to exercise at a level that actually translates into, or predicts improved health is obscured. Respondents may provide more accurate information if they clearly know the activity threshold for improving health. Without this educational clarification the danger is that some individuals may yield minimal benefits despite their efforts. Furthermore, a failure to notice benefits may in turn make one more vulnerable to a lapse into a more sedentary lifestyle. Furthermore, accurate staging is a requisite of stage-matched interventions to promote healthy exercise behavior. An individualized understanding of where an individual is falling short of the recommended criteria may be beneficial feedback facilitative of health promoting change.

The second factor decreasing the predictive utility of SOC regarding health outcome in the present investigation involves an unclear understanding of the nature of “consistent, regular exercise.” Exercise was found to consistently be the best predictor of the criterion variables. Although there was a significant correlation between SOC for exercise and exercise behavior, it was not strong enough for SOC to add much in the way of predictive power in explaining variance in health outcome to self-reported exercise behavior. If respondents are accurately reporting that they are exercising (i.e. action and maintenance SOC), or not yet exercising (i.e. precontemplation, contemplation and preparation) there should be a strong relationship between SOC and self-reported physical activity levels and between SOC and health outcome. The predictive relationship between SOC and exercise behavior may have been weakened by the above described factors.

Regarding the association between SOC for exercise and health outcome, the only SOC levels in which overt healthy behaviors are consistently occurring, by and large, are the action and maintenance stages of change. However, even individuals who are in the action stage, who are actively exercising, have been doing so for less than 12 months (in this study maintenance was defined as 12 months of exercise maintained), and this may not translate to health benefits yet. One might assume that primarily those in the maintenance stage, who have been engaging in a consistent and prolonged exercise regimen over time might be expected to evidence fewer health problems. Indeed, for

adults, successful adoption of an active lifestyle is generally defined as occurring when a previously sedentary person meets CDC/ACSM recommendations for regular physical activity for at least 6 months (Pate et al., 1995). In other words, the marker of successful change has traditionally been the maintenance stage. The other three stages involve the consideration of beginning an exercise regimen, and are thus motivational precursors to overt change. To state the obvious, thinking about exercising should not be expected to be as health promoting as actual consistent exercise behavior. However, Prochaska, DiClemente and Norcross (1992) have described the change process as cyclical as opposed to linear, with individuals progressing through the stages, relapsing into earlier stages and progressing again toward maintenance.

Marcus and associates (2000) cite a personal communication with J.M. Jakicic (1998) regarding a study of the exercise behavior of 7,135 YMCA members, in which the average member evidenced 4.8 lapses per year (defined as at least 7 consecutive days of non-attendance), with 36 days being the average length of the lapse. This suggests that periods of inactivity may be common even among regular exercisers. Thus a regular exerciser, who would otherwise be in the action or maintenance stage of exercise adoption, but is in the midst of a sedentary period/lapse, may fall into the preparation or even contemplation stage. In this example, the individual may demonstrate good health, despite the appearance of relative inactivity and modest intention to change. Without a clearer understanding of the individuals cycle through the stages of change, relapses, and

length of time in which an exercise regimen has been maintained, SOC as a predictor of health outcome is clouded and weakened.

Marcus and associates (2000) have called for research to illuminate the factors involved in maintenance and relapse of healthy physical activity. One way in which investigators may clarify this issue is to ask participants specifically about their history of exercise behavior: Have they *ever* engaged in regular exercise consistent with CDC/ACSM recommendations, and if so, when? What is the longest period of time they have maintained a healthy exercise regimen? If in maintenance SOC, in the past 6 months how often did they lapse into sedentary behavior, and for how long did this lapse last? Retrospective collection of this information may be prone to errors, ideally this information would be collected prospectively, perhaps as part of routine follow-up following an intervention designed to promote exercise behavior. If the intervention involves exercising with a group, perhaps attendance could be tracked, and lapses could be both investigated and reduced.

In addition to staging subjects accurately, it is important to collect physical activity information that is valid. The problems inherent in collecting retrospective, self-report physical activity behavior have been well documented elsewhere (Klesges, et al., 1990). To increase the validity of self-report data researchers have generally assessed retrospective activity varying from the previous week to the previous month. Such a “snapshot” of activity level may not be generalizable to longer time periods (e.g., the

entire year). For the purpose of this investigation, exercise behavior during the “past month” was collected. Weather varies tremendously in Montana and greatly influences the types of activities in which people engage. One may be an avid gardener and walker when the weather is warm, but relatively sedentary when winter and snow arrive. This data set was collected during the spring months prior to the summer pow-wow season to maximize the availability of participants, as many Native Americans travel to take part in pow-wow celebrations. Individuals who dance during pow-wow celebrations may be motivated to begin to increase exercise within the next month (preparation stage) because they want to improve their fitness prior to pow-wow. Therefore, physical activity and SOC for exercise occurring in the Spring season may be different than that which occurs during other seasons.

Finally, the results of this investigation, suggesting low rates of healthy exercise behavior, a high incidence of overweight and obesity, and related health problems is likely an underestimate, as this information was collected via telephone survey. It is unknown how many Native American households across Montana’s reservations do not have telephones, but one might safely assume that households without telephones may be more isolated and impoverished and therefore have members with greater health problems.

Future Directions

The results of this investigation suggest that motivational factors are important in the lifestyle change process. Future research efforts should be directed toward improving our understanding of exercise behavior across seasons among Native Americans in Montana, improving our understanding of the relapse process among regular exercisers, and tracking exercise behavior longitudinally to illuminate the natural history of physical activity change. In addition, investigators may explore methods of increasing the predictive utility of SOC for exercise. Accurate staging of respondents might be achieved by creating a staging algorithm similar to the LongVig5Choice (Reed, Velicer, Prochaska, Rossi, & Marcus, 1997). Randomized, controlled trials aimed at determining the delivery channels most facilitative of healthy exercise behavior adoption and maintenance in Native American communities, with long-term follow-up to track lapses and maximize long-term change is greatly needed.

This investigation provides preliminary evidence to suggest that motivation to exercise is the best predictor of exercise behavior, which in turn is a meaningful predictor of health. Therefore, in developing efficacious lifestyle change interventions in Native American communities, motivation to adopt a new lifestyle may be a central point of focus. Specifically, barriers to exercise should be identified, strengths should be incorporated, and motivation to change may be used to inform the intervention process. The remainder of this discussion expands on possible future directions for the

development and implementation of healthy lifestyle interventions within Native American communities.

Barriers to Physical Activity Promotion and Obesity Prevention Efforts in Native American Communities.

There are a number of potential barriers to exercise promotion/obesity prevention efforts that are unique to Native American communities. For five-hundred years, Native American people have been subjected to oppression by the dominant White culture, manifested in dehumanizing descriptors (e.g. “uncivilized”), disease and genocidal warfare, forced relocation, broken treaties, distorted portrayals in Hollywood, coerced efforts at assimilation, and cultural genocide (Sutton & Broken Nose, 1996; Tafoya & Del Vecchio, 1989). Native people’s experiences with health care providers have often been marred by racism, and such attempts at “help” often involved missionaries, teachers, and social workers forcing the dominant culture’s value systems, while divorcing Native people from the strength and support of their own people and traditions (La Fromboise, Trimble, & Mohat, 1990).

Understandably, a healthy level of skepticism may be directed toward a Western-based lifestyle intervention. La Fromboise and associates (1990) report that Native American people seek out treatment hoping that an expert can provide concrete, practical advice about their difficulties while being sensitive to the individual’s cultural beliefs.

Sutton & Broken Nose (1996) suggest that “culturally sensitive, non-directive approaches that incorporate storytelling and the use of metaphor,” are preferred. Furthermore, it is important to facilitate individual lifestyle change within the greater family and community context. Interventions that focus on individual change while ignoring the broader implications for family relationships may run blindly into powerful impediments.

Differences in beliefs, values, family structure and obligations, and communicative style between the dominant culture and Native American culture are important factors to accurately understand in a lifestyle intervention. For example, quiet listening and reflection may reflect a respectful communicative style, but could be misconstrued as resistance by providers not accustomed to this cultural expression. There may be unique familial obligations that one familiar with the culture can address if the individual does not identify this as a potential barrier or source of facilitation in change. In addition, many Native American people speak both English and their native language. An interventionist capable and comfortable in conducting the intervention in either the native language or English may be better able to establish a collaborative relationship and communicate the value in utilizing cultural strengths in change.

Previous investigators have reported a number of environmental barriers to exercise. One such barrier specific to reservation living involves fear of stray dogs. Many reservations have a large number of stray dogs, that roam in packs and are both wild and relatively unafraid of humans. Fear of dogs has been sighted as a potential

barrier to exercise, if such exercise entails walking or jogging around the community (Acton & Fiore, 1996). Sugarman and associates (1993) have identified lack of motorized transportation as a barrier to completion of treatment for retinopathy in elder Navajo (Sugarman, Bauer, barber, Hayes, and Hughes, 1993). However, Daskivich (1997) did not find that transportation barriers greatly affected exercise behavior in his investigation on the Flathead Reservation in Western Montana. Interventions in Native American communities may benefit from the anticipation of barriers, such that navigation around potential obstacles can occur.

This investigation suggests that environmental barriers are not the *most* important obstacles to regular exercise in this population. To the contrary, respondents who are presently not exercising regularly report that the most powerful barriers to exercise are motivational in nature. Thirty-eight percent of respondents not exercising regularly cited lack of time as the most important barrier to exercise. The next most frequently endorsed barrier, endorsed by 10% of respondents not presently exercising regularly, was feeling “lazy,” followed by 8% indicating they are “too tired or exhausted.” In contrast, less than 1% of the sample endorsed any of the following barriers: diabetes, cancer, safety concerns related to violence, traffic, dogs, or lack of sidewalks; embarrassment/self-consciousness, lack of others to exercise with, lack of skills/knowledge, fear of injury or lack of a convenient place to exercise. This is not to say that environmental barriers are

not important, but rather that they are rarely endorsed as the *most* important barrier to exercise in this sample.

Prevention in a Native American Community

Native American people bring to a prevention effort a number of important strengths that can be utilized to facilitate healthy lifestyle change. Family and community are extremely important. Native American people feel a strong sense of responsibility to the family, and an obligation to dutifully honor their role within the family (Sutton & Broken Nose, 1996). Listening and collaboration are highly valued, as opposed to a directive, confrontational communicative style, as powerfully stated by an Eskimo man:

My grandmother always told me that the white man never listens to anyone, but expects everyone to listen to him. So, we listen! My father always told me that an Eskimo is a listener. We have survived here because we know how to listen. The white people in the lower forty-eight talk. They are like the wind, they sweep over everything. (Coles, 1978, cited in Sutton & Broken Nose, 1996, p.37).

Therefore, an intervention that emphasizes respect for the individual and family, while utilizing the participant's diabetes specific experiences and expertise will be likely to be more facilitative than a non-collaborative approach in which the interventionist is the only one with relevant expertise in lifestyle change. However, standard lifestyle change interventions have involved education combined with a prescribed regimen

(Narayan, Hoskin, Kozak, Krista, Hanson, Pettitt, Nagi, Bennett, & Knowler, 1998; Newman, Hollevoet, Frohlich, 1993; Swinburn, Walter, Arroll, Tilyard, & Russell, 1988).

While secondary prevention interventions, targeted toward Native American people with multiple diabetes-related risk factors, in the last two decades have attempted to include the community and approach the intervention in a culturally relevant and sensitive manner, few have explicitly utilized cultural strengths and traditions to facilitate motivation to address lifestyle change (Carter, Pugh, & Monterrosa, 1996; Lang, 1985; Narayan, et al., 1998; Newman, et al., 1988; Perez, 1998). Narayan and associates (1998) conducted a randomized clinical trial with obese, diabetes at-risk, Pima adults. These investigators compared a behaviorally-based intervention (Pima Action) targeting diet and exercise with a cultural-strength oriented intervention (Pima Pride) involving discussion of Pima culture and history, current lifestyle, and self-directed learning supported by basic printed information on healthy eating and exercise.

The Pima Pride intervention, over a one-year follow-up, was more effective at preventing weight gain and glucose tolerance than the Pima Action intervention. However, neither intervention achieved weight loss, and the investigators noted that an intervention conducted within the context of the individual's family may have had improved efficacy. Curiously, the Pima Pride intervention, which did not specifically, intensively target diet and exercise change, achieved changes in these areas comparable to

those in the Pima Action group. This suggests that enhancing motivation to make lifestyle changes can prompt self-change without intensive “how-to” instruction.

Despite targeted recruitment efforts, the interventions were only able to attract less than a third of those eligible for participation in the community. The investigators report that women and those higher in degree of obesity were more likely to volunteer for participation. This suggests that those who perceive their risk of developing diabetes to be higher may be more inclined to pursue lifestyle change to address these risks relative to those who perceive themselves to be at less risk of developing the disease. Perceived risk for diabetes may be an interesting variable to track during the course of a lifestyle change intervention. Transportation and childcare were also mentioned as frequent barriers to participation. An intervention conducted within the home, that invites family participation may be an effective means of involving those low in motivation, while addressing social, transportation and childcare barriers.

An intervention approach called motivational interviewing may be particularly effective in Native American communities. This approach emphasizes collaboration and respect for the participant. It recognizes the participant as having relevant expertise, and it combines La Fromboise and associates' (1990) recommendation for interventionists to have expertise, concrete, practical suggestions and cultural sensitivity with Sutton and Broken Nose's (1996) advice that interventionists be non-directive. It does this by assisting those low in motivation in exploring (in a way that at least *feels* non-directive)

why change is important specifically to the individual, facilitated by a non-confrontational, warm working relationship; and helping those high in motivation in developing *how* to change through concrete, practical suggestions.

Indeed, Lang (1985) reports that her ethnographic interviews with the Dakota people revealed that,

diabetes is perceived as another imposition on Indian people by Europeans or “whites,” and dietary regimens are perceived as telling people how to live their lives...the diabetic diets (along with other dietary regimens prescribed) invade a most personal and socially important area – eating habits... Low compliance with prescribed diets is not because of incompatible perspectives between one medical system and another regarding the desirability of health, nor an inability to change dietary patterns, but can be understood as a statement of recalled history and on-going Indian-white relations. (Lang, 1985, pp. 255-256).

Good Tracks (1976) has written that Native American people in psychotherapy may perceive the therapist as, “an authority figure representing a coercive institution and an alien dominating and undesirable culture” (p.57). In contrast, the narrative approach emphasizes respect and empowerment, and fosters a spirit of collaboration (O’Hanlon, 1994). The expertise of the individual is explicitly acknowledged and utilized, and the hierarchical nature of the helping relationship is leveled. White and Epston (1990) have written that intervention is warranted when people become identified with their problems and subjected to a “dominant narrative” that disqualifies, limits, denies, or constrains their life choices. Attempts to make interventions culturally specific to minorities have

been rare. Foreyt (1995) in his review of treatment of obesity in minority populations has recommended,

Interventions that exploit intergenerational ties may be more effective than more conventional approaches... The church, in relation to food habits, the extended family, and other social factors, may play a more prominent role with many minorities than is currently emphasized... a didactic approach may be less effective with members of minority groups than more indirect strategies, such as emphasizing story telling, more role playing, linking of folk beliefs to current scientific facts, sharing experiences, and more active learner participation. (Foreyt, 1995, p. 538)

Motivational Interviewing

Given the finding that only 16% of respondents under the age of 45 and 2% of those 45 and older across Montana's seven reservations are currently engaged in a regular regimen of exercise, most people are in an earlier stage of readiness for change. Indeed, 38% of respondents reported that they were either precontemplators or in the contemplation stage of exercise adoption. Too often lifestyle interventions are geared toward those in the action stage of change only, designed to actively alter behavior (e.g. change diet) during the intervention. These action oriented approaches work well for those in the action stage of change, but if one does not recognize that there is a problem to address, or is only beginning to think about change, one is not likely to participate (Prochaska, Norcross, Fowler, Follick, & Abrams, 1992). Given that people vary in their readiness for change, an intervention that facilitates change by matching one's stage of change with relevant change processes will benefit more people.

Miller and Rollnick (1991) have developed a brief (typically from 1 to five sessions) interviewing approach called *motivational interviewing* (MI) that specifically targets the progression through stages of readiness to change. MI was initially developed for the treatment of people with alcohol problems (Miller, 1983). Although the approach continues to be applied primarily to addictive behaviors, increasingly its utility across other problem behaviors is being demonstrated, including HIV risk reduction (Baker & Dixon, 1991), sex offenses, (Garland & Dougher, 1991), pain management, (Jensen, in Press), and adherence to diabetes regimen, (Stott, Rollnick, Rees, & Pill, 1995; Trigwell, Grant, & House, 1997).

MI is characterized by a combination of interviewer style (e.g. warmth, empathy, and respect for the client) and technique (e.g. facilitative questioning, rolling with resistance, and reflective listening; Miller, 1996). Ambivalence is assumed to be at the heart of all considerations of change, and working with this ambivalence represents the process by which people successfully change (Miller & Rollnick, 1991). Ambivalence is characterized by a recognition that there are both positive and negative consequences to change. When interviewers, and concerned others, push the positive reasons for change, the individual often counters with the negatives (e.g. “Yes, but...”).

While this ambivalence is normal, acceptable, and understandable from a MI perspective, others often view the client as “resistant” or “in denial,” both of which can carry quite negative connotations reflecting the concerned other’s frustration and feelings

of powerlessness. Miller and Rollnick (1991) suggest that this “confrontation-denial spiral” is in essence an acting-out of the individual’s inner conflict. Instead, the present approach involves a collaborative effort in which the interviewer, in a non-confrontational manner, facilitates exploration and resolution of the ambivalence involved in change. The interventionist carefully avoids the traditional confrontational approach in which the interviewer asserts the need to change while the client denies it. The interventionist does not seek to persuade directly, but rather systematically elicits from the participant the reasons for concern and for change, reinforces these reasons, while maintaining a general atmosphere of warmth and support (Miller & Rollnick, 1991).

Resistance is not addressed directly, but is adeptly deflected to facilitate further exploration of the individual’s ambivalence. When the individual asserts a powerful reason to not change, the interviewer acknowledges this with reflective listening, and in this way joins the client freeing him/her to continue exploring the reasons for change. In the backdrop, the interventionist is skillfully helping the client develop a discrepancy between present behavior and desired goals for the future, based on evidence that such a discrepancy facilitates behavior change (Miller, 1996; Miller & Rollnick, 1991). The overall goal is to guide the participant in increasing their intrinsic motivation for change, and ultimately it is the client who presents the arguments for change, not the interventionist (Miller & Rollnick, 1991).

Within the alcohol abuse domain, MI's utility has been well demonstrated. In over two dozen randomized trials brief motivational interventions addressing problem drinking have been shown to produce significantly improved outcome relative to untreated controls, and equivalent to those treated more extensively (Bien, Miller, & Tonigan, 1993). It appears that these brief interventions all have in common the use of six elements summarized by the acronym FRAMES (Miller & Sanchez, 1994). That is, most included use of individualized *Feedback*, emphasis on personal *Responsibility* as a matter of free choice in making changes, and some form of direct *Advice* about making changes in drinking behavior. Many offered a *Menu* of change options, an *Empathic* therapeutic style, and efforts to increase the individual's *Self-efficacy* for change through positive reinforcement of optimism and the ability to successfully make changes. Direct confrontation behaviors such as arguing, disagreeing, and emphasizing evidence of impairment have been shown to yield increased resistance from clients, which predicts poorer outcomes at one-year follow-up compared to non-confrontational interventionist styles that emphasized listening and reframing (Miller, Benefield, and Tonigan, 1993).

While efforts to investigate the utility and generalizability of MI in the treatment of alcohol abuse continues, increasingly the approach is being applied to other behaviors of concern. Health care workers typically give advice about the need for patients to increase exercise, medication adherence, and healthful eating, and to decrease their drinking, smoking, drug-use, and consumption of high-fat foods. However, patients

appear to have doubts about being “told what to do” by their health care providers (Stott & Pill, 1990).

Practitioners of MI have recognized that, while patients may be receiving care for matters unrelated to smoking, diet, drinking, or exercise (e.g. stitches or general health check-ups), these meetings are “teachable moments” for brief, lifestyle change interventions. Rollnick and Heather (1992) developed a 5-15 minute MI, stage-matched, intervention for use by health practitioners in medical settings. Borrelli and colleagues (1999) are in the midst of training public health nurses to deliver a 15-30 minute MI intervention targeting smoking cessation while making home visits to follow-up on physical rehabilitation regimens.

Dieticians are exploring motivational strategies to utilize in counseling individuals with diabetes (Brown, Pope, Hunt, and Tolman, 1998). Stott and associates (1996) have trained family doctors and nurses in using MI in their work with Type 2 diabetics, and followed the response to training for three years. At three year follow-up, 90% of practitioners agreed or strongly agreed that these skills have been helpful in their practice (Stott, Rees, Rollnick, Pill, and Hackett, 1996). As a precursor to implementing an MI brief intervention in the treatment of diabetes, Trigwell and associates (1997) evaluated the relationship between motivation (using the Stages of Change Readiness and Treatment Eagerness Scale, SOCRATES) and glycemic control (Using HbA1C level). These investigators found that those with poorer glycemic control were more motivated

to make changes, suggesting that, “feedback of HbA1C level may partly determine the patient’s motivation to control their diabetes.” However, the effect of feedback of HbA1C level alone was quite weak (Trigwell, Grant, and House, 1997). In short, this is an exciting and promising time for applications of MI to lifestyle change.

Oral Tradition and Story-Telling

Native American elders are highly respected within the family and community, and as an individual ages, they are expected to attain wisdom and behave accordingly. This wisdom is passed along to the younger generations. Historically, wisdom about how to live one’s life responsibly and honorably to protect the collective harmony of the tribe, was passed along through storytelling (Linderman, 1996; Lowie, 1935).

The Trickster

The trickster figure stands as an example of the teaching and learning that was a part of the oral tradition of tribes of the plains, and is illustrated through the traditions of the Crow. When the Crow separated from the Hidatsa early in the eighteenth century, the cunning trickster figure, Old-man-coyote began to be discussed as the creator or “first-worker” (Voget, 1996). As the creator of the Crow he was responsible for the punishment of recipients of medicine gifts who did not show proper respect and gratitude, as well as those who broke medicine taboos. However, he did not punish material or moral transgressions. Old-man-coyote represented a Crow Everyman, inspired by a lusty,

hedonistic enjoyment of life. His misadventures depicted him as greedily pursuing food to satisfy an insatiable appetite, behaving foolishly, relishing cunning trickery of humans (which often fails), lusting after pretty women including forbidden daughters and mothers-in-law, and generally exhibiting human weaknesses discouraged by the tribe (Voget, 1996).

Voget (1996) writes that Old-man-coyote was not a simple buffoon.

Being smart and powerful had great appeal, for outwitting the enemy was an ever-present challenge for survival... Old-man-coyote's deceptions and misadventures that Crows, as they laughed at the troubles he had hatched for himself, must have sensed in their own lives... There were lessons to be learned. Despite elaborate plans to fool someone, he often wound up the loser; but his adventures also instructed people in survival and how to get along together. Children learned from Old-man-coyote's behavior that a man who tried to marry his daughters or have sex with his mother-in-law would be laughed at and run out of camp. (Voget, 1996, p.4).

Through Old-man-coyote stories, the Crow learned that the trickster takes advantage of the lack of knowledge in his victims, driving buffalo over a precipice because they were unfamiliar with the land, where he was able to maneuver them into the blinding Sun, for example. His trickery reminded the Crow that naïve trust made victims of those who closed their eyes to what was going on around them. He counseled that brothers should stand together firm, but then ignores his own advice and works at separating people and fostering distrust (Linderman, 1996). The Trickster was ever present and capable of shifting to various animal forms to evade detection (Voget, 1996).

During the last century Crow views of Old-man coyote have changed with the times. Earlier in the century, he was described as a kind of teacher who revealed in his

behavior that the greedy and lecherous would be discovered, ridiculed and punished.

Later, he was promoted by missionaries as the right hand of the creator and explained life as Jesus explained God's way. By the 1940s, he was again taking on properties of a mischievous person who enjoyed tricking people. Presently, the Crow Head Start program, teaching about Crow cultural heritage, depicts his adventures as little more than fairy tales, and families might tell a mischievous child that she is up to tricks just like Old-man coyote (Voget, 1996). He is no longer thought of as creator, and has been replaced by a Christian God, and He-Who-First-Made-All-Things (Voget, 1996). Reportedly, there are a number of Crow elders who are attempting to keep alive the stories of Old-Man-Coyote on the Crow reservation (personal communication, Crow Advisory Board, 1998).

The Trickster figure appears to be as old as time, and has cropped up across cultures around the world through the ages (Jung, 1956). Trickster figures abound in African oral traditions, as well as those of the aboriginal people of Australia. The ancient Greek figure, Hermes, was a trickster, as is some aspects of the Christian Devil, and of the Old Testament Yahweh (Jung, 1956). It appears that most of the American Indian Plains tribes told trickster stories as well. Jung (1956, p. 202) suggests that the trickster figure represents a "collective shadow" that represents a personification and externalization of qualities recognized within individuals and deemed contemptuously beneath the group. Furthermore, he argues that trickster stories are sustained because

they represent the best and most successful way of keeping the shadow figure conscious in order to subject it to conscious criticism.

This rich tradition of using the Trickster figure as a way to convey cultural values can be utilized in healthy lifestyle promotion efforts. In focus groups, Native American people have reported feelings of shame, helplessness, and hopelessness regarding diabetes, and the difficulties of adhering to a healthy lifestyle regimen are attributed to personal weakness. Furthermore, this internalization has contributed to secretiveness about the disease (Acton & Fiore, 1996). Thus, internalized feelings of shame, anger, and helplessness, may contribute to avoidance of addressing lifestyle concerns, and divorce some Native American people from potential helping relationships in their community, critical to facilitating and maintaining change. Narrative theory offers an additional relevant philosophical stance for intervention and suggests ways to strategically utilize Native American cultural strengths of the externalized Trickster.

Narrative Theory and Approaches to Intervention

Narrative theory, a relatively new constructivist approach to psychotherapy, evolved from an understanding that we live in a post-modern world, characterized by increased exchange of information, and the acknowledgment that there are many beliefs, multiple realities, and an exhilarating yet daunting profusion of worldviews, each of which is socially constructed (Neimeyer, 1993). Socially constituted “realities” vary

across cultures, subcultures, times, and circumstances, and are anchored in our assumptions, not in a “bed-rock of truth” (Neimeyer, 1993).

The failure of dominant cultural groups to acknowledge and respect these differences, in addition to causing problems for the members of the dominant culture themselves, can contribute to Native people’s sense of disempowerment, as Western-trained health care providers take authority for the health of the individual. The Irish family therapists Imelda Mccarthy, Nollaig Byrne, and Phil Kearney have asserted that, regardless of what culture they are working with, “too often therapists “colonize” their clients, like countries occupied by more powerful nations, teaching clients to devalue their own language, expertise, and knowledge in favor of the therapists view of things” (O’Hanlon, 1994, p. 23).

Indeed, Lang (1985) reports that her ethnographic interviews with the Dakota people revealed that,

diabetes is perceived as another imposition on Indian people by Europeans or “whites,” and dietary regimens are perceived as telling people how to live their lives...the diabetic diets (along with other dietary regimens prescribed) invade a most personal and socially important area – eating habits... Low compliance with prescribed diets is not because of incompatible perspectives between one medical system and another regarding the desirability of health, nor an inability to change dietary patterns, but can be understood as a statement of recalled history and on-going Indian-white relations. (Lang, 1985, pp. 255-256).

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In contrast, the narrative approach emphasizes respect and empowerment, and fosters a spirit of collaboration (O’Hanlon, 1994). The expertise of the individual is explicitly acknowledged and utilized, and the hierarchical nature of the helping relationship is leveled. White and Epston (1990) have written that intervention is warranted when people become identified with their problems and subjected to a “dominant narrative” that disqualifies, limits, denies, or constrains their life choices. To assist the individual in liberation from these “unitary knowledges” that dominate their lives these therapists externalize the problem and collaboratively work with the individual to challenge the problem’s story (Neimeyer, 1993). Indeed, the core assumption in narrative approaches is that the person is not the problem, the problem is the problem (O’Hanlon, 1994). White and Epston (1990) define and often anthropomorphize the problem behavior as something external to the individual, and through this distancing of the problem, the individual and interventionist are afforded the opportunity to join forces against the problem. The problem can become a metaphoric opponent that can be challenged by the individual.

The process of externalizing the problem has a number of strategic steps. After the problem is personified, the interventionist can begin to explore the problem’s

oppressive intentions; the history of the problem; the false promises made by the problem; situations where the problem has a greater influence; times when the person has demonstrated resistance to the problem; and forces in the person's life that both help and fight against the problem (O'Hanlon, 1994).

The narrative approach and motivational interviewing share similar philosophical bases. Both emphasize a non-confrontational, collaborative approach in which the individual is encouraged to challenge current behavior within a warm, supportive environment. The expertise of the participant is highlighted, and the hierarchical nature of the relationship is leveled. This philosophical stance, emphasizing empowerment and respect for the participant, while working in a collaborative rather than authoritarian manner, may be well received by Native American people of Montana as it is honoring rather than discounting of their voice.

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APPENDIX A: 1999 AMERICAN INDIAN SURVEY

INTRODUCTION - 1999 AMERICAN INDIAN SURVEY

Hello, I'm _____ calling for the Montana Department of Public Health and Human Services. We're doing a study of the health practices of American Indians on Montana's seven Reservations.

1) Is this an American Indian household?

Yes -- Continue

No -- Stop!! We are only interviewing American Indians at this time. Thank you. Goodbye.

Your phone number has been chosen randomly to be included in this study, and we'd like to ask some questions about things people do which may affect their health.

2) Have I reached xxx-xxxx?

Yes -- Continue

No -- Stop!! I'm sorry, I must have misdialed. Goodbye.

3) And, is this a residential number?

Yes -- Continue

No -- Stop! I'm sorry, I was trying to reach a residential number. Thank you. Goodbye.

I would like to stress that we are not trying to sell you anything. The information we are collecting is intended to help the Tribes of Montana in organizing prevention efforts for illnesses such as diabetes and heart disease.

4) Our study requires that we randomly select one American Indian adult who lives in your household to be interviewed. How many American Indian members of your household, including yourself, are 18 years of age and older?

AFTER SELECTION, CORRECT RESPONDENT COMES TO PHONE: Hello, this is calling for the Montana Department of Public Health and Human Services. We're doing a study of the health practices of American Indians on Montana's seven Reservations. Your phone number has been chosen randomly to be included in this study, and we'd like to ask some questions about things people do which may affect their health. I would like to stress that we are not trying to sell you anything. The information we are collecting is intended to help the Tribes of Montana in organizing prevention efforts for illnesses such as diabetes and heart disease.

1. Health Status:

1.1 Would you say that, in general, your health is: Excellent, Very good, Good, Fair, or Poor?

1. Excellent
2. Very good
3. Good
4. Fair
5. Poor
7. Don't know/Not Sure
9. Refused

1.2 Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?

__Enter Number of days

88. None
77. Don't know/Not sure
99. Refused

1.3 Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?

__Enter Number of days

88. None
77. Don't know/Not sure
99. Refused

1.4 During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

__Enter Number of days

88. None
77. Don't know/Not sure
99. Refused

2. Adult Immunizations:

Now I would like to ask you a few question about adult immunizations.

2.1 During the past 12 months, have you had a Flu shot?

1. Yes
2. No – Skip to 2.3
7. Don't know/Not sure – Skip to 2.3
9. Refused – Skip to 2.3

2.2 Where did you receive the flu shot? Was it at: a private doctor's office, Indian Health Service or Tribal Health Services office or clinic, a public health clinic, a senior center, a grocery or retail store, or at some other site?

1. Private doctor's office – Skip to 2.5
2. Indian Health Service or Tribal Health Services office or clinic – Skip to 2.5
3. Public Health clinic – Skip to 2.5
4. Senior center – Skip to 2.5
5. Grocery or retail store – Skip to 2.5
6. Other site – Skip to 2.5
7. Don't know/Not sure – Skip to 2.5
9. Refused – Skip to 2.5

2.3 Has a health care professional ever recommended that you receive a yearly Flu shot?

1. Yes -- Skip to 2.5
2. No
7. Don't know/Not sure
9. Refused

2.4 If the health care professional that you regularly see recommended that you receive a Flu shot, would you get vaccinated?

1. Yes
2. No
1. Don't have a regular health care professional
7. Don't know/Not sure
9. Refused

2.5 There is another vaccine for older adults called the pneumococcal or pneumonia vaccine. Have you ever heard of the pneumococcal or pneumonia vaccine?

1. Yes
2. No – Skip to 3.1
7. Don't know/Not sure – Skip to 3.1
9. Refused – Skip to 3.1

2.6 Have you ever had a pneumococcal vaccination, sometimes called a pneumonia shot?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

3. Hypertension, cholesterol & other chronic conditions:

The next few questions are about chronic diseases such as high blood pressure.

3.1 About how long has it been since you last had your blood pressure taken by a doctor, nurse, or other health care professional?

1. Within the past 6 months (1 to 6 months ago)
2. Within the past year (6 to 12 months ago)
3. Within the past 2 years (1 to 2 years ago)
4. Within the past 5 years (2 to 5 years ago)
5. 5 or more years ago
8. Never
7. Don't know/Not sure
9. Refused

3.2 Have you ever been told by a doctor or health care professional that you have hypertension, sometimes called high blood pressure?

1. Yes
2. No – Skip to 3.6
3. Borderline
4. Only during pregnancy – Skip to 3.6
7. Don't know/Not sure – Skip to 3.6
9. Refused – Skip to 3.6

3.3 Are you now taking any medication to control your blood pressure?

1. Yes
2. No

- 7. Don't know/Not sure
- 9. Refused

3.4 Have you reduced your sodium or salt intake to control your blood pressure?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

3.5 Have you increased your physical activity to control your blood pressure?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

3.6 Has a doctor ever told you that you had any of the following?

Please read	Yes	No	DK/NS	Ref
a. Heart attack or myocardial infarct	1	2	7	9
b. Angina or coronary heart disease	1	2	7	9
c. Stroke	1	2	7	9
d. Chronic obstructive pulmonary disease or COPD	1	2	7	9
e. Liver disease or cirrohsis	1	2	7	9
f. Leukemia	1	2	7	9

3.7 Blood cholesterol is a fatty substance found in the blood. Have you ever had you blood cholesterol checked?

- 1. Yes
- 2. No – Skip to 4.1
- 7. Don't know/Not sure – Skip to 4.1
- 9. Refused – Skip to 4.1

3.8 About how long has it been since you had your blood cholesterol checked?

- 1. Within the past year (1 to 12 months ago)
- 2. Within the past 2 years (1 to 2 years ago)
- 3. Within the past 5 years (2 to 5 years ago)

- 4. 5 or more years ago
- 7. Don't know/Not sure
- 9. Refused

3.9 Have you ever been told by a doctor or health care professional that your blood cholesterol was high?

- 1. Yes
- 2. No – Skip to 4.1
- 7. Don't know/Not sure – Skip to 4.1
- 9. Refused – Skip to 4.1

3.10 Are you now taking any medication to lower your cholesterol?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

3.11 Have you reduced your calorie or fat intake to lower your cholesterol?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

3.12 Have you increased your physical activity to lower your cholesterol?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

4. Tobacco use:

Now I would like to ask you a few questions about tobacco use.

4.1 Have you smoked at least 100 cigarettes in your entire life?

- 1. Yes
- 2. No – Skip 4.10
- 7. Don't know/not sure -- Skip 4.10

9. refused -- Skip 4.10

4.2 Do you now smoke cigarettes everyday, some days, or not at all?

1. Everyday
2. Some days – Skip to 4.4
3. Not at all – Skip to 4.10
9. Refused – Skip to 4.10

4.3 On the average, about how many cigarettes a day do you now smoke?

___ Enter number of cigarettes [76 = 76 or more] -- Skip to 4.5

77. Don't know/Not sure – Skip to 4.5
99. Refused – Skip to 4.5

4.4 On the average, when you smoked during the past 30 days, about how many cigarettes did you smoke a day?

___ Enter number of cigarettes [76 = 76 or more]

77. Don't know/not sure
99. Refused

4.5 About how old were you when you first started smoking cigarettes fairly regularly?

___ Code age in years

77. Don't know/not sure
88. Never smoked regularly
99. Refused

4.6 In the past 12 months, has a doctor, nurse, or other health care professional talked with you about quitting smoking?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

4.7 During the past 12 months, have you quit smoking for 1 day or longer?

1. Yes – Skip to 4.9
2. No – Skip to 4.10

7. Don't know/not sure – Skip to 4.10

9. Refused – Skip to 4.10

4.8 About how long has it been since you last smoked cigarettes regularly, that is, daily?

- 01. Within the past month (0 to 1 month ago)
- 02. Within the past 3 months (1 to 3 months ago)
- 03. Within the past 6 months (3 to 6 months ago)
- 04. Within the past year (6 to 12 months ago)
- 05. Within the past 5 years (1 to 5 years ago)
- 06. Within the past 15 years (5 to 15 years ago)
- 07. 15 or more years ago
- 77. Don't know/not sure
- 88. Never smoked regularly
- 99. Refused

4.9 In the past 12 months, have you used any medicines to help you quit smoking, such as nicotine gum, patches, or pills such as Zyban?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

4.10 Have you ever used or tried any smokeless tobacco products such as chewing tobacco or snuff?

- 1. Yes, chewing tobacco
- 2. Yes, snuff
- 3. Yes, both
- 4. No, neither – Skip to 4.15
- 7. Don't know/Not sure – Skip to 4.15
- 9. Refused – Skip to 4.15

4.11 Do you currently use any smokeless tobacco products such as chewing tobacco or snuff?

- 1. Yes, chewing tobacco
- 2. Yes, snuff
- 3. Yes, both
- 4. No, neither – Skip to 4.15

7. Don't know/Not sure – Skip to 4.15

9. Refused – Skip to 4.15

4.12 About how old were you when you first started chewing tobacco or snuff regularly?

___ Code age in years

77. Don't know/not sure

88. Never smoked regularly

99. Refused

4.13 In the past 12 months, has a doctor, nurse, or other health care professional talked with you about quitting chewing tobacco or snuff?

1. Yes

2. No

7. Don't know/Not sure

9. Refused

4.14 In the past 12 months, have you used any medicines to help you quit using chewing tobacco or snuff, such as nicotine gum, patches, or pills such as Zyban?

1. Yes

2. No

7. Don't know/Not sure

9. Refused

4.15 About what percent of Montanans do you think smoke cigarettes?

Would you say:

1. Less than 25 percent

2. 25 percent

3. 50 percent

4. 75 percent

5. 100 percent

7. Don't know/Not sure

9. Refused

4.16 Do you think Montana's Native American population smokes cigarettes about the same,
more, or less than ALL Montanans?

1. About the same
2. More
3. Less
7. Don't know/Not sure
9. Refused

4.17 About what percent of Montanans do you think chew tobacco or snuff? Would you say:

1. Less than 25 percent
2. 25 percent
3. 50 percent
4. 75 percent
5. 100 percent
7. Don't know/Not sure
9. Refused

4.18 Do you think Montana's Native American population chews tobacco about the same, more, or less than ALL Montanans?

1. About the same
2. More
3. Less
7. Don't know/Not sure
9. Refused

5. Nutrition questions:

The next few questions ask about food you ate or liquids you drank YESTERDAY. Think about the meals and snacks you ate yesterday from the time you got up until you went to bed. Be sure to include food you ate at home, at school, at work, at restaurants, or anywhere else. Again, the answers are for what you ate or drank YESTERDAY.

How many times did you:

5.1 Eat Fruit?

1. None
2. 1 time
3. 2 times
4. 3 or more times

- 7. Don't know/Not sure
- 9. Refused

5.2 Drink fruit juice?

- 1. None
- 2. 1 time
- 3. 2 times
- 4. 3 or more times
- 7. Don't know/Not sure
- 9. Refused

5.3 Eat green salad or uncooked vegetables?

- 1. None
- 2. 1 time
- 3. 2 times
- 4. 3 or more times
- 7. Don't know/Not sure
- 9. Refused

5.4 Eat cooked vegetables?

- 1. None
- 2. 1 time
- 3. 2 times
- 4. 3 or more times
- 7. Don't know/Not sure
- 9. Refused

5.5 Eat hamburgers, hot dogs, fried chicken or other fried meats?

- 1. None
- 2. 1 time
- 3. 2 times
- 4. 3 or more times
- 7. Don't know/Not sure
- 9. Refused

5.6 Eat french fries, potato chips or other fried snacks?

1. None
2. 1 time
3. 2 times
4. 3 or more times
7. Don't know/Not sure
9. Refused

5.7 Eat cookies, doughnuts, pie, or cake?

1. None
2. 1 time
3. 2 times
4. 3 or more times
7. Don't know/Not sure
9. Refused

5.8 Yesterday, how many cans or bottles of **DIET** pop did you drink? (A can or bottle = 12 oz. not a liter; if liters need to calculate)

- ___ number of cans or bottles
77. Don't know/Not sure
 99. Refused

5.9 Yesterday, how many cans or bottles of regular pop, **NOT DIET**, did you drink? (A can or bottle = 12 oz. not a liter; if liters need to calculate)

- ___ number of cans or bottles
77. Don't know/Not sure
 99. Refused

5.10 Do you, or the person who cooks at your house, use solid shortening such as Crisco or lard to cook foods?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

5.11 Do you, or the person who cooks at your house, use butter to cook foods?

1. Yes

- 2. No
- 7. Don't know/Not sure
- 9. Refused

5.12 Do you, or the person who cooks at your house, use cooking oil such as corn oil or vegetable oil to cook foods?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

6. Television watching & media:

The next four questions are about television and other types of media.

6.1 Do you watch television?

- 1. Yes
- 2. No - Skip to 6.4
- 3. No TV -- Skip to 6.4
- 7. Don't know/Not sure - Skip to 6.4
- 9. Refused - Skip to 6.4

6.2 Yesterday, how many hours of television did you watch?

- __ Number of hours (0-24)
 77 Don't know/Not sure
 99 Refused

6.3 About how many hours of television do you watch on a typical day?

- __ Number of hours per day (0-24)
 77 Don't know/Not sure
 99 Refused

6.4 Where do you get most of your health care information? Would you say from: your doctor, newspapers, magazines, television, radio, work, or other sources.

- 11. Your doctor
- 12. Newspapers

- 13. Magazines
- 14. Television
- 15. Radio
- 16. Other sources
- 88. Don't normally read health care information
- 77. Don't know/Not sure
- 99. Refused

7. Physical Activity:

The next questions are about exercise or physical activity that you do as part of your regular job duties. First...

7.1 Are you currently: Employed for wages, Self-employed, Out of work for more than 1 year, Out of work for less than 1 year, Homemaker, Student, Retired, or Unable to work?

- 1. Employed for wages
- 2. Self-employed
- 3. Out of work for more than 1 year – Skip to 7.11
- 4. Out of work for less than 1 year – Skip to 7.11
- 5. Homemaker – Skip to 7.11
- 6. Student – Skip to 7.11
- 7. Retired – Skip to 7.11
- 8. Unable to work – Skip to 7.11
- 9. Refused – Skip to 7.11

7.2 During the past month, did you participate in any light physical activity such as sitting, standing, light cleaning, such as ironing, cooking, washing, dusting or slow leisure walking?

- 1. Yes
- 2. No – Skip to 7.5
- 7. Don't know/Not Sure – Skip to 7.5
- 9. Refused - Skip to 7.5

7.3 How many times in the past week did you take part in this activity?

- ___ Enter times per week
- 777. Don't know/Not Sure
 - 999. Refused

7.4 And when you took part in this activity, for how many minutes or hours did you usually keep at it? (e.g., one hour and thirty minutes = 130)

___ Enter Hours and minutes

777. Don't know/Not Sure

999. Refused

7.5 During the past month, did you participate in any moderate physical activity such as carrying light loads (5-10 lbs.), continuous walking, heavy cleaning such as mopping, sweeping, scrubbing, scraping, painting, plastering, plumbing, or welding?

1. Yes
2. No – Skip to 7.8
7. Don't know/Not Sure – Skip to 7.8
9. Refused – Skip to 7.8

7.6 How many times in the past week did you take part in this activity?

___ Enter times per week

777. Don't know/Not Sure

999. Refused

7.7 And when you took part in this activity, for how many minutes or hours did you usually keep at it? (e.g., one hour and thirty minutes = 130)

___ Enter Hours and minutes

777. Don't know/Not Sure

999. Refused

7.8 During the past month, did you participate in any heavy physical activity such as carrying moderate to heavy loads, shoveling, heavy construction, farming, digging ditches, chopping, or sawing?

1. Yes
2. No – Skip to 7.11
7. Don't know/Not Sure – Skip to 7.11
9. Refused – Skip to 7.11

7.9 How many times in the past week did you take part in this activity?

___ Enter times per week

777. Don't know/Not Sure

999. Refused

7.10 And when you took part in this activity, for how many minutes or hours did you usually keep at it? (e.g., one hour and thirty minutes = 130)

___ Enter Hours and minutes

777. Don't know/Not Sure

999. Refused

The next few questions are about exercise, recreation, or physical activities other than your regular job duties.

7.11 During the past month, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening or walking for exercise?

1. Yes
2. No – Skip to 7.21
7. Don't know/Not Sure – Skip to 7.21
9. Refused – Skip to 7.21

7.12 What type of physical activity or exercise did you spend the most time doing during the past MONTH?

___ Enter Activity Code

- | | | |
|------------------------|------------------------|--------------------|
| 1. Aerobics Class | 20. Horseback Riding | 39. Snow Skiing |
| 2. Back Packing | 21. Hunting Large Game | 40. Soccer |
| 3. Badminton | 22. Jogging | 41. Softball |
| 4. Basketball | 23. Judo/Karate | 42. Squash |
| 5. Biking (Pleasure) | 24. Mountain Climbing | 43. Stair Climbing |
| 6. Boating | 25. Mowing Lawn | 44. Stream Fishing |
| 7. Bowling | 26. Paddleball | 45. Surfing |
| 8. Boxing | 27. Painting/Papering | 46. Swimming Laps |
| 9. Calisthenics | 28. Racquetball | 47. Table Tennis |
| 10. Canoe/Row (Compet) | 29. Raking Lawn | 48. Tennis |
| 11. Carpentry | 30. Running | 49. Touch Football |

- | | | |
|---------------------------|---------------------------|-----------------------|
| 12. Dance-Aerobics/Ballet | 31. Rope Skipping | 50. Volleyball |
| 13. Fish (Bank/Boat) | 32. Scuba Diving | 51. Walking |
| 14. Gardening | 33. Skating-ice or roller | 52. Waterskiing |
| 15. Golf | 34. Sledding, Tobogganing | 53. Weight Lifting |
| 16. Handball | 35. Snorkeling | 54. Other |
| 17. Health Club Exer. | 36. Snowshoeing | 55. Bicycling Machine |
| 18. Hiking-Cross Country | 37. Snow Shoveling | 56. Rowing Machine |
| 19. Home Exercise | 38. Snow Blowing | 99. Refused |

7.13 How far did you usually _____ (activity)?

_____ Enter miles and tenths

777. Don't know/Not sure
999. Refused

7.14 How many times in the past week did you take part in this activity?

___ Enter times per week

777. Don't know/Not Sure
999. Refused

7.15 And when you took part in this activity, for how many minutes or hours did you usually keep at it? (e.g., one hour and thirty minutes = 130)

___ Enter Hours and minutes

777. Don't know/Not Sure
999. Refused

7.16 Was there another physical activity or exercise that you participated in during the last month?

1. Yes
2. No – Skip to 7.21
7. Don't know/Not Sure – Skip to 7.21
9. Refused – Skip to 7.21

7.17 What other type of physical activity gave you the next most exercise during the past month?

___ Enter Activity Code

- | | | |
|---------------------------|---------------------------|-----------------------|
| 1. Aerobics Class | 20. Horseback Riding | 39. Snow Skiing |
| 2. Back Packing | 21. Hunting Large Game | 40. Soccer |
| 3. Badminton | 22. Jogging | 41. Softball |
| 4. Basketball | 23. Judo/Karate | 42. Squash |
| 5. Biking (Pleasure) | 24. Mountain Climbing | 43. Stair Climbing |
| 6. Boating | 25. Mowing Lawn | 44. Stream Fishing |
| 7. Bowling | 26. Paddleball | 45. Surfing |
| 8. Boxing | 27. Painting/Papering | 46. Swimming Laps |
| 9. Calisthenics | 28. Racquetball | 47. Table Tennis |
| 10. Canoe/Row (Compet) | 29. Raking Lawn | 48. Tennis |
| 11. Carpentry | 30. Running | 49. Touch Football |
| 12. Dance-Aerobics/Ballet | 31. Rope Skipping | 50. Volleyball |
| 13. Fish (Bank/Boat) | 32. Scuba Diving | 51. Walking |
| 14. Gardening | 33. Skating-ice or roller | 52. Waterskiing |
| 15. Golf | 34. Sledding, Tobogganing | 53. Weight Lifting |
| 16. Handball | 35. Snorkeling | 54. Other |
| 17. Health Club Exer. | 36. Snowshoeing | 55. Bicycling Machine |
| 18. Hiking-Cross Country | 37. Snow Shoveling | 56. Rowing Machine |
| 19. Home Exercise | 38. Snow Blowing | 99. Refused |

7.18 How far did you usually _____ (activity)?

_____ Enter miles and tenths

777. Don't know/Not sure

999. Refused

7.19 How many times in the past week did you take part in this activity?

___ Enter times per week

777. Don't know/Not Sure

999. Refused

7.20 And when you took part in this activity, for how many minutes or hours did you usually keep at it? (e.g., one hour and thirty minutes = 130)

___ Enter Hours and minutes

777. Don't know/Not Sure

999. Refused

We consider regular exercise to be any physical activity that you perform three times a week for 30 minutes at a time, or five times a week for 20 minutes at a time.

7.21 Do you consider yourself to be a regular exerciser?

1. Yes
2. No – Skip to 7.23
7. Don't know/Not sure – Skip to 7.23
9. Refused – Skip to 7.23

7.22 How long have you been exercising regularly?

1. 6 months or less – Skip to 7.27
2. More than 6 Months – Skip to 7.27
7. Don't know/Not sure – Skip to 7.27
9. Refused – Skip to 7.27

7.23 Are you planning to start exercising regularly within the next 6 months?

1. Yes
2. No – Skip to 7.26
7. Don't know/Not sure – Skip to 7.26
9. Refused – Skip to 7.26

7.24 How confident are you that within the next 6 months you could begin to exercise regularly?

1. Very confident
2. Somewhat confident
3. Not at all confident
7. Don't know/No response
9. Refused

7.25 How confident are you that you could maintain a regular exercise program? Would you say:

1. Very confident
2. Somewhat confident
3. Not at all confident
7. Don't know/Not sure

9. Refused

7.26 What is the most important reason that you don't exercise more or exercise at all?

INTERVIEWERS: DO NOT READ ANSWERS

- | | |
|---------------------------|--------------------------------|
| 1. Lack of time | 15. Not safe-Sidewalks |
| 2. Not important | 16. Not safe-Other |
| 3. Too tired or exhausted | 17. Embarrassed/Self Conscious |
| 4. Lazy | 18. Don't Enjoy |
| 5. Injury | 19. Too Expensive |
| 6. Illness | 20. No one to exercise with |
| 7. Chronic cond-Arthritis | 21. Lack of skills/knowledge |
| 8. Chronic cond-Diabetes | 22. Fear of Injury |
| 9. Chronic cond-Cancer | 23. Lack of convenient place |
| 10. Chronic cond-Bad Back | 24. Other |
| 11. Other chronic cond | |
| 12. Not safe-Violence | 77. Don't know/Not sure |
| 13. Not safe-Traffic | 99. Refused |
| 14. Not safe-Dogs | |

7.27 I am going to read five statements to you. Please tell me which one describes you the best.

1. I am not thinking about becoming more active or doing more exercise to improve my health.
2. I am thinking about being more active or getting more exercise to improve my health, but I haven't made a change yet
3. I have been thinking about being more active or getting more exercise to improve my health and I will in the next month.
4. I have become more active and getting more exercise to improve my health.
5. I have made changes in my exercise and activity level over a year ago and I am keeping to it.
7. Don't know/Not sure
9. Refused

Please tell me whether you agree or disagree with the following statements.

7.28 If I had a friend to exercise with, I'd be more likely to exercise.

1. Strongly agree
2. Agree

- 3. Disagree
- 4. Strongly disagree
- 7. Don't know/Not sure
- 9. Refused

7.29 Regular exercise can improve my health.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 7. Don't know/Not sure
- 9. Refused

7.30 Exercise reduces the risk of heart disease, diabetes, and the progression of diabetes.

- 1. Strongly agree
- 2. Agree
- 3. Disagree
- 4. Strongly disagree
- 7. Don't know/not sure
- 9. Refused

8. Health Care Utilization and Hospitalizations:

The next few questions are about how often and where you go for health care.

8.1 About how many times in the past 12 months have you seen a doctor, nurse, or other health care professional?

___ Enter number of times

- 88. None – Skip to 8.3
- 77. Don't know – Skip to 8.3
- 99. Refused – Skip to 8.3

8.2 Where did you most often go in the past year to see a doctor, nurse, or other health care professional? Would you say: Tribal Health Service, Indian Health Service, an Urban Indian Health program, a private physician, a community health center, or some other site.

- 1. Tribal Health Service – Skip to 8.4
- 2. Indian Health Service – Skip to 8.4

3. Urban Indian Health program – Skip to 8.4
4. private physician – Skip to 8.4
5. community health center – Skip to 8.4
6. other site – Skip to 8.4
7. Don't know/Not sure – Skip to 8.4
9. Refused – Skip to 8.4

8.3 What was the main reason you did not see a doctor, nurse, or other health care professional over the past 12 months?

1. Cost
2. Transportation problems
3. Child care
4. Did need to/feel fine
5. Use other sources for health needs (cultural remedies/healers)
6. Other
7. Don't know/Not sure
9. Refused

8.4 During the past 12 months, how many different times did you stay overnight in a hospital?

- ___ Number of times
777. Don't know/Not sure
999. Refused

9. Diabetes Screening & Family History:

The next questions are about diabetes.

9.1 Glucose or sugar is a substance found in your blood. Have you ever had your blood glucose or sugar checked to see if you have diabetes?

1. Yes
2. Yes – have diabetes – Skip to 9.3
3. No – Skip to 9.3
7. Don't know/Not sure – Skip to 9.3
9. Refused – Skip to 9.3

9.2 When was the last time your blood glucose or sugar level was measured by a health care professional?

1. Within the past year (1 to 12 months ago)
2. Within the past three years (1 to 3 years ago)
3. Over three years ago
7. Don't know/Not sure
9. Refused

9.3 Has any member of your family ever had diabetes?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

9.4 Do you believe that Indian people can prevent getting diabetes?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

10. Diabetes Diagnosis and Health Care Questions:

10.1 Have you ever been told by a doctor that you have diabetes?

1. Yes
2. Yes, but female -- told only during pregnancy -- Skip to 14.1
3. No -- Skip to 14.1
7. Don't know/Not sure -- Skip to 14.1
9. Refused -- Skip to 14.1

10.2 How old were you when you were first told you have diabetes?

___ Enter age in years

77. Don't know/Not sure
99. Refused

10.3 Are you now taking insulin?

1. Yes
2. No -- Skip to 10.5
7. Don't know/Not sure -- Skip to 10.5
9. Refused -- Skip to 10.5

10.4 On an average day, about how often do you use insulin?

___ Times per day

33. Use insulin pump

77. Don't know/Not sure

99. Refused

10.5 Are you now taking any oral medications to control your blood glucose or sugar?

1. Yes

2. No -- Skip to 10.7

7. Don't know/Not sure -- Skip to 10.7

9. Refused -- Skip to 10.7

10.6 How many different types of oral medications are you currently taking?

1. One

2. Two

3. Three or more

7. Don't know/Not sure

9. Refused

10.7 Has a health care professional ever taught you how to monitor your blood glucose or sugar?

1. Yes

2. No

7. Don't know/Not sure

9. Refused

10.8 About how often do you check your blood for glucose or sugar? This includes times when it is checked by a family member or a friend, but NOT when it is checked by a health care professional.

1 __ Times per day

2 __ Times per week

3 __ Times per month

4 __ Times per year

888. Never

777. Don't know/Not sure

999. Refused

10.9 About how many times in the past 12 months have you seen a doctor, nurse, or other health care professional for your diabetes?

__ Enter number of times

88. None

77. Don't know

99. Refused

10.10 Have you ever heard of glycosylated hemoglobin or hemoglobin "A one C"?

1. Yes

2. No -- Skip to 11.1

7. Don't know/Not sure -- Skip to 11.1

9. Refused -- Skip to 11.1

10.11 About how many times in the past 12 months has a doctor, nurse, or other health care professional checked you for glycosylated hemoglobin or hemoglobin "A one C"?

__ Enter number of times

88. None

77. Don't know

99. Refused

11. Diabetes Eye Care:

Now I would like to ask you a few questions regarding eye care.

11.1 Have you ever been told by a health care professional that diabetes can affect your vision by damaging your retina or the back of your eye?

1. Yes

2. No

7. Don't know/Not sure

9. Refused

11.2 Have you ever had your eyes examined in which your pupils were dilated? This would have made you temporarily sensitive to bright light.

1. Yes

2. No -- Skip to 11.4

- 7. Don't know/Not sure -- Skip to 11.4
- 7. Refused -- Skip to 11.4

11.3 When was the last time you had an eye exam in which the pupils were dilated?

- 1. within the past month (0 to 1 month ago) -- Skip to 11.5
- 2. within the past year (1 to 12 months ago) -- Skip to 11.5
- 3. within the past 2 years (1 to 2 years ago)
- 4. 2 or more years ago
- 7. Don't know/Not sure
- 9. Refused

11.4 What is the primary reason you have not had a dilated eye exam in the past 12 months?

- 1. Concerned with potential cost
- 2. Did not know I should/Doctor did not tell me to
- 3. My doctor is not able to
- 4. No Ophthalmologist/Optometrlist in area
- 5. I forgot to
- 6. Other
- 7. Don't know/Not sure
- 9. Refused

11.5 Have you ever been told by a health care professional that diabetes has affected your vision by damaging your retina or the back of your eye?

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

11.6 Have you ever had laser or photocoagulation treatment for this problem? Do not include treatment for cataracts. (NHIS)

- 1. Yes
- 2. No
- 7. Don't know/Not sure
- 9. Refused

11.7 Have you ever been treated for cataracts?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

12. Diabetes Self-foot Care:

Now I would like to ask you some questions about your feet

12.1 How often do you think people with diabetes should specifically check their feet?
Would you say:

1. Twice a day
2. Once a day (correct)
3. Once a week
4. Once a month
5. Don't need to check feet regularly
7. Don't know/Not sure
9. Refused

12.2 Do you think people with diabetes should wash their feet in warm soapy water, cold soapy water, or hot soapy water?

1. Warm soapy water (correct)
2. Cold soapy water
3. Hot soapy water
7. Don't know/Not sure
9. Refused

12.3 What are your chances of having foot problems related to diabetes? Would you say:

1. High
2. Medium
3. Low
4. None
7. Don't know/Not sure
9. Refused

Now I am going to read a series of statements and I would like you to tell me whether you agree or disagree with the statement.

12.4 People with diabetes are at higher risk than the general population of having foot ulcers and other foot problems.

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.5 People with diabetes are at higher risk than the general population of having foot ulcers which can lead to amputations.

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.6 People with diabetes should put lotion or other skin softening oils on their feet

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.7 People with diabetes are more likely to have poor blood flow in their feet, as compared to the general population.

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.8 People with diabetes are more likely to have nerve problems in their feet, as compared to the general population.

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.9 People with diabetes can prevent most foot problems by checking their feet daily and having a health care professional examine their feet at each visit.

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.10 People with diabetes who control their blood glucose or sugar are less likely to have foot problems.

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.11 People with diabetes who smoke or chew tobacco are more likely to have foot problems.

2. Agree (correct)
3. Disagree
7. Don't know/Not sure
8. Refused

12.12 People with diabetes are more likely to become seriously ill from the flu or pneumonia than people who don't have diabetes.

1. Agree (correct)
2. Disagree
7. Don't know/Not sure
9. Refused

12.13 Have you ever had or do you now have ulcers, wounds, or black spots on your feet?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

12.14 Have any portion of your toes, feet, or legs been amputated or cut off?

1. Yes - toes
2. Yes - one foot or leg

3. Yes - both feet or legs – skip to 14.1
4. No
9. Refused

12.15 Have you **EVER** checked the bottom of your feet and between the toes for sores or irritations?

1. Yes
2. No -- Skip to 12.17
7. Don't know/Not sure -- Skip to 12.17
9. Refused -- Skip to 12.17

12.16 How often do you specifically check the bottom of your feet and between your toes for sores or irritations? Would you say:

1. Every day – Skip to 12.18
2. Some days
3. Rarely
4. Never
7. Don't know/Not sure – Skip to 12.18
9. Refused – Skip to 12.18

12.17 What is the main reason you don't check your feet every day?
INTERVIEWERS: DO NOT READ ANSWERS

1. Didn't know I should - Health care professional never told me to
2. Don't feel it's important - My feet are fine
3. I forget to do this
4. Vision is poor - have difficulty seeing my feet
5. I have physical limitations
6. Motivation/feel tired
7. Other
8. Don't know/Not sure
9. Refused

12.18 During the past 12 months, have you worn sandals or other types of "open-toed shoes"?

1. Yes
2. No
3. No feet

7. Don't know/Not sure

9. Refused

12.19 During the past 12 months, have you used a water bottle, heating pad, or worn heated socks to keep your feet warm?

1. Yes

2. No

3. No feet

7. Don't know/Not sure

9. Refused

12.20 During the past 12 months, have you used over-the-counter remedies to remove calluses, corns, or warts on your feet?

1. Yes

2. No

3. No feet

7. Don't know/Not sure

9. Refused

12.21 During the past 12 months, have you noticed a change in the size or shape of your feet?

1. Yes

2. No

3. No feet

7. Don't know/Not sure

9. Refused

12.22 During the past 12 months, have you noticed a change in the feeling or muscle strength of your feet or legs such as pain, burning, tingling, numbness, coldness, or weakness?

1. Yes

2. No

3. No feet

7. Don't know/Not sure

9. Refused

12.23 During the past 12 months, have you had pain in your calf muscles when walking?

1. Yes
2. No
3. No feet
7. Don't know/Not sure
9. Refused

12.24 In the past month, did you put any lotions or oils, such as mineral oil, baby oil, petroleum jelly, or hand cream on your feet?

1. Yes
2. No
3. No feet
7. Don't know/Not sure
9. Refused

13. Diabetes Foot Care from a Health Care Professional:

Now I would like to ask you some questions about the foot-care services you may have received from a health care provider.

13.1 Has a health care professional ever taught you how to take care of your feet or showed you how to look for sores or irritations?

1. Yes
2. No
3. No feet
7. Don't know/Not sure
9. Refused

13.2 Have you ever been told by a health care professional that diabetes can cause problems with your feet?

1. Yes
2. No
7. Don't know/Not sure
9. Refused

13.3 Have you ever been told by a health care professional that you have insensitive feet, or that your feet have lost their protective sensation?

1. Yes

- 2. No
- 3. No feet
- 7. Don't know/Not sure
- 9. Refused

13.4 Have you ever been told by a health care professional that you have poor blood circulation or blood flow problems in your feet?

- 1. Yes
- 2. No
- 3. No feet
- 7. Don't know/Not sure
- 9. Refused

13.6 Has a health care professional ever prescribed special "therapeutic" shoes, special orthotics, or insoles for you?

- 1. Yes
- 2. No -- Skip to 13.8
- 3. No feet -- Skip to 13.8
- 7. Don't know/Not sure -- Skip to 13.8
- 9. Refused -- Skip to 13.8

13.7 Do you currently wear "special" therapeutic shoes, special orthotics, or use insoles now?

- 1. Yes
- 2. No
- 3. No, no feet
- 7. Don't know/Not sure
- 9. Refused

13.9 Has a health care professional ever checked your feet for sores or irritations?

- 1. Yes
- 2. No -- Skip to 14.1
- 7. Don't know/Not sure -- Skip to 14.1
- 9. Refused -- Skip to 14.1

13.10 About how many times in the past 12 months has a health care professional checked your feet for sores or irritations?

___ Enter number of times

88. None – Skip to 13.12

77. Don't know – Skip to 13.12

99. Refused – Skip to 13.12

13.11 During the past 12 months, has a health care professional ever used a small device with a thin moderately stiff plastic line attached, and touched the bottom of your feet to see if you can feel it?

1. Yes

2. No

7. Don't know/Not sure

9. Refused

13.12 Have you been to a podiatrist or foot doctor in the past 12 months?

1. Yes

2. No

7. Don't know/Not sure

9. Refused

14. Demographic Questions:

Just a few more questions and I will be done.

14.1 What is your age?

___ Enter age in years

777. Don't know/Not sure

999. Refused

14.2 Interviewer: Indicate sex of the respondent.

1. Male

2. Female

14.3 About how tall are you without shoes?

___ Feet (enter as separate variables!)

___ Inches

777. Don't Know/Not Sure

999. Refused

14.4 How much do you weigh without shoes?

_____ Weight in pounds

777. Don't Know/Not Sure

999. Refused

14.5 Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?

1. Yes

2. No

7. Don't know/Not sure

9. Refused

14.6 What is the highest grade or year of school you have completed?

1. Never attended school or only kindergarten

2. Grades 1 through 8 (Elementary)

3. Grades 9 through 11 (Some High school)

4. Grades 12 or GED (High School graduate)

5. College 1 year to 3 years (Some college or technical school)

6. College 4 years or more (College graduate)

7. Don't know/Not sure

9. Refused

14.7 What county do you live in?

_____ FIPS county code

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APPENDIX B: PREDICTIVE MODEL

Predictors - in Order of Respective Power: _____ Outcome Variables:

↓ Age → Female Gender → ↑ Exercise → + Beliefs → ↓ MI, CHD

↓ Age → Female Gender → ↑ SOC → ↓ Hypertension

↓ Age → Male Gender → ↓ Healthcare Visits

↓ Age → ↑ Exercise → + Beliefs → ↓ High Cholesterol

↓ Age → ↑ Exercise → ↑ SOC → ↓ BMI

↓ Age → ↑ Exercise → ↑ SOC → ↑ Percept. Of Health

↓ Age → ↑ Exercise → ↓ Diabetes

↑ SOC → ↓ Age → Female Gender → ↑ Exercise Behavior

APPENDIX C: Items and Constructs

<u>Construct</u>	<u>Page(s)</u>	<u>Item(s)</u>
<u>Health Outcome</u>		
Perception of Health Status	123	1.1
Hypertension	125	3.2
MI	126	3.6
CHD		
Stroke		
High Cholesterol	126	3.9
Diabetes	145	10.1
Healthcare Visits	143	8.1
<u>SOC</u>		
SOC	142	7.27
Confidence to begin exercise	141	7.24
Confidence to maintain exercise	141	7.25
<u>Beliefs</u>		
Exercise improves health	143	7.29
Exercise Prevents chronic illness	143	7.30
Fatalism re: diabetes	145	9.4
<u>Constructs</u>	<u>Page(s)</u>	<u>Item(s)</u>

Exercise Behavior

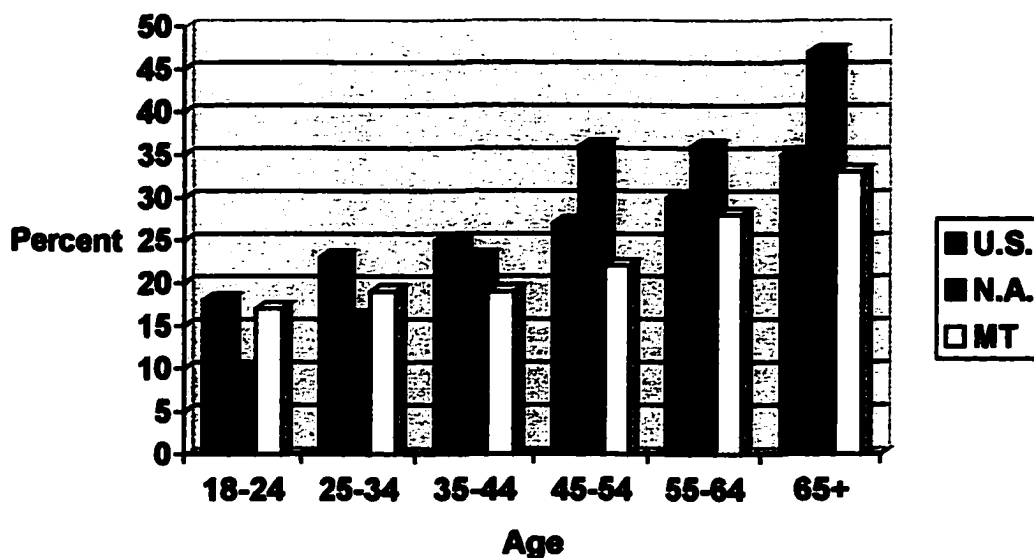
Barriers	141,142	7.26
Sedentary behavior		
T.V. watching	135	6.1, 6.2, 6.3
Regular Exercise	138	7.11

<u>Physical Activity</u>	<u>MET</u>	<u>Physical Activity</u>	<u>MET</u>	<u>Physical Activity</u>	<u>MET</u>
1. Aerobics Class	6.0	20. Horseback Riding	4.0	39. Snow Skiing	7.0
2. Back Packing	7.0	21. Hunting Lg Game	6.0	40. Soccer	7.0
3. Badminton	4.5	22. Jogging	7.0	41. Softball	5.0
4. Basketball	8.0	23. Judo/Karate	10.0	42. Squash	12.0
5. Biking (Pleasure)	6.0	24. Mountain Climb	8.0	43. Stair Climbing	8.0
6. Boating	2.5	25. Mowing Lawn	4.5	44. Stream Fishing	6.0
7. Bowling	3.0	26. Paddleball	6.0	45. Surfing	3.0
8. Boxing	9.0	27. Painting/Papering	4.5	46. Swimming Laps	8.0
9. Calisthenics	4.5	28. Racquetball	7.0	47. Table Tennis	4.0
10. Canoe/Row	7.0	29. Raking Lawn	4.0	48. Tennis	7.0
11. Carpentry	3.0	30. Running	8.0	49. Touch Football	8.0
12. Dance-Aero/Ball	6.0	31. Rope Skipping	10.0	50. Volleyball	3.0
13. Fish (Bank/Boat)	4.0	32. Scuba Diving	7.0	51. Walking	3.5
14. Gardening	5.0	33. Skating-ice or roll	7.0	52. Waterskiing	6.0
15. Golf	4.5	34. Sledding, Tobog	7.0	53. Weight Lifting	6.0
16. Handball	12.0	35. Snorkeling	5.0	54. Other	
17. Health Club Exer.	5.5	36. Snowshoeing	8.0	55. Bicycling Machine	
5.0					
18. Hiking-Cross Ctry	6.0	37. Snow Shoveling	6.0	56. Rowing Machine	9.5
19. Home Exercise	4.5	38. Snow Blowing	4.5	99. Refused	

APPENDIX D: Prevalence of Sedentary Behavior in the U.S. Population Compared to Caucasians and Native Americans Across Montana

Figure 1.

Comparison of Prevalence of Sedentary Behavior Across the U.S. Population and Caucasian and Native Americans Across Montana by Age.



Note: U.S. Population and Caucasian Montanan sedentary rates were collected from BRFSS data from 2000.