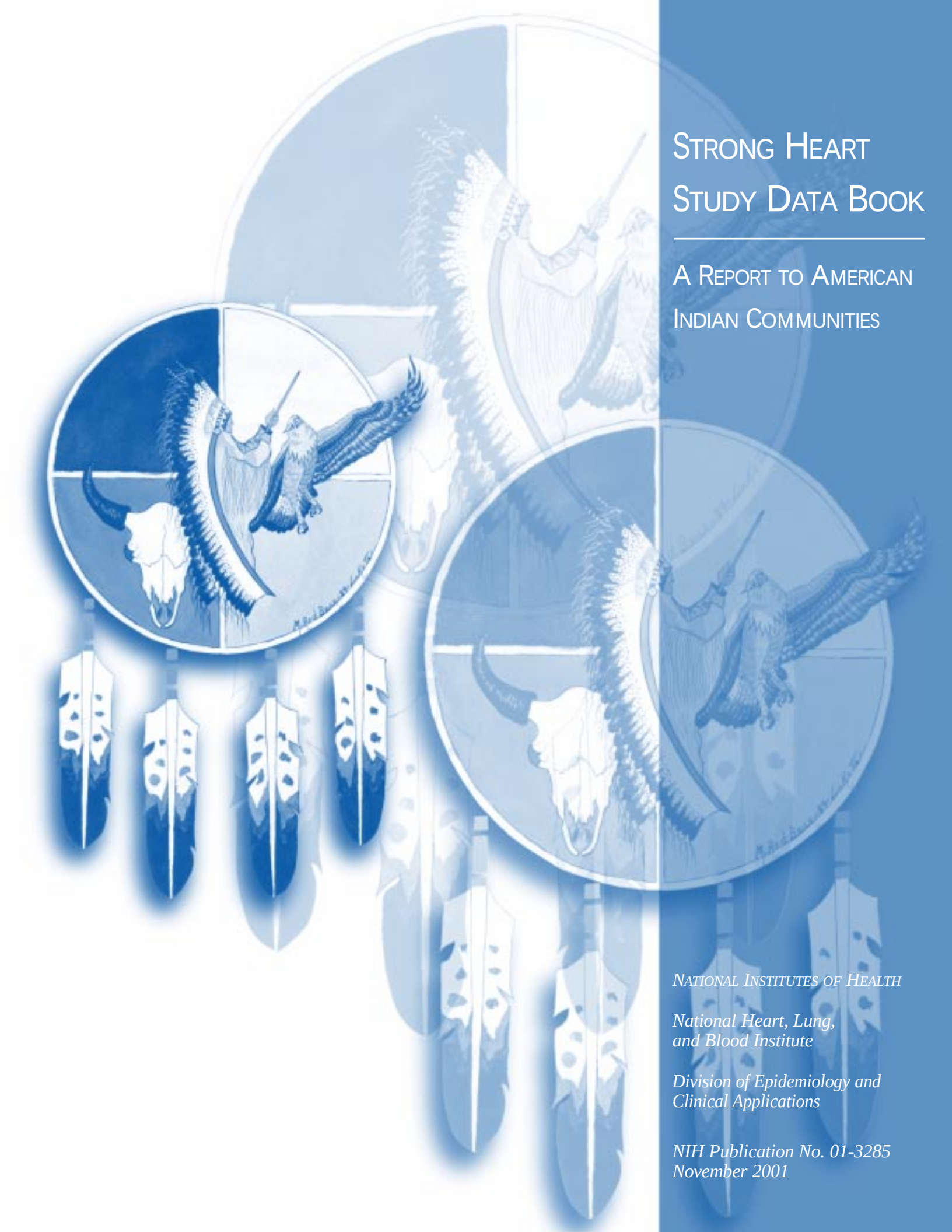
Division of Epidemiology and Clinical Applications

Strong Heart Study Data Book

A Report to American Indian Communities

NATIONAL INSTITUTES OF HEALTH
NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

The cover of this document was based on a painting by Martin Red Bear, an Oglala/Sicangu artist and educator. He is currently employed as a Humanities Instructor by Oglala Lakota College on the Pine Ridge Indian Reservation in South Dakota. He earned an master of arts in Art Education from the University of New Mexico and a bachelor of arts in Visual Arts and Education from the College of Santa Fe. The overall theme of the painting is the circle of life as depicted by the medicine wheel. The man is praying for good health for all living beings.



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PREFACE

The new millennium is an appropriate time to reflect on the accomplishments of biomedical research and to address new goals regarding the health of the Nation. In 1990, the Department of Health and Human Services (DHHS) Secretary Louis Sullivan released Healthy People 2000 with the goals of increasing healthy life expectancy, reducing health disparities among Americans, and achieving access to preventive services for all Americans. Although, indeed, much has been accomplished toward fulfilling these goals, some issues remain. Reducing health disparities was one of the goals of the Healthy People 2000; Healthy People 2010 has committed to a bolder goal—eliminating health disparities among Americans. President Clinton stated in the year 2000 that fulfilling this commitment to eliminate racial and ethnic health disparities by the year 2010 is a moral imperative. The National Heart, Lung, and Blood Institute (NHLBI) agrees.

The NHLBI recognized very early the need for focused research in minority populations where issues unique to the population could best be addressed. The Strong Heart Study, initiated in 1988, was designed to provide a description of cardiovascular disease (CVD) and its risk factors among American Indians. Indeed, data from this multicenter study immediately provided the most representative data available on CVD and many other aspects of the health of American Indians. The 3-year initial study (Phase I) made apparent that the distribution of risk factors and the trajectories of disease among American Indians were not reflective of the national data on all Americans. These data helped to inform Federal and State leaders about the health of the Nation; no other data on American Indians were available. Subsequently, measurement of new risk factors and collection of morbidity and mortality events during Phases II and III allowed the development of risk functions specific to American Indians. This information reinforces both the unique risk factor profile and the disparities in health of American Indians.

The NHLBI provides this data book of the Strong Heart Study to the American Indian communities that have been so cooperative and supportive of this research effort for more than a decade. We also provide it to those responsible for health care delivery in these and surrounding American Indian communities so that they are more fully informed of the health issues specific to American Indians.

We thank the participating American Indian communities. Reductions in health disparities cannot begin until the disparities have been identified. The Strong Heart Study has made a significant contribution to the identification of the health disparities of American Indians. It is our intention that these data will serve as the basis for public health awareness, community planning, and resource utilization to realize the goals of Healthy People 2010 for current and future generations of American Indians.

Claude Lenfant, M.D.
Director
National Heart, Lung, and Blood Institute
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Acknowledgements

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Chairperson/Governor/President and Council members of the following tribes:

- Ak-Chin Pima/Papago Indian Community
- Apache Tribe of Oklahoma
- Caddo Indian Tribe of Oklahoma
- Cheyenne River Sioux Tribe
- Comanche Indian Tribe
- Delaware Nation
- Fort Sill Apache Tribe of Oklahoma
- Gila River Pima/Maricopa (Akimel O'odham/Pee Posh) Indian Community
- The Kiowa Indian Tribe of Oklahoma
- Oglala Sioux Tribe
- Salt River Pima/Maricopa (Akimel O'odham/Pee Posh) Indian Community
- Spirit Lake Sioux Tribe
- Wichita Tribe

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Introduction

Although American Indians in the past had very low CVD rates, CVD today is the leading cause of death among American Indians. Approximately 30 percent of American Indian deaths for all ages is associated with diseases of the heart, and the number of American Indians ages 45 years and older with heart disease exceeds the next three leading causes of death (cancer, diabetes, and unintentional injuries) combined. Data collected by the Indian Health Service in the 1980s had suggested that there might be diversity among American Indian communities in the rates of CVD. In addition, the decline in age-adjusted heart disease rates experienced by the general population was not being observed, which was a cause for great concern. Largely as a result of these observations, the NHLBI initiated the Strong Heart Study in 1988. It was conducted in 13 American Indian tribes in three geographically diverse areas we have called centers. In the Arizona center, the MedStar Research Institute completed examinations in the Gila River and Salt River Indian communities that include Pima and Maricopa (Akimel O'odham/Pee Posh) Indians, and the Ak-Chin Indian Community that include the Pima and Papago Indians. In the Oklahoma center, the University of Oklahoma Health Sciences Center completed examinations in Lawton, Anadarko, and Carnegie from American Indian communities that include the Kiowa, Comanche, Apache, Fort Sill Apache, Wichita, Delaware, and Caddo tribes. The South Dakota and North Dakota Center (the Dakotas) completed examinations of the Oglala Sioux in the Pine Ridge Reservation and the Cheyenne River Sioux in Eagle Butte, South Dakota, and the Spirit Lake Tribe in Fort Totten, North Dakota. Responsibility for the Dakota Center has evolved from the Aberdeen Area Indian Health Service to the Aberdeen Area Tribal Chairmen's Health Board, and, most recently, to the Missouri Breaks Industries Research, Inc, an American Indian-owned corporation.

The objectives of the Strong Heart Study are threefold: to investigate CVD and its risk factors among these centers, to identify differences in CVD among centers, and to determine if the differences in known risk factors for CVD explain the differences in CVD among centers. The study has had a particular focus on the effects of diabetes on CVD and its risk factors because of the high prevalence of diabetes among American Indians.

The initial study included community surveillance for CVD mortality to compare mortality rates among the centers. In addition, physical examinations were conducted on 4,549 American Indian men and women ages 45 to 74 years. This examination provided data to compare risk factors, including high blood pressure, cigarette smoking, and high blood cholesterol levels, and existing disease among the three geographic areas. Following the initial examination, the Strong Heart Study was extended to complete a second examination repeating many of the examination measures to look for change in risk factors and disease status and adding measures on pulmonary function and echocardiography. This second examination, through additional observation and information, provided an opportunity to determine what factors are related to CVD in American Indians and if

risk factors are changing over time. A third examination, recently completed, added additional information on disease and risk factor trends and new measures of atherosclerosis and arteriosclerosis to better understand the kind of CVD that occurs in American Indians. This data book will present data from these examinations.

Largely as a result of the Strong Heart Study, the general assumption that American Indians are at lower risk of developing CVD compared to the general population has been proven wrong. It was commonly thought by researchers and clinicians that American Indians have some inherent protection against CVD; it is now clear that this is probably incorrect, or that this protection, if any, has been largely overridden by the presence of diabetes.

The emerging disparity between CVD mortality and morbidity among American Indians compared to the general population may have occurred from numerous factors. Major cultural changes such as reduction in physical activity, changes in dietary intake, increased rates of smoking and other lifestyle habits might influence CVD. In addition, the Strong Heart Study has confirmed that diabetes is a major risk factor for CVD among American Indians. The study continues to focus on understanding why this increase in CVD occurs in individuals with diabetes and, more importantly, what can be done to reverse the trend.

This data book contains data from the baseline examination on the prevalence of major risk factors of CVD in American Indian men and women ages 45-74 in the American Indian communities from the three centers that participate in the Strong Heart Study. The information is presented in six sections:

Section 1.

Phase I—Enrollment and Demographics provides data on the number of participants from each community and their social and demographic characteristics.

Section 2.

Mortality and Morbidity Rates presents death rates and disease rates by cause from the community mortality survey and examination data.

Section 3.

Knowledge of CVD Factors summarizes community knowledge of factors that increase the risk of disease.

Section 4.

Biologic Risk Factors for CVD shows values for major risk factors and discusses possible treatment strategies.

Section 5.

Diabetes Prevalence and Diabetes-Related Variables provides special emphasis on the CVD risk factor that distinguishes CVD risk for American Indians.

Section 6.

Environmental/Lifestyle Risk Factors— includes lifestyle risk factors such as cigarette smoking, alcohol consumption, diet and physical activity, and discusses strategies for adopting healthful lifestyles.

Since its inception, the Strong Heart Study has made an effort to include a training component in each of the centers to provide an opportunity for young American Indian students to gain experience in the conduct of biomedical research. We believe that through such exposure members of the community may get a better understanding of scientific research and perhaps be motivated to pursue further training that will lead to research or medical careers.

The Strong Heart Study places major emphasis on obtaining input from and sharing results with its participating American Indian communities. Community representatives and physicians participate as members of the Steering Committee, and many community members have provided advice and guidance throughout all phases of the study. The Steering Committee wishes to emphasize the extreme importance of leadership and involvement from Indian communities in research conducted within their communities. This data book is one way through which results will be communicated to participants and community members and translated into improved healthcare systems and prevention programs that will ultimately reverse the rising incidence of CVD in American Indian populations.

1. Phase I—Enrollment and Demographics

Phase I Enrollment. A total of 4,549 people participated in the first Strong Heart Study examination in 1989-91, 1,500 or more at each of the three centers: Arizona, Oklahoma, and the Dakotas. Overall, 62 percent of the enrolled tribal members ages 45 to 74 years who were residing on or near the reservation or community in the 13 participating tribes completed the first examination of the study. Participation rates ranged from 55 percent to 72 percent across the three centers. Forty-one percent of the participants were men and 59 percent were women. Figures 1 and 2 provide the details.

Marital Status. Fifty percent to 63 percent of the male participants were currently married and 42 percent to 50 percent of the female participants were currently married. Two to three times as many women were widowed as men. Figures 3 and 4 show marital status among men and women by center.

Education Levels. Just over 50 percent of American Indians in the Strong Heart Study were high school graduates. Significantly more participants from Oklahoma graduated high school and attended college than did participants from Arizona and the Dakotas. Men and women achieved about the same level of education within each center. Figures 5 and 6 show education levels among men and women by center.

Figure 1. Phase I Enrollment Among Men by Age Group and Center (1989 to 1991)

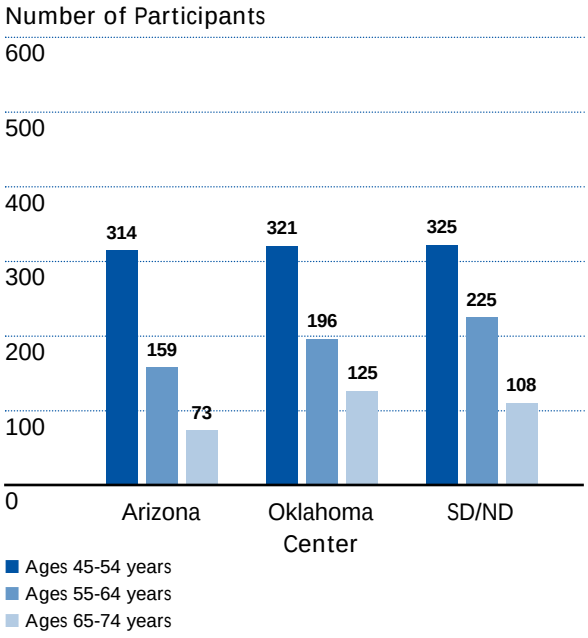
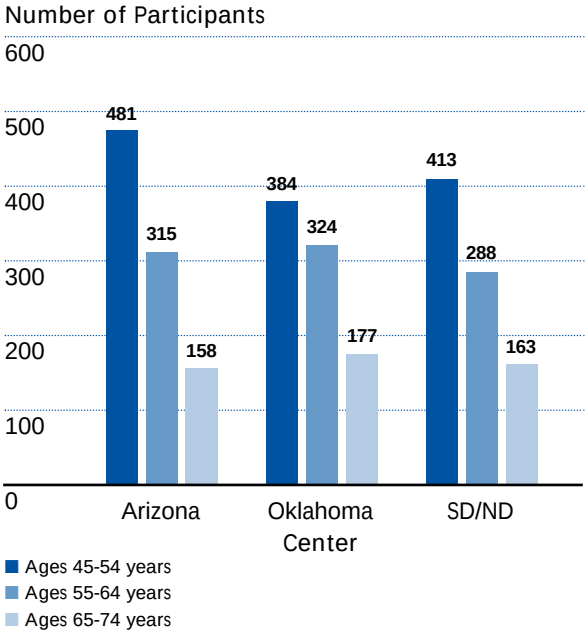


Figure 2. Phase I Enrollment Among Women by Age Group and Center (1989 to 1991)



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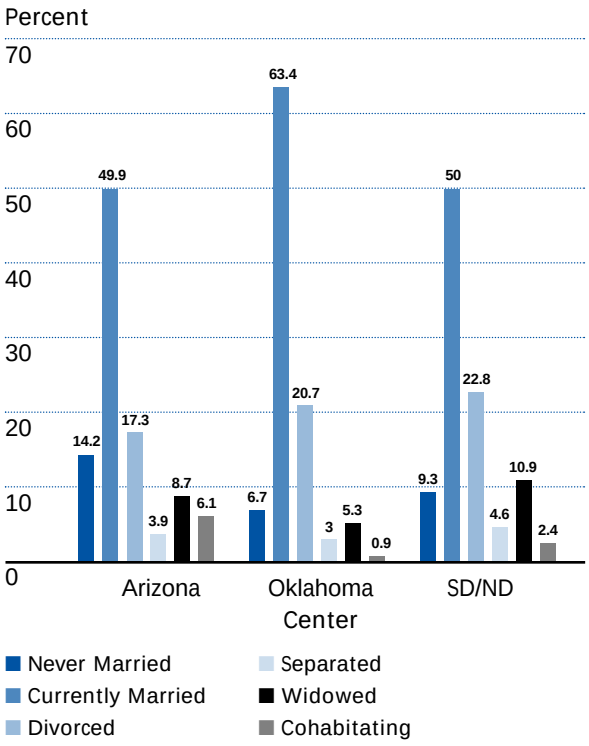

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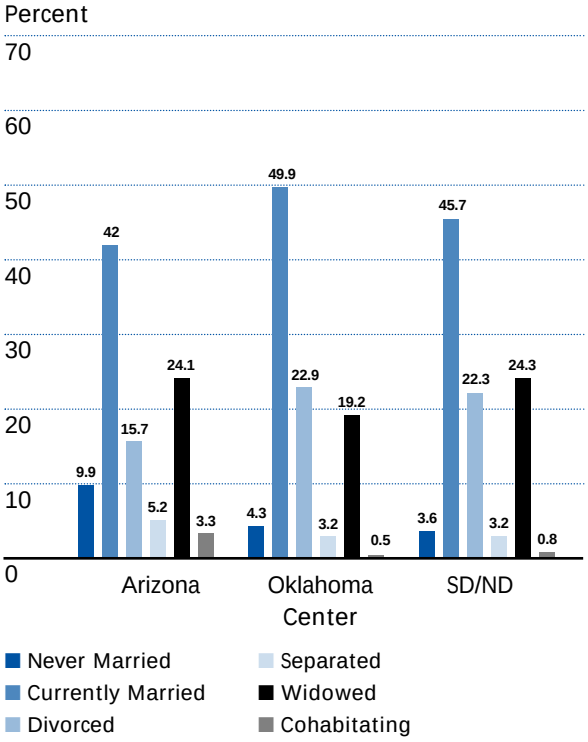

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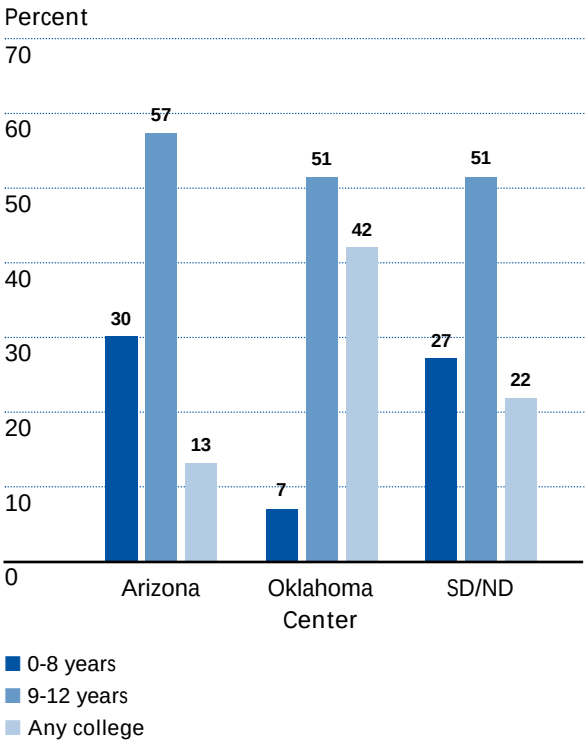
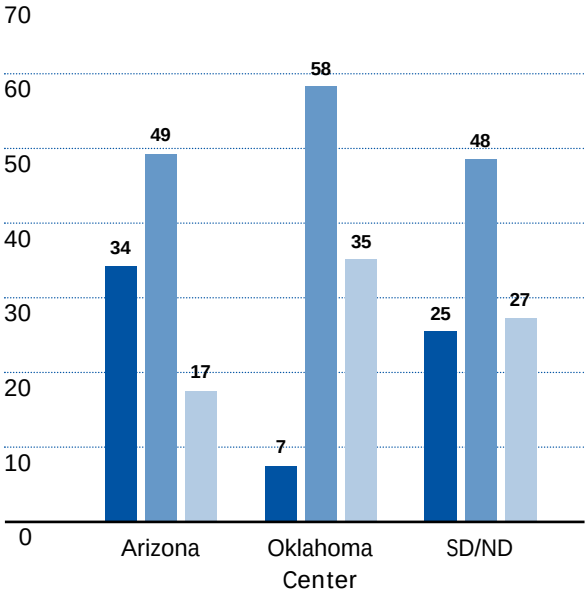


Figure 6. **Education Levels Among Women by Center**



2. Mortality and Morbidity Rates

Prevalence of Heart Attack. A heart attack (myocardial infarction) results from damage to the heart muscle caused when the blood supply to a portion of the heart is reduced or cut off. Among men who came to the first Strong Heart Study examination, definite evidence of a previous heart attack was seen in men from Oklahoma (5.6 percent) and the Dakotas (4.9 percent) more often than in men from Arizona (1.7 percent). Evidence of a previous heart attack was based on standardized interpretation of the electrocardiogram taken during the examination, or a history of a heart attack verified by an expert panel completing a standardized review of the medical records. Definite and possible designations followed standard guidelines of Minnesota Codes for interpreting the electrocardiogram. Across centers, from 4.3 percent to 6.6 percent of men had some indication of a possible previous heart attack. Combining definite and possible heart attack rates shows that from about 7 to 12 of every 100 men ages 45 to 74 in the Strong Heart Study had some evidence of a previous heart attack. Figure 7 shows the prevalence of myocardial infarction among men by center.

Definite evidence of a previous heart attack was less common in women. A lower rate of heart attack in women compared to men is seen in most populations. Between 0.5 percent and 1.5 percent of women at the Strong Heart Study centers had evidence of having already had a heart attack at the time they were examined, and nearly 5 percent of women had signs of a possible prior heart attack. Overall, 5 to 7 of every 100 women ages 45 to 74 in the study had some evidence of a prior heart attack. Figure 8 shows the prevalence of myocardial infarction among women by center.

Prevalence of Coronary Heart Disease. The combined frequency of several types of coronary heart disease (CHD) (heart attack, heart surgery to prevent a heart attack, and chest pain determined to be angina pectoris) is shown for men in Figure 9. Definite evidence of CHD was present in 2.4 percent to 7 percent of all men examined in the Strong Heart Study. Possible heart disease was even more common, ranging from 14.6 percent to 18.2 percent. As was true for heart attack alone, CHD was less common in Arizona men ages 45 to 74 than in those from Oklahoma or the Dakotas. Combining the rates for possible and definite CHD shows that 17 to 25 of every 100 Strong Heart Study men ages 45 to 74 had some evidence of heart disease. These rates show that CHD is a common and important problem in American Indian men. Figure 9 shows the prevalence of CHD among men by center.

Figure 7. Prevalence of Myocardial Infarction (MI) Among Men by Center

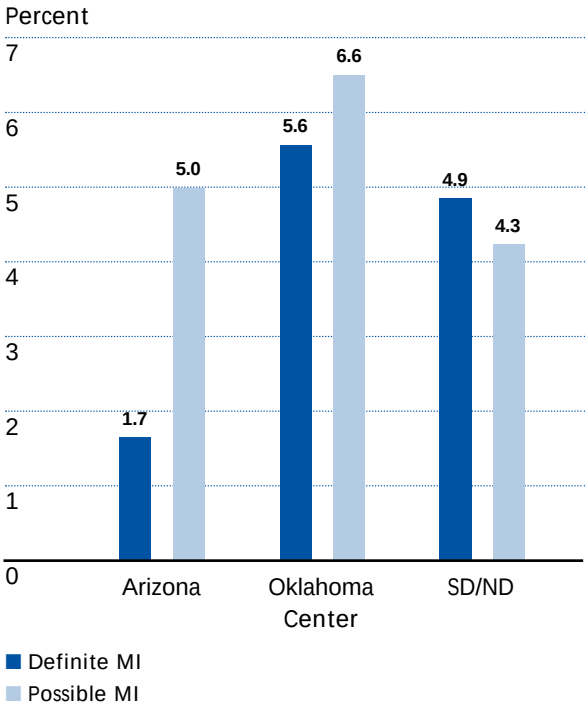
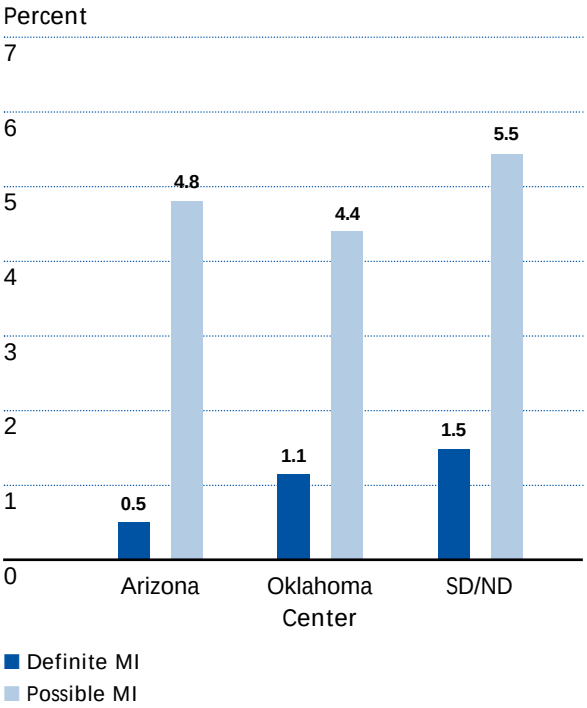


Figure 8. Prevalence of Myocardial Infarction (MI) Among Women by Center



The combined frequency of several important types of CHD for women is shown in Figure 10. Definite evidence of CHD was not common in women (rates ranged from 0.8 percent to 2.3 percent). However, evidence of possible CHD was found in a high percentage of women (19.2 percent to 22.8 percent) and these rates were even higher than those for men. This is due to more electrocardiogram abnormalities and more reported chest pain in women than in men. Combining the rates for possible and definite CHD shows that 20 to 25 of every 100 Strong Heart Study women ages 45 to 74 had some evidence of this condition. These rates show that CHD is a common and important problem in American Indian women.

Prevalence of Stroke. A stroke refers to damage to some part of the brain because of either bleeding into the brain or because the blood supply to a part of the brain is reduced or cut off. Strokes are included as part of CVD because they can result from the same kinds of problems in blood vessels that cause heart attacks. Figure 11 shows that less than 1 percent of women (0.2 percent to 0.7 percent) and from 0.2 percent to 1.4 percent of men reported having had a previous stroke at some time before their first Strong Heart Study examination. In men ages 45 to 74, the rate of previous stroke was higher in participants from the Dakotas and Oklahoma than in those from Arizona, but the number of cases is too small to draw firm conclusions. Except for Arizona, a history of stroke was more common in men than in women.

Incidence of Cardiovascular Disease. Figure 12 presents the annual incidence of CVD among men and women ages 45 to 74 in the Strong Heart Study communities estimated over a 4-year period from the first examination until the second. CVD includes heart attack, congestive heart failure, and stroke and includes those who survived as well as those who died from the disease during this period.

Figure 9. Prevalence of Coronary Heart Disease (CHD) Among Men by Center

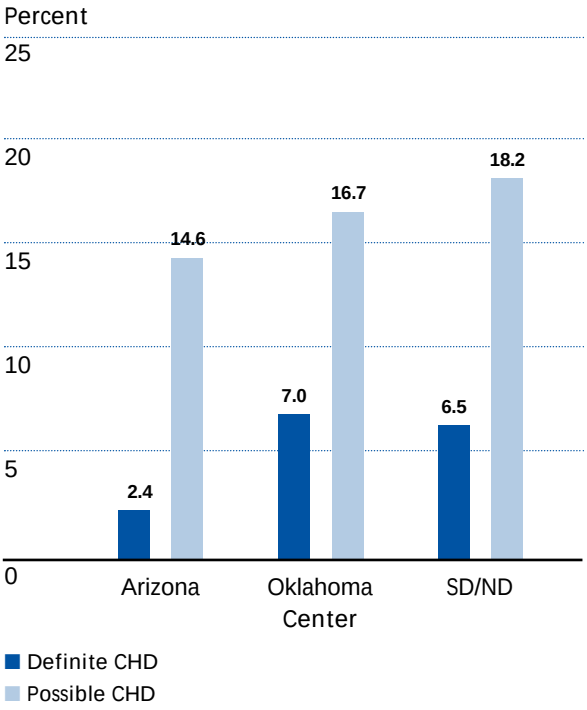


Figure 10. Prevalence of Coronary Heart Disease (CHD) Among Women by Center

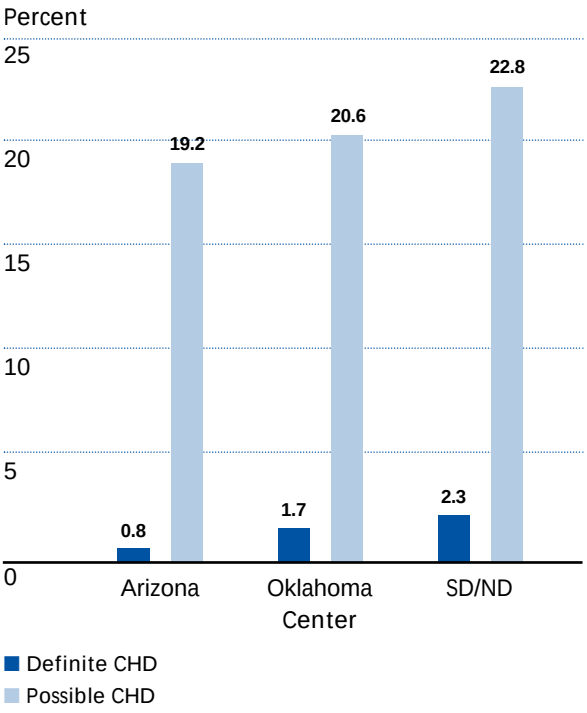


Figure 11. Prevalence of Stroke Among Men and Women by Center

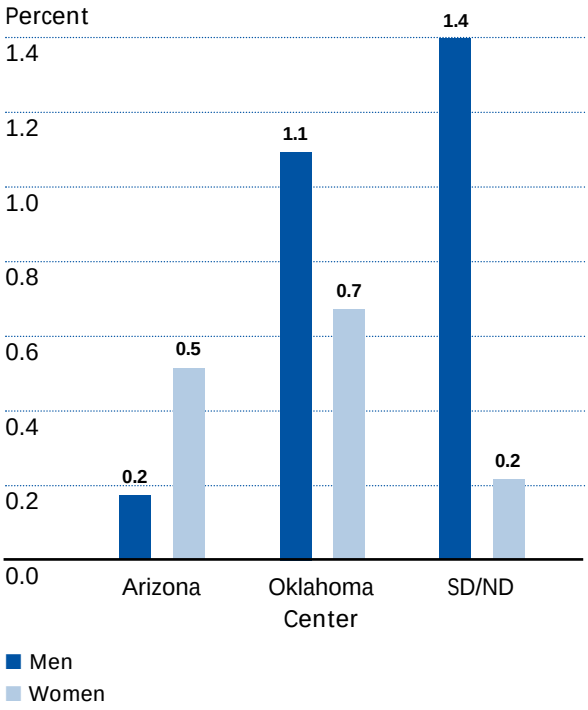
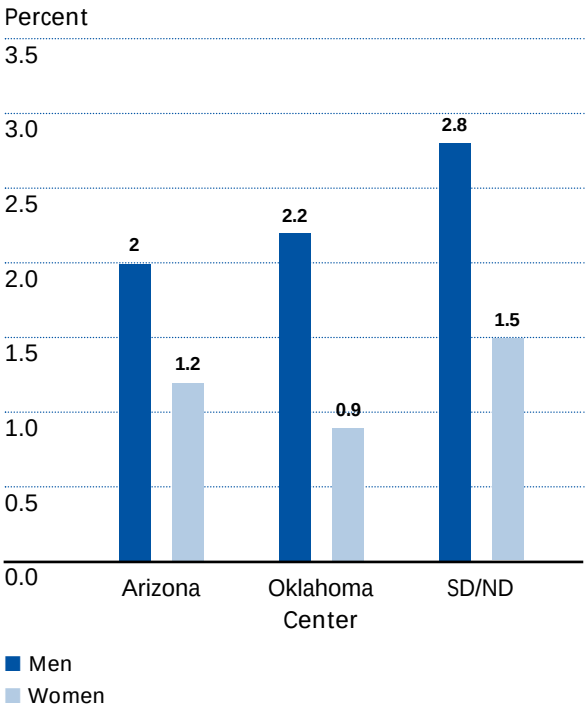


Figure 12. Incidence of CVD Over the 4-Year Period From Exam I to Exam II Among Men and Women by Center



Cardiovascular Disease Death Rates by Cause. Table 1 shows the annual numbers of deaths for every 1,000 men in the Strong Heart Study centers. The mortality rate for total CVD including heart attack, congestive heart failure, and stroke was lowest in Oklahoma men (31 per 1,000 men), followed by Arizona and the Dakotas. Depending on the center, death rates in men from CVD were 1.2 to 2.2 times higher than rates in women. Sudden death (within 1 hour) equaled or exceeded myocardical infarction.

Table 2 shows the annual number of deaths for every 1,000 women in the Strong Heart Study centers. The mortality rate for total CVD (all types) was lowest in Arizona women (19 per 1,000 women) and similar in Oklahoma and the Dakotas. There were some differences by center in which type of CVD had the highest death rate. The death rate in Arizona women was highest for stroke (6 per 1,000) followed by heart attack (MI) and sudden death. In Oklahoma, the highest death rates were for other CHD and stroke, while among Dakota women, other CHD and heart attack were the leading causes of CVD death.

Prevalence of Enlarged Hearts. In the second Strong Heart Study examination, pictures of the heart were made using high-frequency sound (ultrasound), a technique called echocardiography. One of the most important measurements that can be obtained by echocardiogram is an estimate of the weight of the heart's main pumping chamber, the left ventricle. Increased left ventricular muscle weight (left ventricular hypertrophy) has been shown to be a stronger predictor of heart attack and cardiovascular death than

Table 1. Cardiovascular Disease Death Rates Among Men by Cause and Center (Mortality Rate per 1,000 population)*

	Arizona	Oklahoma	Dakotas
Myocardial Infarction	7	3	13
Sudden death	11	10	12
Other coronary heart disease**	15	9	20
Stroke	4	5	7
Congestive heart failure	0	2	2
Other CVD	5	2	3
TOTAL CVD	42	31	56

* Community Mortality Surveillance, (1984—1988) based on death certificate data.
** Total coronary heart disease = myocardial infarction + sudden death + other

Table 2. Cardiovascular Disease Death Rates Among Women by Cause and Center (Mortality Rate per 1,000 population)*

	Arizona	Oklahoma	Dakotas
Myocardial infarction	4	4	5
Sudden death	4	5	3
Other coronary heart disease**	2	9	10
Stroke	6	6	3
Congestive heart failure	0	2	2
Other CVD	3	0	3
Total CVD	19	25	26

* Community Mortality Surveillance, (1984—1988) based on death certificate data.
** Total coronary heart disease = myocardial infarction + sudden death + other

standard risk factors other than older age itself in other populations. Among women, more than one-third of those in Arizona and approximately 3 of 10 of those in Oklahoma and the Dakotas had left ventricular hypertrophy. Among Strong Heart Study men, prevalence rates of left ventricular hypertrophy were lower, approximately 1 in 6 in Arizona and the Dakotas and 1 in 7 in Oklahoma. Better control of hypertension and of overweight/obesity, two of the major causes of left ventricular hypertrophy, would be expected to reduce the prevalence of this form of heart disease. Figure 13 shows the prevalence of left ventricular hypertrophy by gender and center.

The ability of the heart to pump blood out of the heart and through the body is measured by the proportion of the blood in the heart that is pumped out with each heart beat (ejection fraction). Mild ventricular dysfunction is defined as an ejection fraction of less than 54 percent, which, for comparison purposes, was found in 2 percent of apparently healthy individuals of the same age living in New York City. Severe ventricular dysfunction is defined as an ejection fraction less than 40 percent. Individuals with severe ventricular dysfunction are at high risk of CVD. From three (in Arizona) to seven (in the Dakotas) of every 100 Strong Heart Study men had severe ventricular dysfunction, while more than one-sixth of men in all centers had mild ventricular dysfunction. Figure 14 shows the prevalence of mild and moderate-to-severe left ventricular dysfunction among men by center.

Prevalence of Mild-to-Severe Impairment of Heart Function. The prevalence rates of severe cardiac dysfunction were lower among Strong Heart Study women than men, ranging from about 1 in every 100 in the Dakotas to nearly 3 in every 100 in Arizona. Mild ventricular dysfunction occurred in 6 to 9 of every 100 Strong Heart Study women in all three centers. Figure 15 shows the prevalence of mild and moderate-to-severe left ventricular dysfunction among women by center.

Figure 13. Prevalence of Left Ventricular Hypertrophy Among Men and Women by Center

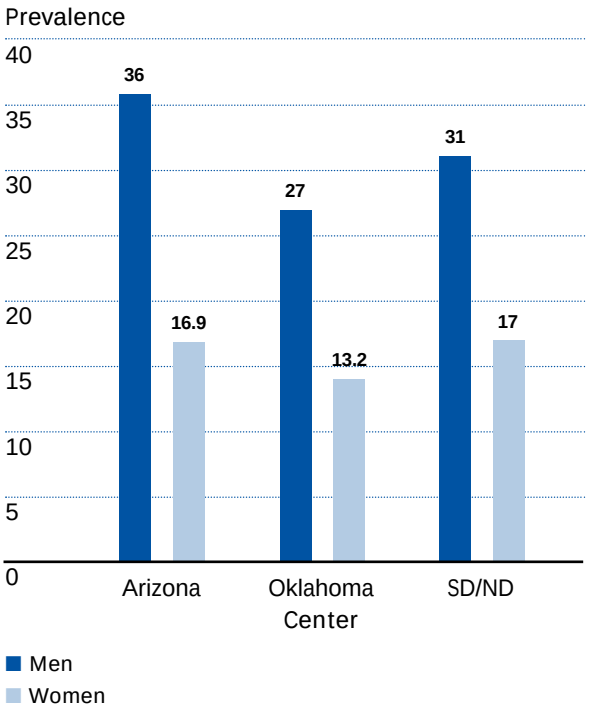
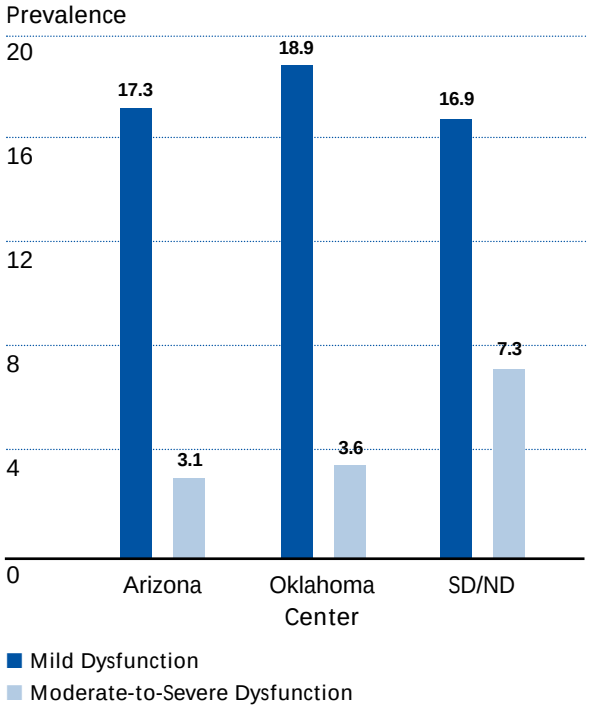


Figure 14. Prevalence of Mild and Moderate-to-Severe Left Ventricular Dysfunction Among Men by Center



Prevalence of Emphysema (Self-Reported). Emphysema is a disease that destroys the lungs and makes breathing very difficult. It is usually caused by smoking or exposure to pollutants in the air. Rates of emphysema are lowest in Arizona and appear slightly higher for men than women as shown in Figure 16. See the later figures in the section on environmental/lifestyle risk factors for relationships of emphysema rates to cigarette smoking.

Prevalence of Arthritis (Self-Reported). Figure 17 shows the percentage of Strong Heart Study participants who reported that a medical person had told them at any time that they have arthritis of any and all kinds (degenerative, rheumatoid, etc.). Women reported more arthritis at all three centers than men.

Prevalence of Cancer (Self-Reported). Figure 18 shows the percentage of Strong Heart Study participants who reported that a medical person had told them at any time that they have cancer (including leukemia and lymphoma). Women at all three sites reported significantly more cancer than men; women from Oklahoma and the Dakotas were more likely to report being told they have cancer than Arizona women.

Nationally, breast and cervical cancer are the two most common types of cancer occurring among American Indian women, while prostate cancer is most common among American Indian men. Because there are effective screening tests for these three types of cancer, annual checkups are recommended for people ages 40 years and older.

In terms of deaths due to cancer, however, cancer of the lung is the leading cause of cancer-related death among both American Indian men and women. Over 90 percent of these cases are directly related to cigarette smoking. Therefore, Strong Heart Study participants who presently smoke are urged to quit.

Figure 15. Prevalence of Mild and Moderate-to-Severe Left Ventricular Dysfunction Among Women by Center

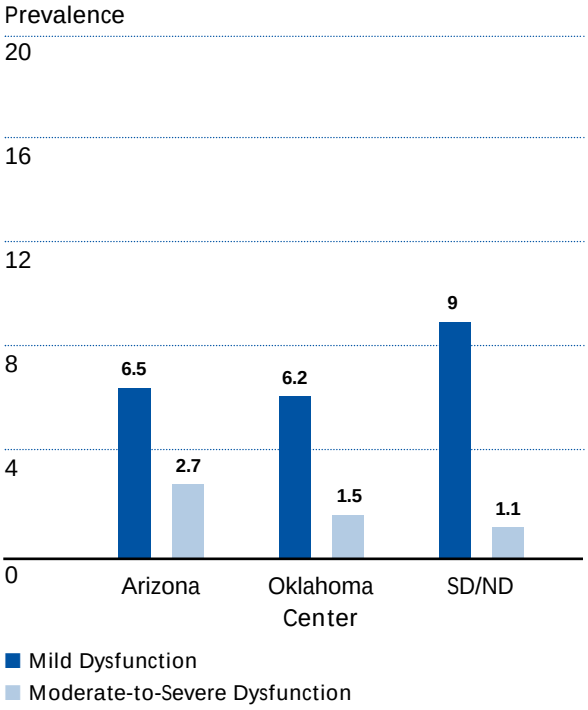


Figure 16. Prevalence of Self-Reported Emphysema Among Men and Women by Center

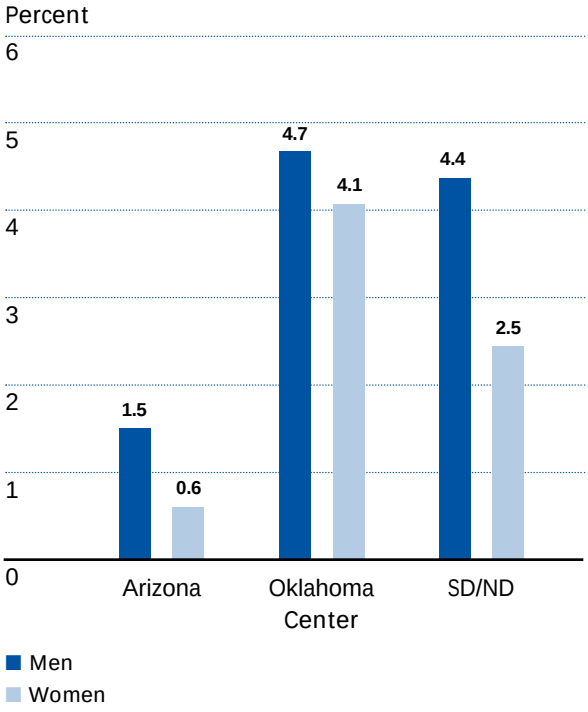


Figure 17. Prevalence of Self-Reported Arthritis Among Men and Women by Center

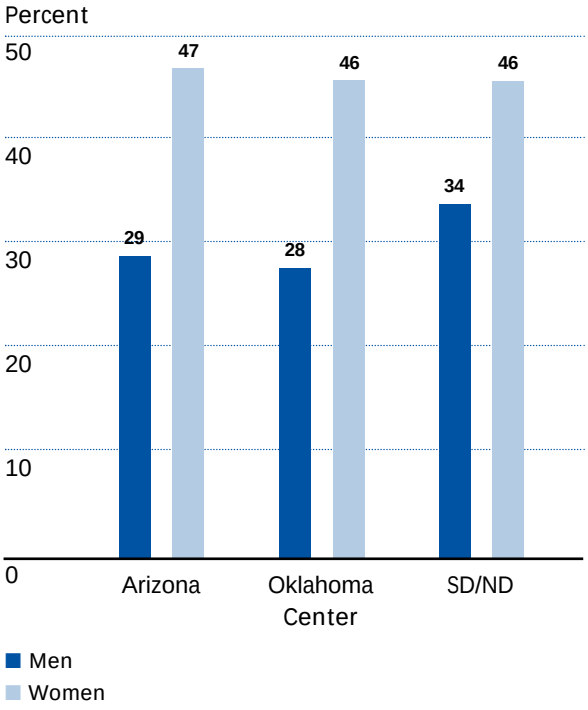
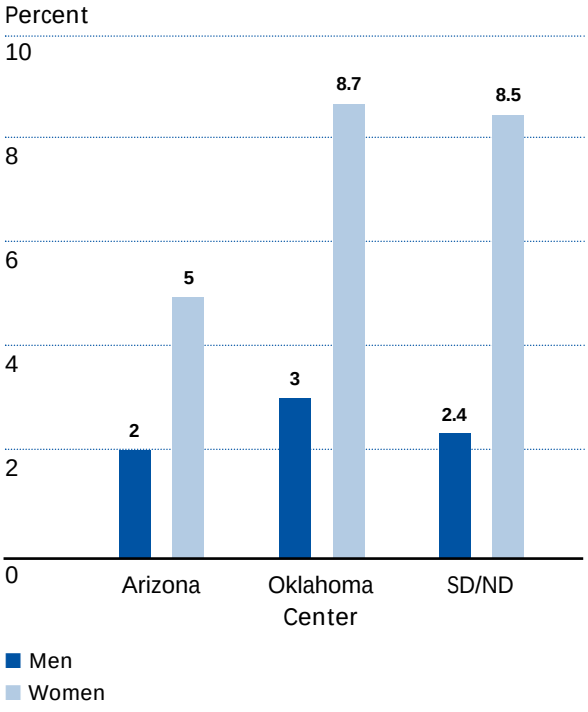


Figure 18. Prevalence of Self-Reported Cancer Among Men and Women by Center



Evidence of Gallstones (Ultrasound and Surgery). Figures 19 and 20 show the percentage of Strong Heart Study men and women participants who were shown to have gallstones according to the gallbladder ultrasound examinations (by ultrasound group) that Strong Heart Study participants received as part of the Phase II examination. These figures also show the percentage of participants who had already had their gallbladders surgically removed at the time of the ultrasound (by surgery group). A high percentage of women at all three centers already had their gallbladders surgically removed at the time of the Phase II examination. When compared with men, women were far more likely to have had their gallbladders surgically removed at all three centers. Among participants still having their gallbladders, however, ultrasound identification of gallstones was roughly equal among men and women.

Figure 19. Evidence of Gallstones Among Men by Center

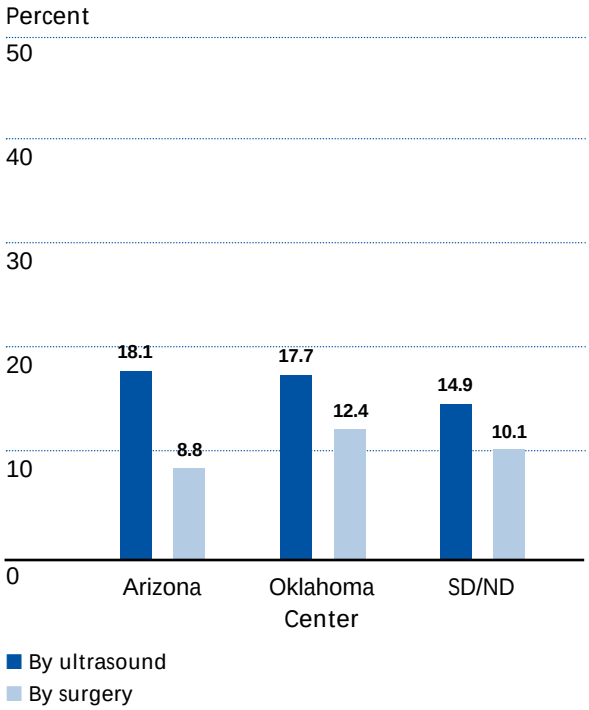
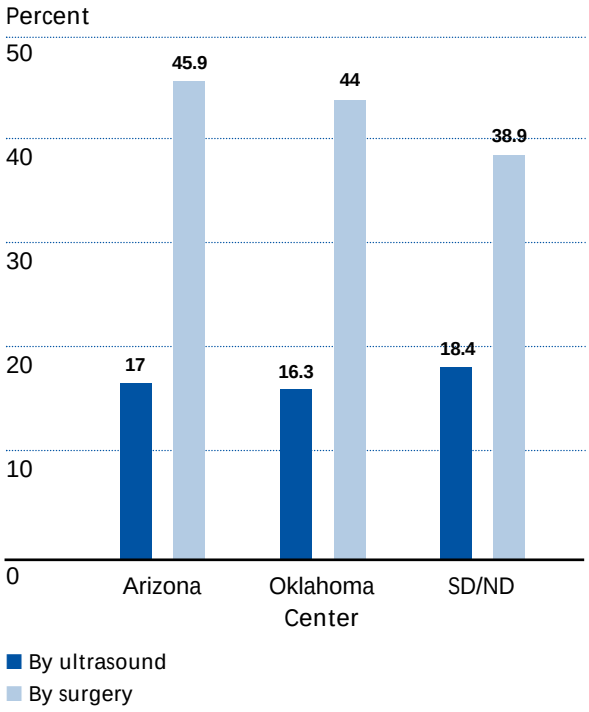


Figure 20. Evidence of Gallstones Among Women by Center



3. Knowledge of Cardiovascular Disease Risk Factors

Development of CVD is associated with several risk factors including high blood pressure, diabetes, high blood cholesterol, stress, overweight, high-saturated-fat diets, physical inactivity, and smoking. One key to preventing CVD lies in controlling these risk factors at both the individual and community levels. At the individual level, health promotion programs aimed at changing knowledge, attitudes, and behaviors of individuals are important. At the community level, tribal initiatives to change practices, policies, and the environment are necessary.

The Strong Heart Study included questions on participants' knowledge of CVD risk factors. Data from these questions are useful to tribal leaders and health planners in designing and implementing CVD risk factor reduction programs. Figures 21 through 28 show participants' risk factor knowledge.

While the Strong Heart Study has consistently provided health education on CVD risk factors to study participants, more comprehensive CVD risk factor education and reduction programs are needed in tribal communities. CVD risk factor knowledge is the first step in risk factor reduction. While most Strong Heart Study participants are knowledgeable about CVD risk factors, changing high-risk behaviors is very difficult at both the individual and community levels. More research is needed to evaluate the best approaches to CVD risk factor reduction in American Indian communities.

Knowledge of High Blood Pressure as a Risk Factor. Blood pressure measurement consists of two numbers, systolic and diastolic blood pressure, representing the blood pressure when the heart is pumping and when it is at rest. Blood pressure is normally measured in the arm, while the individual is sitting, and after a few minutes of rest. High blood pressure is linked with increased risk of heart disease and stroke. Figure 21 presents participants' knowledge that high blood pressure is a risk factor for heart disease among men and women by center.

Knowledge of High Cholesterol as a Risk Factor. Cholesterol is a fatlike substance found in the blood. It can be divided into high density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol, and very low density lipoprotein (VLDL) cholesterol. High levels of (total) cholesterol and LDL cholesterol are linked to higher risk of heart disease. Figure 22 presents participants' knowledge that high cholesterol is a risk factor for heart disease among men and women by center.

Figure 21. Participants' Risk Factor Knowledge: Recognition that High Blood Pressure Increases Risk for Heart Disease Among Men and Women by Center

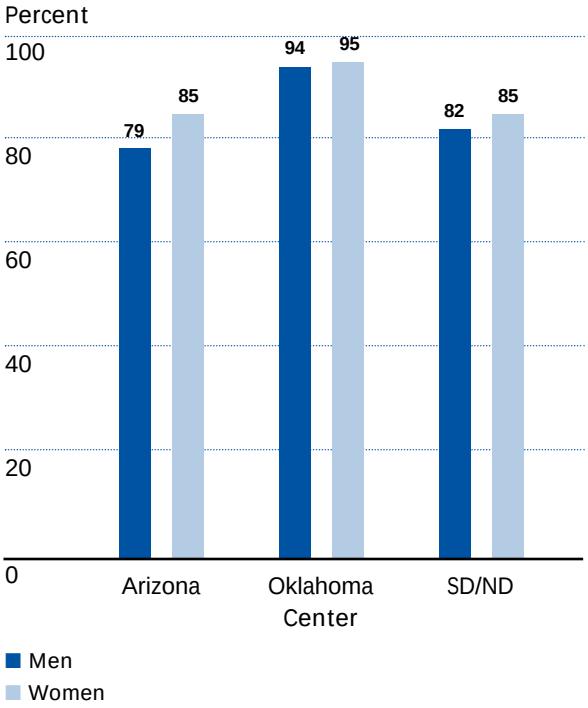
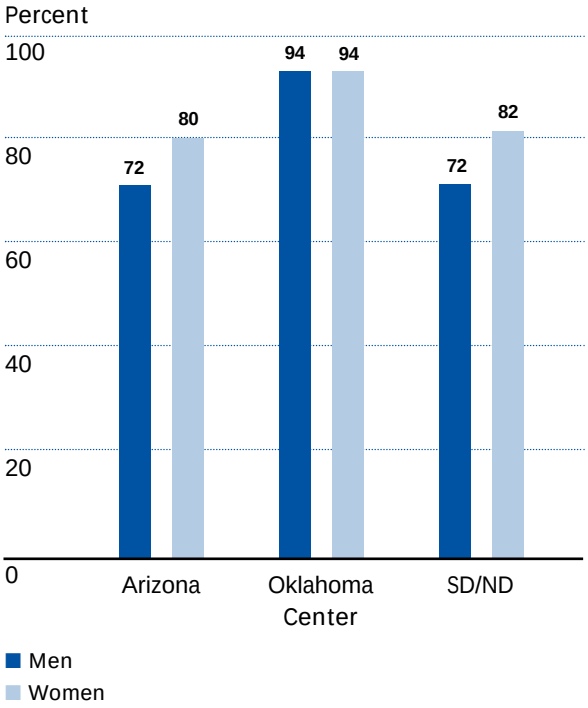


Figure 22. Participants' Risk Factor Knowledge: Recognition that High Cholesterol Increases Risk for Heart Disease Among Men and Women by Center



Knowledge of Overweight as a Risk Factor. Overweight can be assessed by a variety of measurements, the most common of which is weight for height as assessed by body mass index (BMI). Body mass index is determined by dividing weight (measured in kilograms) by height^2 (measured in meters). Based on population surveys, overweight has been defined as a BMI from 25 to 29.9. Obesity has been defined as a BMI of 30 or greater. Higher levels of BMI have been linked to increased risk of heart disease and diabetes. Figure 23 presents participants' knowledge that overweight is a risk factor for heart disease among men and women by center.

Knowledge of Cigarette Smoking as a Risk Factor. Cigarette smoking has been linked to increased risk of heart disease, lung disease and cancer. The risk of disease from cigarette smoking rises with the number of cigarettes smoked and the number of years an individual smoked. Risk declines with the number of years since quitting. Cigarette smokers are urged to quit smoking or, at least, reduce the number of cigarettes smoked. Figure 24 presents participants' knowledge that cigarette smoking is a risk factor for heart disease among men and women by center.

Knowledge of Family History of Heart Disease as a Risk Factor. Further education on the importance of knowing one's family history of heart disease in order to recognize that heart disease risk is increased when there is a family history of the disease. This area of knowledge ranked lowest of all risk factor knowledge areas. The Strong Heart Study has recently received additional funding to further study familial and genetic factors that cause heart disease. Education on the relevance of family history of heart disease will also be provided as part of that study. Figure 25 presents participants' knowledge that family history of heart disease is a risk factor for heart disease among men and women by center.

Figure 23. **Participants' Risk Factor Knowledge: Recognition that Being Overweight Increases Risk for Heart Disease Among Men and Women by Center**

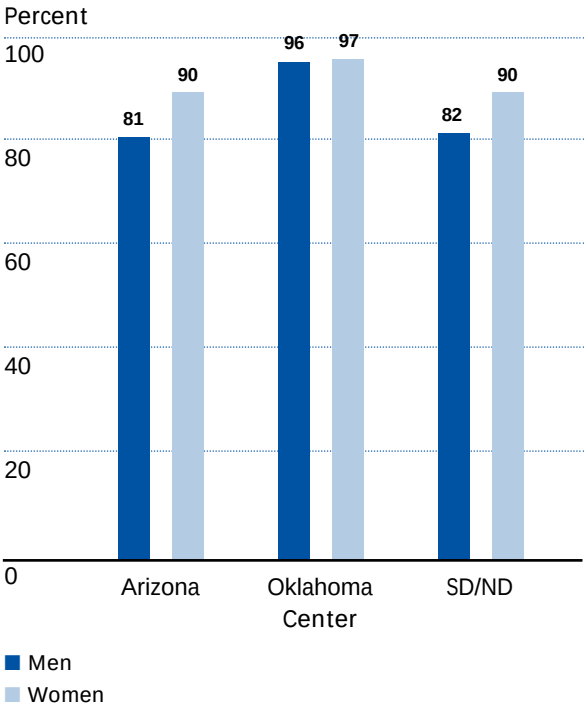


Figure 24. **Risk Factor Knowledge: Participants Recognizing Cigarette Smoking Increases Risk for Heart Disease by Gender and Center**

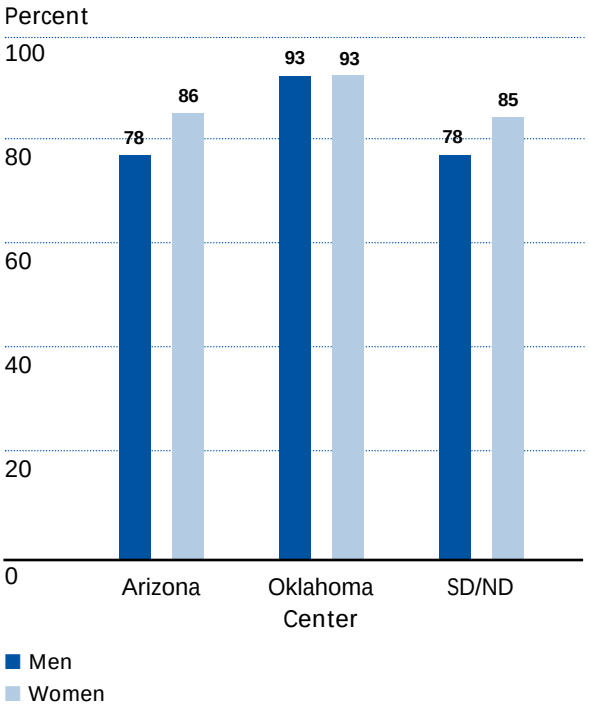


Figure 25. **Participants' Risk Factor Knowledge: Recognition That Family History of Heart Disease Increases Risk for Heart Disease Among Men and Women by Center**

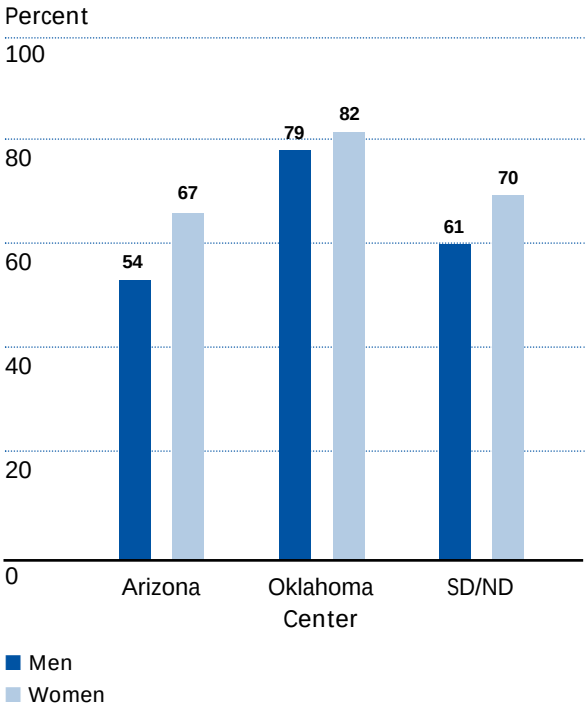
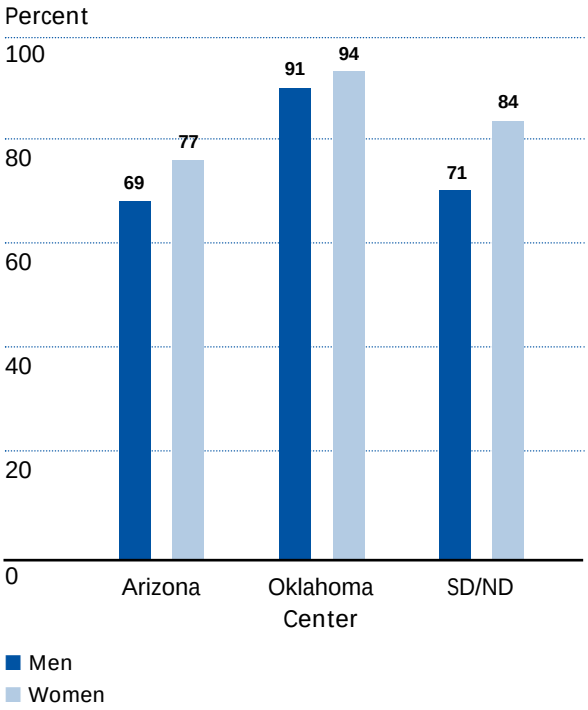


Figure 26. **Participants' Risk Factor Knowledge: Recognition That Worry, Anxiety and Stress Increase Risk for Heart Disease Among Men and Women by Center**



Knowledge of Worry, Anxiety, and Stress as a Risk Factor. Worry, anxiety and stress have been associated with a variety of negative health outcomes including heart disease. Figure 26 presents participants' knowledge that worry, anxiety, and stress are risk factors for heart disease among men and women by center.

Knowledge of Lack of Regular Physical Activity as a Risk Factor. Lack of regular physical activity has become an increasingly important risk factor for heart disease as people move away from traditional life styles. Machines and labor saving devices have reduced physical activity on the job and in the household. Access to television has increased sedentary behavior and reduced people's time for leisure physical activity. Figure 27 presents participants' knowledge that lack of physical activity is a risk factor for heart disease among men and women by center.

Knowledge of High Fat Diet as a Risk Factor. High blood cholesterol is one of the strongest predictors of CHD. Although blood cholesterol levels are influenced by genetic factors, they are also greatly influenced by diet. The most important component of the diet that influences blood cholesterol is saturated fat. The main source of saturated fat in the diet comes from animal fat; including whole fat milk and whole fat milk products such as cheeses. Nutrition education programs can help community members recognize that animal fat is a major source of saturated fat. The use of lean meat, poultry, and fish; removal of the fat from meat before and during cooking; more frequent use of low-fat and non-fat dairy products, including fruits, vegetables, and whole grain food products; and choosing sensible serving sizes of food are effective approaches to a healthy diet that will help to lower the risk of heart disease. Figure 28 presents participants' knowledge that a diet high in animal fat is linked with increased risk of heart disease among men and women.

Figure 27. Participants' Risk Factor Knowledge: Recognition That Lack of Regular Physical Activity Increases Risk for Heart Disease Among Men and Women by Center

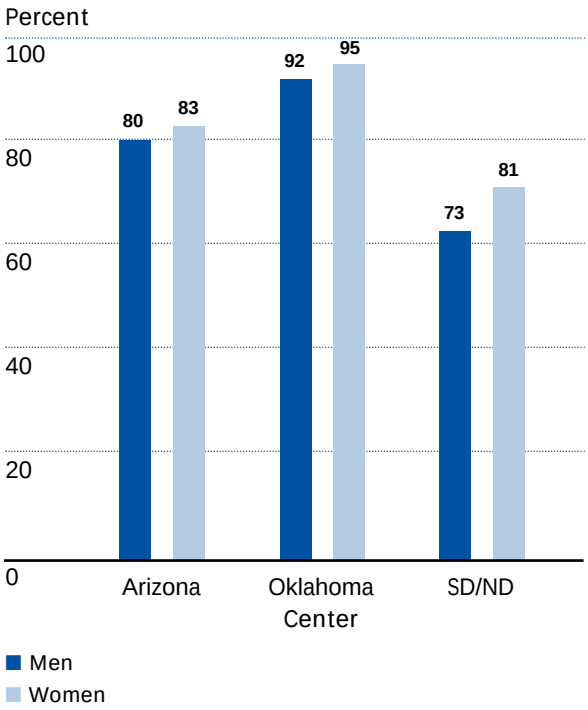
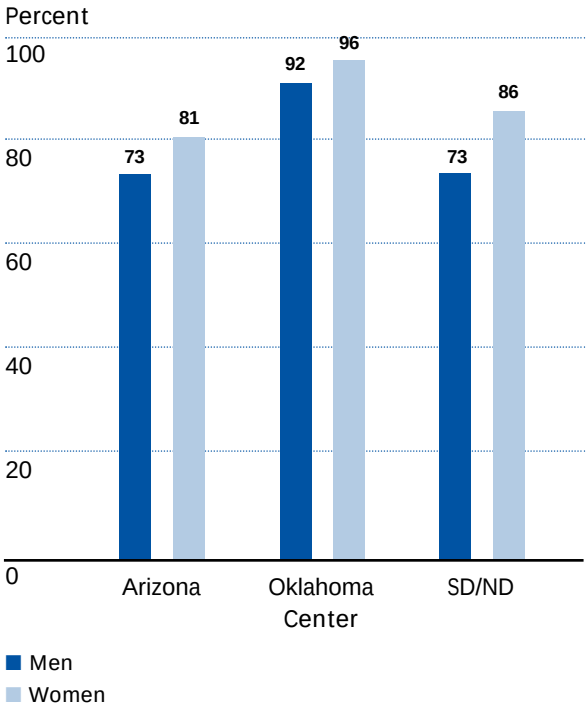


Figure 28. Participants' Risk Factor Knowledge: Recognition That a Diet High in Animal Fat Increases Risk for Heart Disease Among Men and Women by Center



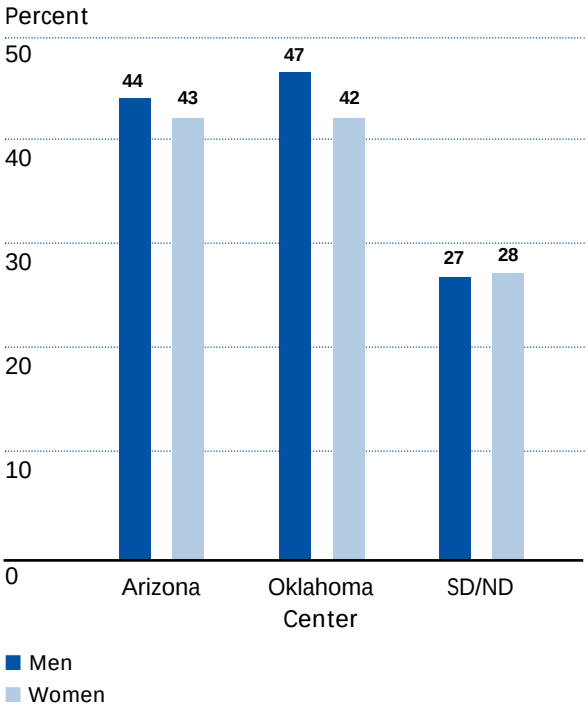
4. Biologic Risk Factors for Cardiovascular Disease

High Blood Pressure. High blood pressure (hypertension) is one of the most important risk factors for heart attack, stroke, and cardiovascular death.

Prevalence. In the first Strong Heart Study examination, more than 4 of every 10 men and women participating in Arizona and Oklahoma and more than 25 percent of those in the Dakotas had elevated blood pressure or were taking medication to control blood pressure. Hypertension was more common among Strong Heart Study participants from Arizona and Oklahoma than in a national survey conducted at the same time. (Third National Health and Nutrition Examination Study, 1988—91), and less common among participants in the Dakotas. Figure 29 shows percentage of participants with hypertension.

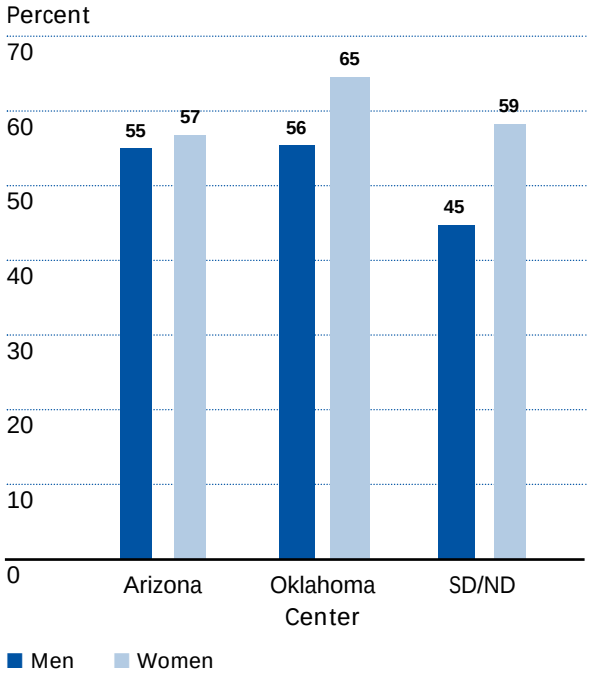
Treatment. Among Strong Heart Study participants with hypertension, nearly 6 out of 10 women in Arizona and the Dakotas and almost 2 of every 3 women with high blood pressure in Oklahoma were taking blood-pressure-lowering medications. The proportion of hypertensive men receiving antihypertensive medication was, compared to women, slightly lower in Arizona, 10 percent lower in Oklahoma, and 15 percent lower in the Dakotas. A similar proportion of hypertensive patients in a national survey was treated. Figure 30 presents these percentages.

Figure 29. Percent of Participants With Hypertension* Among Men and Women by Center



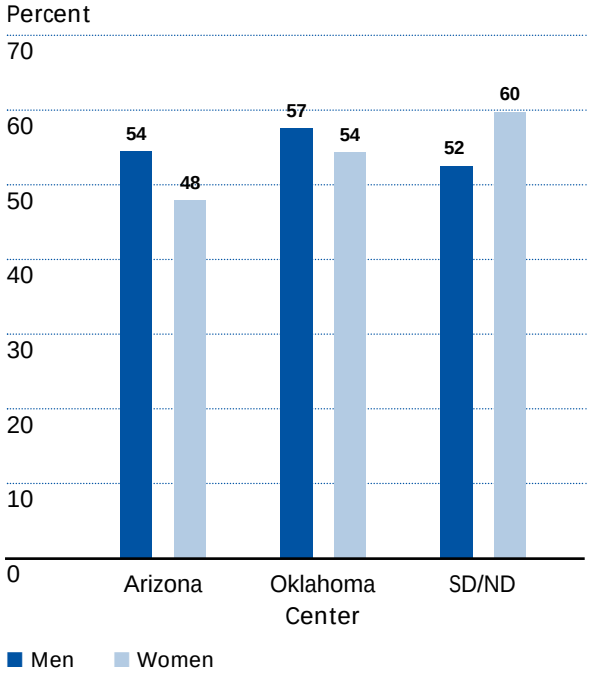
* Hypertension is defined as systolic blood pressure greater than 140 mmHg or diastolic blood pressure greater than 90 mmHg or current use of antihypertensive medication.

Figure 30. Percent of Men and Women Participants With Hypertension Treated by a Physician by Center*



* Hypertension is defined as systolic blood pressure greater than 140 mmHg or diastolic blood pressure greater than 90 mmHg

Figure 31. Percent of Men and Women Participants With Controlled Hypertension by Center*



* Treated and controlled is defined as those study participants on antihypertensive medications that have systolic blood pressure less than 140 mmHg and diastolic blood pressure less than 90 mmHg.

Treatment and Control. Among Strong Heart Study participants receiving medication to control hypertension, more than half of men in all three centers had blood pressure that had been reduced to target levels. Among hypertensive women, 6 out of 10 in the Dakotas and more than half of those in Oklahoma but fewer than half in Arizona had adequate blood pressure control. Strong Heart Study participants with hypertension were equally likely to be treated and more likely to be controlled than those in a national survey. Figure 31 presents these percentages.

Blood Pressure Guidelines. *The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure* defines high blood pressure as systolic blood pressure (SBP) of 140 mmHg or greater, diastolic blood pressure (DBP) of 90 mmHg or greater, or taking antihypertensive medication. Identification and treatment of high blood pressure reduces the risk of CVD and associated morbidity and mortality. The positive relationship between SBP and DBP and cardiovascular risk has long been recognized. This relationship is strong, applies to all people, is strengthened by any increase in blood pressure, and is significant for those with and without CHD. Individuals with SBP in the 140 to 160 range or DBP in the 90 to 99 range should modify their lifestyles to reduce their blood pressure. Lifestyle modifications include weight reduction; moderation of alcohol intake; regular aerobic physical activity; moderation in dietary sodium intake; and increase in potassium, calcium, and magnesium intake. Individuals with evidence of high blood pressure should avoid tobacco. If the individual has organ damage or clinical CVD and/or diabetes, drug therapy is recommended. Drug therapy is recommended when SBP exceeds 160 or DBP exceeds 100, regardless of other existing risk factors. Treatment has been shown to be very effective at reducing the risk of CVD.

Undesirable Blood Fat Levels.

Total Cholesterol. The two most common blood lipids (fats) are cholesterol and triglycerides. Both are necessary for body functions, but excess cholesterol has been conclusively shown to cause atherosclerosis (hardening of the arteries) and heart disease. Excess triglycerides may also lead to heart disease, and when triglyceride levels are very high they can also cause a potentially fatal inflammation of the pancreas. These two blood fats are carried on particles called lipoproteins, the most important of which are low density lipoprotein (LDL) and high density lipoprotein (HDL). Both carry cholesterol, but it is the LDL cholesterol that has been shown to lead to atherosclerosis and heart disease. HDL cholesterol appears to be beneficial, as it helps transport cholesterol out of the blood. The recommended levels for total blood cholesterol in the United States for adult men and women are less than 200 mg/dL, with LDL cholesterol lower than 130 mg/dL for lower risk individuals and lower than 100 mg/dL for highest risk individuals, and HDL cholesterol higher than 40 mg/dL. Triglyceride levels should be no higher than 150 mg/dL. Persons with total blood cholesterol 240 mg/dL or higher or with LDL cholesterol of 160 mg/dL or higher are at especially high risk of CVD. Figures 32 and 33 show the percentages of study participants with total cholesterol greater than or equal to 200 mg/dL and greater than 240 mg/dL.

As shown in Figure 33, for both men and women the Arizona center had the lowest percentage of people equal to or exceeding 240 mg/dL, followed by Oklahoma and the Dakota center. Individuals with total cholesterol at or above these levels should see their doctors about treatments to lower their total cholesterol levels. Treatments include dietary intervention and drug treatments.

LDL Cholesterol. The major component of total cholesterol is LDL cholesterol. When total cholesterol is high, frequently it is because LDL cholesterol is high. LDL

Figure 32. Percent of Men and Women Participants With Total Cholesterol Greater Than or Equal to 200 mg/dL by Center

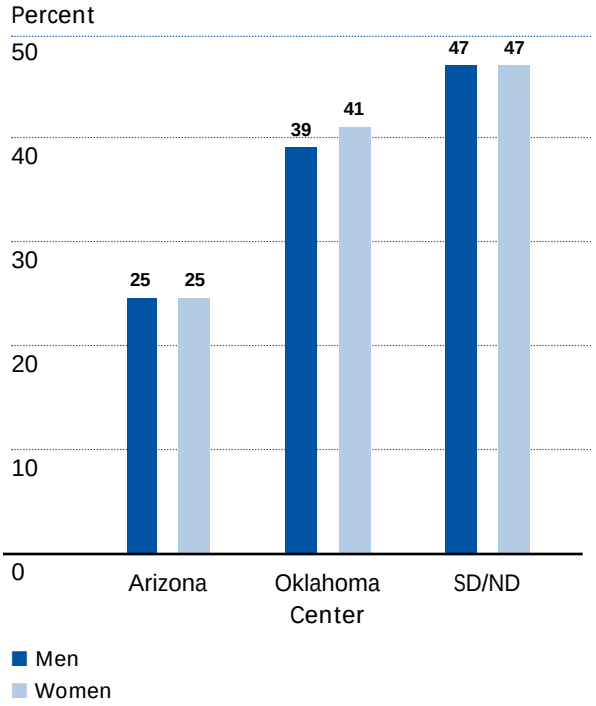


Figure 33. Percent of Men and Women Participants With Total Cholesterol Greater Than or Equal to 240 mg/dL by Center

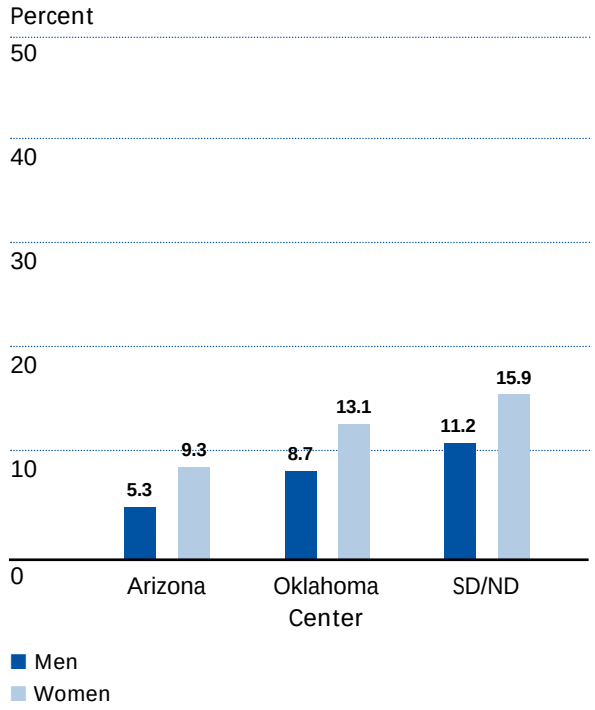


Figure 34. Percent of Men and Women Participants With Low Density Lipoprotein Cholesterol Greater Than or Equal to 130 mg/dL by Center

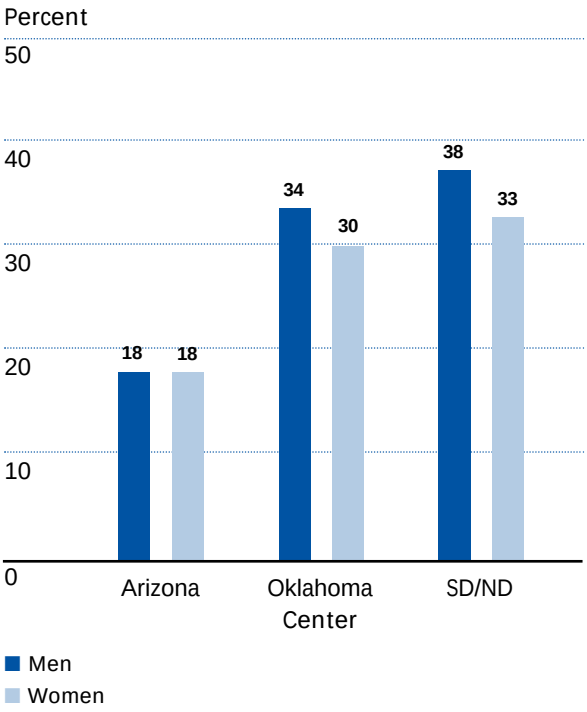
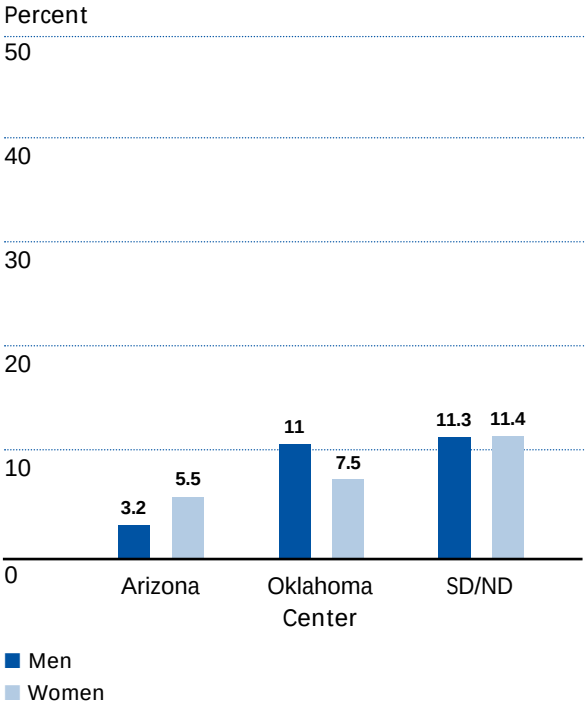


Figure 35. Percent of Men and Women Participants With Low Density Lipoprotein Cholesterol Greater Than or Equal to 160 mg/dL by Center



cholesterol is sometimes called bad cholesterol because people with high levels of LDL cholesterol are at increased risk of CVD. About a third of American Indian men and women in Oklahoma and the Dakotas have LDL cholesterol levels of 130 mg/dL or higher while in Arizona less than 20 percent have LDL cholesterol at or above these levels. The percentages for these levels in study participants are shown in Figures 34 and 35.

HDL Cholesterol. HDL cholesterol is another component of total cholesterol and is sometimes referred to as good cholesterol. For HDL cholesterol, higher levels are better in terms of the risk of CVD. Women frequently have higher HDL cholesterol levels than men of the same age. As a result, more men than women have levels that are considered abnormally low. As seen in Figure 36, almost one-half of men in all centers had HDL cholesterol levels below 40 mg/dL, while about one-quarter of women had HDL cholesterol levels below 40 mg/dL.

Triglycerides. High triglyceride levels appear consistent across the three centers with about one-third of both men and women having had triglyceride levels equal to or exceeding 150 mg/dL as shown in Figure 37.

Similarly, about one-fifth of both men and women had triglyceride levels greater than or equal to 200 mg/dL, as shown in Figure 38.

Figure 36. Percent of Participants With High Density Lipoprotein Cholesterol Less Than 40 mg/dL for Men and Women by Center

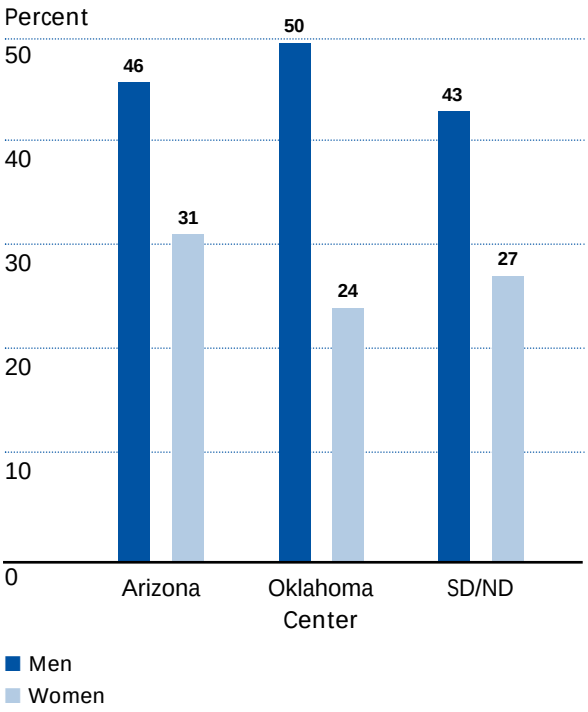


Figure 37. Percent of Men and Women Participants With Triglyceride Levels Greater Than or Equal to 150 mg/dL by Center

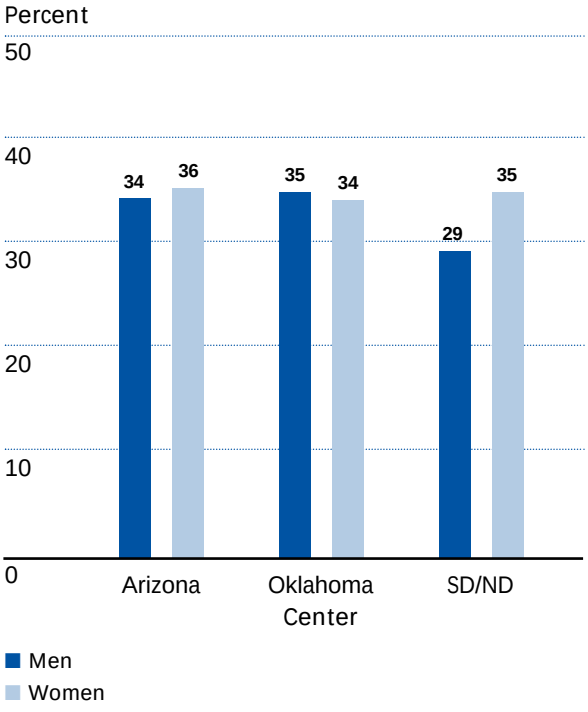
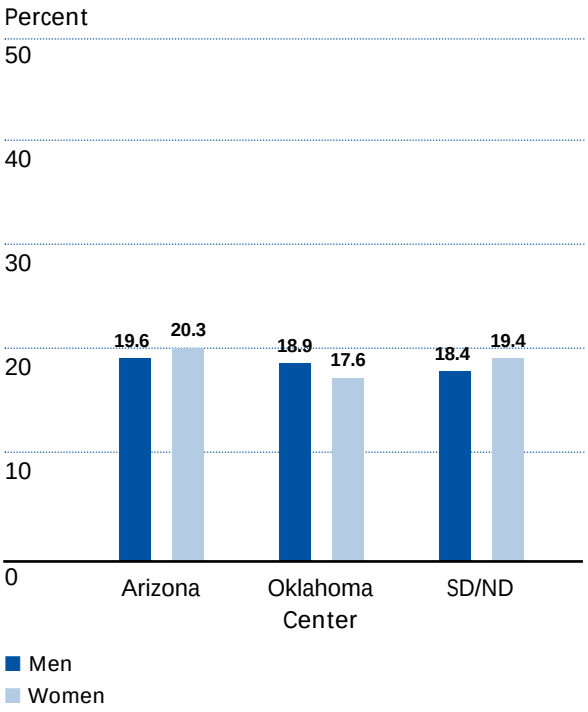


Figure 38. Percent of Men and Women Participants With Triglyceride Levels Greater Than or Equal to 200 mg/dL by Center



Average Blood Fat Levels. Fasting blood samples were taken from all Strong Heart Study participants for a complete lipoprotein profile. All measurements were performed by carefully standardized methods in the Penn Medical Laboratories, and all blood samples were handled and disposed of according to Strong Heart Study and Tribal policies. Mean total cholesterol concentrations were more than 20 mg/dL lower in Arizona participants than those from the Dakotas. Oklahoma participants had intermediate concentrations. Similar patterns were found for mean levels of LDL cholesterol. Mean total cholesterol and LDL cholesterol levels for Strong Heart Study participants were lower than those seen in adults of similar ages from a national survey in 1988 to 1991 (NHANES). Mean HDL cholesterol levels in Strong Heart Study participants were lower than mean levels in a national survey, possibly because diabetes and obesity decrease HDL levels and rates of diabetes and obesity were very high in Strong Heart Study participants. While the lipids in Strong Heart Study participants were generally better than national averages with the exception of HDL cholesterol in both men and women and triglycerides in men, data from the second Strong Heart Study examination in 1994 to 1995 indicate that LDL cholesterol has increased and HDL cholesterol has decreased. Both these changes are associated with increased risk of heart attacks and strokes. For that reason continued emphasis is needed on the prevention and treatment of high blood lipids. Table 3 provides the relevant data.

Cholesterol Guidelines. The National Cholesterol Education Program recommends that adults 20 years and older have a lipoprotein profile (total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides) measured at least once every 5 years. The American Diabetes Association suggests that people with diabetes have a lipoprotein profile every year. Treatment for high LDL cholesterol will vary according to whether you have heart disease, diabetes, or risk factors for heart disease. The risk factors are: cigarette smoking, high blood pressure (≥ 140/90 mmHg), low HDL cholesterol (less than 40 mg/dL), family history of early heart disease (father or brother before age 55; mother or sister before age 65), or age (men 45 years and older; women 55 years and older). Those with two or more risk factors will need to find out their 10-year risk score (chance of having a heart attack in the next 10 years). Your target LDL cholesterol and mode of treatment will vary by your risk score. Highest risk (category I) individuals have heart disease, diabetes, or two or more risk factors with a risk score greater than 20 percent. Individuals in category II (next highest risk) have two or more risk factors and a risk score of 10-20 percent. Individuals in category III (moderate risk) have two or more risk factors and a risk score less than 10 percent. If you have zero or one risk factor, you are in category IV: low-to-moderate risk. Risk score is based on age, total cholesterol level, smoking status, HDL cholesterol level and systolic blood pressure level. Calculation of your risk score can be done easily over the Internet by going to the calculator at http://www.nhlbi.nih.gov/guidelines/cholesterol/pat_pub.htm. Links to more detailed information are also found on this page. A brief summary follows.

Table 3. Mean Lipid Levels for Men and Women by Center

	Men					Women			
	AZ	OK	Dakotas	Total		AZ	OK	Dakotas	Total
Total Cholesterol	177 (43)	193 (35)	199 (43)	190 (41)	Total Cholesterol	181 (42)	196 (37)	202 (40)	193 (40)
LDL Cholesterol	102 (32)	120 (33)	122 (33)	115 (34)	LDL Cholesterol	105 (32)	115 (32)	120 (34)	113 (33)
HDL Cholesterol	44 (14)	42 (12)	44 (14)	43 (14)	HDL Cholesterol	45 (11)	49 (14)	49 (14)	48 (13)
Triglycerides	160 (184)	150 (125)	149 (232)	153 (186)	Triglycerides	153 (106)	147 (102)	149 (129)	150 (112)

Mean levels for triglycerides are calculated as the geometric mean.
Numbers in parentheses are a measure of variation equal to one standard deviation.

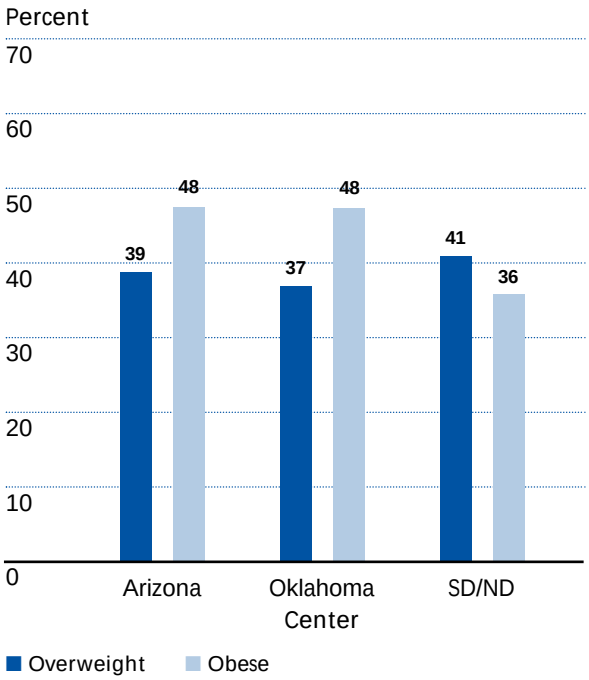
Category I (highest risk) has a goal level for LDL cholesterol of less than 100 mg/dL. Many American Indians fall in this category due to the high prevalence of heart disease and diabetes. Those in categories II and III have a goal level for LDL cholesterol of less than 130 mg/dL. Those in category IV have a goal level for LDL cholesterol of less than 160 mg/dL. Everyone whose LDL is above their goal level will need to begin treatment with therapeutic lifestyle changes (TLC) which include reduction in saturated fat and cholesterol intake, weight reduction, and increased physical activity. Those in category I with an LDL of 130 mg/dL or higher will need to begin drug treatment at the same time as TLC. Drug treatment may also be considered for those whose LDL is 100 to 129 mg/dL. Individuals in category II with an LDL of 130 mg/dL or higher after 3 months of TLC may need drug treatment. Persons in category III with an LDL of 160 mg/dL or higher after 3 months of TLC may need drug treatment. Those in category IV with an LDL 160 mg/dL or higher after 3 months of TLC may also need drug treatment, especially if the LDL is 190 mg/dL or above.

Overweight and Obesity. In most epidemiological health surveys, body mass index (BMI) is used as an indirect indicator of overall body fat. BMI is calculated as the weight in kilograms divided by height squared in meters to take into account the contributions of both weight and height to overall body fat. In the general U.S. population, high levels of BMI are associated with high blood pressure, high cholesterol levels, and diabetes. In the Strong Heart Study, trained interviewers measured the participant's height (with shoes removed) to the nearest centimeter with a vertical mounted ruler. Each participant, wearing light clothing with shoes removed, was measured to the nearest kilogram of weight with a Detecto scale. Overweight was defined as a BMI of 25 to 29.9 for men and women; obesity was defined as a BMI greater than or equal to 30 for men and women. Twenty-five to 34 percent of Strong Heart Study participants were found to be overweight with the rates similar in all three centers. But rates were higher in women than men. The proportion of participants who were obese was highest in Arizona and lowest in the Dakotas. Rates of obesity

were higher among women than men, except in Oklahoma where the rates were similar. The prevalence rates of overweight exceeded national averages by 16 to 36 percent. Obesity and overweight were defined according to NHLBI/NIDDK Clinical Guidelines.

The high rates of obesity and overweight are important modifiable risk factors that contribute to the epidemic of diabetes that is currently afflicting American Indians. Funding has been made available through the NHLBI for research on the primary prevention of obesity in American Indian children. Community-based programs that promote healthier diets and increased physical activities and that are in keeping with traditional Native American values and culture have the greatest likelihood of success. Figures 39 and 40 show the prevalence of overweight and obesity among study participants.

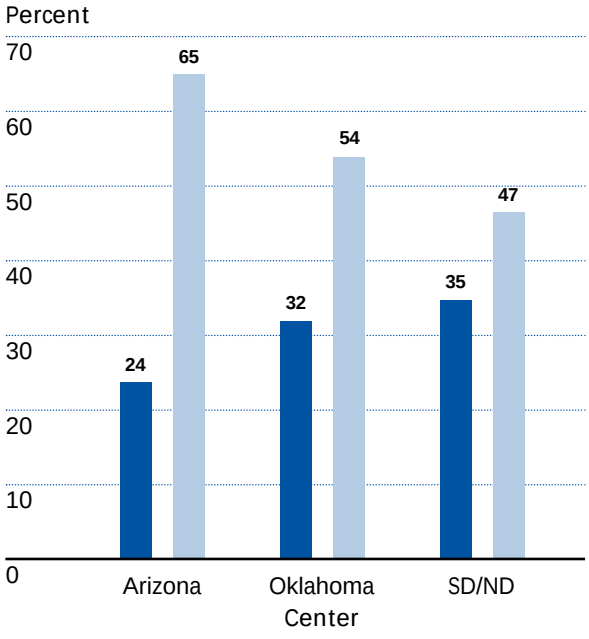
Figure 39. Prevalence of Overweight* and Obesity Among Men by Center**



* Overweight = BMI of 25 to 29.9 for men and women.

** Obesity = BMI of ≥ 30 for men and women.

Figure 40. Prevalence of Overweight* and Obesity Among Women by Center**



* Overweight = BMI of 25 to 29.9 for men and women.

** Obesity = BMI of ≥ 30 for men and women.

5. Diabetes Prevalence and Diabetes-Related Variables

In the Strong Heart Study, glucose tolerance status was determined from fasting plasma glucose (FPG) values and plasma glucose 2 hours after drinking a sugar solution (75 g of glucose, the Oral Glucose Tolerance Test [OGTT]). The 2-hour OGTT was given to all participants except the following: (1) diabetic patients who were being treated with insulin or with oral hypoglycemic drugs, and (2) participants whose FPG was greater than or equal to 225 mg/dL as determined by a finger stick measure. Criteria used to define diabetes mellitus (DM) and impaired glucose tolerance (IGT) were those established by the World Health Organization (WHO) in 1985. The WHO criteria are:

- Diabetes mellitus—FPG ≥ 140 mg/dL OR 2-hour plasma glucose ≥ 200 mg/dL
- Impaired glucose tolerance—FPG less than < 140 mg/dL AND 2-hour plasma glucose in the range of 140 to 199 mg/dL
- Normal glucose tolerance—FPG < 140 mg/dL AND 2-hour glucose < 140 mg/dL.

As shown in Figure 41, among the Strong Heart Study men, Arizona had the highest diabetes rate (64.7 percent) followed by Oklahoma (36.4 percent) and the Dakotas (32.4 percent). Rates of IGT were similar among the three centers (ranging from 13.2 percent to 14.7 percent). The prevalence rates of diabetes in these American Indian populations were several times higher than in the general U.S. population. However, IGT rates were close to those in the general population. Four years later, at the second exam, IGT rates were relatively stable, but diabetes rates increased in all three centers.

The rates of diabetes in Strong Heart Study women were higher than those in men in all three centers. As shown in Figure 42, women in Arizona had the highest diabetes rate (almost 71 percent) among the three centers. The rates in Oklahoma and the Dakotas were similar (40.8 percent and 43 percent, respectively) and were considerably lower than that in Arizona. These rates include both known and newly diagnosed cases of diabetes. Between 8 to 11 percent of Strong Heart Study participants had newly diagnosed diabetes (164 men and 245 women). Similar to the rate for men, diabetes rates in women increased at the second exam.

Figure 41. Glucose Tolerance Status Among Men by Center

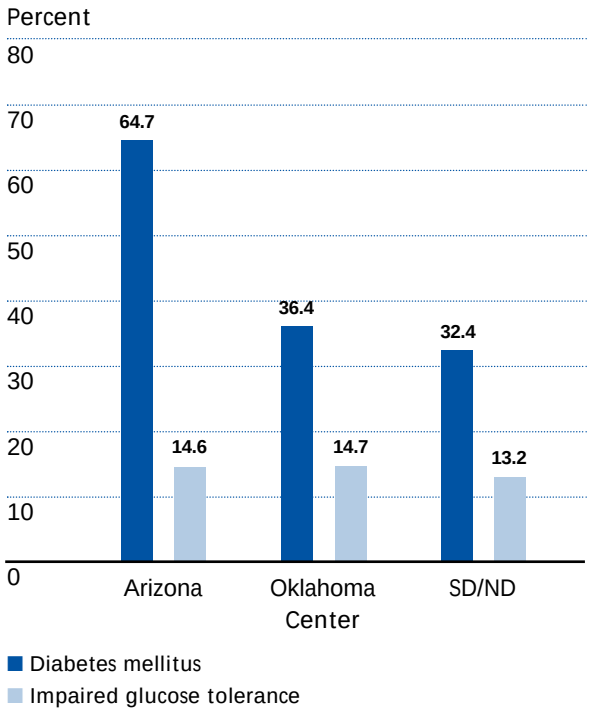
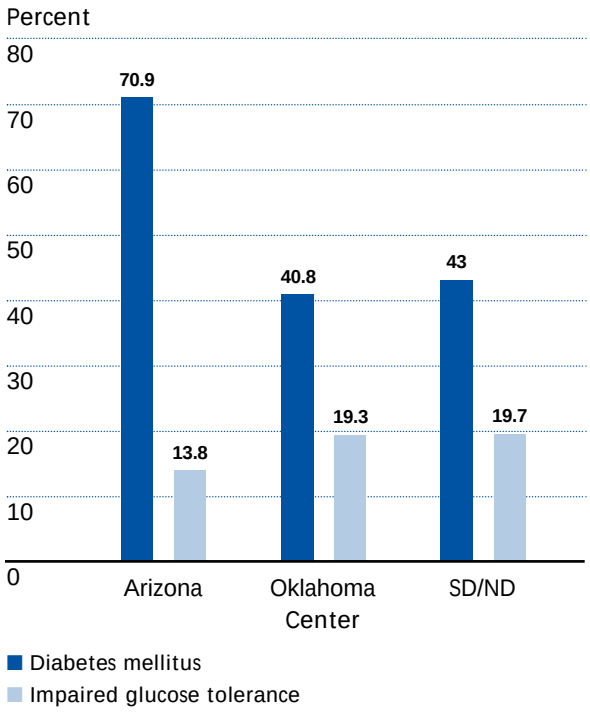


Figure 42. Glucose Tolerance Status Among Women by Center



Blood Sugar Control. The high rates of diabetes emphasize the importance of screening for diabetes in American Indian communities since diabetic complications are reduced when blood sugars are controlled. New criteria from the American Diabetes Association permit screening for diabetes with a fasting blood sugar instead of a blood sugar after drinking a sugar solution. Persons with a family history of diabetes and those who are overweight are encouraged to get blood sugar levels measured once a year. Persons with IGT are at high risk of developing diabetes. In a 4-year period, 30 to 50 percent of Strong Heart Study participants with IGT developed diabetes. For persons who are overweight and have IGT, losing weight through a healthier diet and increased physical activity may reduce the risk of developing diabetes.

Diabetes Treatment and Control. Figure 43 shows more male participants with known diabetes in the Strong Heart Study received oral medication (pills) (22.9 percent in Arizona, 16.5 percent in Oklahoma, and 9.7 percent in the Dakotas) than insulin (15 percent in Arizona, 5.6 percent in Oklahoma and 7 percent in the Dakotas). Only a very small number of diabetic participants received both insulin and pills (less than 0.5 percent). It appears that a large percentage of the Strong Heart Study participants with diabetes did not receive any insulin or pills.

Figure 44 shows that in all three centers more women with diabetes in the Strong Heart Study received treatment than men with diabetes. More female diabetic participants received oral agents than insulin in Arizona and Oklahoma. However, in the Dakotas, the percent of female patients who received insulin was slightly higher.

It is important to know how many diabetic participants who received treatment (either insulin or oral medication or both) actually had their diabetes under control. "Controlled diabetes" is defined here as having a hemoglobin A1c (HbA1c) value less than 7 percent. HbA1c is a component of the blood that

reflects the level of plasma glucose in a person over the last month or so, rather than at the particular time of the measurement as with the plasma glucose value. As shown in Figure 45, Oklahoma had the highest control rate compared to the other two centers in both men (48 percent) and women (40 percent), and Arizona had the lowest in both genders (35 percent in men and 24 percent in women). About half of those with controlled diabetes, were receiving medications. The remaining participants were able to control their diabetes with diet and exercise alone.

Knowledge of Diabetes as a Risk Factor for Cardiovascular Disease. As shown in Figure 46, participants' knowledge that diabetes increases the risk of heart disease was higher among participants in Oklahoma than among participants in Arizona, and the Dakotas. In all three centers, more women than men recognized that diabetes increases risk for heart disease. This information indicates that more health education programs should be designed and implemented for men.

Prevalence of High Hemoglobin A1c. Hemoglobin is the substance in red blood cells that carries oxygen to the cells. Sometimes hemoglobin joins with glucose to become Hemoglobin A1c (HbA1c). The percent of hemoglobin that becomes HbA1c reflects the average blood glucose level for the last month or so. It is very helpful in determining blood sugar control in diabetic patients. For persons with diabetes, the goal should be to have a HbA1c of 7 percent or less. Action should be taken to lower the blood sugar if the HbA1c value is 8 percent or above. As shown in Figure 47, Strong Heart Study participants in Arizona had the highest proportion of participants with high HbA1c values among the three centers with more than one-third of both men and women with high values. The proportions in Oklahoma and the Dakotas were less than half that level. In all three centers, more women than men had high values.

Figure 43. Diabetes Mellitus Treatment Among Men (Examination 1) by Center

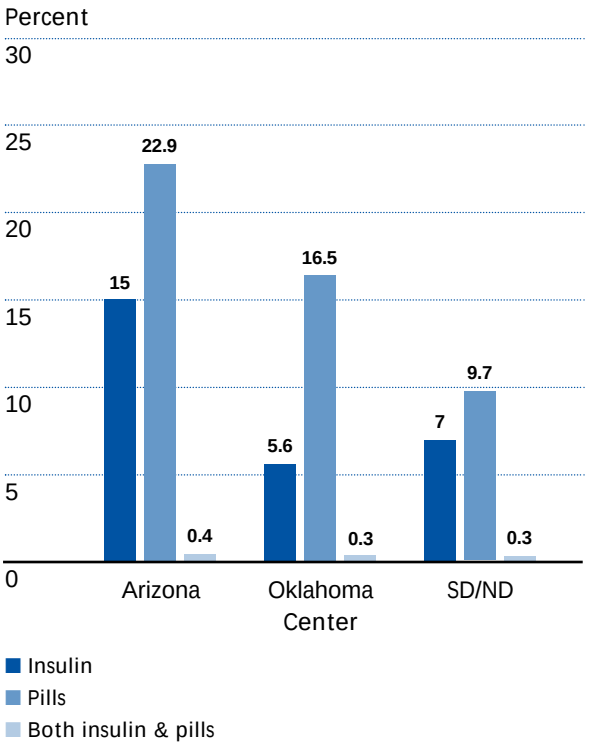


Figure 44. Diabetes Mellitus Treatment Among Women (Examination 1) by Center

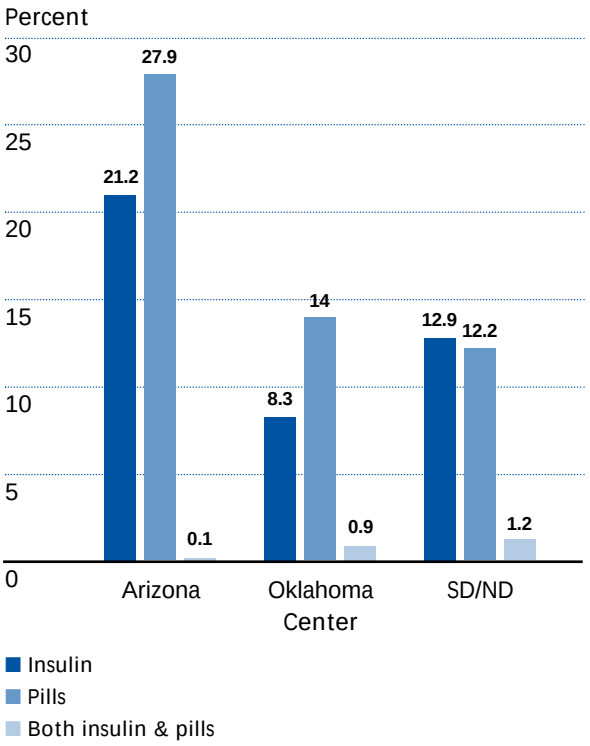


Figure 45. Treated and Controlled Diabetes Mellitus Among Men and Women by Center

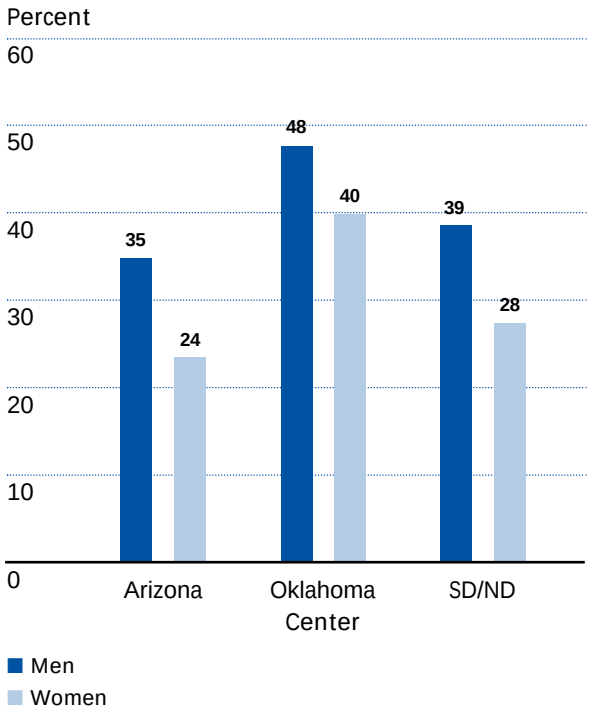


Figure 46. Participants' Risk Factor Knowledge: Recognition That Diabetes Increases Risk for Heart Disease Among Men and Women by Center

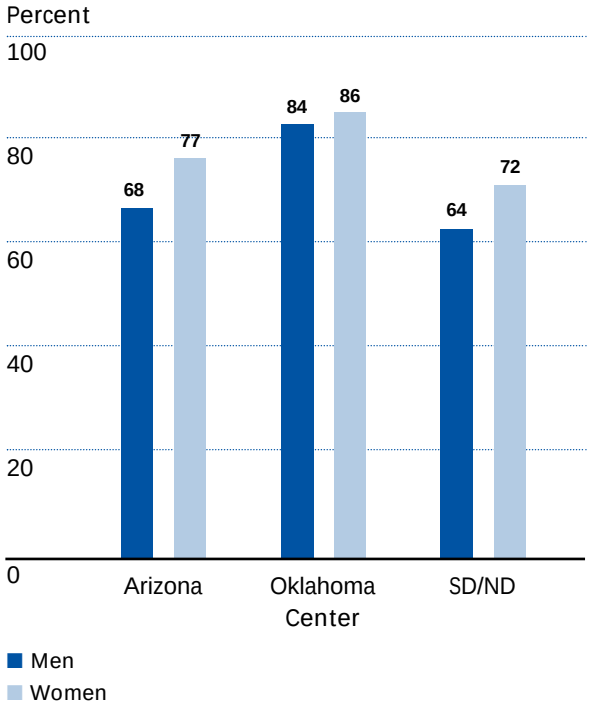
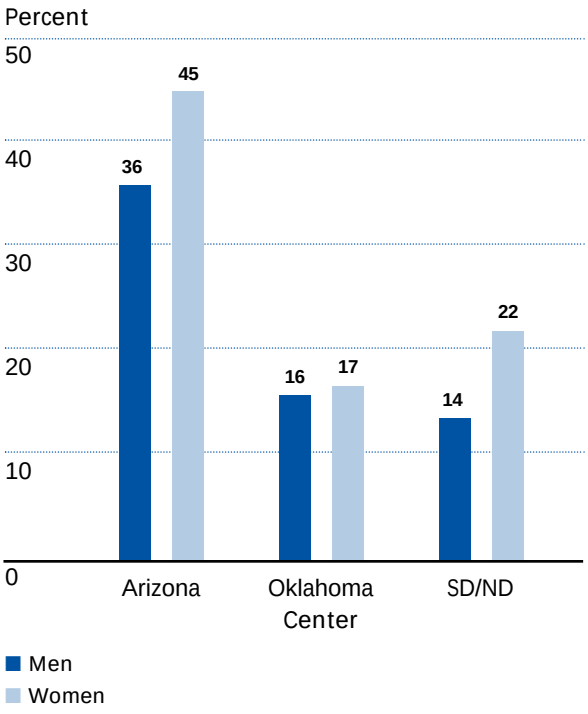


Figure 47. Percent of Participants Having High Hemoglobin A1c (HbA1c Greater Than or Equal to 8 percent)



Kidney Disease. Data from Strong Heart Study and other studies indicate that kidney disease rates are higher among American Indians than other ethnic groups, mostly as a result of the high rates of diabetes. Diabetes damages the kidneys especially when blood sugars are high. This first causes a protein called albumin to leak out in the urine and eventually may result in kidney failure that requires dialysis or kidney transplant to sustain life. People with kidney failure that requires dialysis have a much higher quality of life if they are able to receive a kidney transplant.

Prevalence of Albuminuria. Albumin in the urine (albuminuria) is a test used to detect kidney disease. Normally, very little albumin is found in the urine. Diseases like high blood pressure and poorly controlled diabetes can damage the kidney. The filtering mechanism in the kidney becomes leaky, and albumin escapes from the blood into the urine.

Small but abnormal amounts of albumin in the urine are termed microalbuminuria. Larger amounts, associated with more kidney damage, are called macroalbuminuria.

As shown in Figures 48 and 49, micro and macroalbuminuria were common among the men and women who participated in the Strong Heart Study. Rates also increased significantly in the 4-year followup period. The high rates of albuminuria mean that the Strong Heart Study participants are at risk for kidney failure and heart disease. Better control of diabetes and blood pressure should help reduce the risk of further problems.

Kidney Dialysis. Dialysis is a medical procedure that is used when the kidney fails and toxic wastes build up in the blood. In the Strong Heart Study survey, we determined how many participants are treated with dialysis. These figures may be underestimated, however, because persons on dialysis would be less likely to volunteer for a study. Dialysis is an expensive treatment that takes many hours a week. Better treatment of high blood pressure and diabetes should help prevent kidney failure and the need for dialysis. Figure 50 shows the prevalence of self-reported kidney dialysis among study participants.

Kidney Transplant. An effective treatment for kidney (renal) failure is a kidney transplant. A kidney donated from a relative or a recently deceased donor can be life saving. A transplant occurs when a surgeon replaces the failed kidney with the donor kidney in a person with kidney failure. Medications must be taken to prevent "rejection," a process that can destroy the transplanted kidney. A successful kidney transplant frees the person from dialysis and helps him or her enjoy a more normal life. Very few American Indian patients with kidney failure are receiving kidney transplants. Much more education is needed on kidney transplantation so that more donor kidneys will be available and patients with kidney failure will consider transplantation instead of dialysis.

Figure 48. Prevalence of Albuminuria Among Men by Center

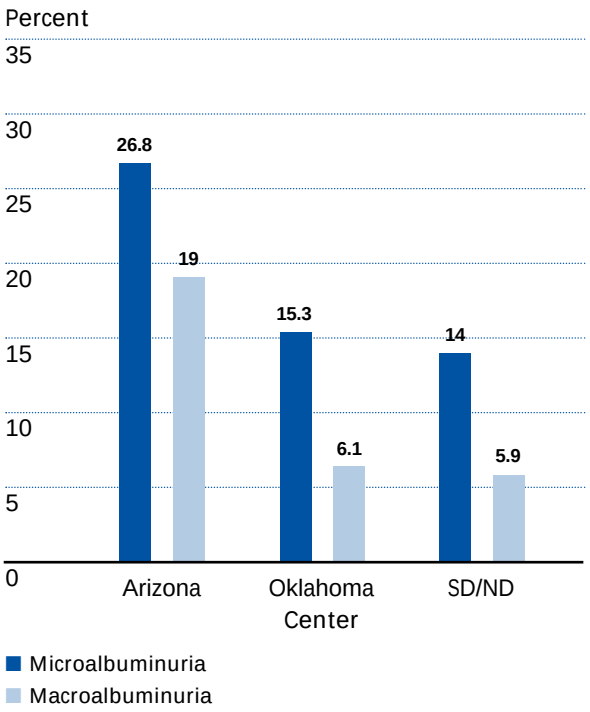


Figure 49. Prevalence of Albuminuria Among Women by Center

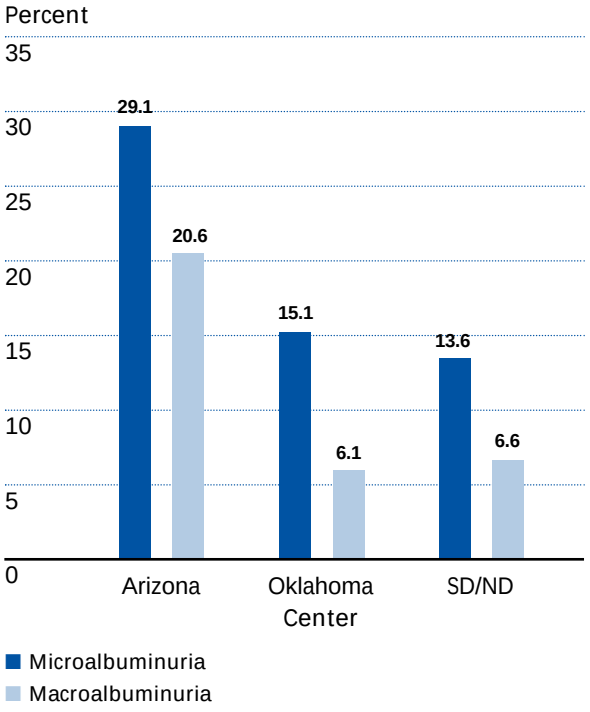


Figure 50. Prevalence of Self-Reported Kidney Dialysis Among Men and Women by Center

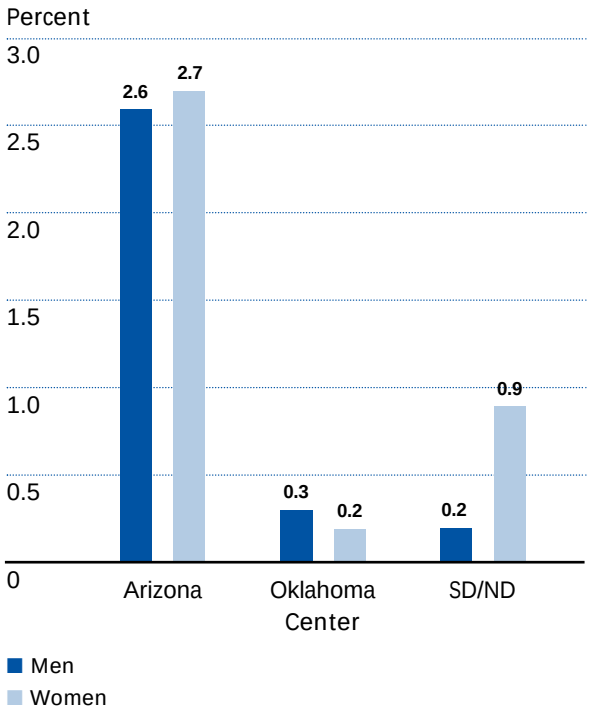
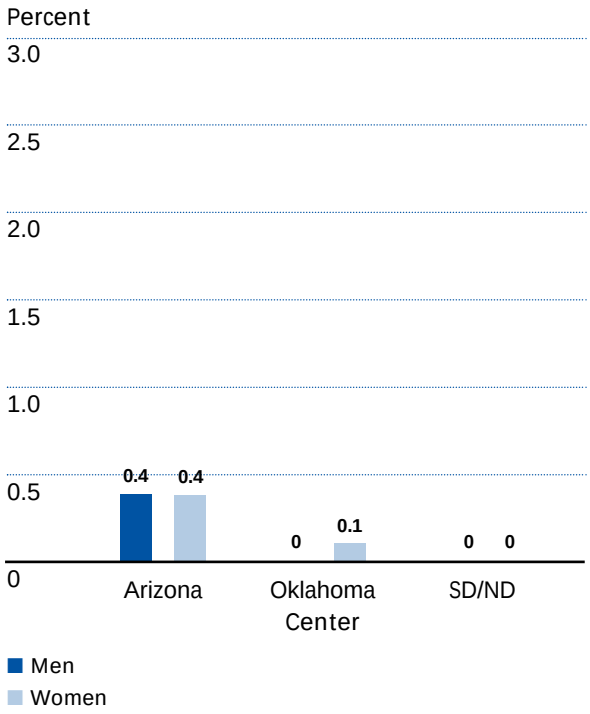


Figure 51. Prevalence of Self-Reported Kidney Transplant Among Men and Women by Center



Data from the second Strong Heart Study examination indicate that albuminuria and renal failure are increasing in men and women in all three centers. More intensive efforts at screening for as well as treatment and control of diabetes and hypertension are needed to combat the epidemic of kidney disease that is affecting American Indian communities.

As shown in Figure 51, the prevalence of kidney transplant is based on all participants in the Strong Heart Study. Most of these individuals do not need a transplant. Therefore these rates must be viewed in relation to the previous figure that shows the number with micro- and macroalbuminuria, which is indicative of an increased risk of kidney failure. The Arizona center had more participants with these conditions and therefore a higher prevalence with a kidney transplant. But, in relation to the proportion on dialysis, the number with a kidney transplant is very low. Communities should consider ways to increase the opportunities for kidney transplant as an alternative to kidney dialysis.

6. Environmental/Lifestyle Risk Factors

Tobacco. Tobacco use and exposure to environmental tobacco smoke (also called secondhand smoke or passive smoking) are known to be risk factors for heart disease, vascular disease, and stroke. Current cigarette smokers were defined as persons who had smoked at least 100 cigarettes during their lifetime and answered "yes" to the question, "Do you smoke now?" Ex-smokers were defined as persons who previously smoked cigarettes on a regular basis, but who answered "no" to the question, "Do you smoke now?" Smoking rates were higher among men than among women; they were highest at the Dakotas center and lowest in the Arizona center. Nationally, 26 percent of men and 23 percent of women of similar ages were reported to be current smokers in 1987 to 1991. Figures 52 through 55 show the prevalence of smoking, number of cigarettes per day among smokers, and exposure to environmental tobacco smoke.

Emphysema. Emphysema is a disease that affects the lungs and makes breathing very difficult. It is usually caused by smoking or exposure to air pollution. Figures 56 and 57 show the prevalence of emphysema among participants. Emphysema rates were lower in Arizona probably because fewer Arizona Indians smoke or have smoked cigarettes. In Oklahoma and the Dakotas, emphysema occurs more commonly among smokers and ex-smokers. Smoking cessation and prevention programs will help reduce rates of emphysema in American Indian communities.

Alcohol. Alcohol use was determined by self-report, with one drink defined as 12 ounces of beer, 4 ounces of wine, or one shot of hard liquor (the alcohol content of these amounts is approximately equivalent). Interviewers were trained to convert other quantities of alcoholic beverages into number of drinks. Current alcohol users were defined as persons who had consumed any alcohol during the previous year, heavy users as persons who consume 14 or more drinks per week, and binge drinkers as persons who consume five or more drinks per occasion. Ex-drinkers were defined as participants who had not consumed any alcohol in the last year but had previously consumed more than 12 drinks of alcohol. A higher proportion of men than women were current consumers of alcohol. Figures 58 and 59 show the prevalence of drinking among participants. Although the prevalence of current alcohol use among Strong Heart Study participants was lower than national rates (63 percent for adult men aged older than 45 and 41 percent

Figure 52. Cigarette Smoking Among Men by Center

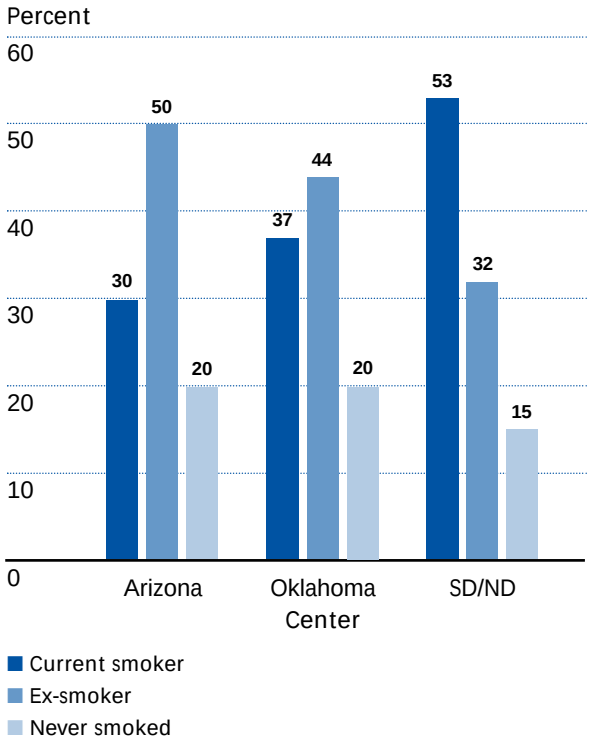


Figure 53. Cigarette Smoking Among Women by Center

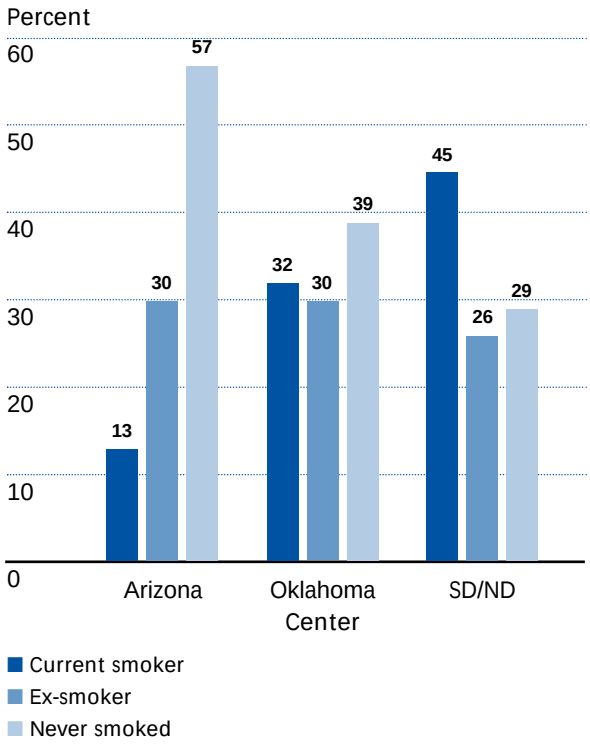


Figure 54. Number of Cigarettes Per Day Among Current Smokers by Center

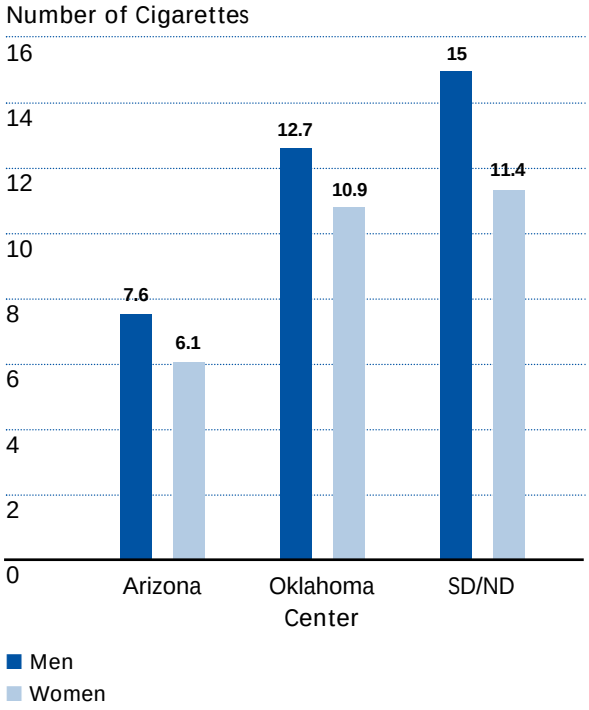


Figure 55. Mean Number of Hours Per Day of Exposure to Environmental Tobacco Smoke

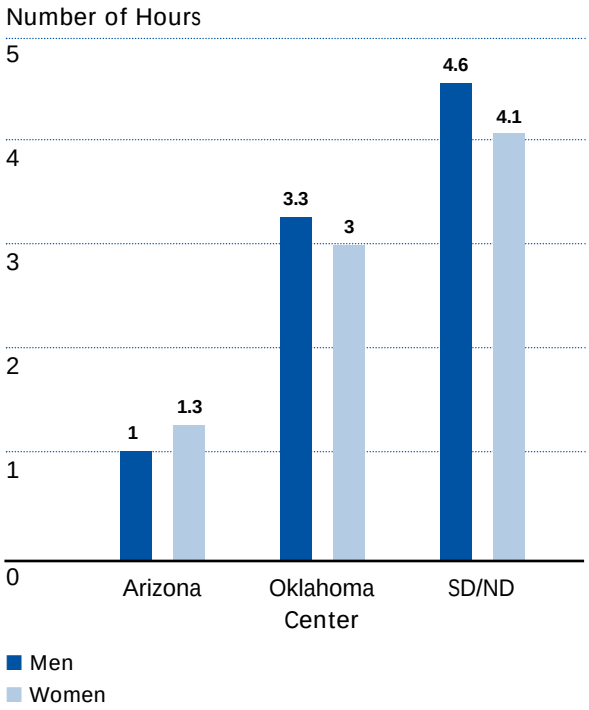


Figure 56. Prevalence of Emphysema Among Men by Smoking Status and Center

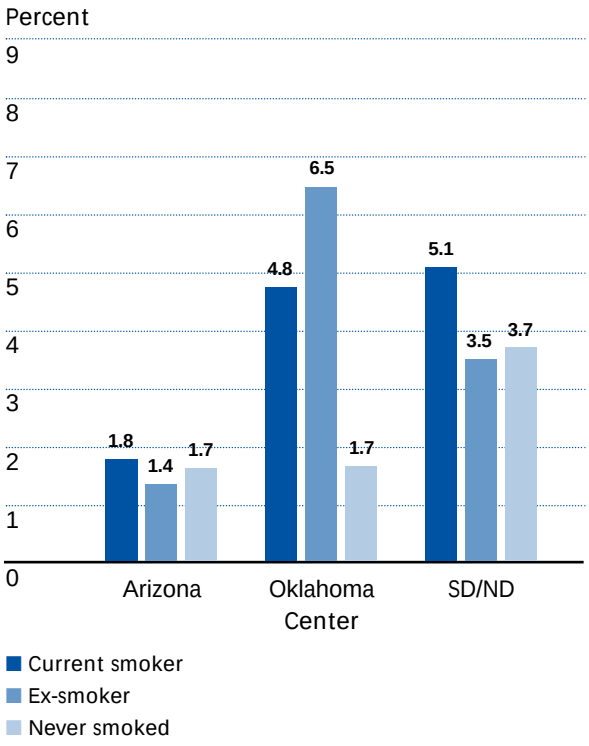
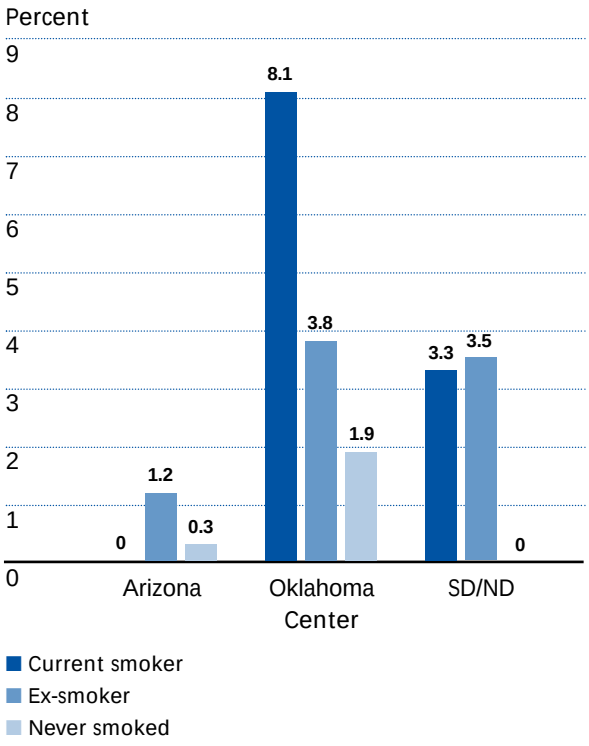


Figure 57. Prevalence of Emphysema Among Women by Smoking Status and Center



for adult women older than 45), heavy drinking and binge drinking occurred more commonly, as shown in Figure 60. Excessive use of alcohol, especially binge drinking, has been associated with hypertension and with sudden death. Abstinence from alcohol or moderation in its use (one drink or fewer per day for women, less than two drinks per day for men) should be encouraged to prevent abuse of alcohol.

Nutrition.

In the first Strong Heart Study examination in 1989 to 1991, 300 Strong Heart Study participants at each center were administered a dietary survey. More extensive data were collected in Phase II (1993 to 1995), when the survey was administered to all Strong Heart Study participants. The results from the second survey are summarized below and compared with the recommended daily allowances for protein, carbohydrates, fat, and vitamins and minerals.

Calories. Calories (kcal) are a measure of the energy in the foods and beverages that a person consumes during a day. The average energy or calorie allowance for a man of reference size (170 pounds) over 51 years of age with light activity is 2,300 kcal/day; for women (143 pounds) over 51 years of age with light activity the allowance is 1,900 kcal/day. Consuming too many calories and engaging in too little physical activity leads to weight gain. It is good health practice to cut down on portion sizes and the amount of food eaten. Figure 61 presents the study participants' mean dietary intake of calories.

Figure 58. Alcohol Drinking Among Men by Center

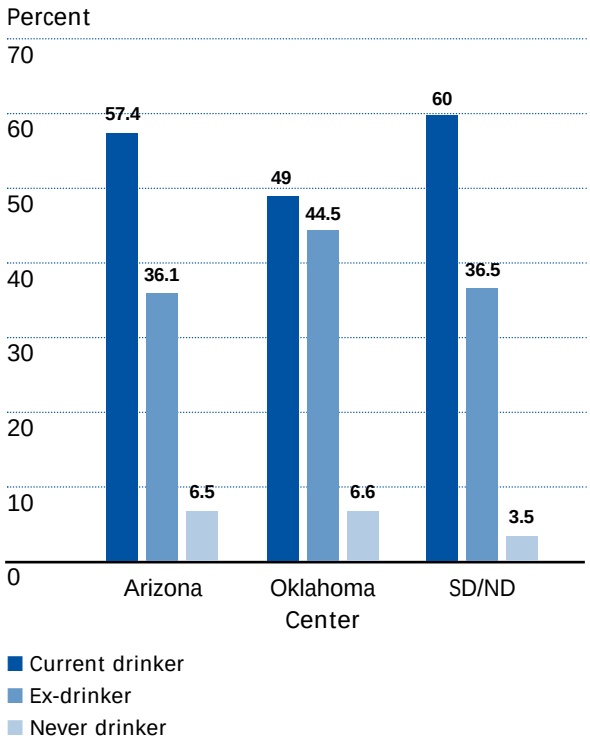


Figure 59. Alcohol Drinking Among Women by Center

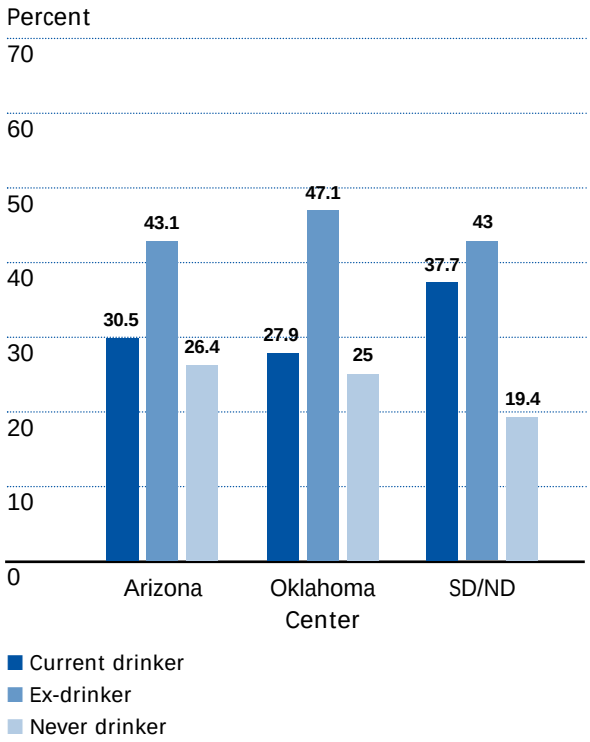


Figure 60. Prevalence of Binge Drinking in the Last Month Among Men and Women Who Are Current Alcohol Users by Center

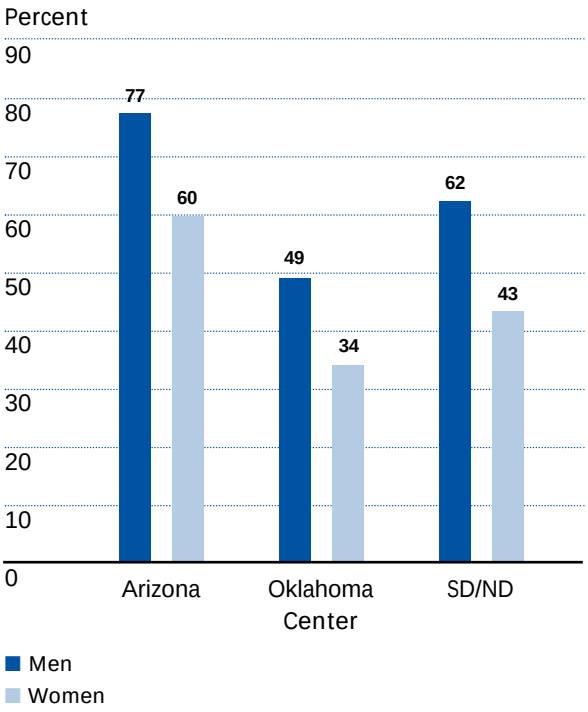
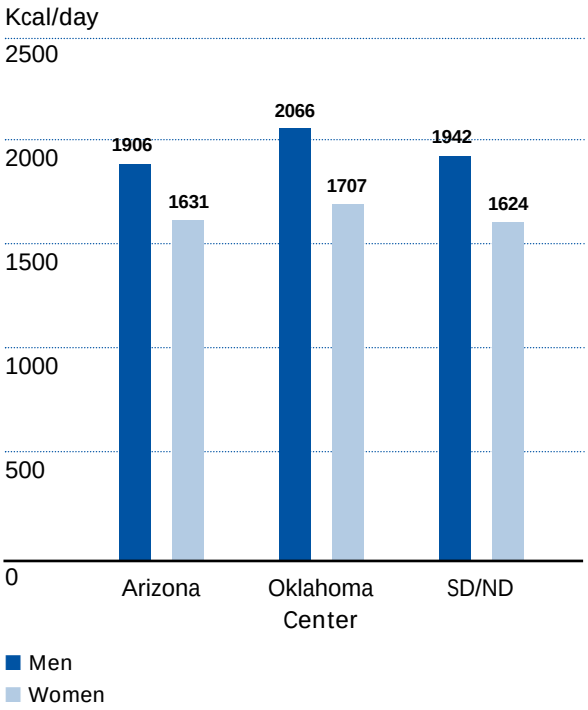


Figure 61. Mean Dietary Intake of Energy* Among Men and Women by Center



* Total calories are generally underreported in surveys.

Figure 62. Mean Dietary Intake of Carbohydrates Among Men and Women by Center

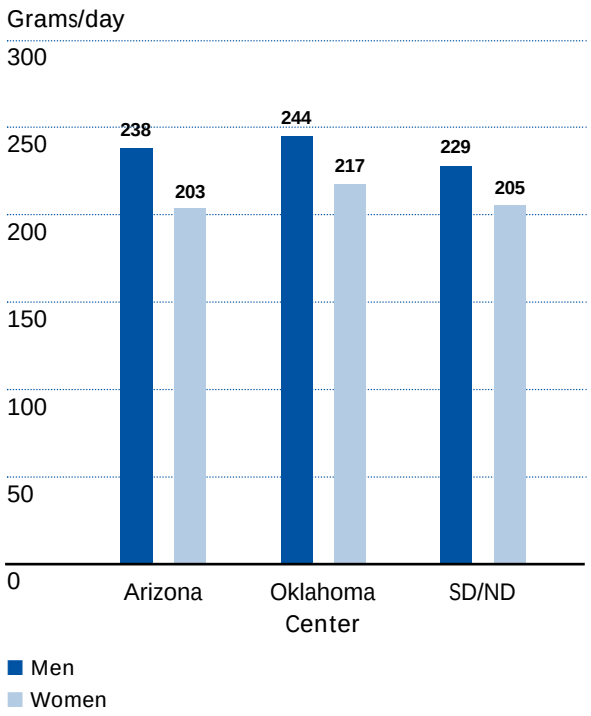
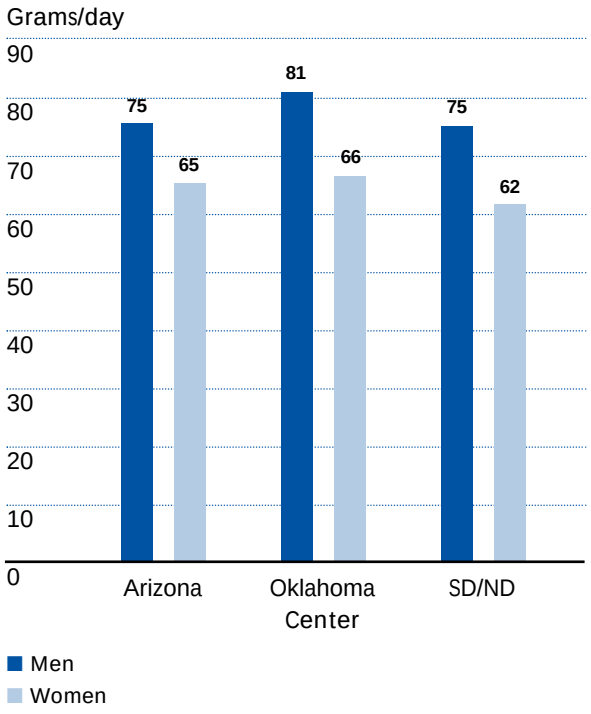


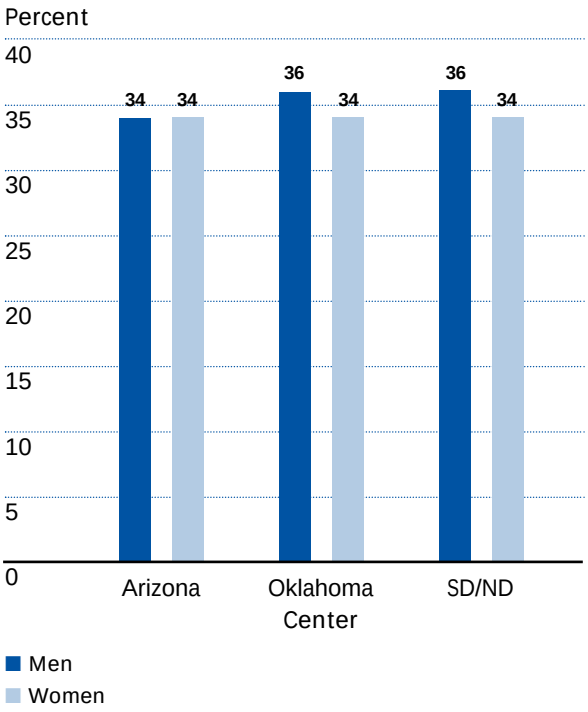
Figure 63. Mean Dietary Intake of Protein Among Men and Women by Center



Carbohydrates. Carbohydrates are found primarily in starches, fruits, and vegetables. Approximately 50 to 60 percent of daily calories should be obtained from carbohydrates. At 50 percent of calories, this would be 288 grams (10.2 ounces) of carbohydrates for intake of 2,300 calories per day and 238 grams (8.4 ounces) for intake of 1,900 calories per day. Study participants in all three centers consumed about half of their calories in the form of carbohydrates. People who have diabetes need to practice carbohydrate counting, since carbohydrates raise blood glucose. The Nutrition Facts Food Label shows the amount of carbohydrate (and other nutrients) in a food product as grams (or milligrams) units and also as a proportion of the reference percent daily value (percent DV). Your local dietitian can assist with carbohydrate counting. Figure 62 presents study participants' mean dietary intake of carbohydrates.

Protein. The recommended daily allowance (RDA) of protein for adults over 51 years of age is 63 grams (2.2 ounces) for men and 50 grams (1.8 ounces) for women. As shown in Figure 63, all participants consumed more than the recommended amount of protein. Protein is found mainly in meat, poultry, fish, eggs, and dairy products. Cereals, breads, and grains also contain some protein. To help prevent weight gain, consume lean meats, remove skin from poultry, and use low-fat cheeses and low-fat or fat-free milk.

Figure 64. Average Percent of Total Calories From Fat Among Men and Women by Center



Fat. Fat in the diet comes primarily from meat, poultry, fish, milk, cheese, butter, shortening, margarine, salad dressings, and oils. The National Cholesterol Education Program recommends consuming less than 30 percent of calories from fat. As shown in Figure 64, Strong Heart Study participants in all three centers consumed more than 30 percent. The average amount of dietary fat consumed is shown in Figure 65. To reduce total fat, cut back on saturated fat, use fish and lean meats, remove skin from poultry, and use low-fat cheeses and non-fat-free or low-fat milk and other dairy products.

Figure 65. Mean Dietary Intake of Fat Among Men and Women by Center

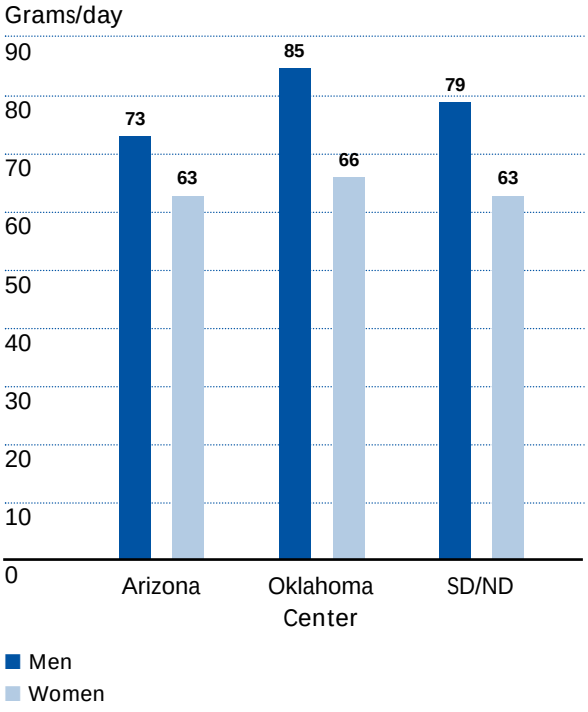
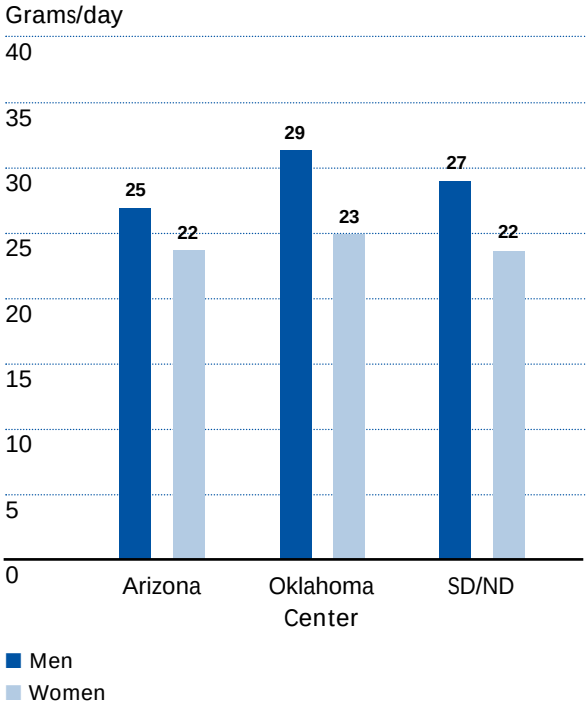


Figure 66. Mean Dietary Intake of Saturated Fatty Acids Among Men and Women by Center



Saturated Fatty Acids. Saturated fatty acids raise blood cholesterol levels. All fat contains a combination of the three major categories of fatty acids—saturated, monounsaturated, and polyunsaturated. Neither monounsaturated nor polyunsaturated fat raise blood cholesterol levels. Liquid vegetable oils, soft margarines, nuts and seeds are major sources of monounsaturated and polyunsaturated fat. Animal products (such as butter, lard, cheese, and beef fats) are high in saturated fat. Coconut oil, palm oil, and palm kernel oil are very high in saturated fat. These fats are used in bakery goods, processed foods, popcorn, oils, and nondairy creamers. Saturated fatty acid intake should be 10 percent of calories (less than 22 grams per day for a 2,000 calorie diet). As shown in Figure 66, participants in all three centers exceeded this level. Use food labels to choose foods with a lower percent DV of saturated fat. To reduce saturated fatty acids, use vegetable oil instead of lard, butter, or hard margarine, and trim fat from meat. To determine type of fat used in bakery goods and other prepared foods, read labels.

Cholesterol. Cholesterol is a fat found only in animal products including meat, poultry, fish, and dairy products. A limit of 300 mg per day of cholesterol is a reasonable recommendation and is the daily value on the Nutrition Facts Food Label. As shown in Figure 67, men in all three centers consumed more cholesterol than women and exceeded the recommended limit of 300 mg/day. Dietary changes that reduce saturated fat will help to reduce cholesterol intake.

Calcium. The average calcium intake was below the recommended intake of 1,000 mg/day for adults less than 50 years of age, and of 1,200 mg/day for adults more than 50 years of age, as shown in Figure 68. Calcium is a mineral found in dairy products including low-fat or nonfat milk, yogurt, and cheese. Other good food sources include leafy green vegetables (broccoli, kale, and collards), lime-processed tortillas, tofu, and

Figure 67. Mean Dietary Intake of Cholesterol Among Men and Women by Center

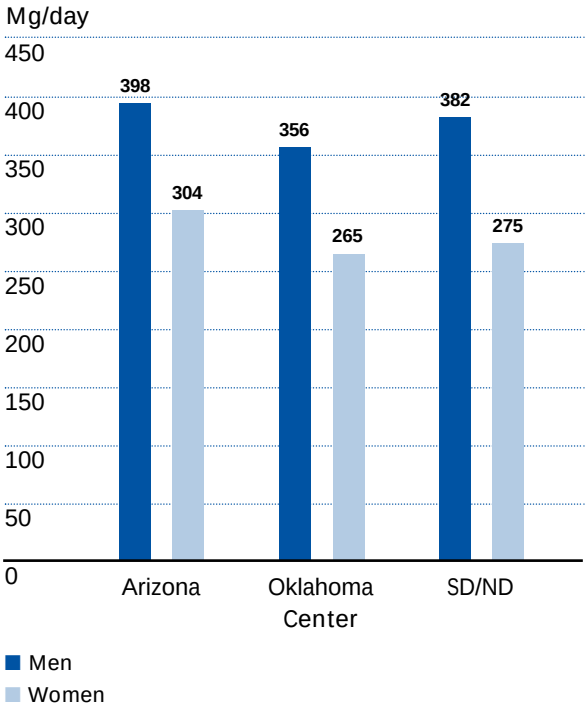
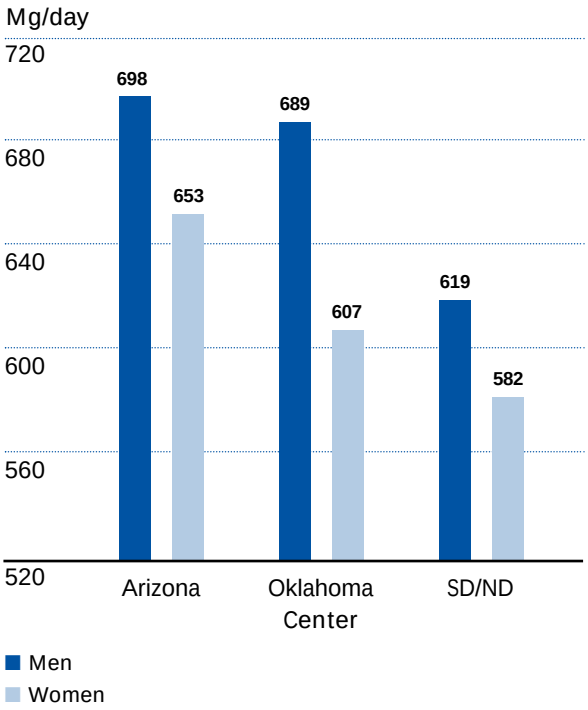


Figure 68. Mean Dietary Intake of Calcium Among Men and Women by Center



calcium-fortified foods including some juices. Lactaid milk can be used in place of regular, low-fat, or nonfat milk to increase calcium intake.

Iron. The average iron intake exceeded the RDA (8 mg/day) for both men and post-menopausal women at all three centers, as shown in Figure 69. The RDA for pre-menopausal women is 18 mg/day. Iron is found in liver, meat, poultry, and fish. Other foods having a relatively high iron content include whole grain and enriched breads and cereals, legumes and dry beans, green leafy vegetables, and eggs.

Potassium. Potassium intakes vary considerably, depending on food choices. Good food sources of potassium include fruits and vegetables such as bananas, potatoes, carrots, and citrus fruit. Meat, poultry and fish are also good sources of potassium. Approximately 1,600 to 2,000 mg of potassium per day is recommended for adults. As shown in Figure 70, average potassium intake exceeded 2,000 mg for both sexes and at all three centers.

Figure 69. Mean Dietary Intake of Iron Among Men and Women by Center

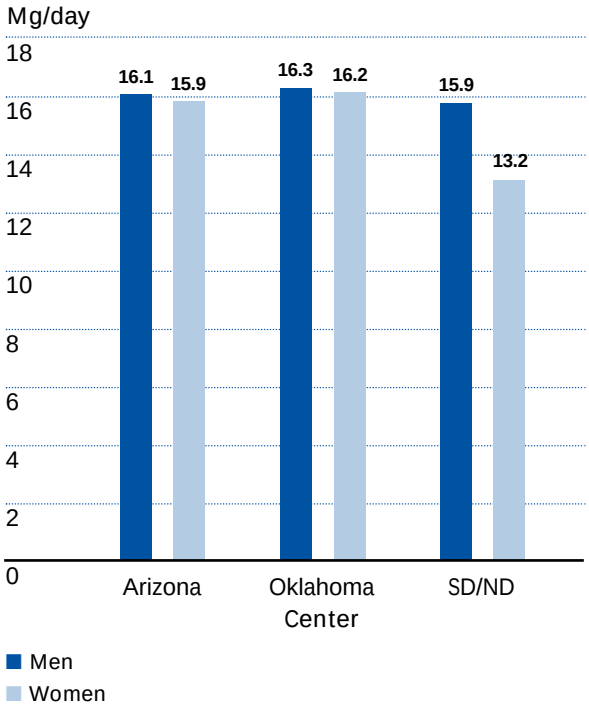


Figure 70. Mean Dietary Intake of Potassium Among Men and Women by Center

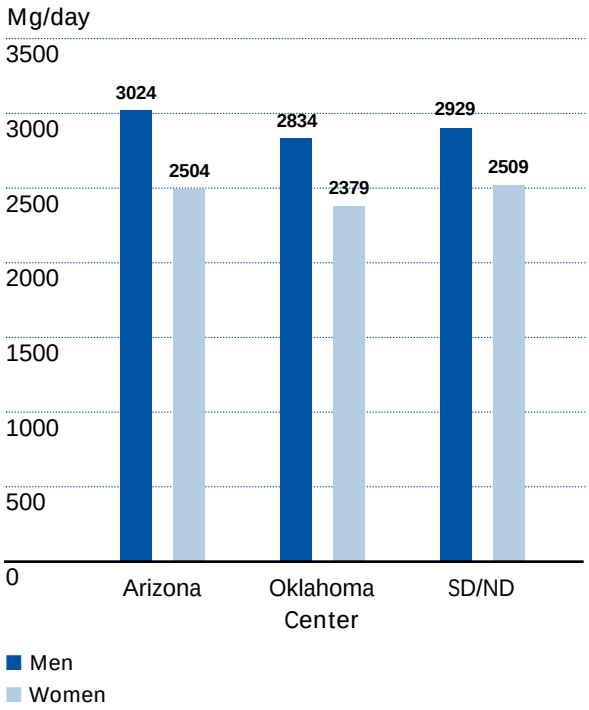


Figure 71. Mean Dietary Intake of Zinc Among Men and Women by Center

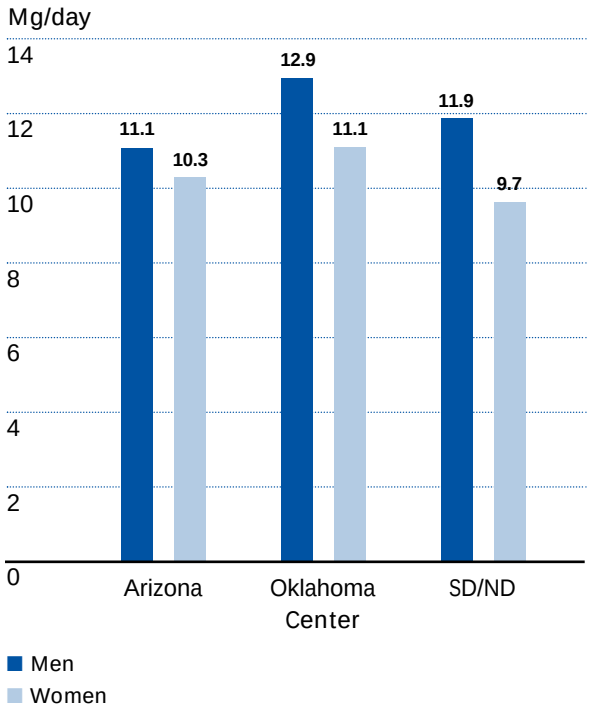
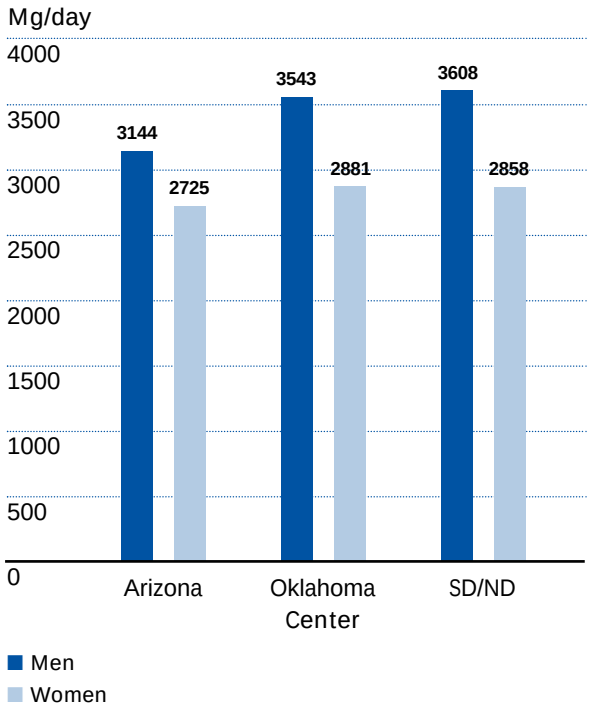


Figure 72. Mean Dietary Intake of Sodium Among Men and Women by Center



Zinc. The RDA for zinc is 11 mg/day for men and 8 mg/day for women. Mean zinc intake met the RDA for men and women at all three centers, as shown in Figure 71. Good sources of zinc are meats, liver, whole grain cereals, nuts, legumes and dry beans.

Sodium (salt). The Food and Nutrition Board of the National Academy of Sciences recommended that daily intake of sodium (salt) be limited to 2.4 grams/day (2,400 mg/day) (NRC, 1989), which is also the daily value on the Nutrition Facts Food Label. As shown in Figure 72, Strong Heart Study participants at all three centers consumed more than the recommended intake. High sodium intake causes blood pressure to increase. Most sodium is added by food processors in products such as breads, cereals, soups, bacon, sausage, cold cuts, and cheese. To reduce sodium levels, read labels and choose food products with smaller percent daily value amounts of sodium.

Vitamin C. Vitamin C is a water-soluble antioxidant. Vegetables and fruit are the major sources of vitamin C — for example, citrus fruits, tomatoes, potatoes, broccoli, strawberries, cabbage, collard greens, spinach, and peppers. As shown in Figure 73, Strong Heart Study participants in all centers except the Dakota men reached the recommended level of vitamin C of 90 mg/day for adult men and 75 mg/day for adult women.

Vitamin A. Vitamin A is a fat-soluble vitamin, which means it will dissolve in fat. Whole and fortified milk, eggs, and liver are the major sources of vitamin A. Deep yellow vegetables such as carrots and dark-green leafy vegetables, such as spinach, are also good sources. Many other fortified foods such as breakfast cereals also provide vitamin A. The RDA of 900 mcg retinol activity equivalents (unit of measurement) for men and 700 mcg retinol activity equivalents for women was met in Strong Heart Study participants as shown in Figure 74.

Vitamin B6. The major sources of vitamin B6 are meat, poultry, and fish, potatoes, sweet potatoes and vegetables. Other good sources are whole grain flour and cereal products, and fortified breakfast cereals. For adults less than 50 years of age, the RDA for vitamin B6 is 1.3 mg/day. Over the age of 50 years, the RDA for vitamin B6 is higher for women, 1.5 mg/day, and for men, 1.7 mg/day. The RDA is 2.0 mg for men and 1.6 for women. As shown in Figure 75, the daily intake requirement for vitamin B6 was met only by women from Arizona and Oklahoma participating in the Strong Heart Study.

Folate. The daily value recommended for folate (folic acid) is 400 mcg. As shown in Figure 76, only men at the Arizona center met this amount. Folate is widely distributed and is found in liver, yeast, deep green leafy vegetables, legumes, dry beans, and some fruits, especially citrus fruits. Fortification of cereal grains with folate became mandatory for enriched grains in the United States as of January 1, 1998. U.S. intake of folate has substantially increased since that time.

Physical Activity. The level of physical activity of the Strong Heart Study participants was assessed with a questionnaire that was developed and validated for American Indians. "Usual activity" was a combination of leisure and occupational activity over the past year. Only activities that demanded energy expenditure greater than that required by activities of daily living such as bathing, grooming, and eating were assessed.

Figure 73. Mean Dietary Intake of Vitamin C Among Men and Women by Center

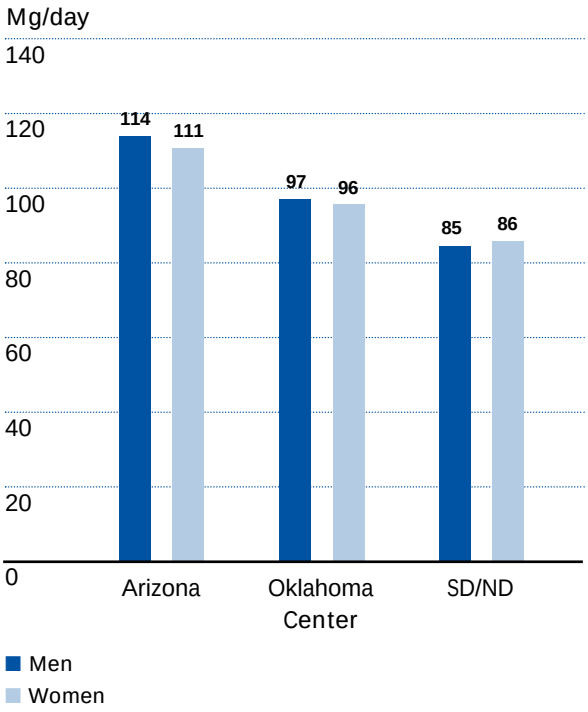


Figure 74. Mean Dietary Intake of Vitamin A

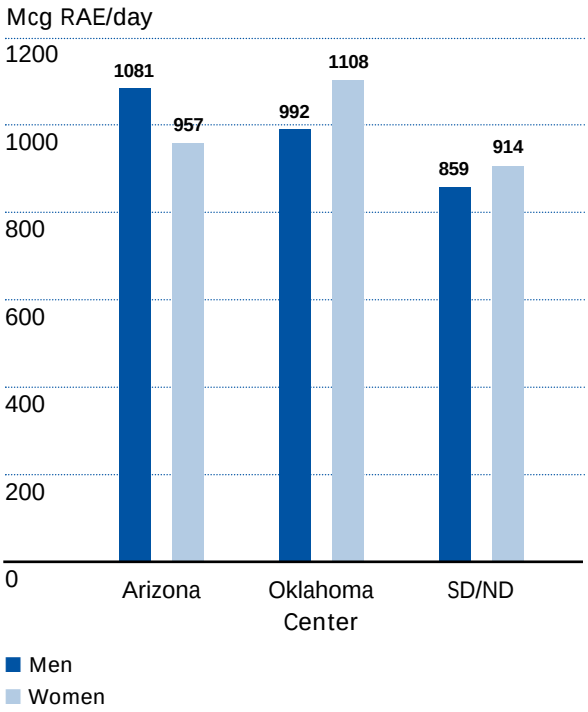


Figure 75. Mean Dietary Intake of Vitamin B6 Among Men and Women by Center

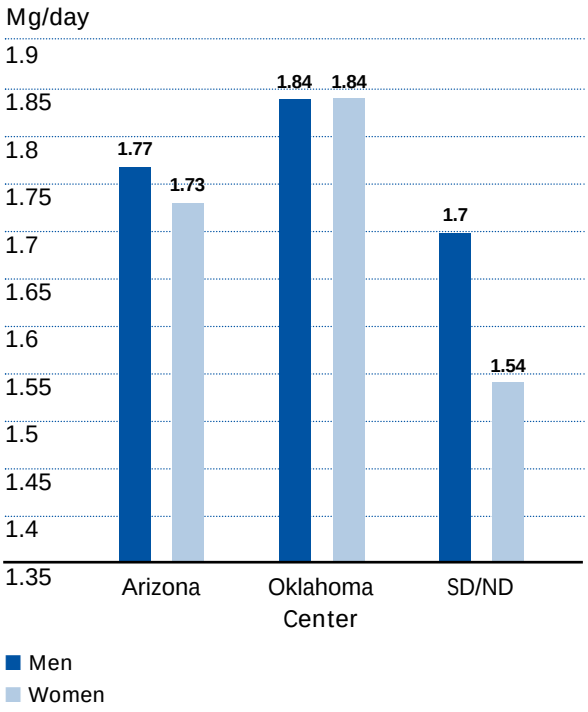
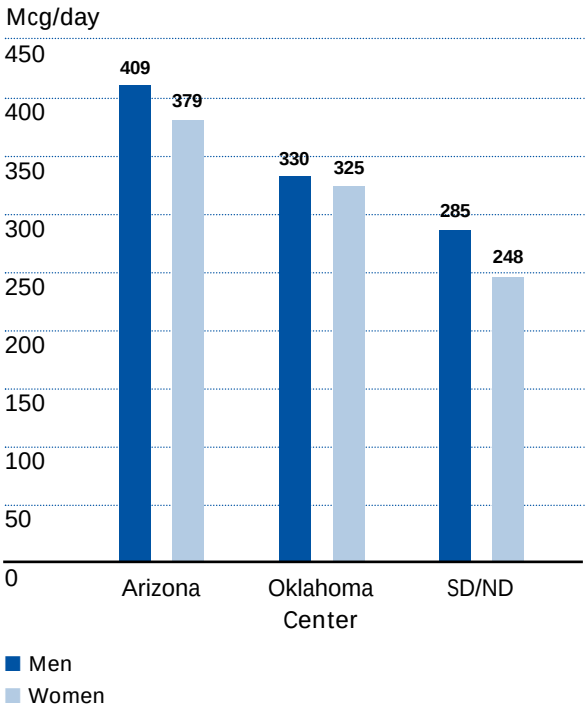


Figure 76. Mean Dietary Intake of Folate Among Men and Women by Center



Lack of Physical Activity. Despite the importance of physical activity for general health and well-being, a large portion of the U.S. population is sedentary. The national data, as reported in the 1996 Surgeon General's Report on Physical Activity and Health, reflect activity within the preceding *month* and are not directly comparable to the Strong Heart Study data. Nationally, about 25 percent of all adults are not active at all, with inactivity being more prevalent among women than men. In 1993, approximately 38 percent of the U.S. population age 55 and older reported no physical activity within the *month* preceding the survey, as reported by the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM). Figure 77 presents Strong Heart Study data on lack of physical activity during the past *year.*

Although not directly comparable with the Strong Heart Study data, the Surgeon General's Report showed that 24 percent of all adults in Arizona were inactive, as were 30 percent in Oklahoma, and 31 percent in South Dakota during the *month* preceding the survey.

Leisure Activity. The most common leisure activities reported by the male participants were gardening, walking, and hunting, whereas walking, gardening, and dancing were the most popular among the women. Figures 78 presents data on study participants' leisure activity.

A list of activities was developed through pilot testing involving the Strong Heart Study population. The list includes walking, gardening/yard work, hunting, dancing, running, swimming, bicycling, and skating. The interviewer read through the list and the participant identified all leisure activities that the participant performed at least 10 times during their life. The participant was then asked to identify any of the activities that they had engaged in during the past year. Estimates of frequency and duration were obtained from

Figure 77. Percent of Men and Women Participants Reporting No Physical Activity During the Past Year by Center

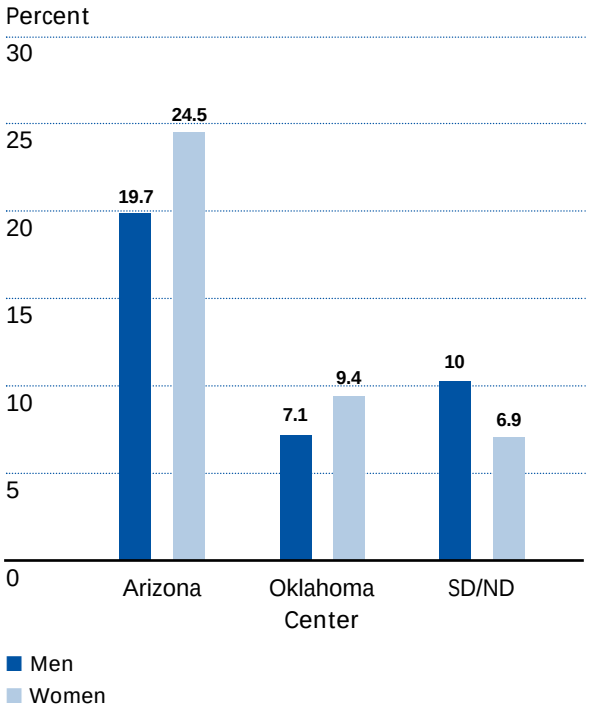
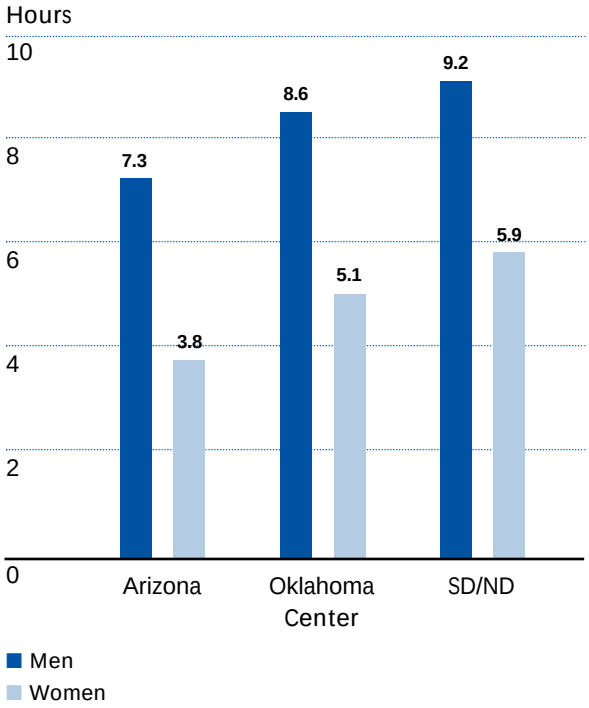


Figure 78. Average Number of Hours of Leisure Activity Per Week Among Men and Women by Center



the participants for each activity, and then average hours per week were estimated. The men at all three centers were at least 50 percent more active than the women. Both the men and the women from the Dakotas were more active than the participants from Arizona and Oklahoma.

Work-Related Physical Activity. The number of hours that each person participated in physically demanding activities during an average workday for each job held over the past year was recorded during the interview. The individual was first asked to identify all jobs held during the past year for more than 1 month. For each job the participant answered questions about usual transportation to and from the job as well as average job schedule. The participant was also asked to specify the usual number of hours per day spent sitting at work. The summation of hours per week of moderate and hard activity provided the estimate of average hours per week exceeding light activity during the past year. As shown in Figure 79, men spent more time in physical activity at work than women, and the men from the Dakotas were the most active. Men and women in Arizona were the least physically active. The American Heart Association (AHA) reports that about 12 percent of all deaths are due to a lack of regular physical activity.

Total physical activity was the sum of past-year leisure hours per week and past-year occupational (moderate + hard) hours per week. As Figure 80 shows, men at all three centers were more active than women. Participants from Arizona reported the least amount of total physical activity during the past year.

The CDC and ACSM report that regular physical activity provides substantial health benefits. According to the CDC and ACSM report, "every U.S. adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week." This can be accomplished by about 30 minutes of moderate-intensity

Figure 79. Average Number of Hours of Occupational Physical Activity Per Week

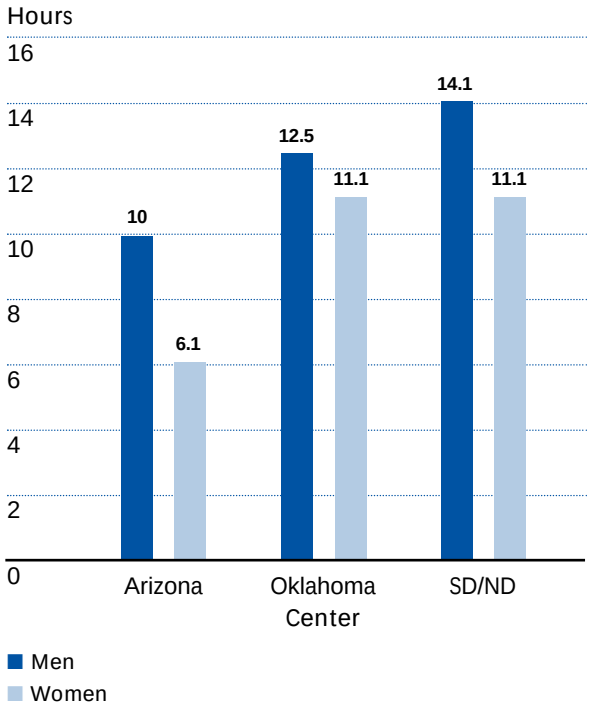


Figure 80. Average Number of Hours of Leisure Time and Occupational Activity Per Week Among Men and Women by Center

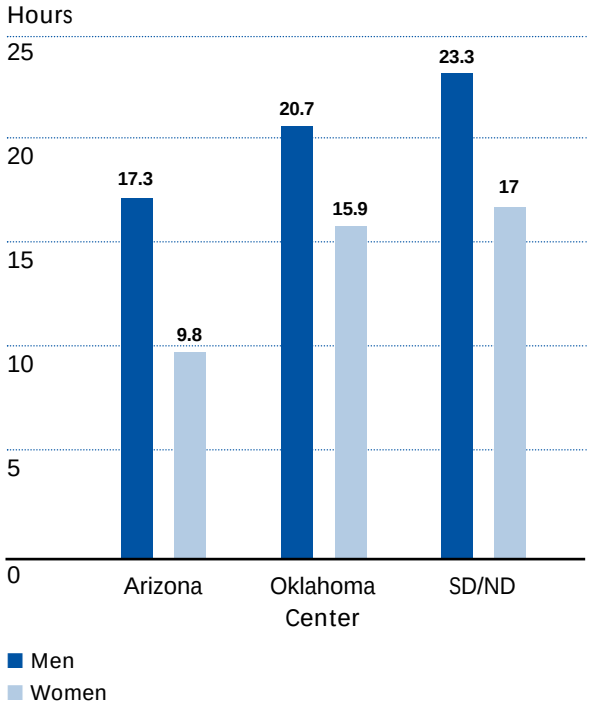
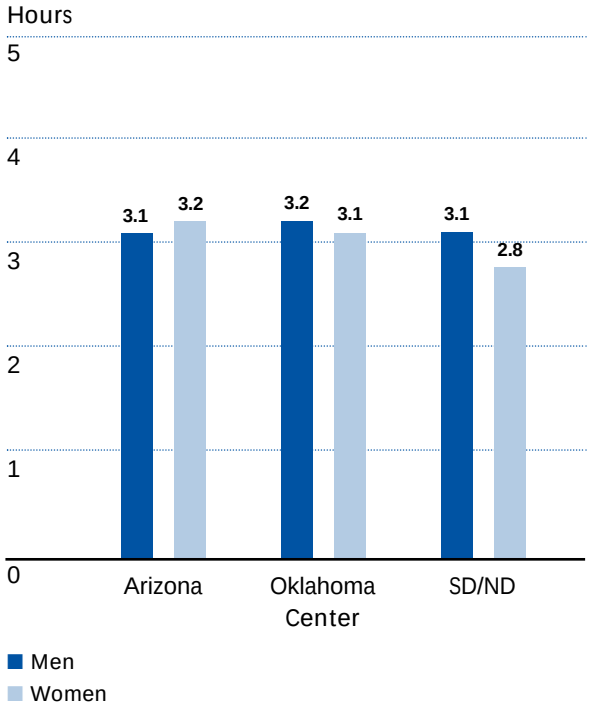


Figure 81. Average Number of Hours of Television Watched Per Day Among Men and Women by Center



activity, such as quickly walking 2 miles. The 30 minutes can also be accumulated in short periods of activity, such as taking the stairs instead of the elevator, walking short distances instead of driving, doing calisthenics, gardening, doing housework, raking leaves, or playing actively with children. Those who perform lower-intensity activities should do them more often, for longer periods, or both. According to the Surgeon General's Report on Physical Activity and Health, significant health benefits can be obtained in longer sessions of moderately intense activities, such as washing windows or floors for 45 to 60 minutes or gardening for 30 to 45 minutes, and in shorter sessions of more vigorous activities, such as bicycling 4 miles in 15 minutes or running 1.5 miles in 15 minutes. The Surgeon General's Report states that "previously sedentary older adults who begin physical activity programs should start with short intervals of moderate physical activity (5 to 10 minutes) and gradually build up."

Time Watching Television. Participants were asked how many hours per day they spent watching television during the past week and during the past year. As shown in Figure 81, the average number of hours per day for the men and women at each center was less than the numbers reported by the Nielsen Report on television watching by people age 54 and older. Television watching is sedentary behavior, and inactivity increases with age. Anyone engaging in physical activity at 50 or older should start slowly and gradually build up to the desired amount of exercise. People with chronic health problems, such as heart disease, diabetes, or obesity, or who are at high risk for these problems, should first consult a physician. The Surgeon General's Report emphasizes that social support from family and friends is consistently and positively related to regular physical activity. Its benefits include: reduced risk of falling and fracturing bones; reduced risk of dying from coronary heart disease; reduced risk of developing high blood pressure and diabetes; maintenance of healthy bones, muscles, and joints; and reduced symptoms of anxiety and depression. The AHA reports that the increase in the risk of coronary heart disease associated with physical inactivity is comparable with the increase in risk associated with high cholesterol, high blood pressure, or cigarette smoking.

Conclusion

The increasing incidence of CVD among American Indians found by the Strong Heart Study is of great concern because rates of CVD are decreasing in other groups in the United States. More intensive programs to reduce CVD risk factors are needed in American Indian communities. Since the risk factors vary by tribal groups, these programs need to be tailored to each community based on the data presented in this book. Diabetes was found to be the most important factor contributing to the rate of CVD among American Indians. Since diabetes rates are high in all American Indian communities, and overweight and low physical activity are the only modifiable risk factors for diabetes, community- and school-based primary prevention programs are urgently needed to promote physical activity and healthy diets so that Indian children can reduce their risk of developing diabetes. Improved control of blood sugar and blood cholesterol, and smoking cessation among American Indians who have diabetes, would reduce their risk of developing CVD.

While hypertension control is as good or better among Strong Heart Study participants than that found in national surveys, further efforts to screen, treat, and control hypertension in American Indian communities would also help to reduce CVD. More attention needs to be placed on control of blood lipids. Similarly, smoking cessation and prevention programs and reduction of excessive alcohol use would help to reduce cardiovascular disease and many other health problems that afflict American Indian communities.

The Strong Heart Study investigators hope that the knowledge that has been gained from this study will be useful to the tribes and the Indian Health Service in planning health promotion and disease prevention and treatment programs. The Strong Heart Study data have already been used to document the need for the Pathways Study, an NHLBI-supported school-based intervention trial for the primary prevention of obesity in American Indians that includes many of the Strong Heart Study communities. Much more needs to be done to reduce the disproportionate burden of chronic diseases that has been documented in American Indian communities so that the health and well-being of future generations will improve.

GLOSSARY

Albumin – protein found in the body.

Albuminuria – the finding of protein in the urine; a sign of declining kidney function.

Angina pectoris – chest pain lasting a few seconds or minutes, usually brought on by stress or exertion and relieved by rest; considered an early sign of heart disease.

Arthritis – inflammatory disease of the joints of the body; the two types are degenerative arthritis and rheumatoid arthritis.

Atherosclerosis – cholesterol-containing deposits occurring in the inner layer of medium and large arteries; atherosclerosis can lead to heart attack and stroke if the blood vessels become clogged.

Body mass index (BMI) – a measure of body fat calculated as the ratio of weight to (height squared) measured in kilograms and meters.

Carbohydrates – the component of food that includes starches, sugars, celluloses, and gums.

Cardiac – referring to the heart.

Cardiovascular disease (CVD) – broad category of diseases of the heart and blood vessels. It includes coronary heart disease, stroke, and heart failure.

Cholesterol – fatlike substance found in animal foods – meat, milk, butter, cheese, and egg yolks; cholesterol is also measured in a person's blood.

Congestive heart failure (CHF) – disease of the heart resulting from the inability of the heart to function adequately as a pump.

Coronary heart disease (CHD) – heart disease resulting from inadequate oxygen supply to the heart, usually because of atherosclerosis.

Degenerative arthritis – Arthritis due to aging or wear and tear on the joints.

Demographic data – descriptive data of a group of people that may include gender, age, race, education, and income.

Dialysis – procedure for filtering the blood of impurities; usually required when the kidneys are no longer able to function.

Diastolic blood pressure (DBP) – blood pressure at the point when the heart is not pumping; the second (lower) of the two numbers used in blood pressure measurement.

Echocardiogram – picture of the heart taken by using sound waves (ultrasonography).

Electrocardiogram (ECG or EKG) – measurement of the electrical activity of the heart taken by placing electrodes on the chest of an individual.

Emphysema – a lung disease resulting from smoking and other causes which leads to breathlessness.

Environmental tobacco smoke – sometimes referred to as passive smoke; exposure to tobacco smoke resulting from the smoking of others.

Folate – one of the B vitamins.

Hemoglobin A1c (HbA1c) – hemoglobin in red blood cells that have been overexposed to glucose because of diabetes or pre-diabetes; measures long-term blood sugar control.

Hypertension – term for high blood pressure; currently defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg.

Impaired glucose tolerance (IGT) – inability of the body to handle sugar properly following food intake; IGT may lead to diabetes.

Incidence rates – a measure of the occurrence of new disease among healthy individuals during a specific time period, such as 1 year.

Kilocalories (Kcal) – a unit of energy used to measure energy intake and energy expenditure.

Leukemia – a cancer-like disease of the blood cells.

Left ventricular hypertrophy – enlargement of the chamber of the heart that pumps blood throughout the body; sometimes an indication of pending heart disease.

Lipid – cholesterol or fats in the blood.

Lipoprotein – particle that allows fats to be carried in the blood; the particle is made up of a fat particle attached to a protein to make it soluble in blood.

Low density lipoprotein – lipoprotein particle; elevated levels have been linked to increased risk of heart disease.

Lymphoma – a neoplastic disorder of the lymphoid tissue.

Macroalbuminuria – high amounts of protein in the urine; usually a serious indication of damage to the kidneys.

Microalbuminuria – low amounts of protein in the urine; usually an early indication of damage to the kidneys.

mmHg – millimeters of mercury; blood pressure is measured in these units.

Morbidity rates – proportion of individuals contracting a disease during a specific time interval such as a year.

Mortality rates – proportion of individuals dying from a disease during a specific time interval, frequently a year.

Myocardial infarction – heart attack resulting from too little oxygen supply to the heart muscle.

mg/dL – milligrams per deciliter; a measure of concentration for such things as cholesterol level.

Obesity – excess body fat; may be measured in a variety of ways, such as body mass index (BMI); for BMI defined as BMI of 30 kg/m^2 or greater.

Overweight – amount of body fat between normal and obese; for BMI defined as BMI between 25 and 29.9 kg/m^2.

Prevalence rate – proportion of individuals who have a disease at a specific point in time.

Renal failure – inability of the kidneys to filter the blood of impurities adequately.

Rheumatoid arthritis – chronic disease of the joints, which may result in pain, swelling of the joints, and limitations on body movement.

Risk factor – a personal characteristic that is associated with increased risk of disease.

Saturated fat – dietary fat that is unhealthy because of its link with high blood cholesterol and atherosclerosis.

Systolic blood pressure (SBP) – blood pressure at the moment the heart has just finished a beat; the first (higher) of the two numbers used in blood pressure measurement.

Stroke – damage to the brain resulting from too little oxygen.

Sudden death – usually associated with cardiac causes; death resulting very quickly (frequently within 1 hour) from causes that are likely to be related to the heart.

Transplantation – transfer of living tissue (kidney, blood, heart) from one individual to another to prolong or improve the quality of life of the recipient.

Triglycerides – a fatlike substance found in the blood; higher levels of triglycerides have been linked to heart disease.

Ultrasound/ultrasonography – a technique for imaging internal components of the body using sound waves that is without harm or discomfort to the patient.

Ventricle – chamber of the heart that serves to pump the blood.

Ventricular dysfunction – inability of the ventricle to pump the blood adequately.

For More Information

To learn more about the prevention and treatment of heart disease, contact:

National Heart, Lung, and Blood Institute (NHLBI)
NHLBI Health Information Center
P.O. Box 30105
Bethesda, MD 20824-0105
Phone: (301) 592-8573
Fax: (301) 592-8563
Web site: http://www.nhlbi.nih.gov

American Indians and Alaska Native
http://hin.nhlbi.nih.gov/minority/nat_frameset.htm

Strong Heart Study
Web site: http://strongheart.ouhsc.edu/

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