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Kristina K. Lee

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Native Americans and Diabetes

Kristina K. Lee

Type II diabetes has reached epidemic proportions among Native Americans. It is estimated that 12.2 percent of all Native Americans in the U.S. have Type II diabetes. This compares with 5.2 percent of the general U.S. population (Diabetes Statistics 1997). The highest rate of diabetes in the world is in the Pima Nation. Half of all Pima Indians age 35 and older have diabetes (West 1974). Diabetes causes severe health complications and is a major cause of death for Native Americans.

What is Diabetes?

Diabetes is a chronic disease in which the body does not produce insulin or properly use insulin. There is no cure. Insulin is a hormone that is needed by the body to convert sugar, starches, and other food into energy needed for daily life. There are two main types of diabetes, Insulin Dependent (IDDM) and Non-Insulin Dependent Mellitus (NIDDM). Between 80 and 90 percent of people with diabetes have Type II and this will be the focus of this paper.

Non-Insulin dependent diabetes mellitus is also known as Type II diabetes. It is characterized by elevated plasma glucose and plasma cholesterol in blood and urine. This is the more common type of diabetes. Type II diabetes is a metabolic disorder in which the body produces insulin, but cannot use it efficiently or does not produce enough. NIDDM affects carbohydrate, fat and protein metabolism, and insufficient insulin secretion or insulin resistance. Type II diabetes disproportionately affects minority populations and the prevalence of diabetes among minorities is increasing.

Almost all Native Americans with diabetes have Type II diabetes.

There are many warning signs of Type II diabetes. These physical ailments include:

- fatigue
 - irritability
 - increased thirst or hunger
 - extreme weight loss
 - blurred vision
 - increased urination
 - sore gums
 - sores that do not heal or are slow to heal
 - frequent infections (skin, gum, bladder)
 - numbness in the hands or feet
- (Diabetes and American Indians 1997; The Dangerous Toll 1997)

One of the most significant problems associated with diabetes is that over half of the people with the disease, do not know they have it. Many people learn they have the disease only after they develop serious diabetes related complications. Late diagnosis increases the risk for more serious health problems. Four of the most common life-threatening complications of diabetes are: blindness (retinopathy), kidney disease (nephropathy) and ultimately, kidney failure, amputations of digits and limbs, heart disease, and strokes. Heart disease is 2 to 4 times more common in people with diabetes. The disease may cause damage to the nervous system (neuropathy) and the blood vessels (cerebrovascular). Between 60 and 65 percent of diabetics develop high blood pressure (hypertension). This increases the risk of strokes with diabetics having a 2.5 higher risk than a non-diabetic (Diabetes Statistics 1997).

Research has indicated three primary factors for the prevalence of diabetes among Native Americans. These factors are genetic predisposition, diet and obesity, and physical activity level. Stress has also been indicated as a possible factor, but very little research or documentation relates it to diabetes (Urdaneta 1989). The interrelationship between these factors appears to cause Native Americans to be more susceptible to diabetes. Other factors that may increase the prevalence of diabetes include: high blood sugar during pregnancy, women with high birth weight babies (over 9 pounds at birth), and ethnic background.

The following chart presents the percent of adults with diabetes in various ethnic groups. These percentages, prepared by Diabetes Statistics, not only include figures of diabetes patients, but also estimates of those individuals that are undiagnosed in the ethnic populations. The percentages of adults (diagnosed and undiagnosed) with diabetes can be divided by ethnicity as follows:

African Americans	9.6 percent
Mexican Americans	9.6 percent
Cuban Americans	9.1 percent
Puerto Rican Americans	10.9 percent
White Americans	5.2 percent
Native Americans	5 to 50 percent

(Diabetes Statistics 1997)

For Hispanics in the U.S., one in every ten adults has diabetes. For Cuban American and Mexican American populations, almost 10 percent have diabetes. For Mexican Americans and Puerto Ricans ages 45-74, approximately 25 percent have diabetes, and in this same age group, 16 percent of Cuban Americans have diabetes. Hispanic women with diabetes have a greater risk of death and complications during pregnancy than the U.S. average. The prevalence of

diabetes among African Americans is comparable to the Hispanic population (Diabetes Among Hispanics 1997).

For African Americans, it is estimated that over 2 million have diabetes. They are 1.6 times more likely to have diabetes than the general U.S. population. Almost 6 percent of African American men have diabetes and almost 8 percent of African American women have diabetes. They often experience higher rates of serious complications such as blindness, amputation, and kidney failure (Diabetes Among African Americans 1997).

The average prevalence of diabetes among Native Americans is more than twice as high as the general U.S. population (West 1974, 1978a,b). Overall prevalence of Type II diabetes among Native Americans is 12.2 percent as compared to 5.2 percent of the general U.S. population (Diabetes Statistics 1997). In less than thirty years, diabetes went from being unranked (1951) as a leading cause of death for Native Americans to becoming the seventh leading cause of death by 1980 (Campbell 1996). Diabetes is the second most common diagnosis for Native Americans admitted to the hospital (West 1974). If current rates continue, Type II diabetes will eventually affect one-half of all Native American adults. For the U.S. population as a whole, less than 10 percent of people age 45 or older have diagnosed or undiagnosed Type II diabetes (Harris 1985). For many Native American nations, this figure jumps to 25 percent or more. For Pima adults age 35 or older, the rate is an astounding 50 percent (Sievers and Fisher 1985). These figures are staggering when recognizing that diabetes was rare in all Native American nations prior to 1940.

The percentage of Native American adults with diabetes, both diagnosed and undiagnosed, ranges from 5 to 50 percent. Prevalence rates vary among different Native American

nations (see Weiss 1984, Appendix 1). At this point in diabetes research, it seems that diabetes is not uniformly distributed across all Native American groups. The extent of acculturation may play a role in this pattern and needs to be researched further. Many nations of the southwest (Pima, Navajo, Tohono O'odham) have extremely high prevalence rates and, as with the Pima, have been researched for many years. Unfortunately, few other nations have been examined for incidence of diabetes and significant cross-cultural data is not available. Another important factor to consider with the wide range of diabetes prevalence is that almost half of those with diabetes are still undiagnosed with the disease.

Diabetes has become a growing health problem among Native Americans since the 1940s (West 1974). There is little documentation of diabetes prior to this time period. According to reports, diabetes was rare in the first part of the twentieth century (Hrdlicka 1908; Sievers 1981). By the 1950s, diabetes was found in many nations. By the 1970s, it was found in epidemic proportions in many nations, West (1974) discovered that within a short period of time, diabetes had spread throughout the Native American populations.

One possible way to examine or explain the change in the occurrence of diabetes among Native Americans is using mismatch theory. It is noted that diabetes and obesity were rare in Native American populations historically. Diabetes became increasingly apparent after the 1940s. As living organisms, humans are adapted to live in a certain environment. We presume that biological adaptations humans have are from past environments. Mismatch theory examines the consequences of diet change. Humans, specifically hunters and gatherers, seek out caloric rich foods in areas of limited resources. Today, food stress is not a problem.

Environmental change occurred as food resources become increasingly dense and available. Since the environment today, does not match the past environment, Native Americans have developed problems with adaptations. These environmental changes in such aspects as diet and activity level occurred rapidly in many Native American communities. Most of these changes were imposed on them by a dominant outside culture.

Genetic Explanations and the Thrifty Gene

Many researchers think that diabetes in Native Americans is a problem in human adaptation and genetics is strongly linked. One of the possible explanations of this evolutionary adaptation was developed by Neel (1962, 1982). In 1962, Neel was the first to argue that diabetes was a genetic adaptation that dealt with changes in lifestyle. His theory was called the "thrifty genotype" hypothesis. People with a thrifty gene were better able to store food as fat during feast periods. The thrifty genotype hypothesis involves quick insulin discharge after a meal, which granted a survival advantage during times of food shortages. Evidence for seasonal stress is widespread among hunters and gatherers in various environments. "Nearly all hunters and gatherers living in seasonal environments continued to be affected by the seasonality with some degree of episodic stress" (Yesner 1994:167). Unfortunately, this one-time advantage has now become a maladaptation which is detrimental giving rise to insulin resistance and eventually Type II diabetes. Today's new environment with high food availability and consumption patterns, combined with decreased physical activity, may lead to diabetes. Neel theorized that the "thrifty" gene probably accounted for the high prevalence of Type II diabetes in Native American

populations. The thrifty genotype became a liability after adopting a modern lifestyle.

Another related theory is Weiss's (1984) "New World Syndrome." This theory states that there is one fundamental mechanism for the high prevalence of certain diseases among Native Americans, diabetes and obesity included. Weiss suggests that Native Americans have a genetic susceptibility to the New World Syndrome due to positive natural selection or genetic drift during the early peopling of the New World. Certain traits were perpetuated by natural selection which provided survival advantages when Native Americans were hunting and gathering. Weiss states that the New World Syndrome is connected to female reproduction. This "suggests that possibility of a gene or genes related to food storage in the form of fat, whose selective advantage pertained to the ability of a woman to become fertile, to carry a child successfully to term, or to nurse an infant" (Weiss 1984:172). Wiedman (1983) also proposed a theory relating female reproduction to the thrifty gene, called the "multiparity" hypothesis. He suggested that the thrifty gene allows females to gain weight for successful pregnancies. The ability to gain weight would increase the birth weight of a child and increase the child's survival rate (Wiedman 1983). Today, this thrifty gene causes problems by the relative ease of significant weight gain. This may lead to obesity and diabetes. Weiss (1984) argued that the "thrifty genotype" must represent some form of altered metabolism. He stated that since World War 11, there has been a significant increase in diabetes and obesity and he argues that it is from the interplay of certain Native American genotypes and changes in their environment, most notably, changes in their diet. The diseases that are becoming rampant today did not present a problem in the past. This is because of

current environmental conditions. According to Weiss, Eskimos have a lower prevalence to the New World Syndrome because of their later migration to the New World. The New World Syndrome presents itself in Native American populations with the onset of obesity sometime after puberty. Later, diabetes develops in adults. The underlying cause for diabetes and obesity seems to be the interaction between the environment and susceptible genotypes.

Ritenbaugh and Goodby (1989:228) suggest "with northern hunting adaptations, rapid changes in lifestyle among this group could lead to the NIDDM seen in present day American Indians and other New World populations." Diet for northern hunting groups consists mainly of animal resources. These sources are low in carbohydrates, low in dietary fiber, moderate in fat, and high in protein. People living in northern latitudes of North America have a high metabolic rate for the production of body heat and blood flow to extremities. Their reliance on animals for their food base suggests irregularity of food availability and possible health problems related to the excessive ingestion of protein. Ritenbaugh and Goodby (1989:230) suggest that "in this context, preferential storage of fat would provide a distinct survival advantage." Therefore, fat could be preferentially stored. As with Neel's thrifty genotype hypothesis, this preferential fat storage would be a survival factor during this period of hunting.

Dietary Change and Obesity

Several researchers have examined the relationship between diet, culture, and diabetes (Jackson 1994; Smith 1994; Thorburn 1987; Wolfe 1994). From food quality to food intake, food plays an important role in the health of a population, both physically and psychologically. In many Native

American cultures, food plays an important role in social situations from everyday life to religious ceremonies and celebrations (Jackson 1994; Lang 1989).

Dietary and cultural changes arose after contact with Euroamericans and these changes impacted the overall health of Native Americans (Jackson 1994). New plants and animals were introduced and many traditionally used plants and animals were destroyed. With the relocation and reservation period in the mid to late nineteenth century, the U.S. government began limiting Native American access to traditional foods and them with food rations and commodities. These goods often consisted of flour, baking soda, sugar, rice, canned meat, bacon, lard, and coffee (Jackson 1994). "Dietary changes usually involve the replacement of high fiber and complex carbohydrate foods with high fat and simple carbohydrate foods" (Jackson 1994:393). The U.S. government also strongly encouraged many traditional hunter and gatherer groups to take up agriculture and become farmers.

Today, diets are generally high in refined carbohydrates, fat, and sodium with very few fruits and vegetables as part of the diet. "In a recent Survey of contemporary Navajo diet, Wolfe and Sanjur (1988) reported that the most frequently consumed foods are fry bread, potatoes, eggs, and sugar, in addition to beverages of soda pop or other sweetened drink mixes. "Traditional" foods eaten include mutton, tortillas, and fry bread. While 53 percent of the households sampled grow corn, squash, and melons in household gardens, most gardens are small and are no longer a major source of food" (Hall 1994:140). Jackson (1994:390) states that "contemporary food choices of American Indians reflect historical ties as well as many changes. A decreased in available variety and quantity of wild animals and plants has paralleled the

loss of traditional lifestyle. Thus, although some individuals in some tribes still eat at least a limited amount of traditional foods, purchased items have generally replaced traditionally hunted, gathered, or cultivated foods."

Feskens (1992) discusses diet and how carbohydrates, fiber, refined sugars, starches, fats, and proteins help or hinder the development of diabetes. Most traditional foods are high in complex carbohydrates, while processed foods are high in simple carbohydrates, sugar, and fat. Thorburn, et al (1987) suggests that diabetes was not found historically because traditional "bushfoods" digested slowly due to the amount of complex carbohydrates. "There is increasing evidence that the replacement of the complex carbohydrates found in desert plants with refined, high caloric, single carbohydrates does produce a very slowly rising blood glucose level and the corresponding insulin levels in non-diabetic subjects" (Justice 1994:119). Swathmary (1986) also hypothesized that the high prevalence of NIDDM among Native Americans was related to proper digestion of carbohydrates.

Brand, et al (1990) conducted research on traditional Pima Indian meals and found that these starchy foods digested slowly and contributed to the protection of the group from diabetes. The Pima diet before 1930 consisted of legumes (wild and cultivated), cacti, fish, seeds, mesquite, and corn. Through acculturation and adoption of government commodity foods, these traditional foods lessened in use, as wheat, lard, sugar, and other processed foods became the bulk of the Pima diet. The traditional foods contained carbohydrates that digested slowly and they have low glycemic and insulin responses.

Obesity

In 1978, West, a prominent diabetes scholar, concluded that obesity was the single most important nutritional factor in the cause of diabetes. He stated that Type II diabetes is genetically determined, with close ties to age and obesity. Records and observations of Native American body type in the 19th and early 20th century, suggest that most Native Americans were generally lean, healthy individuals (West 1978a). There was little historical documentation of obese Native Americans. Today, obesity is very common in Native American populations (West 1978a,b). A medical survey in 1987 documented the prevalence of overweight and obese Native Americans and Alaska Natives and compared those figures to the general U.S. population. For Native American males, 18 years and older, the prevalence of obesity was 13.8 percent. This figure jumps to 28.2 percent for men ages 45 to 54. For non-Indian men of the same age group, the prevalence of obesity is 14.1 percent. For Native American women, 18 years old and older, the prevalence of obesity is 16.6 percent. This compares to only 8.2 percent prevalence for non-Indian women in the same age group (Broussard et al 1991; see Appendix 2).

The extent of obesity in Native American populations is not well understood or documented. Most national health surveys do not include Native Americans. Documentation and research is sketchy and exact research methods of various surveys are often not known. There are problems with the use of terms, "over-weight" and "obese." Obesity is defined using body mass index (BMI) as the indicator. For adults, obesity prevalence is defined as having a BMI greater than or equal to the 95th percentile and overweight is defined as those with a BMI greater than the 85th percentile (Broussard et al 1991). A screening of more than 2000 Native Americans representing 15 tribes

conducted by the Indian Health Service, indicated that 77 percent of all subjects were obese and 84 percent of all persons with diabetes were obese (Diabetes Nutrition Education Materials 1989). It is unclear with this data how the Indian Health Service defined obese. It is possible that the figures include people who are simply "overweight" and not obese as defined by other researchers (Broussard et al 1991).

Obesity and diabetes seem to be highly correlated in Native American populations. Diabetes incidence is greater in obese people than in those who are not obese. "The most frequently encountered explanation for the increased incidence of NIDDM is that obesity increases insulin resistance which results in high circulatory levels of glucose" (Ritenbaugh and Goodby 1989:233). It is not known whether obesity brings out diabetes sooner in people already predisposed to the disease or if it is actually causal (Bennet et al 1976).

Lifestyle choice is often one of the leading factors in weight gain. Weight gain may come from a the constant supply of food, a decrease in physical exertion, and an increased availability of high caloric foods. Cultural traditions play a role in ideas of food and fatness. Lee et al (1985) found that in some Native American communities, fatness is a sign of well-being and that significant weight loss may be sign of concern for people. These views may promote feasting behavior but no corresponding fasting behavior. Food and feasting often play an important role in Native American communities. In addition, socioeconomic conditions may play a role in the types of food available to certain groups. Studies have shown that low socio-economic groups often have diets that have significant amounts of calorie-dense, high fat, and refined carbohydrates (Molls, Leonard, and Watson 1985).

Weiss (1984:157) states that "while obesity is a cardinal risk factor for diabetes in New World populations, there is evidence that the prevalence of diabetes ... cannot be explained by obesity alone." Obesity and its subsequent relationship to diabetes is a serious medical problem for many Native American populations. Knowler et al (1991) stress the importance of research on how obesity increases the incidence of diabetes and whether weight loss programs and preventive weight control programs will reduce the incidence of diabetes.

Reduced Physical Activity

One of the most common statements made about Native Americans is that they do much less physical activity now that they are not hunting and gathering. Many hunting and gathering groups spent significant amounts of physical activity in their lives for the procurement of food. This decrease in physical activity and increase in sedentism has led to an increase in obesity, which in turn, might lead to diabetes. Another possible factor in the reduction of physical activity among Native Americans deals with urban living versus rural living. Urban populations are often more sedentary than rural populations. Urban Native Americans make up over 63 percent of the total Native American population. Urban Native Americans have three times the national rate for diabetes (Urban Indian Fact Sheet 1997).

"Quantification of actual energy expenditure is generally difficult in field studies. Most observations of changing activity levels are based on anecdotal information regarding historical changes in physical activity patterns. It is clear, however, that daily subsistence activities and transportation needs have until recently required moderate to heavy energy expenditure in most tribal groups" (Sievers and Fisher 1981). For example, traditional farming and herding

activities of the Navajo demanded a great deal of physical labor. People often walked long distances to their herds and fields. Today, many Navajo have motor vehicles to get from one place to another. "The implication of this decreased activity level is well understood by many elderly Navajos, who blame reduced physical activity rather than greater food consumption for increasing obesity on the Reservation" (Hall 1994:141).

Diabetes has drastically increased in Native Americans possibly due to recent, rapid lifestyle changes. Diets have changed and activity levels have decreased, both of which seem to contribute to the prevalence of diabetes. Research suggests that these environmental changes "unmask" an underlying Native American genetic susceptibility to diabetes (Knowler et al 1983; Mohs et al 1988; Sievers and Fisher 1981; Weiss et al 1984; Hall 1994; Zimmet et al 1982).

A Look at Diabetes in Several Native American Nations Kiowa

Kracht (1994) presents the changes that occurred for the Kiowa that have led to a high prevalence of diabetes. They include changes in diet and lifestyle, development of obesity, and a decrease in exercise. This situation is similar to many other Native American nations.

Kiowa diet changed significantly. One of the important pre-reservation foods eaten by the Kiowa was bison meat. Other foods included deer, elk, wild fruits, and vegetables. During the reservation period, 1868-1901, Kiowa subsistence and diet changed from wild plant and animal resources to an increased dependence on government commodities of beef, salt pork, flour, and sugar. Due to unsuccessful attempts of the U.S. government to transform the Kiowa into farmers and by the reduction of government rations,

there were periods of starvation and famine in the Kiowa community. Hunger was a major problem at the Kiowa Agency. "The Kiowa were compelled to subsist on the scanty rations available; they had a steady, albeit inadequate food supply that was consumed within a few days. Thus, consuming all available foods at once became a pattern attributable to inadequate ration distributions" (Kracht 1994:151).

Activity levels also changed for the Kiowa. First, the Kiowa were forced to stay on the reservation. They were not allowed to move camp or migrate to other areas. Secondly, by the end of the nineteenth century, the Kiowa were being forced to live in government built houses, thus compelling them to become more and more sedentary. The Kiowa were forced into inactive lifestyles. At the same time, their diet was changing to heavily refined foods. This combination could easily lead to increased obesity and possibly diabetes.

Eskimo/Alaskan Natives

Previously, researchers have presented the relatively rare occurrence of diabetes among Alaskan Natives (Mouratoff et al 1972). Recently though, this position has been challenged by Schraer (1994). Mouratoff (1972) concluded that diabetes was probably rare among the Eskimo because of their high level of physical activity which hindered the development of diabetes. Another reason for the rarity of diabetes was thought to be the lack of obese people in the population. The group Mouratoff (1972) researched was not extremely obese. A survey (Schraer 1994) conducted in 1987 of an Eskimo village found that in a span of fifteen years (1962 to 1987), the number of overweight (BMI>85%) men increased from 3 percent to 16 percent and for women it increased from 6 percent to 27 percent.

Diabetes among Alaskan Natives was rare in the past, but according to Schraer (1994), it is becoming more common. Why is it becoming more common? Schraer argues it is because of lifestyle changes. Traditional foods for Alaskan Natives vary according to the environment in which people live. Traditional foods range from salmon, moose, deer, shellfish, seals, halibut, berries, seaweed, whales, and birds. As with most Native American groups, cultural changes occurred after Western contact. The traditional diet of many Alaskan Natives was low in carbohydrates and high in protein. Research has shown that their traditional diet was fairly balanced for human nutritional needs. By the mid-20th Century, food resources were changing as well as energy expenditure. Technology has given Alaska Natives important labor saving devices such as snowmobiles, chain saws, and fuel oil. Saturated fat and carbohydrates have increased in their diet. These changes have unfavorably affected the health of Alaska Natives.

The occurrence of diabetes among Alaska Natives was thought to be rare up to 1985. In 1985 the Alaska Native Health Service was concerned that Alaska Natives were developing diabetes. In the following year, the health service started a project to register diabetic patients. It was found that diabetes prevalence (age adjusted rates/1000) varied between Alaskan ethnic groups: 27.2 among Aleuts, 22.0 among Indians, and 8.8 among Eskimos (Schraer 1994). Schraer suggests two theories for the differences in diabetes prevalence from one Alaska group to another. First, these differences may reflect different genetic susceptibility among ethnic groups. Second, lifestyle factors may be the most significant component of the occurrence of diabetes. Schraer points out that those regions with the longest contact with

outsiders, are those regions that have the higher prevalence of diabetes.

Pima

Type II diabetes is epidemic among the Pima of Arizona. The Pima were a hunting and gathering group who had successfully adapted to desert life. Euroamerican settlement into their area disrupted their traditional hunting, gathering, and agricultural lifestyle. Two enormous health problems among the Pima today are diabetes and obesity. According to Knowler (1978), the Pima have the highest reported diabetes incidence in the world. Approximately 50 percent of adults over the age of 35 years have diabetes. The Pima have been participating in longitudinal epidemiological research studies as far back as 1965. These studies on diabetes and obesity hope to find the cause(s) of the astronomical rates (Bennett 1976).

Obesity among the Pima is phenomenal (see Appendix 3). For the first half of this century, obesity among the Pima was relatively rare (Hrdlicka 1908; Knowler 1983). Obesity among the Pima has increased significantly during the 20th Century. According to body measurements, when compared to the general U.S. population, all Pima, regardless of age, tend to be more obese (Knowler 1983). At all ages, the Pima exceed the U.S. age-specific medians of body mass index. In 1981 the National Center for Health Statistics indicated that almost 60 percent of Pimas 20 to 34 years old) exceeded the 90th percentile for the body mass index. This compares with 10 percent of the general U.S. population (Berg 1990). The highest body mass index in the population is in the young adults. There have been some increases in age- and sex-specific mean body mass index for the past 25 years. According to Knowler, this would indicate that older members of the population have been less exposed to those factors that lead to

obesity. Pima children today are much heavier in weight than Pima children earlier in the twentieth century. Obesity among the Pima can be traced through families and seems to be connected to the development of diabetes.

Neel's thrifty genotype theory has been applied to the Pima to explain the high incidence of diabetes in research by Bennet et al (1976) and Knowler et al (1981,1983). Knowler's findings (1983) are consistent with the basic principles of Neel's theory. "When food supplies are steady and abundant, as they are for the Pimas today, increased fat storage is detrimental, leading to increased obesity, insulin resistance, and eventually diabetes" (Knowler 1983:113). This increased incidence of diabetes coincides with the increased availability of food resources.

Bogardus et al (1989:1423) hypothesizes that among the Pima, "insulin resistance is determined by a single gene with a co-dominant mode of inheritance." Bogardus suggests that obesity is not the major factor of MaxM (maximal insulin-stimulated glucose uptake rates) and that other environmental factors are not significant factors of MaxM. His research suggests that there is a strong factor among the Pima that MaxM is a familial trait that is not related to obesity, age, and sex. "Family membership was a more important determinant of MaxM than all of the other covariates combined" (Bogardus 1989-1423). According to Bogardus, environmental determinants have only a weak connection to the development of diabetes.

Tohono O'odham

Justice (1994) compares diabetes prevalence rates of the Tohono O'odham to the Pima and finds similar rates. As with other groups, the rates have increased significantly over a short period of time. For the Tohono O'odham, the prevalence of diabetes is 141.79 per 1000 for all ages. The rate

for age 25 years and older is 317.04 per 1000 (Justice 1994). Justice suggests that Neel's "thrifty gene" theory may explain these rates for the Tohono O'odham.

Justice (1994) gives four theoretical stages of the development of diabetes among the Tohono O'odham. The first stage includes periods of periodic famine and food scarcity. People are hunting and gathering, which takes considerable amounts of energy. For the most part, diabetes is absent during this first stage. The second stage is when the availability of food increases and it is available virtually every day. Food scarcity only affects a small number of people on the outskirts of the community. Energy output decreases with the availability of storebought foods. Because of the previous factors, weight gain increases and diabetes begins to occur in adults. In the third stage, obese, diabetic mothers are giving birth, their children are surviving and the children are becoming obese adolescents. The availability of food is still abundant and energy output has continued to decrease. The last stage is the continual decrease of physical activity and continued high prevalence rates in all age groups. According to Justice, the Tohono O'odham have been in the fourth stage since the 1970s.

Implications for Diabetes Treatment

The high prevalence of diabetes among Native Americans has significant implications for their health care. One of the most important steps in developing appropriate treatment is the need for health care professionals to adapt their treatment to include cultural values and ideas of their patients. Education programs need to have cultural knowledge of the targeted groups to better transmit information and assist people with preventing and managing illness and disease. "Diabetes is one field where a collaborative approach

between epidemiologists and anthropologists can contribute substantially to our knowledge of the genetic, metabolic, social, and cultural determinants of the disease" (Young 1994:34).

Another important aspect is the need to change behavioral patterns to deal with conditions that increase the risk of diabetes. Dramatic improvements can occur with proper treatments (change in diet, weight loss and exercise) for Type II diabetes. Glucose levels improve with moderate physical exercise. Exercise also helps lessen secondary complications of diabetes. Management of diabetes relies heavily on behavior modification on the part of the patient. Cultural norms must be taken into consideration when developing these changes. A treatment program that advocates changes which are not only difficult, but also culturally unacceptable, will likely not be followed by the patient. The Gila River Diabetes Prevention Model combines community experiences and diabetes research into a culturally relevant intervention framework for this community (Garcia-Smith 1994). The model is based on the idea that if the cultural ways of the Pima are incorporated into the prevention/treatment program, those afflicted will be more likely to follow the program and it will be more effective. Adherence to a diabetes treatment program depends a great deal on developing management programs which include the patient's culture, rather than ignoring the patient's culture.

Diabetes prevention and treatment programs must combine historical and contemporary information about the population when designing these programs. Each must be tailored to the specific cultural group. The Lorelei DeCora's Porcupine Clinic on Pine Ridge Reservation is teaching diabetics about beneficial diets, exercises, and how to control diabetes. DeCora is attempting to recover

traditional tribal ways of preparing food. She enlists the help of tribal elders in her programs (Sandrick 1997). Health programs need to incorporate cultural adaptations for individual tribal diabetes programs. One such program is the International Diabetes Center and its Staged Diabetes Management (SDM) program which has helped curb diabetes on several Navajo reservations (Innovations 1996). The International Diabetes Center has also developed a partnership with the Indian Health Service and serves many different Native American nations.

There is often a gap that needs to be bridged between the patient's cultural understanding of diabetes and the medical doctor's clinical or western understanding of the disease. Carrese and Rhodes (1995) discuss the possible detrimental implications of discussing advance care planning, treatment risks, and disease complications with traditional Navajo patients. Western bioethics which is a common part of Western medicine is seen as dangerous to these Navajo. "The Navajo way of thinking embraces positive thinking, beauty, harmony, and goodness. If a physician discusses the complications of a disease such as diabetes, the Navajo patient may believe that he or she will become afflicted with those complications. Health care providers should consider the Navajo ethical perspective when offering treatment" (Carrese and Rhodes 1995:826).

Diet is central to the treatment of diabetes. Food has important cultural significance for many Native Americans. These two ideas can cause much controversy in communities regarding the treatment of diabetes. Diet plays an important role both in the etiology and management of diabetes. This also challenges some Native American socio-cultural norms. One program that is attempting to change dietary behaviors is the Indian Health Service Nutrition and Dietetics Training

Program. This program conducts dietary guidance workshops that assist tribal program cooks to make changes in their cooking and menu preparation. It emphasizes the U.S. Dietary Guidelines and how to cook more healthily (Pelican 1995). Native Seeds/SEARCH (Southwest Endangered Arid Lands Resources Clearinghouse) provides native desert seed packets free to Native Americans. It supports the idea that native foods have health benefits and encourages people to plant and harvest foods of the past. Some Tohono O'odham have returned to a traditional diet consisting of prickly pear and other desert plants. Many of these desert plants are high-fiber foods and assist the body in regulating glucose levels (Zastaury 1996).

Reverting to a "traditional" diet is not as simple as it seems. Many questions are raised regarding these ideas. What is the definition of "traditional" foods? Are they the foods eaten during the period of first contact with Non-Native Americans? Who will have access to these traditional foods? How will urban Native Americans gain access to these foods? What images are being projected by a "return" to "traditional"? On one hand, the use of traditional foods might be part of a culture's revitalization. DeCora's use of the knowledge of tribal elders seems beneficial. On the other hand, does stressing the return to "traditional" foods perpetuate stereotypes of Native Americans as living in the bush or living off the land as pristine hunters and gatherers. Does it project an idea that Native Americans should remain (or return) to "traditional" ways regardless of the ability of cultures to change and adapt?

Hall (1994) suggests two options for dealing with the detrimental diabetes problem. He suggests the possibility of genetic engineering to find the aberrant gene and to alter it. Unfortunately, this process would be extremely costly and

time consuming. Native Americans also might not be willing to be a part of a genetic engineering experiment. The second option would be to conduct behavior modification. If behaviors that encourage or support the maladaptive gene could be changed, this would significantly decrease the numbers of Native Americans with diabetes. Educational programs would have to be culturally specific. The focus of this education would be twofold. First, modification of the diet of many Native Americans must be made by decreasing the amount of high-caloric, high fat, and high sugar foods. The second part would stress the importance of exercise and energy expenditure.

Conclusion

Understanding the nature and history of diabetes is important. The interaction between genetic and cultural factors must be considered when researching the disease. Effective treatment of diabetes patients needs to be researched further. What are the most important things needed for people with diabetes or those at high risk? Programs must be established that are culturally sensitive and relevant to each group. These programs should involve dietary changes and increased physical activity. According to newspaper columnist Don Finley (1996), some Pima have resigned themselves to getting diabetes and living their life with the disease. They see diabetes as just a "normal" part of their life and expect to get it. Medical practitioners are worried about this fatalistic view and rightfully so. For researchers and the people with the disease, diabetes continues to be a frustrating disease.

Type II diabetes is found in epidemic proportions in many Native American populations. Research has shown that the primary factors in the prevalence of diabetes are: genetic predisposition, diet, and activity levels. Individually, a single factor may not

have caused such an explosion of diabetes, but combined, they "trigger" the onset of diabetes, like has never been seen before. Mismatch theory and the thrifty genotype hypothesis are plausible arguments for the high prevalence of diabetes in Native American populations. Research has strongly suggested that a major gene(s) influences the risk of Type II diabetes. The manifestation of this gene may depend on environmental facets that have become more prevalent in recent times. The maladaptive trait and the hereditary nature to develop diabetes appears to be the most significant factor, but other factors such as diet and physical activity level muddle a strictly genetic analysis. The environmental factors should continue to be researched. Until diabetes is linked to a specific gene(s) in Native American populations, speculation will continue about the phenomenal prevalence of diabetes in those populations.

With etiological roots that span an unusually broad range of Subjects -from man's prehistory and evolution, to endocrine function and subcellular interactions to behavioral psychology -- diabetes does not yield to the fine, precise, dissecting lens of modern medical science. The more encompassing biocultural view by medical anthropology provides an additional perspective on this disease. Only by examining the interactions between all the determinants of the disease -- environmental, cultural, and biological -- can we hope to understand and solve the diabetes problem. (Urdaneta and Krehbiel 1989:221)

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