End-Stage Renal Disease due to Diabetes Among Southwestern American Indians, 1990–2001

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OBJECTIVE — This study assesses trends in the incidence of diabetes-related end-stage renal disease (ESRD) among southwestern American Indians (SWAIs).

RESEARCH DESIGN AND METHODS — Using the U.S. Renal Data System, we obtained the total number of new cases of treated ESRD in which diabetes was the primary cause of renal failure in 1990 through 2001. The incidence of diabetes-related ESRD was calculated using census population figures and estimates of the SWAI population with diabetes, then age-adjusted to the 2000 U.S. population.

RESULTS — Between 1990 and 2001, the annual number of new patients starting treatment for diabetes-related ESRD in the SWAI total population increased from 154 to 320, and the age-adjusted diabetes-related ESRD incidence per 10,000 population increased 34% (6.2–8.3 per 10,000 people). However, after adjusting for the increasing number of people with diabetes in the SWAI population between 1993 and 2001, the age-adjusted incidence of diabetes-related ESRD among SWAIs with diabetes decreased 31%, from 80.4 to 55.8 per 10,000 people with diabetes. It decreased for both sexes and in all age-groups.

CONCLUSIONS — The increasing incidence of diabetes-related ESRD in the SWAI population parallels the growing prevalence of diabetes. However, since 1993 diabetes-related ESRD incidence decreased in the SWAI population with diabetes, consistent with national trends. This may reflect the reduction in risk factors and improvements in diabetes care practices in Indian communities.

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In the U.S. population, diabetes is the leading cause of end-stage renal disease (ESRD), defined as kidney failure requiring dialysis or transplantation. Diabetest accounted for 44% of new cases of treated ESRD in the U.S. and for 72% of new cases among American-Indian and Alaska-Native populations (1). Moreover, both diabetes and ESRD are therefore growing public health problems among these populations (2–4). During 1996, the age-adjusted incidence of ESRD with diabetes as the primary cause (diabetes-related ESRD) among American Indians and Alaska Natives with diabetes was 1.5 times that of the total U.S. population with diabetes (5). American-Indian communities in the U.S. Southwest have a particularly high number of ESRD cases (6) and a growing prevalence of diabetes, with an increase of ~30% between 1990 and 1997 and a prevalence of 10.5% among adults in 1996 (2,7). No studies, however, have reviewed the recent ESRD trends in this population. Therefore, this analysis focused on southwestern American Indians (SWAIs) with diabetes and examined trends in the incidence of diabetes-related ESRD in this high-risk population.

RESEARCH DESIGN AND METHODS — Data from the U.S. Renal Data System (USRDS) were analyzed to assess trends in the incidence of diabetes-related ESRD among SWAIs with diabetes residing in Arizona, Colorado, Nevada, New Mexico, and Utah. The USRDS (funded by the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health) collects, analyzes, and distributes information on people receiving ESRD treatment from reports to the Centers for Medicare and Medicaid Services, which reimburses >90% of ESRD treatment in the U.S. through the Medicare program. The data collected include demographic and ESRD-related information, such as first date of treatment and primary cause of renal failure. Because most ESRD patients become eligible for Medicare coverage after 90 days of ESRD therapy, only data on patients who have been treated for at least 90 days are included in the dataset.

USRDS data from 1990–2001 were used to estimate the number of incident diabetes-related ESRD cases among SWAIs. Incident diabetes-related ESRD cases were defined as people who initiated ESRD therapy with diabetes as the primary cause of renal failure. Across the study period, the five states accounted for 33% of all new cases of treated ESRD among all American Indians and Alaska Natives in the U.S.; among these, 79%
were diabetes-related ESRD (1). In contrast, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin accounted for 14% of the cases, and Arkansas, Louisiana, and Oklahoma accounted for 13%; for these states, 75% of cases were diabetes-related ESRD.

The incidence of diabetes-related ESRD was calculated using the number of incident cases and two population estimates of SWAIs: 1) estimates of the total American-Indian population from the census and 2) estimates of the subpopulation with diabetes based on the census and diabetes prevalence data from the Indian Health Service (IHS). The increase in diabetes-related ESRD incidence in both populations was compared to determine the extent to which the increase was due to the growing prevalence of diabetes. Diabetes-related ESRD incidence was age-adjusted by the direct method using the 2000 U.S. population, and trends were examined using regression analysis.

RESULTS — The number of SWAIs with diabetes who began treatment for diabetes-related ESRD rose from 154 in 1990 to 320 in 2001 ($P < 0.0001$) (Fig. 1). During each year studied (1990–2001), the absolute number of new cases was greater among women than men; on average, 58% of the new patients were women.

Between 1990 and 2001, the age-adjusted incidence of diabetes-related ESRD rose 34%, from 6.2 to 8.3 per 10,000 people ($P < 0.01$) (Fig. 2). However, incidence trends in the total SWAI population do not account for the increasing number of people with diabetes in this population (2). When diabetes-related ESRD incidence was calculated using estimates of the population with diabetes, a different trend was seen. The age-adjusted diabetes-related ESRD incidence in the population with diabetes leveled off between 1990 and 2001 ($P = 0.13$) after reaching high points in 1993 and 1996. Between 1993 and 2001, the age-adjusted incidence of diabetes-related ESRD among SWAIs with diabetes actually decreased 31%, from 80.4 to 55.8 per 10,000 people with diabetes ($P < 0.05$).

Throughout the entire study period, the incidence of diabetes-related ESRD in the population with diabetes was greater among men but decreased in both sexes from 1993 to 2001 (data not shown). Diabetes-related ESRD incidence was greater among people with diabetes aged ≥55 years compared with younger subjects; incidence was similar among patients aged 55–64 years and those ≥65 years (Fig. 3). From 1993 to 2001, the age-specific incidence of diabetes-related ESRD decreased in all age-groups: 26% for patients aged <55 years (from 64.6 to 48.0 per 10,000 people with diabetes, $P < 0.02$), 40% for patients aged 55–64 years (from 129.4 to 77.5 per 10,000 people with diabetes, $P < 0.02$), and 39% for patients aged ≥65 years (from 144.8 to 88.9 per 10,000 people with diabetes, $P < 0.05$).

CONCLUSIONS — Between 1990 and 2001, the increase in the number of new cases of diabetes-related ESRD among SWAIs contributed to the already large and increasing burden of diabetes within this population (2) and posed a public health challenge to their communities. In the Southwestern region, the number of dialysis facilities has increased nearly twofold since 1991, and dialysis costs have continued to escalate (1). To evaluate and improve diabetes care for American Indians and Alaska Natives and ultimately reduce the disease burden in this population, IHS established Standards of Care for Diabetes in 1986. These standards were revised in the early 1990s to include annual testing for proteinuria and microalbuminuria, as well as recommendations for use of ACE inhibitors and angiotensin receptor blockers (8). Both of these therapeutic agents have been shown to be renoprotective, independent of their effect in reducing blood pressure (9).

The increase in the age-adjusted incidence of diabetes-related ESRD during the study period parallels the growing prevalence of diabetes (2). The increase in incidence of diabetes-related ESRD treatment may also be attributable to the increased use of treatment due to improved access to health care. However, after taking into account the growing number of people with diabetes from 1993 to 2001, the age-adjusted incidence decreased by 31%. These findings are consistent with national trends. Both the number of new diabetes-related ESRD cases and the inci-
The decline in diabetes-related ESRD incidence in the SWAI population with diabetes may be explained, in part, by the promising trends in the prevalence of risk factors for diabetes-related ESRD and the use of preventive-care measures among American-Indian and Alaska-Native populations. Risk factors for diabetes-related ESRD include familial and genetic factors, duration of diabetes, hyperglycemia, hypertension, and hyperlipidemia (3,11). Between 1994 and 2003, the proportion of American-Indian and Alaska-Native adults with diabetes who were monitored at least annually with glycosylated HbA1c tests to measure the level of glycaemia control increased from 47 to 86% (K.J.A., personal communication), and the mean HbA1c decreased from 9.8 to 7.9% (12). Use of ACE inhibitors and angiotensin receptor blockers increased significantly in the American-Indian and Alaska-Native population with diabetes, from 35% in 1996 to 73% in 2003; the mean diastolic blood pressure decreased significantly from 78 to 75 mmHg (12). The adjusted mean total cholesterol levels decreased significantly from 208 mg/dl in 1995 to 194 mg/dl in 2001 (13). Moreover, the prevalence of macroproteinuria, a sign of renal disease, decreased from 31% in 1994 to 14% in 2003 (12).

An alternative explanation for the decline in diabetes-related ESRD incidence in the population with diabetes might be that SWAIs are not surviving long enough to develop ESRD, which occurs ~15–20 years after onset of diabetes (14). Premature mortality among American Indians with diabetes as a result of the growing prevalence of cardiovascular disease could reduce the number of people who ultimately develop ESRD (15,16).

This analysis has several limitations. First, the data are for people who were receiving ESRD treatment as reported to the Centers for Medicare and Medicaid Services and do not include: 1) patients who died of ESRD before receiving treatment, 2) people who refused treatment, and 3) people who were not reported to the Centers for Medicare and Medicaid Services. Second, racial/ethnic misclassification of American Indians in the USRDS may have resulted in an underestimation of incidence (17). This phenomenon would be relatively unlikely, however, because of the higher volume of ESRD cases among American Indians in the southwest compared with other U.S. regions and the high proportion of cases attributed to diabetes in that population (18). Third, underreporting of American Indians in U.S. census counts may result in an overestimation of incidence. Fourth, IHS data on diabetes prevalence may not be representative of the total American-Indian population in the southwest and may result in overestimation or underestimation of the number of people with diabetes and, therefore, the incidence of diabetes-related ESRD. Though these biases may have affected the magnitude of incidence estimates, trends in incidence would not be affected if the biases remained constant over time. Finally, lack of data on disease duration did not allow for risk stratification.

Diabetes-related ESRD is a costly and disabling condition that disproportionately affects minority populations and is associated with high mortality (1). Unfortunately, the number of new cases of diabetes-related ESRD is likely to continue to increase with the aging of the population and the growing prevalence of diabetes. Furthermore, the downward trend of incidence in the population with diabetes may reverse in the future if people develop diabetes at younger ages and if duration of diabetes becomes longer, consequently increasing the risk of developing ESRD. More effective interventions are needed to prevent both diabetes and diabetes-related renal disease among all American Indians and Alaska Natives. Engaging in regular exercise, improving nutrition, reducing body weight, and taking medications such as metformin may prevent or delay the onset of diabetes among adults with impaired glucose tolerance (19,20). As a result of the congressionally appropriated funding in 1997 for the Special Diabetes Program for Indians, many tribes have implemented programs to improve nutrition and increase physical activity in American-Indian and Alaska-Native communities (12). Among people with diabetes, interventions to aggressively control hyperglycemia and hypertension, along with the use of ACE inhibitors, have been shown to prevent or delay the development of diabetes-related ESRD (21–23). The decreasing trend in diabetes-related ESRD incidence observed in the study population may be the result, in part, of the improvements in diabetes care practices seen in American-Indian and Alaska-Native communities during the past decade and may represent a promising trend toward a true reversal in this devastating complication of diabetes.

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References
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