

KIDNEY DISEASE AMONG THE INDIGENOUS PEOPLES OF OCEANIA

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The prevalence of kidney disease is increasing among the indigenous peoples of Oceania—the region of the world that includes Australia, New Zealand, Papua New Guinea, and thousands of smaller islands. The number of indigenous people with early kidney disease is hard to quantify, but risk factors, including hypertension and diabetes, are widespread. The incidence of kidney failure is known in major population centers, where dialysis treatments are available, but few data are available elsewhere in Oceania. Nevertheless, the incidence of end-stage renal disease among Aborigines, Torres Straits Islanders, Pacific Islanders and Maori is considerably higher than in the surrounding non-indigenous populations, and most of the kidney failure is attributed to diabetes. Despite the high incidence of kidney failure among indigenous people, few receive kidney transplants, and geographic and economic constraints limit the availability of dialysis treatment. Consequently, clinical management should emphasize prevention, screening, and early intervention. (*Ethn Dis.* 2006;16[suppl 2]:S2-24–S2-30)

Key Words: Kidney Disease, Indigenous, Oceania, Diabetic Nephropathy

INTRODUCTION

Chronic kidney disease and kidney failure are increasing among indigenous peoples throughout Oceania, with serious implications for individuals, families, healthcare systems, and governments. Hemodialysis administered three times weekly at a local dialysis center is the most widely available form of renal replacement therapy in this part of the world, but dialysis treatment centers are often geographically concentrated within major population centers, and patients living at a considerable distance from these centers may have to choose between death and relocation. Because of the substantial cost associated with hemodialysis, the increasing incidence of end-stage renal disease (ESRD) in Oceania also affects how governments and healthcare systems allocate scarce resources. This paper reviews the frequency and determinants of kidney disease in Oceania and describes ongoing efforts to address this epidemic.

GEOGRAPHY AND POPULATION

Oceania encompasses all of Australia, New Zealand, Papua New Guinea, as well as the thousands of coral atolls and volcanic islands of the South Pacific Ocean, including the Melanesia, Polynesia, and Micronesia archipelagos (Figure 1).¹ Oceania represents 5.3% of the Earth's land area and has a population of 31,090,000 people, 20,000,000 of whom reside in Australia and 4,000,000 in New Zealand. Ancestries of Oceanic people are complex because of migrations and genetic admixture,² so they are often divided into groups according to geography and ethnicity rather than genetic origin. Much of the

data presented in this review come from studies of Pacific Islanders (primarily Polynesians) from New Zealand, Aborigines from Australia and the Torres Strait Islands, Chamorros and Carolinians from the Mariana Islands of Micronesia, and Nauruans from the Micronesian island of Nauru. Few data on kidney disease are available from other populations in Oceania, but where appropriate, these data are reviewed as well.

PREVALENCE, INCIDENCE, CO-MORBIDITY, AND OUTCOMES OF KIDNEY DISEASE

Underlying the epidemic of kidney disease among indigenous peoples of Oceania is the epidemic of type 2 diabetes mellitus (Table 1), resulting from rapid economic transition and subsequent changes in diet and lifestyle.^{3–14} Diabetes is 2–5 times more common and appears at an earlier age among the indigenous peoples than in the primarily White, nonindigenous populations of New Zealand and Australia.¹⁵ ESRD is attributed to diabetes in 63% of Maori dialysis patients, 55% of Pacific Islanders, and 47% of indigenous Australians. In comparison, only 17% of the treated ESRD in nonindigenous residents of Australia and New Zealand is attributed to diabetic nephropathy.¹⁶ In the Mariana Islands and Guam, 76% of new ESRD cases are attributable to diabetes.¹⁷

Kidney disease is heralded by the appearance of elevated urinary albumin excretion, and elevated albuminuria is common in the indigenous populations of Oceania. For example, albuminuria ≥ 30 $\mu\text{g/mL}$ is found in 41% of Nauruans ≥ 20 years of age,¹⁸ and

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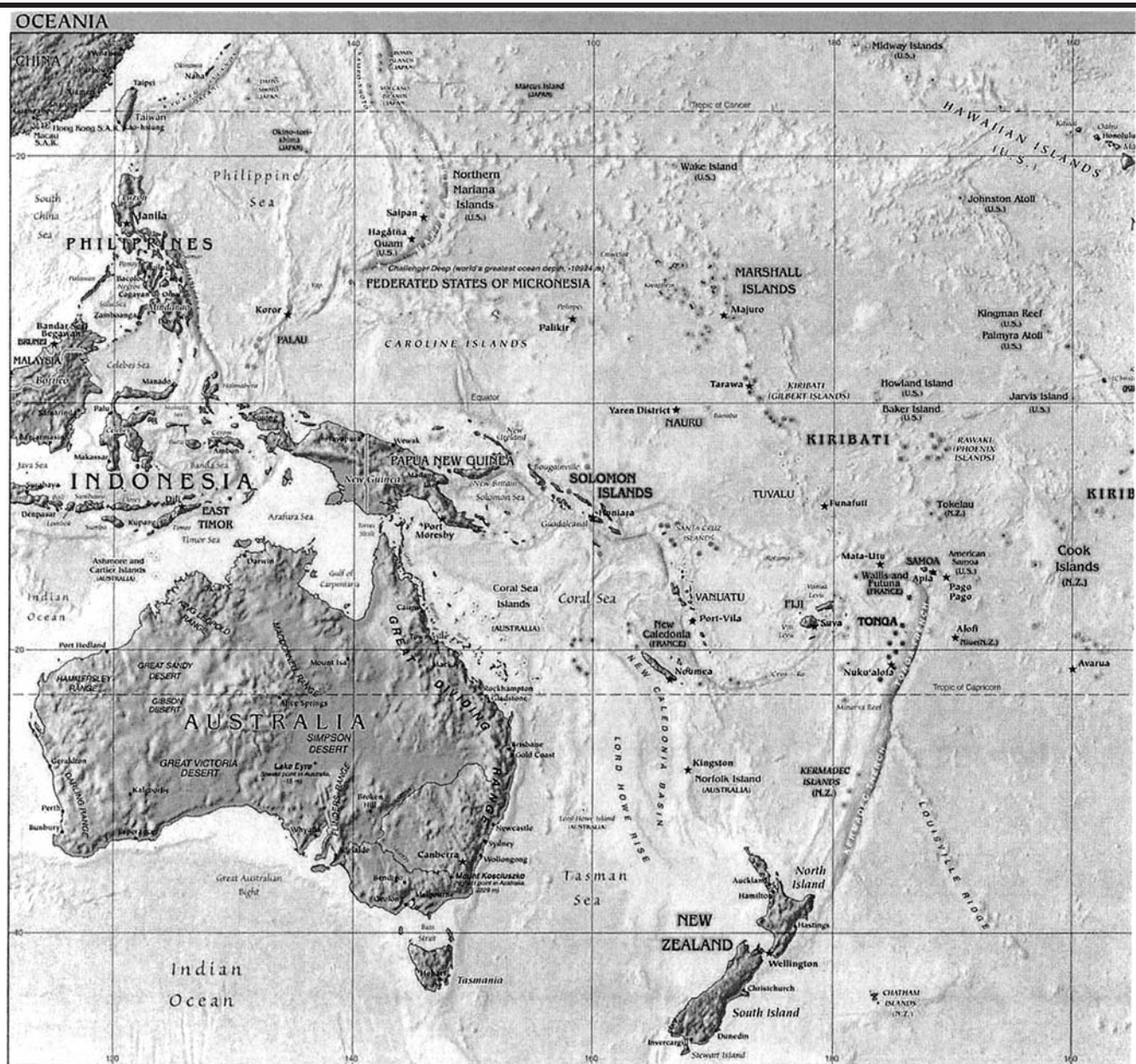


Fig 1. Map of Oceania¹

albuminuria $\geq 20 \mu\text{g/mL}$ is found in 26% of adults ≥ 25 years of age in one ethnic group in New Guinea.¹⁹ In both of these populations, the prevalence of elevated albuminuria was higher among those with type 2 diabetes mellitus. The prevalence of microalbuminuria is also high among Australian Aborigines, whether or not they have diabetes.²⁰ Indeed, among those with microalbuminuria, only 22% had type 2 diabetes. Nevertheless, in Aborigines with di-

abetes, the odds of microalbuminuria was 1.8 times that of White Australians with diabetes.¹⁵ Similarly, in South Auckland, New Zealand, the prevalence of microalbuminuria among diabetic Maori was 1.2 times that of Whites with diabetes.¹²

The incidence of ESRD rose steadily in all ethnic groups in Australia and New Zealand over the 10-year period between 1991 and 2000 (Figure 2), but was highest and rose most rapidly among

Aboriginal and Torres Straits Islanders. Incidence rates for Pacific Islanders and Maori were also high, compared to the mostly White non-indigenous population.¹⁶ A steady increase in new cases of ESRD was also observed in the Commonwealth of the Northern Mariana Islands (CNMI) over a 20-year period from 1982 to 2002, driven primarily by an increasing number of people with diabetic ESRD.¹⁷ The Transpacific Renal Network of the United States, which

Table 1. Prevalence of diabetes in indigenous Oceanic peoples

Indigenous Population	Description	Percent	Reference
Micronesia			
Chamorros from Guam	Age ≥30	10.7	Pinhey et al. 1997
Republic of Kiribati	Urban Men	9.1	King et al. 1984
	Urban Women	8.7	
Saipan	Adults	11	Durand et al. 1996-7
Marshall Islands	Adults ≥30 years	27	Yamada et al. 2004
Nauru	Adults	24	Zimmet et al. 1984
Polynesia			
Samoa	Men 29-62	3.3	Tsai et al. 2001
	Women 29-62	5.4	
American Samoa	Men age 29-62	25	Tsai et al. 2001
	Women age 29-62	15	
Tonga	Age-standardized adults ≥15 years	15.1	Colagiuri et al. 2002
Tahiti	Adults ≥16 years	18	Mou et al. 1999
Maori	Adults 40-59	21	Simmons et al. 1994
Polynesians in New Zealand	Adults 40-59	25	Simmons et al. 1994
Melanesia			
New Caledonia	Adults age 30-59	10.2	Papoz et al. 1996
Torres Strait	Adults	26	Leonard et al. 2002
Australian Aboriginals	Adults ≥35	29.6	O'Dea et al. 1993

tracks ESRD in the protectorates of Guam, Saipan, and American Samoa as well as the states of Hawaii and California, found that the crude incidence rate of newly diagnosed ESRD was higher in Guam and Hawaii, where the proportion

of indigenous people is high, than in the US population in general (Figure 3).²¹

The age at which people develop ESRD is considerably younger among indigenous peoples in Oceania than among the mostly White nonindige-

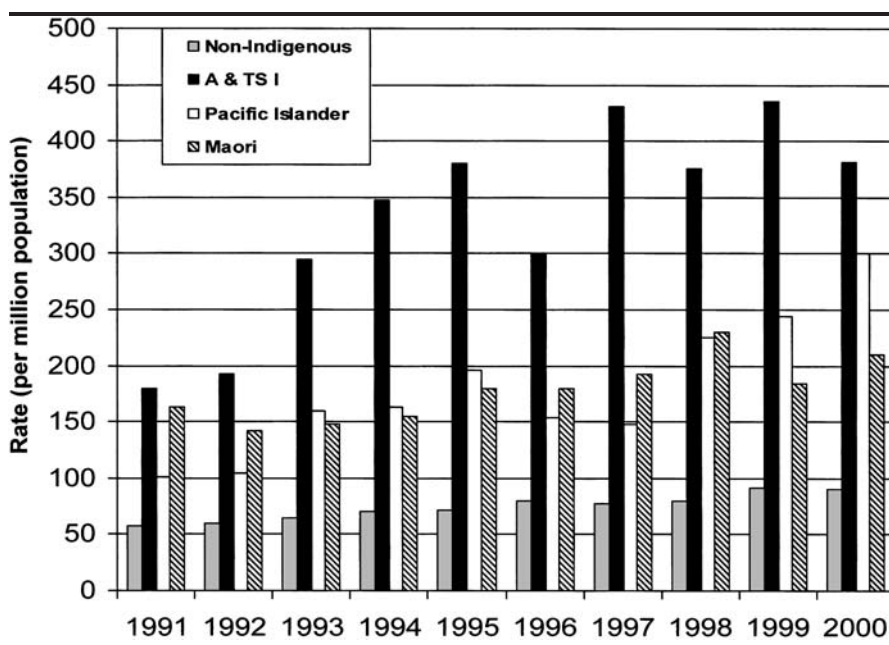


Fig 2. Incidence rates of end-stage renal disease for indigenous and nonindigenous people from Australia and New Zealand. A&TSI refers to Aborigines and Torres Strait Islanders. Adapted with permission of McDonald¹⁶

nous people. The mean age at onset of renal replacement therapy for nonindigenous people is 60 years, whereas Aboriginals are, on average, 48 years old, Maoris are 44 years old, and Mariana Islanders are 56 years old.^{16,17}

The earlier onset of kidney disease among indigenous people is associated with an earlier onset of coronary artery disease. Age-specific rates of coronary artery disease are 1.5 to 2 times higher among the indigenous populations of Australia and New Zealand.²² Age-specific rates of lung disease are also higher, reflecting the higher prevalence of tobacco use among indigenous populations in these countries.²³

Mortality on dialysis is significantly higher among Maori and Aboriginals in comparison with the nonindigenous population after adjustment for comorbidities.¹⁶ By contrast, mortality in Pacific Islanders is not significantly different than in the nonindigenous New Zealanders,¹⁶ and Chamorros from Micronesia have a significantly better survival on dialysis than diabetic patients in the United States.¹⁷ A recent paper using data from the Transpacific Dialysis Network found just the opposite, that mortality on dialysis was significantly lower among Pacific Islanders, with the exception of Chamorros, than among Whites.²⁴ The reasons for this disparity are not known, except that different groups of Pacific Islanders were evaluated in the different studies.

In much of Oceania, improvements in survival on dialysis over the years have greatly increased the number of people receiving renal replacement therapy. While this finding is good news for patients, it places additional financial burdens on the public health systems and governments.

RISK FACTORS FOR KIDNEY DISEASE

Diabetes is the single greatest risk factor for kidney disease in Oceania,

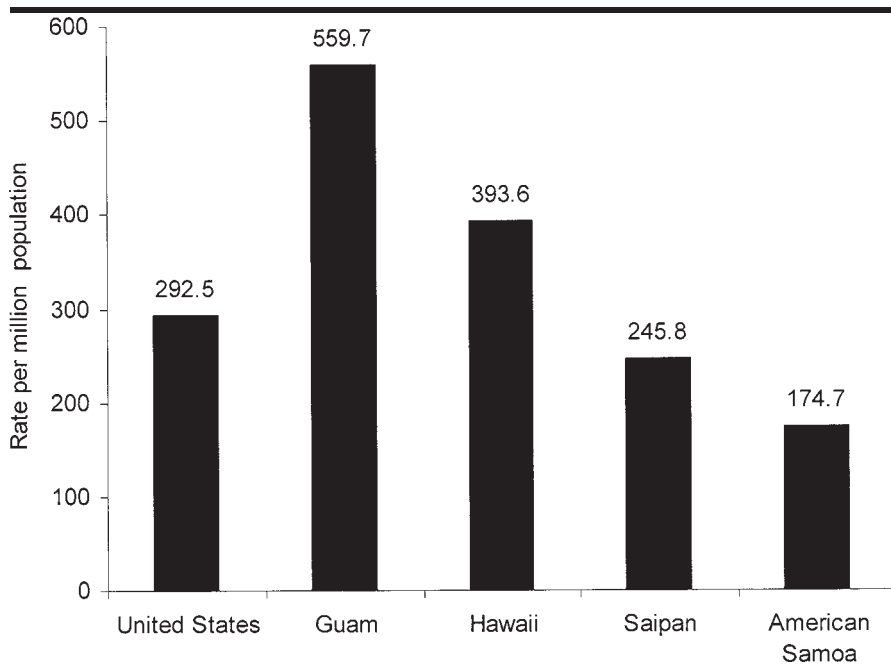


Fig 3. Crude incidence rate per million population of newly diagnosed end-stage renal disease in patients receiving chronic renal replacement therapy, by region, Transpacific Renal Network, 2002 (ESRD Network #17). Data from Hirokawa²¹

and the risk of diabetic kidney disease increases with duration of diabetes. Other risk factors for kidney disease, including low birth weight, exposure to diabetes in utero, vitamin deficiencies, and hypertension, may have particular relevance in this part of the world.

The risk of both diabetes²⁵⁻²⁷ and diabetic nephropathy^{28,29} increases in individuals with low birth weight, and this risk may increase further when it is followed by rapid weight gain in early childhood.³⁰⁻³¹ While intrauterine growth retardation affects a quarter of live births in developing countries annually,³² it does not affect indigenous populations of Oceania uniformly. Low birth weight is a problem in New Guinea³³ and among Australian Aborigines,³⁴ but high birth weight is more common in Micronesia³⁵ and Polynesia.³⁶ Thus, although intrauterine growth retardation may play a role in the etiology of kidney disease in some indigenous Australians³⁷ and New Guineans,³³ it does not likely contribute substantially to the epidemic of ESRD in Oceania.

Exposure to maternal diabetes in utero increases the risk of kidney disease

in the offspring who develop diabetes.³⁸ Animal experiments suggest that maternal diabetes during pregnancy enhances the risk of kidney disease by reducing nephron number in the offspring.³⁹ Since diabetes often develops at younger ages among indigenous peoples of Oceania, women are more likely to have diabetic pregnancies, exposing their offspring in utero to a higher risk of developing kidney disease later in life. The increasing prevalence of diabetes among younger women may explain, in part, the increasing prevalence of diabetic kidney disease in their offspring.

Nutritional deficiencies that affect a developing fetus may also predispose to chronic kidney disease and kidney failure. Vitamin A (retinol) and its main derivative, retinoic acid, are involved in nephrogenesis. Although human data on the relationship between vitamin A and nephron mass are not available, the existing animal data suggest that even a mild vitamin A deficiency during pregnancy could lead to a nephron deficit in the offspring that enhances the risk of kidney disease.⁴⁰ If intake of vitamin A is inadequate to meet the

needs of a developing fetus, it may increase the risk of developing kidney disease later in life. Vitamin A deficiency is frequently encountered in developing nations and is well documented in the South Pacific.^{41,42}

Hypertension may, by itself, cause kidney disease, but it also accelerates the progression of other kidney diseases. Although the definition of hypertension varies among studies, the prevalence of hypertension appears to be rising among indigenous populations of Oceania.⁴³⁻⁴⁹ Like obesity, hypertension may be a consequence of rapid economic transition and subsequent changes in diet and lifestyle.⁵⁰

ACCESS TO HEALTH CARE

Indigenous peoples of Oceania may have a higher risk of kidney disease, in part, because of decreased access to preventive care. The wide expanse of ocean is but one geographic impediment; other barriers include mountains in Papua New Guinea and deserts in Australia. People who live in remote areas may have to travel a considerable distance to see a healthcare provider. In New Zealand, people who must travel >30 minutes to see a general practitioner are disproportionately Maori.⁵¹ In Papua New Guinea, despite the decentralization of health services, a distance ≥ 3.5 km between village and clinic accounts for a 50% decrease in mean attendance.⁵² Decentralization of health care, however, may have a paradoxical effect. Several years after the implementation of district health centers in Papua New Guinea, a study by the World Health Organization found that while clinics were geographically closer to the populations they served, access to care was still compromised by poorly qualified workers, diversion of funds, unavailability of transportation, and inadequate professional supervision.⁵³

Even when patients attend clinic, the services offered may be of variable quality. In 2001, only three diabetes educators worked in Papua New Guinea; hemoglo-

bin A1C testing was available at only one lab; and virtually no testing for diabetes complications was available.⁵⁴ By contrast, an audit of diabetes care in a remote Australian Aboriginal community's primary healthcare setting found that 80% of diabetic patients with microalbuminuria were treated with angiotensin-converting enzyme inhibitors.⁵⁵

Many other potential barriers to care exist in Oceania. Cultural differences may impact patients with incipient or established kidney disease. In New Zealand, Maori people are more likely to smoke (another risk factor for diabetic kidney disease) and to not follow their diabetes diets¹² than nonindigenous people. In Samoa, culture-specific health beliefs lead patients to consult indigenous healers before allopathic physicians.⁵⁶ The cost of consultation may also be an obstacle. In New Zealand, many Maori patients cannot afford the fee for primary care.⁵⁷

Once diagnosed with early kidney disease, indigenous patients in Oceania may not have access to a nephrologist. A pioneering program in Australia has simplified therapy for early kidney disease so that nurses⁵⁸ or even low-skilled workers can provide care.⁵⁹⁻⁶¹ The goal of this program is to slow the progression of early kidney disease to prevent or delay dialysis.

When kidney disease progresses to ESRD, renal replacement therapy in the form of dialysis or transplant is necessary to sustain life. Geographic obstacles in Oceania usually force patients to migrate to urban centers where dialysis is accessible. When whole families are involved, the financial and social costs may be considerable. Alternatively, dialysis may be provided at home to people living in remote locations, as in the Australian Remote Area Dialysis Programme⁶² or through community hemodialysis, in which a dialysis machine is located at a community center in a small village and shared by two or more patients. Patients use the dialysis machine with the assistance of a paid caregiver who has undergone basic

training in its set-up and use.^{63,64} Continuous ambulatory peritoneal dialysis is another dialysis modality that can be used in remote locations.^{65,66}

The best form of renal replacement therapy, transplantation, is available to indigenous kidney patients in some parts of Oceania. In Australia and New Zealand, however, the proportion of indigenous patients who are referred for renal transplantation is lower than for the nonindigenous population.¹⁶ Furthermore, once accepted for transplantation, indigenous people are less likely to receive a graft. This finding is due, in part, to lower rates of living donation among Aboriginal patients, but among the Maori, rates of living donation are equal to those of nonindigenous donation, and Pacific Islanders are actually more likely to participate in living donation than nonindigenous families. Among those who received cadaveric grafts, indigenous people receive fewer well-matched grafts.¹⁶ Disparities in transplant rates exist in other parts of Oceania as well; indigenous people often receive fewer transplants than others.²⁴

CONCLUSIONS

Kidney disease is increasing in prevalence among the indigenous populations of Oceania. Since dialysis is so costly and difficult to deliver in this part of the world, identification of vulnerable individuals through screening and early initiation of treatment should be a public health priority.

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Manuscript draft: Nelson, Weil

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