

# Review of diabetes among Indigenous peoples



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## **Introduction**

The first case of diabetes among Indigenous people was recorded in Adelaide in 1923 [1]. Records prior to this time showed that Indigenous people were fit, lean, and did not suffer from any form of metabolic condition, which were largely believed to be a characteristic of European populations [2]. The earliest detailed studies investigating the development of diabetes in Indigenous populations were not undertaken, however, until the early 1960s. These and subsequent studies found a significant correlation between the development of a 'westernised' lifestyle and the levels of type 2 diabetes in the Indigenous population [3].

Since that time, type 2 diabetes has been recognised as one of the most important health problems for Indigenous populations across Australia, with the overall prevalence likely to be around four times that of the general population. As well as making a major contribution directly to the excess mortality experienced by many Indigenous populations, type 2 diabetes is associated with a number of other chronic conditions, particularly renal disease. Type 2 diabetes is also responsible for a variety of complications, the frequency of which are likely to increase in the future.

## **The burden of diabetes among Indigenous populations**

The overall burden of a disease like diabetes can be measured in a number of ways, but three key indicators are its prevalence, and its impact in terms of mortality and hospitalisation. (The incidence of diabetes would also be a useful indicator, but there is no systematic collection about new cases of type 2 diabetes among Indigenous people. There are some data about the incidence of type 1 diabetes.)

## Prevalence

### Population surveys

The only national estimates of the prevalence of diabetes among Indigenous people come from population surveys conducted by the Australian Bureau of Statistics (ABS), the most recent being the 2004-2005 National Aboriginal and Torres Strait Islander Health Survey (NATSIHS) [\[4\]](#).

Diabetes/high sugar levels were reported by 6% of Indigenous people who participated in the 2004-2005 NATSIHS [\[4\]](#). These problems were reported more frequently by Indigenous people living in remote areas (9%) than by those living in non-remote areas (5%). The proportions represent a slight, but not statistically significant, increase from those reported to the 2001 National Health Survey (NHS) [\[5\]](#).

After adjusting for differences in the age structures of the two populations, diabetes/high sugar levels were around 3.4 times more common for Indigenous than for non-Indigenous people [\[4\]](#). The ratio between Indigenous and non-Indigenous females (4.1) was higher than that between Indigenous and non-Indigenous males (2.9).

Overall, a lower proportion of Torres Strait Islander (5%) than Aboriginal people (6%) reported having diabetes/high sugar levels (the difference is not statistically significant), but the proportion was 11% for Torres Strait Islanders living in the Torres Strait area [\[4\]](#).

The crude prevalence of 6% documented by the 2004-2005 NATSIHS is Higher than the prevalence of 5% reported by the 2001 NHS, which was slightly higher than that reported to the 1994 National Aboriginal and Torres Strait Islander Survey (NATSIS): 3.5% of Indigenous males and 4.7% of Indigenous females reported having diabetes [\[6\]](#),[\[5\]](#). Between the 2001 NHS and the 2004-2005 NATSIHS, the prevalence increased from 7% to 9% for people living in remote areas and from 4% to 5% for those living in non-remote areas [\[4\]](#).

The prevalence of diabetes increases with age, with the increase occurring at much younger ages among Indigenous people – the prevalence reported by Indigenous people aged 35-44 years was around five times that reported by non-Indigenous people (Table 1) [\[4\]](#).

Table 1: Diabetes - proportions of people reporting diabetes/high sugar levels as a 'long-term health condition', by Indigenous status, and Indigenous:non-Indigenous ratios, Australia, 2004-2005

Age group (years)	Indigenous people	Non-Indigenous people	Ratio
15-24	1.0	0.5	2.0
25-34	4.3	0.6	7.2
35-44	10.0	2.0	5.0
45-54	20.7	4.0	5.2
55+	32.1	11.6	2.8

Source: Australian Bureau of Statistics, 2006 [4]

Note: Ratio is the Indigenous proportion divided by the non-Indigenous proportion.

### Specific studies

Surveys such as the 2004-2005 NATSIHS provide some evidence of the prevalence of diabetes among Indigenous people, but better evidence is provided by specific studies involving a combination of self-reported information, physical examination and biochemical testing. A number of studies in the past decade or so provide estimates for various Indigenous populations, but interpretation of these estimates, and comparison with those from earlier studies, is complicated by methodological changes and refinement of techniques [7]. Major issues are the changes over time in the diagnostic criteria for diabetes and the fact that many studies have not taken account of the age structure of the population studied in estimating the prevalence [7] [8].

Despite these limitations, the various studies have confirmed broadly the estimates derived from the ABS surveys. An overall prevalence of between 10 and 30% for Indigenous people is likely to be 2-4 times that of non-Indigenous Australians [9] [10].

Impaired glucose tolerance (IGT), where blood sugar levels are at an above-normal level, but not quite high enough for a diagnosis of diabetes, has been reported to range between 3 -19% in Aboriginal people aged less than 35 years [11].

### Gestational diabetes

Few reports have been published about gestational diabetes mellitus (GDM), but information from the Northern Territory Midwives' Collection found that around 6.3% of Indigenous women in the Territory developed GDM, compared with 4.1% of non-Indigenous women [12]. After allowance is made for the younger ages generally of the Indigenous women compared with the non-Indigenous women, the level of GDM among Indigenous women was 2.3 times that among non-Indigenous women.

### Type 1 diabetes

A study of type 1 diabetes among children aged 0-14 years in New South Wales found that the annual incidence of 13.9 per 100,000 was similar for Indigenous and non-Indigenous children [13]. An earlier study of children aged 0-14 years in Western

Australia found no cases of type 1 diabetes among Indigenous children, but one case of impaired glucose tolerance (IGT) [14].

## **Mortality**

Diabetes is also a major contributor to Indigenous mortality, being responsible for more than 8% of deaths of Indigenous people living in Qld, WA, SA and the NT in 1999-2003 [15]. The numbers of deaths from 'endocrine, nutritional and metabolic diseases' (almost 90% of which were due to diabetes) were 7.5 times higher for Indigenous males than the number expected from rates for non-Indigenous males and 10.5 times higher than expected for Indigenous females. Among people aged 35-54 years, the death rate of Indigenous males was 21 times the rate of non-Indigenous males and the rate of Indigenous females 37 times that of non-Indigenous females.

## **Hospitalisation**

As is the case with most health conditions, hospitalisation rates are not an accurate reflection of the burden of diabetes in the community. This is reflected in the fact that diabetes was recorded as the principal diagnosis in only 1% of episodes of hospitalisation for both Indigenous males and females in 2003-04 [15]. Of these episodes, 17% were for type 1 diabetes. (Of course, diabetes also contributed to many other episodes of hospitalisation, for which it wasn't recorded as the principal diagnosis.)

Despite this limitation of the data, the higher levels of diabetes among Indigenous than among non-Indigenous people are reflected in hospitalisation figures. Australia-wide in 2003-04, age-adjusted hospitalisation rates of Indigenous males and females for type 2 diabetes as the principal diagnosis were eight and ten times higher than those of non-Indigenous males and females [15]. As well as admissions for diabetes as a principal diagnosis, the condition was also reported frequently as an additional diagnosis in admissions for care involving dialysis, cardiovascular disease (including ischaemic heart disease and stroke), respiratory disease, and for bacterial diseases.

## **Factors contributing to diabetes development among Indigenous populations**

A number of studies have noted the link between diabetes and high levels of obesity among Indigenous populations [16] [17] [18] [19] [20] [21] [22] [23] [24]. It has been suggested that high levels of central obesity (which is particularly common among Indigenous people) may be linked to the 'thrifty genotype', and/or other genetic factors [7] [25] [26] [27].

Regardless of the role of genetic factors, contemporary Indigenous diets and levels of physical activity are likely to be the crucial factors in the high levels of obesity seen among many Indigenous populations. The 'westernisation' of Indigenous communities has seen the replacement of a varied nutrient-dense diet with an energy-dense diet, high in fat and refined sugars [28] [29]. As well as contributing to the development of obesity, the increased consumption of snack foods, fruit-

flavoured-juices, sugar-sweetened cool drinks, white bread, sugar, and canned meats in some Indigenous communities has been linked with the incidence of high blood pressure [9] [16].

According to the 2004-2005 NATSIHS, 75% of Indigenous people living in non-remote areas of Australia were either sedentary or exercised at only a low level in the two weeks prior to their interview [4]. (A 'low' level exercise was defined as between 100 and 1,600 minutes of exercise in two weeks.)

This proportion is slightly higher than the 71% of Indigenous people living in non-remote areas who reported to the 2001 NHS that they were either sedentary or exercised at only low levels [30]. According to the 2001 NHS, the percentage of Indigenous people taking no exercise was much greater than the percentage of non-Indigenous people – 43% compared with 30% [30]. Similar proportions of Indigenous and non-Indigenous people reported exercising at a 'moderate' level, but a slightly higher proportion of non-Indigenous people (7%) than Indigenous people (5%) reported exercising at a 'high' level.

Based on information collected as a part of the 2004-2005 NATSIHS, 57% of Indigenous people aged 15 years or older were overweight or obese, with no real difference according to remoteness of residence [4]. The slightly higher proportion of Indigenous men (58%) than Indigenous women (55%) were overweight or obese. Almost 6% of Indigenous people aged 15 years or older were underweight, with 4% of Indigenous men and 7% of Indigenous women having a BMI of less than 18.5.

After adjusting for differences in the age structures of the two populations, the level of being overweight or obese was 1.2 times higher for Indigenous people aged 15 years or older than for their non-Indigenous counterparts [4].

Overweight and obesity were more common among Torres Strait Islanders aged 15 years or older (61%) than among Aboriginal people in that age range (56%) (the difference is not statistically significant) [4]. The level of overweight and obesity was particularly high among Torres Strait Islanders living in the Torres Strait area, with 86% having a BMI of 25.0 or greater.

The progression of risk factors, particularly obesity, was studied as part of a five-year follow-up study of young Indigenous people living in four communities in the Kimberley region of WA [16]. Less than 3% of people were overweight at the commencement of the study, but 17.6% were at follow-up. Overall, BMI increased significantly over the five-year period, from 16.9 to 20.8 for males, and from 17.7 to 21.8 for females.

The role of obesity and physical inactivity were analysed in studies which involved a group of diabetic Indigenous people returning to a 'traditional' diet and lifestyle [9] [18] [21] [23] [24]. These studies documented improvements in fasting glucose and glucose tolerance, and significant reductions in hyperinsulinaemia and fasting triglyceride levels. In addition to these changes, reductions in blood pressure and increased bleeding time (indicative of reduced thrombosis) were noted.

Like most conditions affecting Indigenous people, diabetes is linked to socioeconomic status – the greater the environmental, social and economic disadvantage experienced by Indigenous people, the greater the levels of type 2 diabetes, associated complications, and other chronic conditions in the population [31]. Improvements in socioeconomic and related conditions are seen as necessary if the prevalence of type 2 diabetes and associated complications (and of other chronic conditions) is to be reduced. This will involve working within other government sectors and community organisations [32].

Documenting the levels of risk factors for diabetes should be a high priority area, as these important health measures are essential for evaluating the effectiveness of intervention programs [7]. Currently, existing knowledge and data of the major risk factors for diabetes in Australia are far from complete, and this is even more evident for the Indigenous population. Available data indicate, however, that obesity is on the rise and levels of physical activity are dropping, which can be expected to result in more diabetes in Australia for all populations [7].

## **Diabetes-related complications among Indigenous Australians**

As noted above, the main complications of diabetes (manifest through microvascular and macrovascular changes) are renal disease, retinopathy, heart disease, infections, cerebrovascular disease, and neuropathy (as well as a variety of more minor complications) [7] [12]. The impact of diabetes-related complications has not been studied in most Indigenous populations [12], however, so inferences must be made from the findings of research conducted in the NT.

In contrast to the pattern seen in most developed countries, the main cause of death in Indigenous diabetics may be renal disease and not cardiovascular disease [33] [34] [35] [36] [37]. Most of the mortality is related to end-stage renal disease, for which the incidence among the Indigenous population in the Northern Territory is 20-30 times than that of the non-Indigenous population [20].

Diabetes is recognised as the main cause of legal blindness in the developed world [7]. In the Northern Territory in 1994, approximately 28% of Indigenous people with diabetes had some degree of retinopathy, which was vision-threatening in 13% of cases [12]. There is also evidence of Indigenous patients with diabetes developing retinopathy in their thirties, much earlier than generally recognised.

In terms of heart disease, it has been reported that at least 19% of diabetic patients are admitted to hospital as a result of cardiovascular complications [12]. Medical records reveal that 4% had a previous myocardial infarction and 7% a history of angina. A further 4% had a history of cerebrovascular disease, which was responsible for 2.3% of the hospital admissions of diabetics.

Diabetics are also more susceptible to infections (particularly bacterial) than are non-diabetics. A study of the hospitalisation of Indigenous diabetics in central Australia in the mid 1980s found that infection was the primary reason for admission in 60% of cases, which comprised 4.6% of all Indigenous admissions [38]. Almost 21% of

deaths of Indigenous diabetics in Australia in 1995 were attributed to infection [26]. Based on health service records, it has been reported that bacterial infections are the second most common cause of death of Indigenous diabetics (after renal disease) [35].

The combination of infection (due to peripheral vascular disease) and peripheral neuropathy can lead to chronic foot problems, the hospitalisation for which increased almost three-fold among Indigenous people in central Australia between 1992 and 1997 [39] [40]. Foot complications were responsible for around 10% of admissions of diabetics, with Indigenous people being responsible for slightly more than 90% of admissions for diabetic foot. More than one-third of admissions for foot complications required a surgical procedure – mainly debridement, but 7% required an amputation of toe or higher.

## Management of diabetes

Given there is currently no available cure for diabetes, effective management of the condition is crucial. From time of diagnosis, a major focus is on improving glycaemic control to minimise the microvascular and macrovascular complications [11].

Improvement of glycaemic control can be achieved through:

- weight loss – which can reduce the need for medications (oral hypoglycaemics or insulin), reduce blood pressure in obese hypertensive subjects, and improve hyperlipidaemia;
- dietary changes – mainly involving reduction in carbohydrate intake and increased mono-unsaturated fat and fibre intakes. Reducing meal size but increasing frequency can also improve glycaemic control;
- increased physical activity – exercise can improve glycaemic control, hypertension and total serum cholesterol levels; and
- medications – oral hypoglycaemic agents can help 'postpone' the complications of diabetes, but their role in glycaemic control deteriorates with time. Insulin therapy may be needed to achieve optimal glycaemic control [11].

As well as addressing the direct risk factors (obesity, physical inactivity and poor diet) for diabetes, attention needs to be directed also to factors such as smoking and alcohol. Smoking is a major risk factor for vascular disease especially with co-existing diabetes. Diabetic smokers should be informed on the risks of smoking, repeatedly encouraged to stop, and supported during cessation and through the high risk relapse period (immediately after cessation) [41]. Alcohol too, should be limited and consumed in strict moderation. Ethanol (the main constituent of alcohol) may cause increased energy intake, and a pre-disposition to hypoglycaemia or hyperglycaemia. Ethanol may also lessen cooperation with treatment schedules and interact with medication. It has been suggested that alcohol should be limited to less than four standard drinks per day for men and two standard drinks per day for women (40 and 20 grams of ethanol per day respectively) [41].

Good management of diabetes involves also the monitoring and special care of associated conditions brought about by diabetic complications. Special attention needs to be directed to:

- screening for diabetic retinopathy – eyes should be screened regularly by an ophthalmologist (at time of diagnosis and then usually every year);
- foot care – people with type 2 diabetes should be assessed routinely for loss of protective foot sensation. Specific management strategies focus on control of infection and neuropathy, referral for specialist podiatry care, regular review and follow-up, relief of pressure on ulcers/wounds, and access to appropriate footwear and foot care services; and
- diabetic nephropathy – annual screening for micro-albuminuria, with treatment when indicated [\[11\]](#).

Other important aspects are control of blood pressure and infections. Screening and control of blood pressure are important because hypertension in people with diabetes is associated with accelerated progression of both microvascular and macrovascular complications [\[11\]](#). People with diabetes experience higher rates of pneumonia, bacterial, fungal, skin, and urine infections, so good hygiene and early treatment of skin sores, wounds, and urine infections is important in preventing the progression of these conditions [\[10\]](#). The National Health and Medical Research Council (NHMRC) also encourages people with high risk underlying conditions (such as diabetes) to have annual influenza and 5-yearly pneumococcal vaccinations [\[42\]](#).

Many of these aspects of diabetes management require frequent visits to a general practitioner or a member of a diabetes health care team. For many Indigenous populations, however, access to linguistically and culturally appropriate services is often limited, particularly in rural and remote areas [\[31\]](#) [\[43\]](#). High rates of hospital admissions often result, as high morbidity is generally coupled with generally poor self-management and control, and increased complications in Aboriginal people with type 2 diabetes [\[43\]](#) [\[44\]](#).

## **Prevention and control of diabetes mellitus**

### **Primary prevention**

Primary prevention aims to prevent the emergence of disease in susceptible populations or individuals. In the case of type 2 diabetes, this involves removing or modifying behavioural and environmental risk factors (such as obesity, sedentary lifestyle and poor diet) prior to the onset of disease or manifestation of symptoms [\[11\]](#) [\[45\]](#). This has usually included promoting healthy eating and physical activity, and maintenance of normal body weight, [\[11\]](#). In the majority of cases, programs targeting the primary prevention of diabetes centre on healthy lifestyle promotion, in the form of food intake [\[10\]](#).

### **Secondary prevention**

Secondary prevention consists of early detection of asymptomatic diabetes followed by prompt, effective interventions that may lessen the condition's impact [\[46\]](#). As

previously discussed, the risk factors for diabetes are also common to conditions such as cardiovascular disease and some cancers. As a consequence, prevention strategies that reduce levels of these risk factors are likely to have widespread health benefits across the broader spectrum of health categories [26]. Prevention activities can be aimed at the whole population (aiming to eliminate lifestyle and environmental factors – the 'population approach') or targeted at particular individuals or groups, especially those at high-risk (the 'high-risk' approach) [26].

In view of the fact that quite some time usually elapses between the actual onset of type 2 diabetes and its recognition, it is now recommended that active case detection be undertaken for all high risk groups. This includes all people with impaired glucose tolerance or impaired fasting glucose and for all Indigenous people aged 35 years and over (and younger in communities with a high prevalence of diabetes) [45]. Screening for diabetes in high-risk populations is justified because early treatment of the disease reduces morbidity from long-term complications.

### **Tertiary prevention**

Tertiary prevention involves lessening or eliminating long term impairments that may result from diabetes, such as foot and eye problems [46]. There are a number of programs addressing the whole Australian population, and community-based programs have been shown to be effective in Indigenous communities in central Australia and the Kimberley region of WA [47] [48]. It is important, also, that mainstream programs incorporate Indigenous-specific initiatives which will require resources at regional and community level [11].

## **Policies and strategies**

Following the identification in 1996 of diabetes as one of Australia's national health priority areas [26], the National Diabetes Strategy and Implementation Plan identified principles for developing strategies for the prevention and management of diabetes among Indigenous people [32]. The plan emphasised that strategies should be part of a holistic approach to health care and should, where possible, deliver services in the communities where people live. Strategies should also include training of local Aboriginal Health Workers and staff of Aboriginal community-controlled services and build their capacity to deliver training and services with minimal external intervention. Finally, strategies should be based on needs determined by the community and programs should be developed, supported and run by the community itself. Also, in the ongoing management of diabetes, local recall and reminder tools should be established to implement and coordinate diabetes strategies. Local registers should be part of a holistic approach, as they are also useful for the control of other chronic diseases. Monitoring standards of care should also be undertaken to ensure that delivery of care is optimised.

The National Diabetes Strategy and Implementation Plan was followed in 1999 with the release of Australia's *National Diabetes Strategy 2000–2004* [49]. Despite the fact that all Australian health ministers agreed that the strategy would ensure 'access to effective, efficient, evidence-based and economically viable services and programs for diabetes prevention and care for all people living in Australia', progress

appears to have been slow. It is true that the 2001-02 Commonwealth budget included an allocation of \$43.4 million over four years for a National Integrated Diabetes Program (NIDP) [49]. Of the planned eleven guidelines developed in approval with the National Health and Medical Research Council (NHMRC) the first eight have been presented to and endorsed by the NHMRC – Type 1 diabetes in children and adolescents; Primary prevention; Case detection and diagnosis; Diagnosis and management of hypertension; Prevention and detection of macrovascular disease; Identification and management of diabetic foot disease; Lipid control in Type 2 diabetes; Management of diabetic retinopathy; Blood glucose control; Renal disease; and Patient education [45].

At about the same time as the National Diabetes Strategy and Implementation Plan was released, separate work was commissioned to examine the epidemiology of diabetes among Indigenous people and the evidence supporting primary care management of the disease. This work resulted in two significant reports, *Review of the epidemiology, aetiology, pathogenesis and preventability of diabetes in Aboriginal and Torres Strait Islander populations* [10] and *Systematic review of existing evidence and primary care guidelines on the management of non-insulin-dependent diabetes in Aboriginal and Torres Strait Islander populations* [50], but there appears to have been little progress since that time. Fortunately, the findings of the latter report have been updated as part of a separate publication supported by NACCHO [11].

Also at the same time, the Western Australian Department of Health was working on the development of the *Western Australian Diabetes Strategy 1999* (the Strategy was formally released in 2002) [51]. The fundamental principle of the section of the Strategy related to Aboriginal people was to develop culturally-appropriate strategies with the aid of local Aboriginal communities, Aboriginal health organisations, and local Aboriginal health services [51]. This also calls for a greater level of empowerment for Aboriginal people and health services, and for them to be given the resources to implement their own diabetes prevention programs. To do this, the Strategy outlines that a greater emphasis is to be placed on strengthening Aboriginal primary infrastructure, as well as supporting regional Aboriginal health plans.

This Western Australian Strategy eventually led to the release of another strategy, *Healthy lifestyles – A strategic framework for the primary prevention of diabetes and cardiovascular disease in Western Australia 2002-2007* [52]. This was also released in 2002, in response to the seven National Health Priority Areas, of which diabetes is one [53]. This strategy was developed through an extensive literature review, as well as focus group discussions with a number of key stakeholders (including Aboriginal medical services) [53]. It is unclear, however, as to how this Strategy will be applied in a culturally specific and appropriate way to Aboriginal communities, or what the benefits will be.

The latest strategy document released by the New South Wales Health Department – *NSW chronic disease prevention strategy 2003-2007* – outlines the main chronic disease focuses in New South Wales. The Strategy has been designed to target seven of the most serious chronic conditions affecting the NSW population, including type 2 diabetes. The Strategy notes that diabetes prevalence and mortality figures for NSW Indigenous people are severely lacking (due to under-reporting of

Indigenous status), but that diabetes should be coordinated with Aboriginal health promotion programs. In order to develop this process and as part of the Strategy, the Collaborative Centre for Aboriginal Health Promotion was established. In the future, the Centre aims to implement a greater number of Aboriginal health promotion and diabetes programs. It proposes to do this by strengthening leadership, encouraging workforce development, liaising and maintaining key networks, enhancing the sharing of relevant information about diabetes (in collaboration with the HealthInfoNet, and providing technical advice and support on Aboriginal health promotion matters).

In view of the seriousness of diabetes, reflected in its identification as a national health priority area, it appears that much more could have been done to progress its prevention, case detection and management – particularly for Indigenous people, but also for the general population.

## Summary

There is no doubt that type 2 diabetes mellitus is a major health problem for many Indigenous people. The prevalence of diabetes among Indigenous people is around four times that of the general population, and its impact in terms of mortality and hospitalisation is even higher. The full extent of the morbidity and mortality arising from the various microvascular and macrovascular complications of diabetes is not well documented, but is certain to increase.

The development of diabetes and the progression to complications can be prevented [\[11\]](#), so clearly much more needs to be done. But, as with most other areas of Indigenous health, committed strategies addressing this national health priority area are lacking for Indigenous people.

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