



Epidemiology of diabetes in New Zealand: revisit to a changing landscape

Grace Joshy, David Simmons

Abstract

Aim The aim of this review is to describe the evolution of the burden of diabetes, its risk factors and complications in New Zealand, and the current national strategies underway to tackle a condition likely to impact on the national ability to afford other health services.

Methods The MEDLINE database from 1990 was searched for New Zealand-specific diabetes studies. The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) Reports from 1990–2004 and Ministry of Health (MoH) publications and reports were also reviewed. Key contact people working in the field of diabetes care in every district health board (DHB) were contacted, and information on current initiatives for diabetes control and prevention were collected.

Results The prevalence of diabetes (known and undiagnosed), impaired glucose tolerance (IGT) / impaired fasting glucose (IFG) and gestational diabetes are tabulated by ethnic group. The latest New Zealand Health Survey (NZHS) result of known diabetes: European 2.9%, Māori 8%, Pacific 10.1%, Asian 8.4%. Diabetes risk factors have been examined and the reported rates have been compiled. Māori and Pacific people have a particularly high prevalence of diabetes risk factors (e.g. obesity, physical inactivity, insulin resistance, metabolic syndrome) compared with Europeans. The profile of diabetic patients in New Zealand has been summarised using publications on their clinical characteristics. The latest available data on ethnic specific clinical characteristics are a decade old. With the suboptimal participation in the *Get Checked* program: 63% Europeans/Others, 27% Māori, 92% Pacific (possibly overestimated) people in 2004, the results may not be representative. The burden of diabetes complications and diabetes related mortality has been reviewed. A high proportion of Māori and Pacific dialysis patients and new renal disease patients from the ANZDATA registry have diabetes comorbidity. The inadequacy of official statistics in New Zealand and the scarcity of indepth studies across the country, including ethnic perspectives, has been clearly demonstrated.

Conclusions While the diabetes epidemic has continued to impact increasingly on New Zealanders and its health services over the past 5 years, a growing number of Government and DHB-funded initiatives are in place to prevent diabetes and its complications. A nationally agreed strategic plan is now urgently needed on how best to monitor and control the increasing incidence and prevalence of diabetes in the New Zealand population as well as the proportion with undiagnosed diabetes, impaired glucose tolerance, and impaired fasting glucose.

Almost a decade has passed since Simmons^{1,2} painted the portrait of diabetes epidemiology in New Zealand and warned about the increasing risk of diabetes and its complications, especially for Māori and Pacific peoples. When Moore and Lunt³ re-

examined the situation in 2000, they found the burden of diabetes and its complications escalating, especially end-stage renal failure (ESRF). They also noted the ageing population structure, increasing Pacific population (mostly of Samoan, Tongan, Niuean, and Cook Islands origin), and the obesity epidemic. Since this time, New Zealand's population has continued to age (median age has increased 2.5 years over 10 years). Furthermore, it has grown by 6%, with a 40% increase in the Asian population (2001–2005).⁴ These figures point to an increasing Type 2 diabetes burden for New Zealand.

The New Zealand Ministry of Health has responded to the growing diabetes epidemic with a diabetes strategic plan⁵ in 1997, a Diabetes Implementation Plan⁶ in 2000, and a "Diabetes Toolkit"⁷ for district health boards (DHBs) in 2001. The latter included the establishment of Local Diabetes Teams at DHB level and the free annual *Get Checked* programme for diabetes patients. A set of guidelines for the management of Type 2 diabetes were released in 2003.⁸ A Ministry of Health/ Health Research Council grant was put out to tender in 2001 and again in 2003, which was subsequently awarded to the Te Wai o Rona: Diabetes Prevention Strategy team in the Waikato/Lakes districts.⁹

Results from a large number of important studies have been published since the last review, which have confirmed the picture of a disease increasing in numbers, especially at a younger age and consistent with a lowering of the age at onset of Type 2 diabetes.

The aim of this review is to describe the current burden of diabetes and the current district-based strategies underway to tackle a condition likely to impact on the ability of New Zealand to afford other health services.

Methods

A comprehensive review was undertaken using MEDLINE database, reviewing diabetes prevalence or complications studies/surveys reporting New Zealand-specific figures. Experimental intervention trials have been excluded. The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) Reports from 1990–2004, the MoH publications / reports, and New Zealand Society for Study of Diabetes conference abstract books from 2000 have been reviewed.

The latest unpublished results from the *Get Checked* programme, being the only national diabetes surveillance tool, were obtained from the MoH. The diabetes teams in all DHBs were consulted via email regarding current (unpublished) initiatives on diabetes control and prevention (10/21, 48% response). While a comprehensive attempt has been made to include current unpublished diabetes initiatives, there could be a limitation on the number of such initiatives included in this article due to the limited response.

Prevalence of diabetes

As with many other countries,²⁵ currently there are no up-to-date national diabetes prevalence data for New Zealand. The only area with comprehensive epidemiological data is South Auckland, where between 1991 and 1995 a household survey of 100,000 residents was undertaken²⁶ with a nested study of those with undiagnosed diabetes undertaken thereafter.²³

Table 1 shows the prevalence of diagnosed and undiagnosed diabetes in different population-based surveys by ethnic group. As no significant and consistent gender differences in prevalence have been found,²⁷ prevalence data have been integrated.

Table 1. Prevalence (%) of known diabetes, undiagnosed diabetes, and IGT/IFG in New Zealand by ethnicity

Variable			European	Māori	Pacific	Asian
Prevalence (%) of known diabetes—all ages						
Christchurch Workforce Survey ¹⁰	1982-83 [†]	≥15	2.78%	11.27%	–	–
SADP household survey ¹¹	1992–95*	All ages	1.86%	5.21%	4.01%	4.32%
New Zealand Health Survey ¹²	1996/97* [‡]	≥15	3.10%	8.30%	8.10%	4%
New Zealand Health Survey ¹³	2002/03* [§]	≥15	2.9%	8%	10.1%	8.4%
Pacific Study ¹⁴	1996*	≥20	–	–	12.0%	–
Ngatai Porou Hauora Register ¹⁵	2003*	≥25	–	7.1%	–	–
Northland Survey ¹⁶	2003		6% (no ethnic specific data reported)			
Prevalence (%) of known diabetes—40+ age group						
Auckland Workforce ¹⁷	1990 ^a	40–64	1.06%	5.26%	5.28%	2.82%
Christchurch elderly ¹⁸	1991	≥65	10%	–	–	–
Auckland Surgical Ward ¹⁹	1990–91	40–59	6.0%	18.3%	16.1%	7.8%
		60–69	7.9%	31.7%	30.2%	16.7%
		40–49	1.5%	6.8%	4.7%	4.1%
SADP household survey ¹¹	1992–95	50–59	3.8%	13.1%	12.1%	8.0%
		60–69	5.6%	15.0%	12.6%	11.4%
		40–49			7.6%	
Pacific Study ¹⁴	1996	50–59			23.1%	
Prevalence of diabetes in other subgroups						
Christchurch, Type 1 (prevalence/100,000) ²⁰	2005	<25	274	81	77	52
Gestational diabetes ²¹	1994–95		3.3%	7.9%	8.1%	5.5%
Prevalence % of Undiagnosed Diabetes (percentage of total diabetes)						
Dunedin General Practice ²²	1990	50–69	(20)			
Christchurch elderly ¹⁸	1991	≥65	4.0 (30)			
Waikato Discover Diabetes	1993	40–59	0.8	4.6		
		60–79	2.1	6.1		
Auckland Workforce Survey ¹⁷	1990	40–64	0.8 (42)	4.64 (48)	3.59 (40)	4.72 (57)
SADP ²³	1996	40–59	3.3 (30)	10.6 (48)	13.7 (51)	
		60–79	2.7 (24)	7.9 (33)	9.1 (29)	
Te Wai o Rona, Waikato ²⁴	2004	45–64		7.0		
Prevalence(%) of IGT/IFG						
Auckland Workforce Survey ¹⁷	1990	40–64	1.93	7.40	5.21	7.82
SADP ²³	1996	40–59	7.4	22.7	19.4	
		60–79	22.1	22.3	16.9	
Te Wai o Rona, 2004 ²⁴	2004	45–64		15.5		

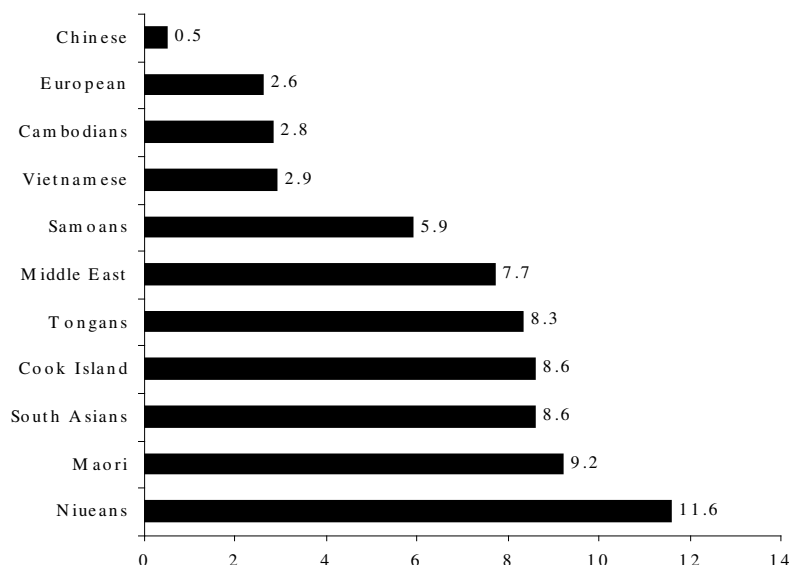
* Age standardised; [†] Crude prevalence, Europeans include Asians, Māori include Polynesians; [‡] Asians include others; [§] Europeans include others; SADP=South Auckland Diabetes Project.

The SADP survey¹¹ found a high prevalence of diabetes in the non-European populations of New Zealand (except in Chinese and Cambodians); the highest prevalence was found in South Asians—e.g. Asian Indians. (Figure 1). The

prevalence of diabetes among Chinese was also low on the Middlemore Hospital surgical wards¹⁹ at this time and has been shown in other Chinese populations.²⁸

The NZHS 2002/03 results showed an increased diabetes prevalence of 8.4% among Asians living in New Zealand when compared with 1996/7, although South Asians were also included in the Asian category.

Figure 1. Prevalence (%) of known (Type 1 and Type 2) diabetes among 40–49 year olds in South Auckland (by ethnic group)



Source: South Auckland Diabetes Project (SADP) survey, 1992–95.¹¹ Middle East=e.g. Iranians, Iraqis, Egyptians; South Asians=e.g. Indians, Sri Lankans, Bangladeshi.

Compared with Europeans aged ≥ 40 years, the prevalence of undiagnosed diabetes is more than three-fold among Māori and more than four-fold among Pacific peoples.²⁷ HbA1c screening of 50,819 subjects aged 20+ years found that Māori, Pacific people, and Indians had particularly high rates of elevated HbA1c.

The age-standardised proportion of individuals with HbA1c $>6\%$ in these ethnic groups were increased six-fold. Preliminary results from Te Wai o Rona Diabetes Prevention Strategy²⁴ in the Waikato are consistent with the South Auckland data, but the age-specific prevalence of undiagnosed diabetes was greater than predicted in the younger age groups.

Risk factor screening is still recommended in New Zealand,²⁹ although many of those with undiagnosed diabetes (25.0%) and dysglycaemia (31.4%) have no diabetes risk factors.³⁰ Past studies have indicated the earlier onset of Type 2 diabetes in Māori (8–10 years earlier) and Pacific people (5–9 years earlier) than Europeans.^{31,32}

The NZHS 1996/97 figures are in agreement with the results from the SADP survey regarding age at diabetes diagnosis among Europeans (50–55.5 years), Māori (41–43

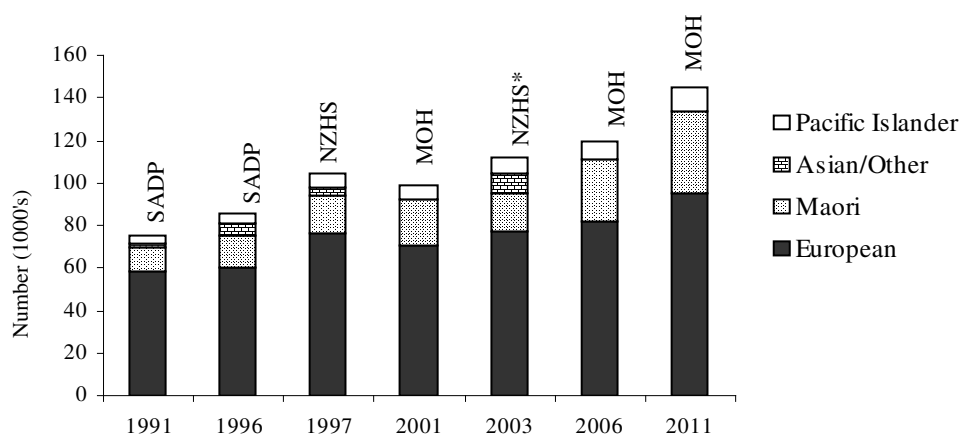
years), and Pacific (45–47 years)—but the NZHS 2002/03 results for Māori and Pacific are contradictory (50 and 51 years respectively).

About 10–15% of diagnosed diabetes is Type 1 diabetes among European New Zealanders; it is approximately 5% among other ethnic groups. Of concern, the incidence of Type 1 diabetes diagnosed before 20 years of age in Canterbury, New Zealand has increased 3.4-fold in 30 years—from 6.79 to 22.79 patients/100,000 per year starting from 1970.³³ This increase is considered consistent with a worldwide increase in Type 1 diabetes.

In the most recent national study, Campbell-Stokes et al³⁴ estimated the average annual incidence in 1999/2000 to be 17.9 per 100,000 (95% CI: 15.9–20.0) among children under 15 years. Unlike earlier studies, this study found that Māori, Pacific people, and Asians all had significantly lower incidence rates (both absolute and relative to their respective population proportions) than Europeans, although the basis of the ethnicity definition is not stated.

Although the prevalence of Type 1 diabetes was found to be lower in non-Europeans in a recent Christchurch study, they also noted the increasing number of Māori, Pacific, and Asian people with diabetes.²⁰

Figure 2. The changing epidemiology of diabetes in New Zealand: 1991–2011 (indicates numbers, and proportions by ethnicity, of people with diabetes)



Sources: 1991 & 1996 – South Auckland Diabetes Project (SADP) survey estimates.¹¹
 1997 – NZHS 1996/97¹² (New Zealand Health Survey).
 2003 – NZHS 2002/03¹³ (*Europeans include Others).
 2001, 2006, & 2011 – Ministry of Health estimates.³⁵

Figure 2 shows the projected numbers with known diabetes by ethnic group across all surveys to date, although the cross comparisons are limited by the changing definitions of ethnicity and diabetes. Figure 2 also shows the different MOH diabetes forecasts for New Zealand (based upon the NZHS 96–97 and South Auckland Household Survey 91), which may be underestimates (e.g. the 2003 predictions were

already less than the prevalence of diabetes among Europeans, Pacific peoples, and Māori males in the NZHS 2002/03 survey).

The age at onset of Type 2 diabetes has also been dropping, with increasing numbers of children and adolescents with Type 2 diabetes and women with Type 2 diabetes in pregnancy. The Auckland Diabetes Centre has reported increasing prevalence of Type 2 diabetes in adolescents.³⁶ The prevalence of Type 2 diabetes among the adolescent clinic attendees was 1.8% in 1996, and 11.0% in 2002.

Northland Diabetes Service has reported that Type 2 diabetes presents before the age of 30 years in 2.66% of Māori diagnosed with diabetes.³⁷ Among South Auckland women with gestational diabetes mellitus (GDM), a high proportion (4.3% European, 21% Māori, 21% Pacific) of Polynesians had permanent diabetes postnatally.³⁸

Gestational diabetes

A review of 1994/95 hospital records in South Auckland showed high rates of GDM in Māori and Pacific women who attended oral glucose challenge tests compared with Europeans²¹. This study found that Pacific women were more likely to be screened (68.5%) when compared with Māori (47.3%) when both have high rates of GDM and Type 2 diabetes.

Risk factors for diabetes

The prevalence of obesity in New Zealand has increased from 9.4% in 1977 to 19.9% in 2003 among males, and from 10.8% to 22.1% among females.³⁹ Māori and Pacific people have a particularly high prevalence of obesity,²³ physical inactivity,¹³ insulin resistance,¹³ and metabolic syndrome²⁷ compared with Europeans (Table 2).

The association between body composition and central fat distribution with risk of diabetes appears to be independent of ethnicity⁴⁰. While Asians appear to have comparatively lower obesity⁴¹, Rush et al⁴² have found high body fat composition for Asian Indians compared with Europeans for a given BMI.

Complications

Table 3 shows the risk factors for microvascular and macrovascular disease in the New Zealand studies to date. The poor glycaemic and lipid control among patients attending the clinic from 1992–95⁴⁴ appears to have continued into this century. The Otago register has reported a mean HbA1c of 7.2% for Type 2 patients; 50.1% had HbA1c result >7% in 1998.⁴⁵ The results of the *Get Checked* programme showed that 63% of Europeans, 27% of Māori, and 92% of Pacific people with diabetes had a free annual check in 2004 (personal communication, MoH). But the denominators are derived from the MOH forecast estimates and actual percentage of Pacific people getting free checks may be much lower. The 2004 results show poorer metabolic control (HbA1c > 8%), for Māori (40%) and Pacific people (51%) with compared with European/Other (23%).

Table 2. Prevalence of risk factors for diabetes and its complications

Risk factor	Study/Survey	European	Māori	Pacific	Asian
Metabolic syndrome (%) by ATP III criteria**	SADP 1996 ²⁷ , 40–59 years:				
	Males	24.6	52.8	48.5	
	Females	13.4	51.8	45.5	
Insulin resistance (%)	East Coast 2003 ¹⁵ :				
	25–29 years		43		
	30–39 year		44		
Sedentary (%)	NZHS 1996/97* [§]	14.7	19.8	14.1	20.5
	NZHS 2002/03 ^{41*} †	11.2	12.6	17.8	22.3
	SPARC Survey ⁴³ 1997–01 [§] :				
	5–17 years	8.0	10.0	19.0	12.0
	≥18 years	9.0	12.0	10.0	17.0
Obesity (%)	NZHS 2002/03 ⁴¹ *†‡				
	Church study ¹⁴ . (BMI>32) *			43.0	
	Male			45	
	Female	18.9	28.3	60	
	SADP 1996 ²³ (BMI≥31), 40-79yr	26	63	69	5.7
Smoking (%)	NZHS 2002/03 ^{41*} †	21	47	33	11

*Age standardised.

† European includes Other.

**The ATP III criteria for metabolic syndrome were considered to have been met when 3 or more of the following factors were present: waist circumference >102cm for men or >88cm for women, treated hypertension or systolic blood pressure (sBP) ≥130mmHg and/or diastolic blood pressure (dbp) ≥85mmHg as mean of two readings, triglycerides ≥1.7mmol/L, HDL <1.04mmol/L for men or <1.29mmol/L for women, fasting blood glucose (FBG) ≥6.1mmol/L, or diabetes.

‡ Obesity is body mass index (BMI) ≥30 for European/Other/Asian, BMI ≥32 for Māori/Pacific.

§ Asian includes Other.

Table 3. Clinical characteristics of diabetes patients

Variable	Waikato Diabetes Clinic ⁴⁴ 1992-95			South Auckland Survey 1996 ^{46, 47, 48}		
	Type 1	Type 2	Type 2 - I*	European	Māori	Pacific
Metabolic Control						
HbA1c (%) ⁴⁸				7.4 ± 1.7	9.6 ± 2.6	9.2 ± 2.6
Random blood glucose (mmol/L)				10.3 ± 5.0	11.8 ± 4.8	11.6 ± 5.8
Fructosamine (mmol/L)	376 ± 78	321 ± 73	360 ± 67			
Lipids						
Cholesterol (mmol/L)	5.2 ± 1.1	5.8 ± 1.2	5.8 ± 1.1	6.0 ± 1.3	6.2 ± 1.5	5.8 ± 1.3
HDL (mmol/L)	1.5 ± 0.5	1.1 ± 0.3	1.2 ± 0.5	1.1 ± 0.3	1.0 ± 0.3	1.0 ± 0.2
Triglycerides (mmol/L)	1.7 ± 1.4	3.1 ± 3.6	2.9 ± 3.8			
Renal Characteristics						
Albumin creatinine ratio [†] (mg/day)				2.18	9.06	4.38
Blood Pressure						
Systolic (mmHg)				141 ± 25	145 ± 31	135 ± 24
Diastolic (mmHg)				81 ± 12	84 ± 13	80 ± 13
% on anti-hypertensive medication ⁴⁶ (complication free cohort)				44%	33%	33%
Physical Characteristics						
BMI (kg/m ²)	25.6 ± 4.6	30.6 ± 5.8	29.8 ± 5.5	30.5 ± 6.6	33.3 ± 6.8	33.4 ± 5.8

Data are mean ± SD unless otherwise stated; * Transferred from diet/pill to insulin; † Data are geometric mean.

Diabetes-related mortality

NZHS mortality data has attributed 3% of deaths in 2000 to diabetes.⁵⁵ Difficulties in the coding of diabetes have been recognised for many years,⁴⁹ yet continue to be rediscovered^{56 57} with 45%–55% under-coding especially among non-insulin using (Type 2) patients.

In spite of inadequate mortality statistics, the standardised mortality rate for diabetes mellitus during 1999 were 62.5 per 100,000 in Maori versus 11 in non-Maori⁵⁸. A 10-year follow-up of the predominantly European Type 2 diabetic cohort in Canterbury showed increased mortality (standardised mortality ratio 2.17), the cause of death being predominantly attributable to cardiovascular disease (CVD) (69.8%).⁵⁹

The Canterbury insulin-treated Diabetic Registry has reported a CVD-related standardised mortality ratio of 4.48 for diagnosis age <30 years and 2.05 for diagnosis age ≥30 years among those who commenced insulin within 12 months of diagnosis.⁶⁰

The meta-analysis of studies from Asia Pacific region (including 10,326 subjects from New Zealand) revealed that the hazard ratio associated with diabetes was significantly higher for fatal cardiovascular disease (1.97), fatal coronary heart disease (2.19,) and fatal cerebrovascular disease (2.0).⁶¹

Table 4 shows the ethnic specific death rates from ESRD and ischaemic heart disease in the SADP cohort age 40–79 years.⁴⁹ The standardised mortality ratio for renal failure is 8.37%, estimated from the Canterbury insulin-treated Diabetic Registry.⁶⁰ This reflects the renal failure rate in insulin treated diabetes patients in a registry that has predominantly European patients (97.7%).

Cardiovascular and cerebrovascular diseases

Very few reports relating to heart disease exist (Table 4). A review of records from Middlemore Hospital has reported significant ethnic differences in the prevalence of diabetes among in-patients aged 40+ with acute MI.⁵²

Diabetic nephropathy

Among the 449 new renal disease patients entering the ANZDATA registry in 2003,⁵⁴ 45% had diabetes (23% of European patients, 65% Maori, 67% Pacific, 50% Asian).

Diabetic nephropathy (40%) was the most common cause of end-stage renal disease (ESRD) in New Zealand, followed by glomerulonephritis (26%) and hypertension (10%). Type 2 diabetes (non-insulin and insulin requiring) was identified in 94% of diabetic nephropathic patients on the registry.

From the prospective data from ANZDATA reports, the numbers with of diabetes-related ESRD in Maori population are the highest, but appear to have reached equilibrium (Figure 3). The incidence of diabetes related ESRD in Europeans while lower than other ethnic groups, has also doubled since 1992. The crude prevalence of proteinuria and ESRD were higher in Maori and Pacific people compared with Europeans in the SADS survey⁶² in 1990 (Table 4).

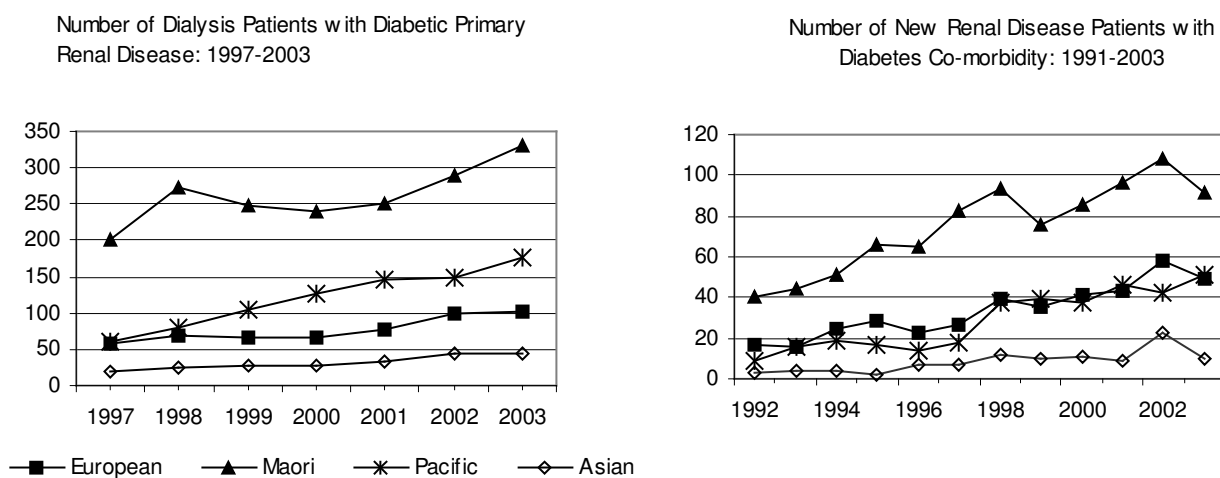
Table 4. Diabetes-related mortality and complications

Mortality	European	Maori	Pacific	Asian
Five-year mortality rates among Type 2 diabetes patients aged 40–79 in 1991 ^{†49}	16.3%	26.2%	16.8%	
For ischaemic heart disease	5.7%	6.3%	4.6%	
For end-stage renal failure	0.8%	8.9%	2.9%	
Renal complications				
Proteinuria in 1990 ⁴⁷	5.4%	30.2%	13.0%	
Microalbuminuria in 1990 ⁴⁷	22.1%	26.7%	33.3%	
End-stage renal failure in 1990 ⁴⁷	0.3%	4.7%	3.3%	
Crude incidence (per 100,000) of diabetes-related renal disease in New Zealand in 2001*	1.5	18.2	19.8	3.8
Cardiovascular complications				
Self-reported known 'heart attack' in 1992–93 ^{‡46}	11%	11%	11%	
Eye complications				
Blindness in 1992–93 ⁴⁶	2.0%	6.6%	7.7%	
Laser treatment in 1992–93 ⁴⁶	7.2%	19.2%	12.3%	
Cataract in 1992–93 ⁴⁶	6.2%	14.4%	16.0%	
Vision-threatening retinopathy in 2002 ⁵⁰	2.5%	4.3%	4.9%	4.6%
Foot complications				
Self-reported leg/foot symptoms in 1992–93 ⁴⁶	37%	42%	29%	
Amputation in 1990 ⁵¹	2.2%	2.8%	1.0%	
Foot ulcer in 1990 ⁵¹	1.7%	2.7%	8.4%	
Prevalence of diabetes among cardiovascular and renal disease patients				
Among MI patients aged 40+ in 1992–93 ⁵²	14.7%	36%	37.9%	
Among patients with congestive cardiac failure ⁵³	17%	34%	36%	
Among new renal disease patients in 2003 ⁵⁴	23%	65%	67%	50%

*Estimated from ANZDATA Registry 2001 and Census 2001; [†] Age and sex standardised; [‡] Age adjusted to total diabetes population; MI=Myocardial infarction.

A familial predisposition to renal disease was suggested from one study showing that the predisposition to diabetic nephropathy in Polynesians was associated with a family history of renal disease (rather than a family history of diabetes), yet associated with diabetes through relative hypoinsulinaemia and hyperglycaemia.⁶³ Diabetic nephropathy among children and young adults with Type-1 diabetes was reportedly 19% in the Waikato area.⁶⁴

Figure 3. Numbers of dialysis patients with diabetic primary renal disease and new renal disease patients with diabetes (by ethnicity)



Source: ANZDATA Reports 1998--2004

Other diabetes-related complications

Few studies of diabetic eye and foot disease have been undertaken. A summary is shown in Table 4. The SADP study in 1992–93 found significant ethnic differences in the rates of blindness, laser treatment, and cataract among people with diabetes: Maori and Pacific people having double the proportions as those of European descent.⁴⁶

Retinopathy was present in 41% of a Type 2 diabetes cohort in Canterbury at baseline.⁵⁹ A decline in the rates of vision-threatening diabetic retinopathy from 11.5% in 1993 to 1.5% in 2002 has been reported in diabetes patients in the Waikato area, but Maori had a high failure-to-attend-screening rate (32.3%) compared with the overall rate of 18.7%.⁵⁰ *Get Checked* results for 2004 indicated low eye-screening rates of less than 70% overall, with less than 60% for Maori and Pacific groups. The rate in those aged under 26 was 13%.⁶⁴

The prevalence of hospital discharges for diabetic foot disease in New Zealand increased from 13.56 in 1980 to 25.79 in 1993.⁶⁵ The total inpatient cost for the management of diabetic foot disease in New Zealand (population 3.3 million) for 1993 was estimated to be in the range of NZ\$10–11 million.

The SADP study found significantly higher numbers of Pacific peoples with major lesions (amputation or ulcer/blister) compared with European or Maori diabetes patients (Table 4).⁵¹ The Ministry of Health estimated that Pacific people have more than double rate of lower limb amputation (43.6 per 100,000) in adults aged 25+ compared with the total New Zealand average (17.4)⁶⁶ in 2004.

The Auckland Leg Ulcer Study in subjects aged 40+ years showed that 18% of cases had diabetes as a comorbidity whereas only 5.5% of controls had diabetes.⁶⁷

Conclusions

While the diabetes epidemic continues to impact increasingly on New Zealanders and its health services during the past 5 years, a growing number of Government and DHB-funded initiatives are in place to prevent diabetes and its complications (e.g. Lets Beat Diabetes and Diabetes Projects Trust in Counties-Manukau, Ngati Porou Hauora Ngatai and Healthy Programme in Taiwawhiti, Te Whai Matauranga o te Ahua Noho lifestyle program in Otago, and Te Wai o Rona: Diabetes Prevention Strategy in Waikato/Lakes).

Moreover, several district diabetes registers are in place or are under development (e.g. in Otago, Canterbury, Waikato and South/West Auckland), and these are complemented by the *Get Checked* data. ANZDATA renal and the emerging Australasian Diabetes in Pregnancy Society diabetes in pregnancy registers, along with a several eye screening registers also contribute to our understanding of diabetes in New Zealand.

The *Get Checked* dataset is apparently due to be extended, and this may help provide a more detailed and comprehensive view of diabetes and its care. Work is now needed on how best to monitor the incidence and prevalence of diabetes as well as the proportion of people with undiagnosed diabetes, impaired glucose tolerance, and impaired fasting glucose. How else will we know that the growing resources directed towards lifestyle change are having an effect?

To date, the data gathered relating to metabolic control and complications are patchy, however they suggest that New Zealand needs to do more to reduce the impact of diabetes on cardiovascular, renal, eye, foot, and pregnancy related complications. This is particularly the case for Maori and Pacific peoples, whose metabolic control remains poorer than that for European New Zealanders.

More aggressive blood pressure, glycaemic, and lipid control would appear to be needed, and the development of ways to deliver this within the context of New Zealand (i.e. to its people and its health service) are urgently required. Such increases in medication use and services (in both primary and secondary care) are likely to cost more initially and yet little data exists to guide such development.

PricewaterhouseCoopers Ltd estimated that the Type 2 diabetes cost in 2001 approached NZ\$400 million and was predicted a rise to more than NZ\$1000 million by 2021.⁶⁸ They also estimated that the total cost of diabetes could be reduced over 20 years if existing services are increased as soon as possible (by \$10 million each year in their enhanced services model). The models used are not perfect, yet more complete than the earlier Health Funding Agency report.⁶ It is surprising that more detailed economic data is not available.

While there have been a relatively large number of publications relating to diabetes in New Zealand over the last 5 years, a significant proportion were from South Auckland in the 1990s and these data are now ageing. More importantly, while services are developing in primary and secondary care, evaluation has rarely been sufficiently robust to lead to publication in peer-reviewed journals. Indeed, funding for such “diabetes translational research” has been uncommon and fits poorly into the existing research funding paradigm.

If we are to develop more complex models of care, and increase access to modern pharmaceuticals and devices, then it is also clear that we need more research into the impact of such service developments on the incidence, prevalence, and costs of diabetes and its complications. While this will not come cheaply, it will be cheaper than the alternative.

A nationally agreed strategic plan is now urgently needed on how best to monitor and control the increasing incidence and prevalence of diabetes. In addition, major national surveys are required now to ascertain the proportion of those people living in New Zealand with impaired fasting glucose or impaired glucose tolerance, as well as those with undiagnosed diabetes.

Author information: Grace Joshy, Research Fellow; David Simmons, Professor of Medicine; Waikato Clinical School, University of Auckland, Hamilton

Acknowledgements: We acknowledge Professor Ross Lawrenson (Head of Waikato Clinical School, University of Auckland), Dr Paul Drury (President, NZSSD), Sandy Dawson (Ministry of Health), and DHB-level diabetes teams for their valuable input.

Correspondence: Grace Joshy, Research Fellow in Diabetes Epidemiology, University of Auckland Waikato Clinical School, Waikato Hospital, Private Bag 3200, Pembroke Street, Hamilton. Fax: (07) 839 8712; email: joshyg@waikatodhb.govt.nz

References:

1. Simmons D. The epidemiology of diabetes and its complications in New Zealand. *Diabetic Medicine*. 1996;13:371–5.
2. Simmons D. Diabetes and its complications in New Zealand: an epidemiological perspective. *N Z Med J*. 1996;109:245–7.
3. Moore MP, Lunt H. Diabetes in New Zealand. *Diabetes Res Clin Pract*. 2000;50(Suppl 2):S65–71.
4. National population estimates (March 2005 quarter). Wellington: Statistics New Zealand; 2005.
5. Strategies for the prevention and control of diabetes in New Zealand. Wellington: Ministry of Health; 1997.
6. Diabetes 2000. Wellington: Ministry of Health; 2000.
7. DHB Toolkit – Diabetes: to reduce the incidence and impact of diabetes. Wellington: Ministry of Health; 2001.
8. Management of Type 2 Diabetes. Wellington: New Zealand Guidelines Group; 2003.
9. Community diabetes study involves 15,000 Maori. News Release, Health Research Council of New Zealand, 2003.
10. Brown CRS, Hider PN, Scott RS, et al. Diabetes mellitus in a Christchurch working population. *N Z Med J*. 1984;97:487–9.
11. Simmons D, Harry T, Gatland B. Prevalence of known diabetes in different ethnic groups in inner urban South Auckland. *N Z Med J*. 1999;112:316–19.
12. Taking the Pulse. The 1996/97 New Zealand Health Survey. Wellington: Ministry of Health; 1999.
13. A Portrait of Health: Key Results of the 2002/2003 New Zealand Health Survey. Wellington: Ministry of Health; 2004.

14. Bell AC, Swinburn BA, Simmons D, et al. Heart disease and diabetes risk factors in Pacific Islands communities and associations with measures of body fat. *N Z Med J*. 2001;114:208–13.
15. Tipene-Leach D, Pahau H, Joseph N, et al. Insulin resistance in a rural Maori community. *N Z Med J*. 2004;117(1207). URL: <http://www.nzma.org.nz/journal/117-1207/1208/>
16. Reti SR. Self-reported diabetes in Northland, New Zealand. *Diabetes Care* 2005;28:1258–9.
17. Scragg R, Baker J, Metcalf P, Dryson E. Prevalence of diabetes mellitus and impaired glucose tolerance in a New Zealand multiracial workforce. *N Z Med J*. 1991;104:395–7.
18. Lintott CJ, Hanger HC, Scott RS, et al. Prevalence of diabetes mellitus in an ambulant elderly New Zealand population. *Diab Res and Clin Pract*. 1992;16:131–6.
19. Simmons D, Laughton SJ. Diabetes detection on the surgical wards in an area with a high prevalence of diabetes. *N Z Med J*. 1993;106:156–7.
20. Wu D, Kendall D, Lunt H, et al. Prevalence of Type 1 diabetes in New Zealanders aged 0-24 years. *N Z Med J*. 2005;118(1218):URL: <http://www.nzma.org.nz/journal/118-1218/1557/>
21. Yapa M, Simmons D. Screening for gestational diabetes mellitus in a multiethnic population in New Zealand. *Diabetes Res Clin Pract*. 2000;48:217–23.
22. Bourn D, Mann J. Screening for noninsulin dependent diabetes mellitus and impaired glucose tolerance in a Dunedin general practice--is it worth it? *N Z Med J*. 1992;105:208–10.
23. Simmons D, Thompson CF, Volklander D. Polynesians prone to obesity and type 2 diabetes but not hyperinsulinaemia. *Diabet Med*. 2001;18:193–8.
24. Simmons D, Rush E, Crook N, Johnstone W. (Abstract) Prevalence of abnormal glucose tolerance among participants in Te Wai O Rona: Diabetes Prevention Strategy: preliminary findings. New Zealand Society for Study of Diabetes: 29th Annual Scientific Meeting, 2005.
25. Diabetes Atlas. 2nd ed: International Diabetes Federation; 2003.
26. Simmons D, Gatland B, Fleming C, et al. Prevalence of known diabetes in a multiethnic community. *N Z Med J*. 1994;107:219–22.
27. Simmons D, Thompson CF. Prevalence of the metabolic syndrome among adult New Zealanders of Polynesian and European Descent. *Diabetes Care*. 2004;27:3002–4.
28. The Decoda Study Group. Age and sex-specific prevalence of diabetes and impaired glucose regulation in 11 Asian cohorts. *Diabetes Care*. 2003;26:1770–80.
29. Kenealy T, Braatvedt G, Scragg R. Screening for type 2 diabetes in non-pregnant adults in New Zealand: practice recommendations. *N Z Med J*. 2002;115:194–6.
30. Simmons D, Thompson CF, Engelgau MM. Controlling the diabetes epidemic: how should we screen for undiagnosed diabetes and dysglycaemia? *Diabet Med*. 2005;22:207–12.
31. Simmons D, Shaw LS, Kenealy T, et al. Ethnic differences in diabetic nephropathy and microalbuminuria: The South Auckland Diabetes Survey. *Diabetes Care*. 1994;17:1405–9.
32. Lunt H, Lim CW, Crooke MJ, Smith RBW. Clinical and metabolic characteristics associated with urinary albumin excretion in non-insulin dependent diabetic subjects attending the Wellington Hospital diabetes clinic. *N Z Med J*. 1990;103:143–5.
33. Willis JA, Scott RS, Darlow BA, et al. Incidence of type-1 diabetes mellitus diagnosed before age 20 years in Canterbury, New Zealand over the last 30 years. *Journal of Pediatric Endocrinology & Metabolism*. 2002;15:637–43.
34. Campbell-Stokes PL, Taylor BJ. Prospective incidence study of diabetes mellitus in New Zealand children aged 0 to 14 years. *Diabetologia*. 2005;48:643–8.
35. Ministry of Health. Modelling diabetes: forecasts to 2011 – Public Health Intelligence Occasional Bulletin No 10. Wellington: MOH; 2002.

36. Hotu S, Carter B, Watson PD, et al. Increasing prevalence of type 2 diabetes in adolescents. *J Paediatr Child Health* 2004;40:201–4.
37. McGrath NM, Parker GN, Dawson P. Early presentation of type 2 diabetes in young New Zealand Maori. *Diabetes Res Clin Pract.* 1999;43:205–9.
38. Simmons D, Thompson CF, Conroy C. Incidence and risk factors for neonatal hypoglycaemia among women with gestational diabetes mellitus in South Auckland. *Diabet Med.* 2000;17:830–4.
39. Ministry of Health. Tracking the obesity epidemic – Public Health Intelligence Occasional Bulletin No 24. Wellington: MOH; 2004.
40. Rush EC. Central obesity and risk for type 2 diabetes in Maori, Pacific, and European young men in New Zealand. *Food Nutr Bull.* 2002;23:82–6.
41. Ministry of Health. 2002/2003 New Zealand Health Survey Datacubes – Public Health Intelligence. Charting our Health. Wellington: MOH; 2004.
42. Rush E, Plank L, Chandu V, et al. Body size, body composition, and fat distribution: a comparison of young New Zealand men of European, Pacific Island, and Asian Indian ethnicities. *N Z Med J.* 2004;117(1203). URL: <http://www.nzma.org.nz/journal/117-1207/1203/>
43. Sport and Recreation New Zealand. SPARC Facts Series (1997–2001): Ethnic Profiles; 2002.
44. Dunn PJ. Current state of metabolic control achieved in a New Zealand diabetes clinic. *N Z Med J.* 1996;109:98–101.
45. Coppell K, Manning P. Establishing a regional diabetes register and a description of the registered population after one year. *N Z Med J.* 2002;115(1160). URL: <http://www.nzma.org.nz/journal/115-1160/146/>
46. Simmons D, Gatland BA, Leakehe L, Fleming C. Ethnic differences in diabetes care in a multiethnic community in New Zealand. *Diabetes Res Clin Pract.* 1996;34(Suppl):S89–S93.
47. Simmons D, Kenealy T, Shaw LM, et al. Diabetic nephropathy and microalbuminuria in the community. *Diabetes Care.* 1994;17:1404–10.
48. Zgibor JC, Simmons D. Barriers to blood glucose monitoring in a multiethnic community. *Diabetes Care.* 2002;25:1–6.
49. Simmons D, Schaumkel J, Cecil A, et al. High impact of nephropathy on five year mortality rates among patients with Type 2 diabetes mellitus from a multi-ethnic population in New Zealand. *Diabetic Medicine.* 1999;16:926–31.
50. Reda E, Dunn P, Straker C, et al. Screening for diabetic retinopathy using the mobile retinal camera: the Waikato experience. *N Z Med J.* 2003;116(1180). URL: <http://www.nzma.org.nz/journal/116-1180/562/>
51. Simmons D, Scott D, Kenealy T, Scragg R. Foot care among diabetes patients in South Auckland. *N Z Med J.* 1995;108:106–8.
52. Simmons D, Bhoopatkar M. Diabetes and hyperglycemia among patients with myocardial infarction in a multiethnic population. *Aust N Z J Med.* 1998;28:207–8.
53. Bhoopatkar H, Simmons D. Diabetes and hyperglycaemia among patients with congestive cardiac failure in a multiethnic population. *N Z Med J.* 1996;109:268–70.
54. ANZDATA Registry Report 2004. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, South Australia, 2004.
55. Mortality and demographic data 2000. Wellington: New Zealand Health Information Service, Ministry of Health; 2004.
56. Coppell K, McBride K, Williams S. Under-reporting of diabetes on death certificates among a population with diabetes in Otago Province, New Zealand. *N Z Med J.* 2004;117(1207). URL: <http://www.nzma.org.nz/journal/117-1207/1217>

57. Chen F, Florkowski CM, Dever M, Beaven DW. Death certification in New Zealand Health Information Service (NZHIS) statistics for diabetes mellitus: an under-recognised health problem. *Diabetes Res Clin Pract.* 2004;63:113–8.
58. Bramley D, Hebert P, Jackson R, Chassin M. Indigenous disparities in disease-specific mortality, a cross-country comparison: New Zealand, Australia, Canada, and the United States. *N Z Med J.* 2004;117(1207). URL: <http://www.nzma.org.nz/journal/117-1207/1215>
59. Florkowski CM, Scott RS, Coope PA, Moir CL. Predictors of mortality from type 2 diabetes mellitus in Canterbury, New Zealand; a ten-year cohort study. *Diabetes Res Clin Pract.* 2001;53:113–20.
60. Florkowski CM, Scott RS, Graham PJ, et al. Cause specific and total mortality in the Canterbury (New Zealand) insulin-treated Diabetic Registry population: a 15 year follow-up study. *Diabet Med.* 2003;20:191–7.
61. Asia Pacific Cohort Studies Collaboration. The effects of diabetes on the risks of major cardiovascular diseases and death in the Asia-Pacific region. *Diabetes Care.* 2003;26:360–6.
62. Simmons D, Kenealy T, Shaw LM, et al. Diabetic nephropathy and microalbuminuria in the community. *Diabetes Care.* 1994;17:1404–10.
63. Thomson CF, Simmons D, Collins JF, Cecil A. Predisposition to nephropathy in Polynesians is associated with family history of renal disease, not diabetes mellitus. *Diabetic Medicine.* 2001;18:40–6.
64. Scott A, Whitcombe S, Bouchier D, Dunn P. Diabetes in children and young adults in Waikato Province, New Zealand: outcomes of care. *N Z Med J.* 2004;117(1207). URL: <http://www.nzma.org.nz/journal/117-1207/1219/>
65. Payne C, Scott R. Hospital discharges for diabetic foot disease in New Zealand: 1980-1993. *Diabetes Res Clin Pract.* 1998;39:69–74.
66. Tupu Ola Moui: The Pacific Health Chart Book 2004. Wellington: Ministry of Health; 2004.
67. Jull A, Walker N, Hackett M, et al. Leg ulceration and perceived health: a population based case-control study. *Age and Ageing.* 2004;33:236–41.
68. Type 2 Diabetes: Managing for Better Health Outcomes. PricewaterhouseCoopers Economic Report for Diabetes New Zealand Inc; 2001. Available online. URL: <http://www.diabetes.org.nz/resources/pwcreport.html> Accessed May 2006.