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# **A Literature Review of the Epidemiology of Type II Diabetes in New Zealand**

**Dr Rob McNeill, Dr Janet Clinton, Dr Pod Perkins, Dr Paul Brown,  
Sarah Appleton and Faith Mahony**

**Prepared by:  
Eman Radwan**

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# 1 Introduction

Efforts are being made at different district health boards around New Zealand in an attempt to control the growing epidemic of type 2 diabetes. Over the past 25 years, studies show the growing prevalence of type 2 diabetes. Previous published papers have discussed diabetes and its complications (Joshy & Simmons, 2006; Simmons, 1996). The aim of this report is to draw a picture of the current situation of the different aspects of the disease to be able to evaluate the efforts of Counties Manukau District Health Board (CMDHB) to contain the growing epidemic of diabetes. Accordingly, the report is structured into different sections.

The *first section* of this report displays data on risk factors for diabetes in New Zealand including obesity, diet, physical activity, smoking, hypertension and hyperlipidemia. The *second section* discusses diabetes as a disease - whether it is diagnosed or undiagnosed. An earlier stage of the disease, impaired glucose tolerance/fasting glucose is also investigated. The section ends with a discussion of gestational diabetes mellitus (GMD). The *third section* reports the efforts made to control the disease and its complications. Much effort is involved in monitoring patients with diabetes and its complications, especially in South Auckland. The *fourth section* discusses the published research on different complications of the disease. The *last section* displays the latest figures of diabetes monitoring for the different district health boards across the country.

Disease specific mortality will be addressed in a separate report. Some relevant information extracted from different data sets - and relevant to the different sections of this report - has been published in a previous report. It is not reported here for the sake of duplication.

## 2 Risk Factors

### 2.1 Obesity

Obesity can be defined as a disease in which excess body fat has accumulated to the extent that health may be adversely affected (WHO, 2000). Classifying obesity and overweight is expected to reflect not only the excess body fat but also the extent of health risk that it opposes (WHO, 2000). Classification helps in identification of those at increased risk of morbidity and mortality, and in prioritizing interventions and evaluating them (WHO, 2000). Classification also assists comparison of groups and populations (WHO, 2000).

Most current epidemiological studies have used the body mass index (BMI) to define the degrees of obesity (Barnett & Kumar, 2004). The BMI is calculated as the subject's weight in kilograms divided by the square of their height in metres. Table 1 shows the World Health Organisation cut-off points for classifying people as underweight, healthy weight, overweight, obese and morbidly obese (Barnett & Kumar, 2004; WHO, 2000). The ideal healthy BMI is between 18.5 and 24.9.

**Table 1: World Health Organisation Classification of Overweight and Obesity**

WHO Classification	BMI (Kgm/m <sup>2</sup> )
Underweight	<18.5
Healthy weight	18.5-24.9
Overweight (grade 1 obesity)	25-29.9
Obese (grade 2 obesity)	30-39.9
Morbid/Severe obesity (grade 3 obesity)	>40

Many studies have found a strong correlation between the BMI and incidence of diabetes and cardiovascular disease morbidity (Barnett & Kumar, 2004; Hu et al., 2001; Schulze & Hu, 2005; Simmons, 1996). Some studies have examined the relationship between body fat and BMI among different ethnic groups. These indicate that Asian populations can have more body fat at the same BMI of Caucasian ethnic groups (E. C. WHO, 2004). In contrast, Maori and Pacific Island populations, or other Polynesian groups, can have less body fat at the same BMI of Caucasian ethnic

groups (Rush et al., 2004; Swinburn, 1998; E. C. WHO, 2004). Obesity related risks - as measured by the BMI – have been found to differ by ethnicity. At certain BMI values the health risk is different among different ethnic groups. A study involving Asian populations defined health risks at lower values than the WHO cut-off points (Rush et al., 2004; E. C. WHO, 2004).

Therefore, it is sometimes difficult to depend on BMI to identify the level of health risk in a certain population. A recommendation released by the World Health Organisation suggests an increased risk at BMI 23 to 27.5 kg/m<sup>2</sup> and a high risk >27.5 kg/m<sup>2</sup> for Asian populations (E. C. WHO, 2004). These findings are relevant to the New Zealand context because of the changing demography that this country is experiencing.

A New Zealand Ministry of Health publication used data from serial cross sectional surveys with representative samples to study the obesity epidemic over a period of 26 years from 1977 to 2003 (Ministry of Health, 2004). These used the body mass index (BMI) as a measure of overweight and obesity. Sources of data are displayed in Table 2.

**Table 2: Nationally representative surveys with measured BMI**

Survey	Year	Age (years)	Sample size (for BMI)	
			Total	Māori
National Diet Survey	1977	20–64	1,761	106
Life in New Zealand	1989	15–74*	2,924	202
National Nutrition Survey	1997	15–74*	4,100	638
New Zealand Health Survey	2003**	15–74*	10,813*	3,648

\*Subset of the data set, excluding the 75+ years age group.

\*\*Actually 2002/03, but referred to as 2003 throughout this report.

For Māori, there were insufficient respondents in the earliest (1977) survey, so analysis was restricted to the 1989 to 2003 period.

In the 1997 and 2003 surveys, the cut-off points used to calculate obesity and overweight were higher for Māori and Pacific populations. These used 26 to 31.9

kg/m<sup>2</sup> for overweight and  $\geq 32$  kg/m<sup>2</sup> for obesity. Extreme obesity for all ethnic groups was  $\geq 40$  kg/m<sup>2</sup> (Ministry of Health, 2004). The justification given to use higher cut-off points for these two ethnic groups was that at any given BMI level those ethnic groups had less fat than Caucasians (Swinburn, 1998).

The growth rate was measured by calculating the average annual percentage change (AAPC) separately for mean and median BMI, and for overweight and obesity prevalence. The AAPC is estimated for the whole observation period, assuming a constant rate of change over the period concerned. Table 3 shows the AAPC calculated over the whole period of 26 years. This is the period covered by the four surveys from which data was extracted (Ministry of Health, 2004).

**Table 3: Selected sample statistics, ages pooled, 1977–2003**

	Males			Females		
	1977	2003	AAPC (%)	1977	2003	AAPC (%)
Mean BMI	25.5	26.9	0.20	24.5	26.4	0.28
Median BMI	25.1	26.3	0.18	23.8	25.2	0.23
Overweight (%)	41.5	42.1	0.05	26.1	27.7	0.23
Obese (%)	9.4	19.9	2.93	10.8	22.1	2.79

These figures confirm that New Zealand is suffering from a growing obesity epidemic, starting before 1977 where almost 51 percent of males and 37 percent of females were already either overweight or obese (Ministry of Health, 2004). The prevalence of obesity doubled from 9 to 20 percent in males and 11 to 22 percent in females, with an AAPC of 3 percent for both genders assuming log linearity (Ministry of Health, 2004). In contrast, the change in overweight prevalence appeared to be minimal. One explanation is that some overweight individuals moved to the obese section, while others who had normal BMI became overweight, with the result that

the number of people with normal BMI decreased by about one fifth (Ministry of Health, 2004).

A study covering an 11 year period from 1982 to 1993/94 showed an increasing prevalence of obesity among European/Pakeha aged 35-64 years who were living in Auckland (G. Simmons, Jackson, Swinburn, & Yee, 1996). The age standardised mean weight increased by 4.3 kg in men and 3.1 kg in women. There was a significant increase in the mean BMI among men from 25.6 to 26.4 and women from 24.6 to 25.1 (Simmons et al., 1996). The proportion of overweight increased 45% to 50% for men, and from 27% to 32% for women. Obesity proportion also increased over the study period: for men from 8% to 14%, and women 10% to 13% (Simmons et al., 1996).

In 1989 a cross sectional national survey was conducted (Ball, Wilson, Robertson, Wilson, & Russell, 1993). The age standardised mean BMI for age group 18-65 years was 24.7 for women and 25.5 for men (Ball et al., 1993). This is very similar to the 1982 values reported in the Auckland sample (Simmons et al., 1996). However, there was a difference in the age groups studied; being 35-64 years in the Auckland study, and 18-65 years in the national study.

A study tracking changes in major cardiovascular risks in Auckland found that approximately 52.8% of men and 36.5% of women were obese or overweight in 1982 which increased to 70.9% and 57.0% respectively in 2002-3 (Metcalf et al., 2006).

In a study examining the relationship between BMI or truncal fat and insulin resistance it was found that Maori women are more likely than European/Pakeha women to have insulin resistance for any BMI or total or truncal fat (McAuley et al., 2002)

Youth obesity has been studied at different intervals with different age groups. In 1989, the 'Life in New Zealand' survey showed the prevalence of obesity among the

age group 15-18 years to be 5% (Hohepa, Schofield, & Kolt, 2004). The same age group had a prevalence of both overweight and obesity of 27% in 1997. In 2002/03, children aged 11-14 showed a prevalence of both overweight and obesity of 33.5% (Hohepa, et al., 2004). It is worth noting that the definition of overweight and obesity changed between 1997 and 2002. In 1997 this was given as a BMI  $\geq 25$ kg/m<sup>2</sup> for Europeans and  $\geq 26$  for Maori and Pacific. In 2002/03 it was defined as a BMI  $\geq 85^{\text{th}}$  percentile for BMI by age and sex and based on reference data drawn from international reference data (Hohepa et al., 2004).

Childhood obesity is an independent risk factor for adulthood obesity. There is an increasing prevalence of childhood obesity in developed countries (Turnbull et al., 2004). A study, in the Hawke's Bay, evaluated the BMI of children aged 11-12 years old at two points in time - in years 1989 and 2000 (Turnbull et al., 2004). Over an 11-year period, there was a marked increase in mean BMI and the prevalence of obesity and overweight. (Turnbull et al., 2004). There was no significant difference in the ethnic representation among the study population across the two time points. The average ethnic representation was 28% for Maori, 65% for European/Pakeha, 4% for Pacific people and <1% for Other ethnicities (Turnbull et al., 2004). The BMI geometric mean was 18.1 in 1989 and 19.8 in 2000. After adjustment for gender and ethnicity, there was a statistically significant difference in BMI between the two years with an overall relative increase of 9 % (Turnbull et al., 2004). The percentage of overweight doubled from 11% in 1989 to 21% in 2000 while obesity increased from 2.5% to 9% which reflects the growing obesity epidemic (Turnbull et al., 2004).

A study was conducted at seven Auckland primary schools, involving children aged 5-10 years, mostly from the lower deciles (Tyrrell et al., 2001). Obesity was assessed by BMI and by percentage body fat as measured by bioelectrical impedance. About 14% of children had a BMI greater than the reference 95<sup>th</sup> percentile for age and sex (Tyrrell et al., 2001). The study found that age and ethnicity significantly affected the obesity rates. Obesity rates increased by age. It reported an obesity rate of 11.5% for the 5 year old group and 14.5% for the 10 year old group (Tyrrell et al., 2001). The prevalence of obesity by BMI differed by ethnicity. Maori and Pacific Island children

were significantly more likely to be obese than European children with an odds ratio of 1.9 and 3.0 respectively. Asian children were less likely to be obese than European children - odds ratio, 0.7. The percentage rates by BMI were: 8.5% European/Pakeha; 16% Maori; 24% Pacific 5.5% Asian; 12% Indian and 15% other ethnicities (Tyrrell et al., 2001).

The Children's Nutrition Survey, conducted in 2002-03, among children aged 5-14 years showed that 29% of Pacific children, around 17% of Maori children, and 7% of European children were classified as obese (Ministry of Health, 2003). High rates of overweight and obesity have been found in Pacific pre-school children. Grant and colleagues' study of Pacific children aged 2-5 years, conducted between December 1998 and August 1999, reported percentages of 65% overweight and 45% obesity (Grant et al., 2004).

An attempt was made to measure the healthcare cost of obesity in New Zealand (Swinburn et al., 1997). Swinburn and colleagues estimated the total one-year cost of health care attributed to obesity-related disorders was NZ\$135 million. Although the cost attributed to Type 2 diabetes was higher than NZ\$61m a substantial proportion of the real total costs in this study could be categorised under coronary heart disease and hypertension (Swinburn et al., 1997). The NZ\$135m cost represents 2.5% of the total (public and private) health care expenditure (Swinburn et al., 1997). Mortality attributed to high BMI among the New Zealand population aged >25 years was 11% of all deaths in 1997 (Stefanogiannis et al., 2005).

## **2.2 Diet**

A recent WHO/FAO expert consultation report on diet, nutrition and prevention of chronic diseases sets population nutrient goals. It recommends an intake of a minimum of 400gms of fruits and vegetables per day for the prevention of chronic diseases such as heart disease, diabetes, cancer and obesity (WHO, 2003). Data from the 1997 National Nutrition Survey showed a mean vegetable and fruit intake of 420g/day for men and 404g/day for women (Tobias et al., 2006).

One study provided a unique description of what European pre-school children (average age 3.5 years of age) consume in New Zealand (Theodore et al., 2006). When compared to the Ministry of Health guidelines, it was found that more than a quarter of the pre-school children were not eating the recommended daily intake of fruit servings. More than half of the children were not consuming the recommended servings of vegetables per day (Theodore et al., 2006). About 85% of children received treat foods (biscuits, cakes, chips, candy bars, etcetera) at least daily (Theodore et al., 2006).

A study with a representative sample of primary and intermediate schools in New Zealand aimed to measure the obesogenic food environment in the schools (Carter & Swinburn, 2004). It was found that the schools food environment was not conducive to healthy food choice. This was evidenced by high sales of high fat items (pies, sausage rolls) and such items were also the most available. Less than one fifth of the schools reported having a food policy. Of those schools that did have a policy the effectiveness was measured subjectively as there was no clear definition of effectiveness (Carter & Swinburn, 2004). Two thirds of the schools operated their food services for profit which may have further placed the priority on profitability rather than healthiness (Carter & Swinburn, 2004).

The New Zealand National Children's Nutrition Survey (2002) showed that Maori and Pacific children aged 5-14 years were significantly more likely to skip breakfast or lunch compared to other groups (Utter, Scragg, Schaaf, & Fitzgerald, 2006). More than 40% of Pacific children and 23% of Maori children skipped breakfast either sometimes or always (Utter et al., 2006). Maori children were 3 times more likely, and Pacific children nearly 5 times more likely, than other groups to buy some of their food from school tuck-shop (Utter, Scragg, Schaaf, & Fitzgerald, 2006).

The 1997 National Nutrition Survey tested the food security problem across 8 aspects (Parnell et al., 2001). Food security definition incorporates affordability as well as accessibility to appropriate food (Parnell et al., 2001). Pacific people, irrespective of gender, showed significantly higher levels of food insecurity along all aspects. New

Zealand European/Pakeha and Others reported the least food insecurity, and Maori fell between the two (Parnell et al., 2001). Across all groups, females were more likely to experience food insecurity than males (Parnell et al., 2001). Physical proximity to areas of purchase was not included in the 8 aspects studied. Although the data showed the older group were the most food secure food, the elderly were under-represented and this may have mask a problem in that subgroup (Parnell et al., 2001).

In 1997, for people older than 25 years old, the mortality attributed to inadequate vegetables and fruits intake was 6% (Stefanogiannis et al., 2005; Tobias et al., 2006), 18% of ischemic heart deaths, 11% of ischemic stroke deaths and 3% of cancer deaths at all sites combined (Tobias et al., 2006).

### **2.3 Physical activity**

Physical activity can be defined as any form of body movement that results in an increase in metabolic demand (Kahn et al., 2002). It is only since about 1990 that compelling evidence from large prospective studies has begun to emerge on the role of regular physical activity and adequate levels of cardio respiratory fitness in the prevention of diabetes (La Monte, Church, & Blair, 2005).

A study to determine the prevalence of physical inactivity among older New Zealanders ( $\geq 60$  years) found almost half (49%) did not undertake any leisure-time physical activities and 16% did not undertake any physical activity (Galgali, Norton, & Campbell, 1998). Women were nearly twice as likely (1.9 times) as men not to participate in any kind of physical activity (Galgali et al., 1998).

The national 'Push Play' campaign was developed in 1999 with the aim of increasing awareness of the benefits of physical activity and encouraging New Zealanders to think about becoming more active (Bauman et al., 2003). Evaluation of the programme showed a significant increase in the number of adults who *intended* to be more active from 1.8% in 1999 to 9.4% in 2002. Yet there were *no sustained changes*

in physical activity levels in the serial evaluations. In 1999, more than a third (39%) reported 5+days activity per week and in 2000 this increased to 45%. In 2002, however, it dropped back to 38% (Bauman et al., 2003). The Hillary Commission and SPARC have conducted serial surveys which identified an 3 percent increase in the proportion of adults who are active for at least 150 minutes per week (Sports and Recreation New Zealand, 2003).

A New Zealand workforce study used the '10,000 steps a day' model as a measure for adequate physical activity and showed that 43% (78/181) of the study participants averaged more than 10,000 steps per day (Schofield, Badlands, & Oliver, 2005). This was consistent with the findings of the self reported physical activity gathered by Hillary commission and SPARC (Sports and Recreation New Zealand, 2003).

Data extracted from the National Children's Nutrition Survey (2002) involving children aged 5-14 showed that Maori and Pacific children were significantly more active than New Zealand European/others group in some of the activities studied (Utter et al., 2006).

Data from a 2003 national survey provided information about primary health care providers advice on physical activity and Green Prescription (Croteau et al., 2006). In answer to two questions on this topic, 13% percent of respondents reported receiving physical activity advice and 3% reported receiving a Green Prescription from a general practitioner or a practice nurse (Croteau et al., 2006). Overweight and obese patients, and patients with one or more chronic diseases, were significantly more likely to get advice on physical activity or Green Prescription (Croteau et al., 2006). Further, it indicated that sedentary but healthy individuals - who were at risk of illness due to their lifestyle - were not targeted by these interventions as a means of primary prevention (Croteau et al., 2006).

The presence of policies and plans to promote physical activity at the local territorial level was investigated as there is evidence that municipality-level policies promoting

spaces and facilities for physical activity can have an important influence on population levels of physical activity (Bullen & Lyne, 2006). Between October 2004 and February 2005, a survey was conducted in which 78% (58/74) of the Territorial Local Authorities (TLAs) agreed to participate. More than half (59%) reported having an overall plan or policy for physical activity. Urban TLAs were significantly more likely to have plans in place than rural TLAs (OR=8.2, 95% CI 1.57-42.8). The TLAs with a high proportion of their population living in the most deprived deciles were significantly less likely to have a policy, plan, or funding for physical activity promotion (Bullen & Lyne, 2006).

A New Zealand study identified that regular physical activity (at least 5 times a week and at least 150min a week) was associated with a 50% approximate reduction of risk of being insulin resistant or having impaired glucose metabolism (diabetes or IFG/IGT) in a predominantly Maori rural population (Mann et al., 2006).

## **2.4 Smoking**

Smoking markedly enhances cardiovascular disease risk in diabetes. Stopping smoking is at least as effective for reducing cardiovascular disease risk as reducing cholesterol, controlling blood pressure and glycaemia (Williams & Pickup, 2004).

The New Zealand Health survey 1996/97 (Ministry of Health, 1999) indicated a quarter (25%) of the adult population smoked and a quarter of the adult population reported that they were ex-smokers. Smokers were significantly more likely to be male than female (26.4% vs 23.5%;  $p < 0.0001$ ) and to be younger than older ( $p < 0.0001$ ). Half of the adult Maori population ( $\geq 15$  years) were smokers. This compares with 23% of European/Pakeha, 28% Pacific and 10% for Others. Young Maori women, aged 15 to 44 years, had the highest smoking rate with prevalence around 60%. Only a quarter of European/Pakeha women and one fifth of Pacific women in this age group was a smoker (Ministry of Health, 1999). Current smoking status correlated strongly with socioeconomic status as measured by NZDep 96 score. The proportion of current smokers in the most deprived areas was more than double

the proportion of current smokers in the least deprived areas (Ministry of Health, 1999).

In the 2002/03 New Zealand Health Survey (Ministry of Health, 2004), the prevalence of current smokers at 23% was lower than the 1996/97 rate of 25%. Unlike the earlier survey, the 2002/03 survey found no significant difference between men and women. Maori and Pacific ethnicities continued to show a significantly higher prevalence of smoking than European/Pakeha, Others and Asian ethnicities. The higher prevalence of smoking still showed the strong correlation with deprivation. This was evidenced by the highest prevalence of both men and women smokers in the most deprived deciles as of the NZDep2001 (Ministry of Health, 2004)

Metcalf and colleagues compiled the evidence for the prevalence of smoking over the 20 year period 1982-2003. They examined data from 4 consecutive cross sectional studies which reported data on cardiovascular risk factors (Metcalf et al., 2006). This suggests a decrease in smoking prevalence over time and an increased prevalence of those who have never smoked. Reported data did not include Maori or Pacific ethnicities because there was no historical data with which to compare the findings, and data for 'Others' was not included because of the small numbers. The percentage of self reported current smoking fell between 1993/94 and 1998 in both men and women in most age groups with little change between 1994 and 2002/03. In 2002/03, the average prevalence of current smokers among those aged 35-64 years was 17% for men and 12% for women. In 1982, these figures were 28% and 24.5% respectively. The percentage of those who had never smoked increased between 1982 and 2002/03. Among those aged 35-64 years this increased from 37% to 48% for men and 50% to 59% for women (Metcalf et al., 2006).

## **2.5 Hypertension**

Hypertension is not a risk factor for the development of diabetes, but is a complication of diabetes. Hypertension is also present in association with hyperlipidemia, obesity and hyperinsulinaemia in metabolic syndrome (Simmons &

Thompson, 2004). The review by Metcalf and colleagues, referred to above, which reported smoking prevalence also reported hypertension over the past 20 years (Metcalf et al., 2006). Overall mean systolic and diastolic blood pressure levels decreased in the period 1982 to 2003 as did the percentage of those with poor blood pressure control. The mean systolic blood pressure decreased in both males and females in all age groups. Maori, Pacific and Others data was not reported. Mean diastolic blood pressure showed the same downwards trend between 1982 and 1993/94 but for the remainder of the period remained approximately unchanged. The proportion of participants with poor blood pressure control, as evidenced by blood pressure >150/90 mmHg and taking no medication, dropped dramatically from 20% in 1982 to 3% in 2002/03 in men and from 12% to 1% in women (Metcalf et al., 2006). The total proportion of people with blood pressure <150/90mmHg increased by approximately 20% over the study period (Metcalf et al., 2006). It is worth noting that the WHO cut-off points for hypertension at that time was 140/90 mmHg (World Health Organisation, 1996).

A study of hypertension prevalence among a multicultural workforce was conducted between May 1988 and April 1990 (Scragg, Baker, Metcalf, & Dryson, 1993). Age adjusted mean blood pressure levels within each gender were higher for Maori, Pacific and Asian groups when compared with European/Pakeha (Scragg, Baker, Metcalf, & Dryson, 1993). However, when BMI was controlled for, the mean blood pressure increase difference was reduced to half indicating that BMI can explain some of the significant increase in these groups (Scragg, Baker, Metcalf, & Dryson, 1993).

It is notable that Maori, Pacific and Asian groups are three times less likely to have their hypertension treated compared to European/Pakeha (Scragg, Baker, Metcalf, & Dryson, 1993). A study among non Maori, non Pacific older men and women aged 65-84 years was conducted using the data of the University of Auckland Heart and Healthy Study (C. Bullen et al., 1998). They found that around 50% of participants (n=996) had hypertension (150/90mmHg) and were under treatment with antihypertensive medications (C. Bullen et al., 1998).

The mortality attributed to high systolic blood pressure in the New Zealand population aged >25 years in 1997 was 13% of all deaths (Stefanogiannis et al., 2005).

## **2.6 Hyperlipidemia**

Hypercholesterolemia is one of the criteria of ‘metabolic syndrome’. It is also a complication associated with diabetes. It is a risk factor for cardiovascular diseases (Williams & Pickup, 2004).

A study among non-Maori, non-Pacific men and women aged 65-84 years showed a prevalence of 46% of high blood cholesterol ( $\geq 6.5$  mmol/l) for women compared with only 17% among men in the same age group (C. Bullen et al., 1998). Metcalf and colleagues’ study of trends in cardiovascular risk factors over the period 1982 to 2003, referred to above, also tracked mean total cholesterol. Data showed decline in serum cholesterol levels with increased use of lipid lowering medications over time (Metcalf et al., 2006).

The mortality attributed to high cholesterol level among the New Zealand population aged > 25 years was 17% in 1997 (Stefanogiannis et al., 2005).

## **3 Diabetes**

This section covers the published literature on diagnosed diabetes, undiagnosed diabetes, impaired glucose tolerance/fasting glucose and gestational diabetes mellitus in New Zealand.

### ***3.1 Diagnosed Diabetes***

The 1983 Christchurch Skellerup workplace study indicated that diabetes prevalence among European/Pakeha and Asians aged 40-64 years was 4% compared with 17% among Maori/Pacific people, with a total prevalence of 3% (Brown, Hider, Scott, Malpress, & Beaven, 1984). A later study of the same age group in an Auckland workforce indicated a prevalence ranging from 1.5 to 5%. The European/Pakeha group had the lowest prevalence (1.5%), Maori and Pacific had the highest at 5%, and 3% of the Asian group had diagnosed diabetes (Scragg, Baker, Metcalf, & Dryson, 1991).

A household study was conducted in inner urban suburbs of South Auckland between 1991 and 1994 (D. Simmons, Thompson, & Volklander, 2001). Those aged 40-79 years were screened for diabetes by random blood glucose. Those with values  $\geq 6$  mmol/l (within 2 hours of last meal) or  $\geq 6.5$  mmol/l (2 hours or more after last meal) were invited to have OGTT. The total prevalence of diabetes (known and newly diagnosed) was three times higher in Pacific and Maori people in the 40-59 year age group than European/Pakeha (i.e., Pacific 25%, Maori, 21%, European/Pakeha 7.5%). Although prevalence increased with age in for all ethnicities, the same pattern was seen for those aged 60-79 years (i.e., Pacific, 29%, Maori, 23% and European/Pakeha 11%) (D. Simmons, Thompson, & Volklander, 2001).

Between April 1992 and December 1993, the South Auckland Diabetes Project team visited all households in Otara and Mangere districts to collect data on diabetes. Age adjusted prevalence of self reported diabetes showed a similar pattern, although Maori

reported the highest prevalence at nearly 5%, Pacific 3.5% with 2% in the European/Pakeha population (D. Simmons, Gatland, Leakehe, & Fleming, 1996).

The Northland New Zealand Diabetes Service found that 5% (51/1052) of Maori people with diabetes on their register had diabetes before the age of 30 years and 28 of these (55%) were diagnosed with Type 2 diabetes (McGrath, Parker, & Dawson, 1999). The majority of these patients had a positive family history of diabetes (86%). Most were overweight with a BMI >25 (86%). Kidney affection in the form of microalbuminuria or nephropathy was present in 62% of patients. Retinopathy was present in 35% of patients (McGrath, Parker, & Dawson, 1999).

In 2003, Tipene-Leach and colleagues tested the prevalence of diabetes and insulin resistance among a predominantly Maori population living in the East Coast of the North Island (Tipene-Leach et al., 2004). The overall age standardised diabetes prevalence was nearly 11%, while the insulin resistance prevalence was three times higher at 37%. Highest age specific diabetes rates were in those aged 60-69 years (34% prevalence). Age specific insulin resistance was highest in those aged 30-39 years (44% prevalence) (Tipene-Leach et al., 2004).

The proportion of type 2 diabetes among adolescents is sharply rising. A study was conducted at the Auckland diabetes centre. This centre receives patients with diabetes from the greater Auckland region (Hotu, Carter, Watson, Cutfield, & Cundy, 2004). It compared the proportion of those visiting the centre with Type 2 diabetes, with all diabetic adolescents aged 14-20 years of age, at two different time intervals - October 1996 to February 1997 and April to August 2002. Data showed that the proportion of adolescents with Type 2 diabetes increased six fold between 1997 and 2002 (Hotu, Carter, Watson, Cutfield, & Cundy, 2004). In 1996, 108 people with diabetes attended the clinic, out of which only 2 patients were Type 2 diabetes (2%). In 2002, the clinic had 163 attendants out of which, 18 were diagnosed with Type 2 diabetes (11%). All 18 patients identified as either Maori or Pacific. Mean age at diagnosis was 15 years and mean BMI at diagnosis was 34.6kg/m<sup>2</sup> - all but one had a BMI >30. Two-thirds (12/18, 67%) had a positive family history of Type 2 diabetes (Hotu, Carter, Watson,

Cutfield, & Cundy, 2004). The incidence rate tripled during the period 1997 to 2001, a significant difference, (1997/99 = 12.5%, 6/48 patients vs 2001/01 = 36% 10/28 p=0.017) (Hotu, Carter, Watson, Cutfield, & Cundy, 2004).

Campbell and colleagues estimated the average annual incidence of Type 2 diabetes among New Zealand children aged from birth to 14 years old at 0.84/100,000 (95%CI:0.37-1.26/100,000) (Campbell-Stokes, Taylor, & New Zealand Children's Diabetes Working, 2005).

The 'Get Checked' programme aims to provide free annual checks for people with diabetes to improve management and outcomes. 'Get Checked' started operating in the South Island on August 2000. in Primary Health Organisations (PHOs) operating in the area. It also involved some practices that were not affiliated to any PHO, but were willing to participate in the programme (Tomlin, Tilyard, Dawson, & Dovey, 2006). Data were collected from 242 practices (i.e., all practices in the South Island outside Christchurch city and 14 practices within Christchurch). All records of the first review between August 2000 and May 2003 were examined. When invited to participate in the programme, 80% of patients on the diabetes register responded.

New Zealand European/Pakeha made up 90% of those on the register, Maori comprised 5% and Pacific people only 1%. The number of Maori and Pacific on the register was estimated to be less than 30% of South Island estimated prevalence for these ethnic groups. Although caution is needed in generalising the findings, Maori and Pacific Island patients with Type 2 diabetes were significantly younger than their New Zealand European counterparts - mean age for Maori/Pacific was 57 years versus 67 years for European/Pakeha (Tomlin, Tilyard, Dawson, & Dovey, 2006). The combined Maori and Pacific group had a significantly higher BMI than their European/Pakeha counterparts for both males and females. Smoking was significantly higher among the Maori and Pacific patients with Type 2 diabetes (Tomlin, Tilyard, Dawson, & Dovey, 2006).

An audit of the outcomes of care in young people with diabetes showed that type 2 diabetes comprised nearly 9% of all cases of diabetes in age group < 26 years old; the majority were of non European/Pakeha ethnicity (63%) and all were overweight (Scott et al., 2006).

### **3.2 Undiagnosed Diabetes**

Undiagnosed diabetes was examined in some studies. The Christchurch study of Skellerup employees undertaken by Brown and colleagues (1984) - and referred to above - also provided information about undiagnosed diabetes in workers aged 16 years or older. The study identified 15 new diabetes cases and 3 gestational diabetes cases. The ratio of known diabetes to the newly diagnosed diabetes in the study was 1:1 as the known diabetes cases were also 15. These figures indicate that 50% of diabetes cases were undiagnosed. The overall prevalence of diabetes (newly diagnosed and known) was 3% (Brown, Hider, Scott, Malpress, & Beaven, 1984).

There appears to be a higher prevalence of undiagnosed diabetes in Maori, Pacific and Asian populations compared with European/Pakeha groups, particularly in those aged under 45 years. A study conducted in Auckland and Tokoroa over a 2 year period 1988-1990 examined the prevalence of undiagnosed diabetes in a New Zealand multiracial workforce aged 16 years and older (Scragg, Baker, Metcalf, & Dryson, 1991). It reported an estimated prevalence of undiagnosed diabetes ranging from nearly 1% to nearly 5% (European/Pakeha nearly 1%; Maori, 4.5%, Pacific 3.5%; Asian nearly 5% respectively) (Scragg, Baker, Metcalf, & Dryson, 1991). The higher estimated prevalence of undiagnosed diabetes reported for Maori, Pacific and Asian populations is supported by IGT data drawn in the same study. This was significant even after controlling for age, income and BMI (Scragg, Baker, Metcalf, & Dryson, 1991). The ratio of estimated undiagnosed diabetes to known diabetes decreased with age. The highest ratio was 1.36 for the age group 40-44 years. (Scragg, Baker, Metcalf, & Dryson, 1991).

A multi-ethnic screening programme was implemented in Waikato to identify undiagnosed diabetes and revealed an estimated prevalence of 1.2% (56/4521). Inclusion criteria were being Maori and aged at least 20 years old, being European/Pakeha over 40 years, or being obese and/or having a family history of diabetes. Screening was done by measuring random capillary blood glucose. Those with  $>8\text{mmol/l}$  were invited to OGTT (Lawrenson, Dunn, Jury, & Sceats, 1993). Only a third (34%) of the estimated target population at risk attended the screening.

A study among a predominantly Maori East Coast population revealed a prevalence of nearly 6% of newly diagnosed Type 2 diabetes (Mann et al., 2006). Another study conducted in inner urban suburbs of South Auckland estimated the prevalence of undiagnosed diabetes. In the 40-59 years age group there was a much higher estimated prevalence in Maori and Pacific populations than in European/Pakeha (10.5%, 14% and 3% respectively) (D. Simmons, Thompson, & Volklander, 2001). The estimated prevalence declined with age for Maori and Pacific (9%, 8%) (D. Simmons, Thompson, & Volklander, 2001). The ratio between the newly diagnosed and known diabetics was almost 1 in the 40-59 age group and decreased in the older age group, 60-79 years (D. Simmons, Thompson, & Volklander, 2001).

There is tentative evidence that up to 20 percent of patients referred by New Zealand general practitioners for OGTT will be diagnosed with diabetes. A study of patients referred by their general practitioner for OGTT was conducted in the period between July 2002 and December 2003 across the wider Auckland region (Baatvedt, Gamble, & Kyle, 2006). Non pregnant patients, not previously diagnosed with diabetes, were referred to OGTT by their general practitioners where reasons for referral were not mentioned. Out of the 310 patients who agreed to participate, 72 (23%) patients were diagnosed as having diabetes by 2 hours glucose OGTT  $\geq 11.1\text{ mmol/l}$ . This finding can not be generalised as the reason for referral was not known. Also, analysis of characteristics of the study population indicates the sample is not representative of the population. The mean age of all groups (normal, IGT, Diabetes) was around 50 and BMI means were all overweight or obese (Baatvedt, Gamble, & Kyle, 2006). This suggests that this group already had some risk factors which increased their possibility

of being referred to OGTT. The main concern was the diagnostic sensitivity of fasting glucose in detection of diabetes. The authors remarked that diabetes diagnosis sensitivity (on subsequent OGTT) can be up to 75.8 if the cut-off point is 5.5-6.1 mmol/l of fasting glucose. Out of the 85 patients with fasting glucose 5.5-6.1 mmol/l, eighteen (21%) patients had impaired glucose tolerance and eleven (13%) had diabetes on OGTT (Braatvedt, Gamble, & Kyle, 2006).

### **3.3 Impaired Glucose Tolerance (IGT/IFG)**

A review of research evidence suggests that Maori, Pacific (and Asian) populations have a significantly higher prevalence of impaired glucose tolerance. The Christchurch study among employees of a multiracial Skellerup workforce referred to above identified an overall prevalence of 1.6% for glucose intolerance (Brown, Hider, Scott, Malpress, & Beaven, 1984). It identified a significantly higher IGT prevalence amongst Maori, Pacific and Asian groups than the European/Pakeha group (7%, 5%, 8%, 2% respectively) (Scragg, Baker, Metcalf, & Dryson, 1991).

The study conducted among Maori East Coast population in the North Island, referred to above, revealed an overall prevalence of 5% of impaired glucose tolerance and impaired fasting glucose (Mann et al., 2006). Also the study of those living in South Auckland (see above) reported a much higher IGT/IFG prevalence in Maori and Pacific than European/Pakeha in the 40-59 age group (23%, 19%, 7% respectively). This group difference declined in the 60-79 age group (D. Simmons, Thompson, & Volklander, 2001). Last, the study testing the metabolic characteristics of patients with apparently normal fasting plasma glucose showed a 24% (74/310) prevalence of impaired glucose tolerance as of 2 hours OGTT  $\geq 7.8 - 11.0$  mmol/l (Braatvedt, Gamble, & Kyle, 2006).

### **3.4 Gestational Diabetes (GDM)**

GDM is defined as any degree of glucose intolerance with onset or first recognition during pregnancy (American Diabetes Association, 2006).

South Auckland is an area with a high proportion of Maori and Pacific women, an ethnic group known to be at increased risk for GDM. Universal screening for GDM has been recommended locally for many years but there is evidence that high risk groups may be under-screened (Yapa & Simmons, 2000). A 1994 study found the GDM prevalence was higher in Maori and Pacific women than Europeans or other groups screened (8%, 8%, 3%, 5.5% respectively). However, in spite of the clear universal agreement over the need for screening Maori and Pacific as high risk groups, the authors estimated that half of Maori (53%) and nearly a third (31%) of Pacific women were not screened. They estimated that 45-72% GDM likely cases went undetected (Yapa & Simmons, 2000).

Maternal hyperglycaemia has been found to contribute positively to hypoglycaemia of the newborn. In a study carried out in South Auckland in the period between January 1993 and December 1994 (D. Simmons, Thompson, & Conroy, 2000), past history of GDM was significantly associated with hypoglycaemia of the newborn (51.2 vs. 27.2%,  $p=0.01$ ). The higher the maternal hyperglycaemia at diagnosis by the fasting glucose level ( $6.8 \pm 1.7$  vs.  $5.7 \pm 1.1$  mmol/l,  $p<0.001$ ) the more likely that the newborn suffered hypoglycaemia (D. Simmons, Thompson, & Conroy, 2000). Pacific women were most likely to deliver big babies who suffer hypoglycaemia. In the postnatal period, Maori and Pacific women had a higher incidence of Type 2 diabetes compared with European/Pakeha and 'Other' women (21.4, 21.7 vs. 4.3 and 12%,  $p=0.035$ ) (D. Simmons, Thompson, & Conroy, 2000). Similarly there was a higher prevalence of neonatal hypoglycaemia - diagnosed at a level of  $\leq 1.6$  mmol/l - in Maori, Pacific and Other ethnicities compared to European/Pakeha ethnicities (7%, 17%, 8% and 4%  $p=0.027$  (D. Simmons, Thompson, & Conroy, 2000).

Peri-natal mortality is higher in those diagnosed Types 2 diabetes and/or GDM. A study of peri-natal mortality over a period of 12 years (1985-1997) revealed a mortality rate of 12.5 per 1000 in the non diabetic population and 39.1 per 1000 in type 2 diabetic population and a rate of 16.2 per 1000 in GDM (Cundy et al., 2000). Within the gestational diabetes group of women, a subgroup was identified as newly presenting Type 2 diabetes mellitus confirmed by early postpartum testing. The peri-

natal mortality of this newly diagnosed Type 2 diabetes was as high as 56.2 per 1000 (10/178) which when added to the Type 2 diabetes peri-natal mortality was significantly higher than the other groups (Cundy et al., 2000).

## **4 Disease Monitoring and Control**

### ***4.1 Disease monitoring***

The diabetes care support service (DCSS) was developed in south and west Auckland as a service linking general practice based audit with an independent confidential perusal of the audit by a diabetes specialist team (D. Simmons et al., 1997). The evaluation of this service was published in 1997. The process was seen as combining the specialist diabetes team skills and scientifically appropriate approaches for diabetes care with general practitioner skills and methods of service delivery at primary care setting. A diabetes care sheet was developed to collect information on the patients' demography, anthropometric measurements and diabetes history. Risk factors were noted including, smoking, glycaemia, lipids, blood pressure, foot care and microalbuminuria. Also treatment and diabetic tissue damage such as blindness, leg amputations, end stage renal disease was noted. This audit involved 3296 patients living in South Auckland and 1315 patients living in West Auckland (D. Simmons et al., 1997).

Some parameters were used in the 1997 audit to evaluate the monitoring of the different aspects of care. Recording of weight, blood pressure, lipids, foot pulse, urine albumin and long term glycaemia, which were recorded at least annually, were evaluated. Eye review was performed every 2-3 years at this audit. Overall, South Auckland general practices had slightly higher percentage of recording than West Auckland (D. Simmons et al., 1997). Table 4 shows the results of recording the different parameters of diabetes care as a result of the audit. The prevalence of identified complications among the group was mentioned in the complications section of this report.

**Table 4: Basic Audit results (30 September 1995) of monitoring diabetes associated risks.**

<b>Item recorded</b>	<b>South Auckland N=3296 (%)</b>	<b>West Auckland N=1315 (%)</b>
Weight recorded	2479 (75)	972 (74)
Blood pressure	2925 (89)	1130 (86)
Long term glycaemia	2913 (88)	1106 (84)
Eye review	2521 (76)	792 (60)
Urine albumin	1465 (44)	428 (33)
Lipid records	2191 (66)	684 (52)
Foot pulse	1639 (50)	632 (48)

Another two-pass audit was conducted with 12 to 24 months lapse between first and second audit. The two pass audit was completed by March 1998 (Kendall, Lunt, Moore, & McSweeney, 1999). General practices involved were in North Canterbury. The screening rate for eye examination, foot examination, serum creatinine, lipid profile and microalbuminuria assay increased significantly between the two audits (Kendall, Lunt, Moore, & McSweeney, 1999).

**Table 5: Comparison of diabetes complications screening between first and second audit rounds (Kendall, Lunt, Moore, & McSweeney, 1999)**

<b>Item recorded</b>	<b>First pass screening rate %</b>	<b>Second pass screening rate %</b>	<b>P value</b>
Eye examination	65	75	<0.001
Foot examination	66	76	<0.001
Blood pressure measurement	92	92	0.99
Glycated haemoglobin	81	84	0.01
Serum Creatinine	82	88	<0.001
Lipid profile	63	72	<0.001
Microalbuminuria assay	39	54	<0.001

Counties Manukau District Health Board (CMDHB) was one of the first district health boards to develop a programme to manage some of the chronic diseases that consume a large portion of health care expenditure. The idea first came to notice when CMDHB records revealed a very high proportion of potentially avoidable hospitalisations. In the 2000/01 fiscal year it was estimated that 30% of hospital admissions could be prevented by a more integrated type of primary care. As a result CMDHB commenced development of its 'chronic care management' (CCM) plan involving four chronic diseases; chronic obstructive pulmonary diseases (COPD), Diabetes mellitus, congestive heart failure (CHF) and COPD/asthma (Wellingham, Tracey, Rea, Gribben, & Chronic Care Management, 2003).

The CCM programme was initiated in 2001 in two pilot practices (Counties Manukau District Health Board, 2005). Since then, the programme has been evaluated and tools have been distributed, installed and supported in a further 40 practices. As at November 2004, 4231 patients were enrolled across the diabetes, cardiovascular diseases, and congestive heart failure and COPD modules (Counties Manukau District Health Board, 2005). Evaluation reported an average decrease in HbA1c of 0.32. Decrease was greatest among those who started with an Hb1Ac  $\geq 9.0$  (decrease 1.2) and smaller among those who started with an Hb1Ac  $\geq 7.0$  (decrease 0.5) (Counties Manukau District Health Board, 2005).

Evidence from screening programmes suggests that Maori, Pacific and Asian populations with diabetes are less likely to be screened regularly for potential prevention of diabetes related complications. In the Waikato, a mobile retinal camera was used for screening patients with diabetes (Reda et al., 2003). Nearly a third of Maori and Pacific patients failed to attend (32%) and more than a quarter (27%) of Asian patients did not; 13% of the European/Pakeha group did not attend (Reda et al., 2003).

Similar findings are reported by the Ministry of Health which launched its national 'Get Checked' programme in June 2000. The programme aims to provide free annual checks for people with diabetes to improve management and outcomes of the disease.

The percentage of programme uptake was significantly higher among Non-Maori people with diabetes with two-thirds uptake of (65.5%). Maori uptake of the programme was 40%. Among those gaining access to the programme, 60% of Maori had a glycated haemoglobin  $\leq 8\%$ ; their non-Maori counterparts had a percentage of 73% (Ministry of Health, 2004).

A South Island evaluation of the 'Get Checked' programme covering the period 2000-03 was conducted. The audit involved 242 Christchurch participating general practices – full details are referred to in an earlier part of this report (Tomlin, Tilyard, Dawson, & Dovey, 2006). All 'first review' records were examined. Of the Type 2 diabetes, significantly more European/Pakeha than Maori and Pacific people who had their 'foot checks' (95% vs 93%  $p < 0.05$ ) and retinal examinations (77% vs 71.6%  $p < 0.001$ ) (Tomlin, Tilyard, Dawson, & Dovey, 2006). The Maori/Pacific group were less likely than European/Pakeha to be managed by diet alone (24% vs 37%;  $p < 0.001$ ). European/Pakeha were also more likely to receive statins to control hyperlipidemia than the Maori/Pacific group (19% vs 16%;  $p = 0.05$ ). ACE inhibitors for controlling hypertension and/or nephropathy, were significantly more likely to be prescribed to Maori/Pacific group than European/Pakeha (51.5% versus 46.5%;  $p = 0.01$ ) (Tomlin, Tilyard, Dawson, & Dovey, 2006).

Evaluating health status revealed ethnic disparities. All parameters showed significantly poorer disease management for Maori and Pacific groups than European/Pakeha. Maori and Pacific patients with Type 2 diabetes were significantly less likely to have good control of their hyperglycemias measured at HbA1c  $\leq 8.0\%$  than European/Pakeha (61% vs 79%  $p < 0.001$ ). The European/Pakeha group had a significantly larger number of patients with blood pressure less than 140/80. Slightly less than 5% of European/Pakeha met the criteria of high risk microvascular complications. In contrast 9% of the Maori and Pacific patients met the criteria for high risk ( $p < 0.001$ ). Levels of lipids were not significantly different. Although microalbuminuria results showed some significant differences between European/Pakeha and the Maori/Pacific groups, one single result of microalbuminuria

is not sufficient especially if the time of collection of sample is unknown (Tomlin, Tilyard, Dawson, & Dovey, 2006).

A further evaluation of 'Get Checked' in South and West Auckland general practices covered all audits completed within 1 January 2003 and 31 December 2003 (Robinson et al., 2006). The audit represents a continuation of the efforts of the DCSS and is provided without charge to practices if they are willing to participate. A total of 205 general practices participated. Of all the Type 2 diabetes patients identified, 68% were audited. The main reason for not being audited in this study was because patients were either recently enrolled at the practice or patients moved to another practice (Robinson et al., 2006).

The audit revealed Maori and Pacific people had the highest mean number of consultations for diabetes (5.7 and 5.4 respectively) within the study period, while Indian and other Asian groups had the lowest means (4.2 and 4.1 respectively). Audit results were stratified by ethnicity (Robinson et al., 2006) which was not presented in the first audit performed in 1995 (D. Simmons et al., 1997). Pacific, Maori and Asian patients with Type 2 diabetes were less likely than European/Pakeha patients to have an audit completed even after adjusting for age and gender (Robinson et al., 2006). There was a significant difference in recording BMI, smoking status, foot examination and urinary albumin : creatinine ratio among different ethnicities (80%, 76%, 81%, 58.5% and 68% percent recordings respectively (Robinson et al., 2006).

When the 2003 figures were compared to the parameters audited in 1995, an improvement can be detected in most of these parameters, notably with a slightly different naming of the parameter. For example in 1995, weight was recorded while in 2003 the BMI was calculated from the weight and recorded. In 1995, lipid records did not specify whether they measured TC : HDL ratio and this was available from the 2003 data. There was variability in recording of examinations among different ethnic groups as for glycated haemoglobin, systolic blood pressure and lipid records (TC : HDL ratio). However, this was not significant with total percentages of 88%, 94% and 83% respectively (Robinson et al., 2006) and showed improvements since

the recording of audits in 1995 (D. Simmons et al., 1997). The overall prevalence of patients with diabetes who had glycated haemoglobin >8.0 was 38%. This varied significantly across ethnic groups and was found to be highest among Pacific people and Maori (56%, 49.5%). The Indian group had a prevalence of 45%. Prevalences in the Asian, Others and European/Pakeha groups were 22.7%, 30.%, 25% and 22% respectively. The prevalence of different risk factors and complications identified in this study is presented in Table 6.

**Table 6: Prevalence of different risk factors and complications in patients involved in the study in South and West Auckland general practices (Robinson et al., 2006)**

<b>Adverse Risk factor or complication</b>	<b>European</b>	<b>Maori</b>	<b>Pacific</b>	<b>Other Asian</b>	<b>Indian</b>	<b>Other</b>	<b>Total</b>	<b>P value</b>
<b>Current Smoker</b>	13.1	34.9	17.8	17.6	7.7	17.3	18.0	0.000
<b>BMI &gt;30</b>	46.6	76.0	73.7	12.6	24.9	48.1	56.7	0.000
<b>HbA1c &gt;8.0</b>	22.7	49.5	55.7	30.2	44.9	25.0	37.6	0.000
<b>Systolic BP&gt;140mmHg</b>	32.6	27.6	23.7	28.4	24.0	36.4	29.0	0.000
<b>TC: HDL ratio&gt;4.5</b>	27.3	46.3	35.4	33.8	34.8	31.4	33.4	0.000
<b>At risk feet<sup>1</sup></b>	36.5	33.0	23.2	31.6	24.2	36.8	31.3	0.000
<b>High urinary albumin: creatinine ratio<sup>2</sup></b>	27.4	55.2	50.4	34.4	36.6	24.8	39.3	0.000

A study conducted in South Auckland estimated that around 6% of diabetes patients do not get any regular care for their diabetes (D. Simmons & Fleming, 2000). The characteristics of those patients were compared to those receiving ongoing care. Patients with no ongoing care were defined in this study as ‘patients with known diabetes who have not seen anyone for their diabetes (general practitioner or local diabetes service) in the previous 10 months prior to the study’ (D. Simmons & Fleming, 2000). Those of Maori ethnicity were significantly less likely to receive regular care and comprised 36% (39/107) of all diabetes patients who were not receiving on going care. A similar percentage was found for Pacific people at 34.5%

<sup>1</sup> At risk feet: having abnormal pulses, sensory change, foot deformities or history of foot ulcer.

<sup>2</sup> High albumin: creatinine ratio: 2.5mg/mmol for men and 3.5mg/mmol for women.

(37/107) with 27% of Europeans (29/107) not receiving regular care. There were insufficient numbers in the 'others' group (2/107) to report meaningful data (D. Simmons & Fleming, 2000). Patients with diabetes and not on regular care are significantly more likely to be diagnosed either after gestational diabetes or during screening of asymptomatic individuals (D. Simmons & Fleming, 2000).

## 5 Complications

### 5.1 *Macro-vascular complications*

Cardiovascular disease (CVD) accounts for the majority of macro-vascular complications. It is the main cause of death in type 2 diabetes and is two to four-fold more frequent than in normo-glycaemic individuals (Valeri, Pozzill, & Leslie, 2004). In the WHO multinational study, cardiovascular diseases accounted for 52% of deaths in Type 2 diabetes patients (Morrish, Wang, Stevens, Fuller, & Keen, 2001).

There appear to be difference by ethnicity. Studies reported below suggest that Maori and Pacific patients with Type 2 diabetes are less likely to take antihypertensive medication, to have higher rates of heart attack than European/Pakeha patients and to higher rates of mortality

The New Zealand Guidelines Group (NZGG) recommended a tight control of blood pressure for people with diabetes of <130/80 mm Hg (NZGG, 2003). A two pass audit of screening for diabetes complications measured a mean systolic and diastolic level of  $141\pm 20/81\pm 10$  and  $140\pm 20/81\pm 10$  for the first and second audit respectively (Kendall, Lunt, Moore, & McSweeney, 1999). This study was completed by March 1998; a long time before the New Zealand guidelines for control of hypertension in people with diabetes were published. Yet the screening rate for hypertension among people with diabetes was as high as 92% in the two audits (Kendall, Lunt, Moore, & McSweeney, 1999).

In South Auckland, the prevalence of taking antihypertensive medications among people with diabetes showed a significant difference among different ethnic groups whereby European/Pakeha were more likely to take medication (D. Simmons, Gatland, Leakehe, & Fleming, 1996). The prevalence of taking antihypertensive medications was 44%, 33% and 33% among European, Maori and Pacific ethnicities (D. Simmons, Gatland, Leakehe, & Fleming, 1996). The percentage of those having a

history of having a heart attack was significantly higher in Maori and Pacific groups than the European/Pakeha group (11%, 11%, 6%) (D. Simmons, Gatland, Leakehe, & Fleming, 1996).

Similarly a study of hospital admissions in South Auckland reported that prevalence of known diabetes in association with an acute myocardial infarction was more than a third for Maori and Pacific (36%, 38%), a quarter for 'Others' (26%) and 15% for European/Pakeha patients (25%) (D. Simmons & Bhoopatkar, 1998). These figures show that Maori diabetics are 2.4 times, and Pacific diabetics 2.5 times, more likely to suffer acute myocardial infarction than diabetic European/Pakeha. Those in the 'Others' group are 1.6 times more likely to suffer acute myocardial infarction compared with diabetic European/Pakeha. Overall, hospital mortality was almost 13% among patients with diagnosed diabetes, and 14% for other patients (D. Simmons & Bhoopatkar, 1998). The higher the hyperglycaemia the higher the mortality rate with a peak of 25% for glucose  $\geq 20$ mmol/l (D. Simmons & Bhoopatkar, 1998).

Another study in New Zealand reviewed hospital admissions for acute myocardial infarction and identified a prevalence of 12% of known or new diabetes, but 45% had a glycated haemoglobin above the reference range (Moore & Lunt, 2000).

An audit of general practices in South and West Auckland in 1995 revealed a prevalence of myocardial infarction and coronary artery by-pass of 8% (249/2985) and 9% (104/1129) respectively among the people with diabetes in the participating general practices (D. Simmons et al., 1997). The prevalence of cerebrovascular accidents and transient ischemic attacks among the same studied group was 7% (208/2977) and 110% (110/1118) in south and west Auckland general practices respectively (D. Simmons et al., 1997).

A study was conducted predict mortality among patients with Type 2 diabetes who presented at hospital with acute myocardial infarction (AMI) or acute cardiac failure (ACF) (Kerr, Gamble, Doughty, Simmons, & Baker, 2006). The study population was

a cohort of 4193 individuals with Type 2 diabetes living in South Auckland, who had their primary care records audited by the Diabetes Care Support Services (DCSS) between 1994 and 30 June 1999, and who presented at hospital over a 2 year period ended June 2001; 319 patients were recruited. (Kerr, Gamble, Doughty, Simmons, & Baker, 2006). The study showed that patients with Type 2 diabetes and heart disease were more likely to get readmitted for MI/CCF during the 2 year study period with a frequency of 45% (143/319). Eighteen patients (5.5%) died during their index admission, while further 31 (10%) died within 3 months of discharge. All cause mortality for patients with Type 2 diabetes admitted to hospital with myocardial infarction was 52% after a mean follow up of 3.8 years (Kerr, Gamble, Doughty, Simmons, & Baker, 2006). The study showed that diabetic patients with history of myocardial infarction are 7.2 times more likely (95% CI 5.2-9.9) to die early than other individuals with Type 2 diabetes. Maori were 80% more likely to die early and those who have had diabetes a longer time had a worse prognosis (Kerr, Gamble, Doughty, Simmons, & Baker, 2006).

New Zealand participated in the Global Registry of Acute Coronary Events with another 14 countries (Franklin et al., 2004). The study showed that approximately 1 in 4 patients presenting with acute myocardial infarction were people with diabetes (Franklin et al., 2004).

## ***5.2 Micro-vascular complications***

### **5.2.1 Renal Complications**

A study carried out in New Zealand found that chronic renal disease remains the second most likely cause of death and morbidity after cardiovascular disease in people with diabetes (Endre, Beaven, & Buttimore, 2006).

Self reported prevalence of renal replacement therapy among people with diabetes showed no significant difference among different ethnicities with prevalence of 4%, 2% and 1.7% for Maori, Pacific Island and Europeans respectively (D. Simmons,

Gatland, Leakehe, & Fleming, 1996). An audit of general practices in South and West Auckland in 1995 revealed a prevalence of diabetic end stage renal failure of 1% (34/2994) and 0.4% (5/1144) respectively among the people with diabetes in the participating general practices (D. Simmons et al., 1997). A similar audit was performed during the year 2003 (Robinson et al., 2006). It showed that Maori and Pacific people have a significantly high prevalence of high albumin : creatinine ratio with a prevalence of 55% for Maori and 50% for Pacific people while European/Pakeha, Indian, other Asian and Others had a lower prevalence (27%, 37%, 34% , 25% respectively (Robinson et al., 2006).

Another study showed that the 2 year integrated patient survival for patients with diabetic nephropathy entering a renal replacement programme was 53%; for five years this was halved at 24%. This is a much poorer outcome than non diabetic nephropathy counterparts, who had figures exceeding 85% and 75% respectively (Neale & Bailey, 1990).

Data from the Australian and New Zealand Dialysis and Transplant Registry showed that in 2005 Type 2 diabetes accounted for 37% of primary renal disease in new patients (McDonald, Chang, & Excell, 2006). The ratio of men to women in this group was 1.8 where men were 105 and women were 58 (McDonald, Chang, & Excell, 2006). Men accounted for 38.6% (105/272) of primary renal disease of new patients and women for 35% (58/164).

A further study estimated that diabetic nephropathy could be responsible for at least \$36 million in direct annual healthcare costs (Endre, Beaven, & Buttimore, 2006)

### **5.2.2 Eye Complications**

An audit of some general practices in South and West Auckland in 1995 revealed a prevalence of blindness of 0.8% (25/2990) and 0.7% (8/1139) respectively among the people with diabetes in the participating general practices, while the prevalence of eye

intervention in the form of surgery or laser related to diabetes was 10.8% in South Auckland (308/2848) and 12.3% in West Auckland (135/1102) (D. Simmons et al., 1997).

Maori and Pacific people with diabetes have higher rates of eye complications. The South Auckland Diabetes Project registered self reported diabetic tissue damage (D. Simmons, Gatland, Leakehe, & Fleming, 1996). Maori and Pacific ethnicities showed a significantly higher prevalence of diabetic eye pathology. The prevalence of one or two eyes blindness was 7%, 8% and 2% among Maori, Pacific and European/Pakeha respectively (D. Simmons, Gatland, Leakehe, & Fleming, 1996). The prevalence of having laser treatment to the eyes was 19%, 12% and 7% among Maori, Pacific and European/Pakeha respectively. While the prevalence of cataract was 14%, 16% and 6% among Maori, Pacific and European/Pakeha respectively (D. Simmons, Gatland, Leakehe, & Fleming, 1996).

### **5.2.3 Leg Complications**

Diabetic admissions for 1987 were identified by a computer survey of discharge codes at Middlemore hospital and the discharges related to diabetic foot were identified (Thompson, McWilliams, Scott, & Simmons, 1993). The median length of stay for peripheral vascular disease was 19 days (range 1-184). European/Pakeha patients admitted with peripheral vascular disease were significantly older than other diabetic patients (71 years vs 61 years  $p < 0.001$ ). Ulcers accounted for 55% of admissions, gangrene for 22%, isolated cellulitis for 7% and other tissue damage for 16% of admissions for peripheral vascular disease (Thompson, McWilliams, Scott, & Simmons, 1993).

The local crude annual incidence of amputation was approximately 47.1/100,000 diabetic patients. An annual cost of NZ \$612,517 was estimated for management costs for diabetic feet in 49 Middlemore patients (i.e \$12,500 per patient). Of those available for prognosis 33 patients were traceable, out of which 12% died in the same year and 36% died in the subsequent 2 years. This confirms the high mortality

associated with peripheral vascular disease (Thompson, McWilliams, Scott, & Simmons, 1993).

Simmons and colleagues reported poor feet care and a high prevalence of foot lesions among people with diabetes living in South Auckland (D. Simmons, Scott, Kenealy, & Scragg, 1995). The frequency of amputation among European/Pakeha, Maori and Pacific was similar (2.2%, 2.8% and 1% respectively), and there was a similar prevalence of diabetic patients with no feet lesions (48%, 48% and 53% respectively) (D. Simmons, Scott, Kenealy, & Scragg, 1995). The frequency of people having their feet examined in the past 12 months among Europeans, Maori and Pacific Island were 56.5%, 72% and 62% respectively. A study of hospital discharges showed that 39% of non-traumatic lower limb amputation were associated with diabetes as a co-diagnosis (Solomon, van Rij, Barnett, Packer, & Lewis-Barned, 1994).

An audit of general practices in south and west Auckland in 1995 revealed a prevalence of leg amputations of 0.5% (14/2990) and 0.9% (10/1139) respectively among the people with diabetes in the participating general practices (D. Simmons et al., 1997).

Self reported leg/foot symptoms among people with diabetes living in South Auckland was collected through the South Auckland Diabetes Project (D. Simmons, Gatland, Leakehe, & Fleming, 1996). The prevalence was 42%, 29% and 37% among Maori, Pacific Island and European/Pakeha respectively. The prevalence of having a leg ulcer or an amputation was not significantly different among different ethnicities (6%, 5% and 7% respectively) (D. Simmons, Gatland, Leakehe, & Fleming, 1996).

In 1994, over a 2 year study period, diabetes accounted for nearly 39% of non traumatic lower limb amputations and accounted for 36% of the total costs (Solomon, van Rij, Barnett, Packer, & Lewis-Barned, 1994).

## **6 District Health Board Reports**

The websites of the 21 district health boards were searched for updated data on diabetes in their publications. Information was extracted from their annual plans, reports or health needs assessment documents. Some district health boards did not have the relevant information on their website, including Lakes District Health board, Tairāwhiti District Health Board and Waikato District Health Board. A summary of relevant information from each report is displayed in Table 7.

**Table 7: Latest Reports Published by District Health Boards giving Figures on Diabetes management**

<b>Report Name</b>	<b>Indicator Name</b>	<b>Value</b>
<b>Canterbury District Health Board</b>		
Canterbury District Health Board report for the year ended 30 June 2006 (Values for 2005)	Total Proportion of Diabetics with annual checks	48%
	By ethnicity: Maori	24%
	Pacific	51%
	Other	51%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b>	72%
	By ethnicity: Maori	57%
Pacific	74%	
Other	73%	
Total Proportion of Diabetics with HBA1c > 8% (relatively <b>POOR</b> control)	22%	
By ethnicity: Maori	34%	
Pacific	52%	
Other	21%	
<b>Hawke's Bay District Health Board</b>		
Annual Report 2006 Hawke's Bay District Health Board (Values for 2005)	Total Proportion of Diabetics with annual checks	41.2%
	By ethnicity: Maori	25.7%
	Pacific	54.2%
	Other	48.4%
	Total Proportion of Diabetics with HBA1c ≤ 8% (relatively <b>GOOD</b> control)	71.5%
	By ethnicity: Maori	56.8%
Pacific	55.7%	
Other	76.1%	
<b>Hutt Valley District Health Board</b>		
Hutt Valley District Health Board Annual Report 2006	Total Proportion of Diabetics with annual checks	78%
	By ethnicity: Maori	46%
	Pacific	89%
	Other	86%
	Total Proportion of Diabetics with HBA1c ≤ 8% (relatively <b>GOOD</b> control)	74%
	By ethnicity: Maori	59%
	Pacific	50%
	Other	80%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b>	82%
By ethnicity: Maori	82%	
Pacific	79%	
Other	82%	
<b>Nelson Marlborough District Health Board</b>		
Nelson Marlborough District Health Board Annual Report 2005/06	Total Proportion of Diabetics with annual checks	67.2%
	By ethnicity: Maori	31%

Report Name	Indicator Name	Value
	Pacific	113% <sup>3</sup>
	Other	71.9%
	Total Proportion of Diabetics with HBA1c ≤ 8% (relatively <b>GOOD</b> control)	77.8%
	By ethnicity: Maori	67.3%
	Pacific	75%
	Other	78.2%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b>	67%
	By ethnicity: Maori	62%
	Pacific	63.9%
	Other	67.3%
<b>Northland District Health Board</b>		
Northland District Health Board: Health Needs Analysis 2005	Total Proportion of Diabetics with annual checks	2198
	By ethnicity: Maori	1045
	Pacific	13
	Other	1140
	Total Proportion of Diabetics with HBA1c > 8% (relatively <b>POOR</b> control)	32%
	By ethnicity: Maori	42%
	Pacific	39%
	Other	23%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b>	75%
	By ethnicity: Maori	68%
Pacific	----	
Other	----	
	Total Age standardised rate/1000 of Hospital discharges with Primary or secondary Diagnosis of diabetes 2003/04	17
	By ethnicity: Maori	48
	Pacific	38
	European	12
	Other	72
<b>South Canterbury District Health Board</b>		
South Canterbury District Health Board Annual Plan 2006/07	The percentage of undiagnosed diabetes patients who entered onto diabetes register. <sup>4</sup>	84.4%
	By ethnicity: Maori	25.9%
	All Others	89.9%
	Total Proportion of Diabetics with	76%

<sup>3</sup> The Ministry of Health diabetes model has underestimated the number of Pacific People with diabetes compared with the actual number who had annual checks- accurate population information is available 5 yearly through the Census and has to be estimated in intervening years.

<sup>4</sup> Numerator/denominator: No. of diabetes patients on the diabetes register/estimated no. of people with diabetes.

Report Name	Indicator Name	Value
	annual checks and regular <b>Eye screening</b> By ethnicity: Maori All Others	83% 76%
	Total Proportion of Diabetics with HBA1c ≤ 8% (relatively <b>GOOD</b> control) By ethnicity: Maori All Others	82% 62.9% 82.4%
<b>Southland District Health Board</b>		
A strategy to Reduce The Incidence of Diabetes in Southland, 2004	Total Proportion of Diabetics with annual checks, 2003 By ethnicity: Maori Pacific All Other	58% 21% 34% 66%
	Total Proportion of Diabetics with HBA1c > 8% (relatively <b>POOR</b> control), 2003 By ethnicity: Maori Pacific All Other	23.2% 40.2% 42.9% 22%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> By ethnicity: Maori Pacific Other	77.3 69% 57% 78%
<b>Auckland District Health Board</b>		
Auckland District Health Board, 2006 Annual Report (Get Checked data)	Total Proportion of Diabetics with annual checks By ethnicity: Maori Pacific All Other	50% 25% 91% 44%
	Total Proportion of Diabetics with HBA1c > 8% (relatively <b>POOR</b> control), 2005 By ethnicity: Maori Pacific All Other	33% 39% 49% 24%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> By ethnicity: Maori Pacific Other	No data available
<b>Taranaki District Health Board</b>		
Annual Report 2006	Total Proportion of Diabetics with annual checks By ethnicity: Maori Pacific All Other	91.8% 50.9% 119.6% 103%
	Total Proportion of Diabetics with HBA1c > 8% (relatively <b>POOR</b> control), 2005	16.2%

Report Name	Indicator Name	Value
	By ethnicity: Maori Pacific All Other	27.8% 40.7% 14.4%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> By ethnicity: Maori Pacific Other	61.7% 55.9% 66.7% 62.5%
<b>Wairarapa District Health Board</b>		
A Picture of Wairarapa Health Status 2005	Total Proportion of Diabetics with annual checks By ethnicity: Maori Pacific All Other	No data available
	Total Proportion of Diabetics with HBA1c > 8% (relatively <b>POOR</b> control), 2004 By ethnicity: Maori Pacific All Other	22.6% 26.9% 43.8% 21.3%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> , 2004	83%
	Rate of Diabetes Hospitalisations per 10,000 year 2003 By ethnicity: Maori Non Maori Total	38.89 19.56 20.39
<b>West Coast District Health Board</b>		
Annual Report for the Year Ended 30 June 2006	Total Proportion of Diabetics with annual checks (2005) By ethnicity: Maori Pacific All Other	55.2% 26.0% 40.8% 60.1%
	Total Proportion of Diabetics with HBA1c ≤ 8% (relatively <b>GOOD</b> control) (2005) By ethnicity: Maori Pacific All Others	79.0% 79.4% 100% 78.9%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> (2005) By ethnicity: Maori Pacific Other	87.4% 79.4% 100% 87.9%
<b>Whanganui District Health Board</b>		
Whanganui District Health Board Annual Report 2005-2006	Total Proportion of Diabetics with annual checks (2005) By ethnicity: Maori	No data 40%

Report Name	Indicator Name	Value
	Pacific	32%
	All Other	75%
	Total Proportion of Diabetics with HBA1c $\leq$ 8% (relatively <b>GOOD</b> control) (2005)	No data
	By ethnicity: Maori	37%
	Pacific	41.7%
	All Others	19.3%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> (2005)	No data
	By ethnicity: Maori	78%
	Pacific	75%
	Other	
<b>Bay of Plenty District Health Board</b>		
Statement of Intent 2003 - 2006	Total Proportion of Diabetics with annual checks (2003)	58%
	By ethnicity: Maori	45%
	Pacific	45%
	All Other	65%
	Diabetes case management (2003)	30%
	By ethnicity: Maori	40%
	Pacific	40%
	All Others	26%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> (2003)	84%
	By ethnicity: Maori	80%
	Pacific	80%
	Other	85%
<b>Capital &amp; Coast District Health Board</b>		
District Annual Plan 2006/09 "Accelerating Change"	Total Proportion of Diabetics with annual checks (04/05)	67.0%
	By ethnicity: Maori	50.0%
	Pacific	70.0%
	All Other	70.0%
	Total Proportion of Diabetics with HBA1c $\leq$ 8% (relatively <b>GOOD</b> control) (04/05)	73%
	By ethnicity: Maori	62.0%
	Pacific	51.0%
	All Others	79.0%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> (04/05)	No data available
	By ethnicity: Maori	
	Pacific	
	Other	
<b>Waitemata District Health Board</b>		
Health Needs Assessment Update 2005: Health and Health care of Waitemata	Total Proportion of Diabetics with annual checks (04/05)	55%
	By ethnicity: Maori	38%

<b>Report Name</b>	<b>Indicator Name</b>	<b>Value</b>
residents	Pacific	98%
	All Other	54%
	Total Proportion of Diabetics with HBA1c ≤ 8% (relatively <b>GOOD</b> control) (04/05)	70%
	By ethnicity: Maori Pacific All Others	57% 51% 75%
<b>Otago District Health Board</b>	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> (04/05)	67%
	By ethnicity: Maori Pacific Other	65% 49% 69%
	<b>Otago District Health Board</b>	
	Otago District Health Board Statement of Intent 2005-2008 (Financial Year 2005/06)	Total Proportion of Diabetics with annual checks (04/05)
By ethnicity: Maori Pacific All Other		41% 65% 85%
Total Proportion of Diabetics with HBA1c ≤ 8% (relatively <b>GOOD</b> control) (04/05)		No data
	By ethnicity: Maori Pacific All Others	85% 85% 85%
	Total Proportion of Diabetics with annual checks and regular <b>Eye screening</b> (04/05)	No data
	By ethnicity: Maori Pacific Other	75% 83% 84%

## **7 SUMMARY**

### **7.1 Risk Factors**

#### **7.1.1 OBESITY**

Obesity is a significant risk factor for Type 2 Diabetes. Over the past 25 years the New Zealand population is gaining weight and obesity and overweight percentages have steadily increased in all sections of the population. Eleven percent of all deaths in 1997 were attributed to obesity (or overweight). The healthcare cost of obesity was estimated at NZ\$135 million, or 2.5% of total healthcare expenditure.

During 1977-2003 the percentage of obesity has doubled with more people moving from overweight into obesity. The most common measure to assess overweight and obesity is the body mass index (BMI). Age and ethnicity significantly affect the prevalence of overweight and obesity. Although it is recognised that Maori, Pacific populations have less body fat at the same BMI as European/Pakeha, these groups consistently show a higher prevalence of overweight or obesity at all age groups. Childhood obesity is an independent factor for adult obesity and its prevalence among preschoolers, children and young adolescents is increasing, particularly in Maori, Pacific and some Asian ethnicities.

#### **7.1.2 DIET**

Findings from National Nutrition Surveys and other research over the past ten years indicates that approximately half of all young New Zealanders (pre-school and school children) do not consume the recommended intake of fruit and vegetables to prevent chronic diseases. The school environment is not conducive to healthy food choices and much of the food sold in tuck shops and canteens is high in fats. Food security differs by ethnicity with Maori and Pacific school children being significantly more likely to skip meals and to buy food from tuck shops. Although adults met the minimum intake of fruit and vegetables, Pacific and Maori people reported lower food

security. In 1997 overall mortality attributed to inadequate nutrition (fruit and vegetables) was 6%; ischemic heart deaths and ischemic strokes were the main contributors.

### **7.1.3 PHYSICAL ACTIVITY**

Over the last 15 years compelling evidence from large prospective studies has shown the need for regular physical activity and adequate levels of cardio-respiratory fitness in the prevention of diabetes (La Monte et al., 2005).

New Zealand studies indicate that less than half of all New Zealanders report achieving the recommended level of activity (5+days and at least 150min per week). Physical activity varies by age, gender, and ethnicity. Women are less likely to exercise than men. Nearly half of older adults (aged  $\geq 60$  years) did not undertake any leisure-time physical activity. The National Nutrition Survey of children aged 5-14 years showed that Maori and Pacific children were significantly more active than other groups in some activities

National survey data shows that sedentary but otherwise healthy adults – who are potentially at risk - are unlikely to get advice on physical activity from their practitioners. Overweight and obese patients are more likely to get advice but evidence from the ‘Push Play’ campaign suggests that intention to exercise is not matched by sustainable change.

### **7.1.4 SMOKING**

Smoking markedly enhances cardiovascular disease (CVD) risk especially in those with diabetes. Stopping smoking is at least as effective in reducing CVD risk as reducing other diabetes indicators – reducing cholesterol, controlling blood pressure and glycaemia. National surveys indicate the prevalence of smoking has steadily decreased over the 25 years, 1982-2003. Approximately 25% are current smokers and a quarter report being an ex-smoker. Smoking is strongly correlated with

socioeconomic status. Approximately half of the adult Maori population smoke and young Maori women have the highest rate.

### **7.1.5 HYPERTENSION**

Hypertension is not a risk factor for development of diabetes, but it is one of the complications of diabetes. Over the 25 year period, 1982-2003, mean blood pressure (diastolic and systolic) levels in the general population reduced, as did the proportion of those with poor blood pressure control. Maori, Pacific and some Asian groups have higher mean blood pressure levels than European/Pakeha, even after adjusting for BMI. Notably these groups are three times less likely to have their hypertension treated than European/Pakeha.

## **7.2 Diabetes**

### **7.2.1 DIAGNOSED DIABETES**

Studies have reported variable rates of prevalence. Partly this can be explained by the different study designs and sampling. However there is consistent evidence to indicate that Maori and Pacific populations have a higher prevalence than European/Pakeha.

Several studies in the early 1990s examined prevalence in South Auckland suburbs, which have a high proportion of Maori and Pacific people. These indicated a prevalence of more than 20% in Maori and Pacific adults older than 40 years of age. Another study found a lower age adjusted prevalence of 11% in Maori, however more than a third of those screened (37%) were found to have insulin resistance, a precursor to diabetes. Diabetes diagnosis before the age of 30 is increasing; and the proportion of adolescents with Type 2 diabetes is rising sharply – a three to six fold increase during 1997-2002. The majority of patients diagnosed with diabetes have a positive family history and a high BMI, kidney affection and retinopathy.

## **7.2.2 UNDIAGNOSED DIABETES**

Similarly studies beginning with the 1984 Skellerup study have reported variable estimates of the prevalence of undiagnosed diabetes. The same pattern of greater estimated prevalence in Maori, Pacific and some Asian groups than European/Pakeha is evident. Prevalence ranges from 4-10.5% for Maori, and 3.5-14% for Pacific, and less than 1% for European/Pakeha. In addition, Maori and Pacific are likely to have higher rates of impaired glucose tolerance, a precursor of diabetes. There is evidence that 20% of patients referred by their general practitioners for OGTT will be diagnosed with diabetes. Of concern is that where population screening is offered, there is a low uptake of screening (34%) in groups potentially at risk

## **7.2.3 GESTATIONAL DIABETES**

There is clear universal agreement over the need to screen for gestational diabetes mellitus (GDM). There is evidence that Maori and Pacific populations are likely to be under-screened despite their higher rates of prevalence of GDM (e.g. Maori/Pacific 8% vs 3% European/Pakeha). Peri-natal mortality is higher in those diagnosed with Type 2 diabetes and/or GDM.

## **7.3 DISEASE MONITORING AND CONTROL**

Evidence for disease monitoring comes from the 'Get Checked' programme, the Counties Manukau District Health Board chronic care management plan (CCM) and general practice audits organised by the Diabetes Care Support Service (DCSS). The latter audits can be traced from 1995 through to 2002.

Taken together the evidence suggests that Maori, Pacific and Asian populations are less likely to be screened regularly for potential prevention of diabetes related complications. Maori uptake of the 'Get Checked' programme which provides free annual checks for people with diabetes to improve diabetes management and

outcomes was significantly lower than European/Pakeha. Maori who did participate had higher glycated haemoglobin.

Evidence suggests that Maori and Pacific patients with Type 2 diabetes show poorer control on all aspects of management of the disease (hyperglycaemia, microalbuminuria). Audit data show that Maori and Pacific patients data were less likely to be completed. There is some evidence for poor control in some Asian groups– especially Indian patients.

## **7.4 COMPLICATIONS**

People living with Type 2 diabetes frequently experience a range of diabetes-related complications which are associated with significant morbidity and mortality.

Complications include cardiovascular disease, renal complications, and eye and leg complications.

### **7.4.1 Cardiovascular Disease (CVD)**

CVD is the main cause of death (approx 50%) in Type 2 diabetes. It is 2-4 folds more frequent than in those with normal glycaemic levels. The New Zealand Guidelines Group recommends tight control of blood pressure for diabetics and antihypertensive medication is recommended frequently. Maori and Pacific people are less likely to take anti-hypertensive medication and have a significantly higher incidence of heart attack.

### **7.4.2 Renal Complications**

Chronic renal disease is the second most likely cause of morbidity and mortality in those living with Type 2 diabetes. Type 2 diabetes accounts for more than a third of primary renal disease in new patients. There is evidence that the 2-year integrated survival for those with diabetic nephropathy is around 50 percent and this is halved for 5-year survival. Compared to European/Pakeha, Maori and Pacific patients with diabetes are at greater risk of renal complications and have a significantly higher

prevalence of high albumin:creatinine. Diabetic nephropathy is estimated to be responsible for at least NZ\$36 million in direct annual healthcare costs.

### **7.4.3 Eye and Leg Complications**

Eye and leg complications are frequent in uncontrolled or advanced diabetes and are a significant cause of hospitalisation and/or surgical interventions. Maori and Pacific have higher rates of eye complications than European/Pakeha. They have higher rates of both diabetes-related surgery and cataracts.

Leg and foot complications include gangrene, cellulites, ulcers and 'diabetic feet'.

Leg complications are a significant cost to the New Zealand Health system.

Middlemore Hospital, within CMDHB, estimated an annual cost of \$612,517 for management costs for 49 patients (i.e. \$12,500 per patient). There appear to be few ethnic differences in the prevalence of self reported leg complications or hospital admissions.

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