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The impact of diabetes on the health of Queenslanders

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INSIDE

SUMMARY

- An estimated 7.0% of adults in Queensland have diabetes based on blood glucose levels.
- The rates among males (7.0%) and females (6.9%) are similar.
- An additional 16.1% of males and 18.0% of females have Impaired Glucose Tolerance (IGT) – a condition highly predictive of subsequent development of type 2 diabetes.
- Rates of self-reported diabetes have increased dramatically in the past two decades. Similar increases are reported in other industrialised countries.
- Overweight and obesity are major contributing factors in the development of diabetes and IGT. The prevalence of diabetes is 4 times higher among obese individuals compared with normal weight individuals.
- Recent large lifestyle intervention clinical trials (low fat diet and increased physical activity) in several countries have shown a reduced risk of progression to diabetes in persons with IGT.
- The hospital separation rate for diabetes as either principal diagnosis or as a secondary condition with a diabetes-related principal diagnosis increased from 691.9 per 100,000 persons in 1995/96 to 871.6 per 100,000 persons in 2000/01, a 26% increase.
- Mortality rates for diabetes as principal cause of death have increased by 2.6% per year between 1986 and 2000, from 11.1 per 100,000 persons in 1986 to 14.7 per 100,000 persons in 2000.
- Mortality rates increased with age during 1997 to 2000, with males having higher rates than females at all ages.

- The hospital separation ratio for areas with the highest proportions of people identified as Indigenous was four times higher than areas with the lowest proportion identifying as Indigenous during 1999/00 and 2000/01.

- The mortality ratio in areas where more than 40% of residents were Indigenous was six-and-a-half times higher than in areas with less than 5% Indigenous population.

- Hospital separation and mortality ratios for diabetes in 'Very Remote' areas were significantly higher compared to other areas. These findings largely reflect the impact of the high proportion of Indigenous people living in remote areas.

- Hospital separation and mortality ratios were highest in the most socially disadvantaged areas.

- Hospital separation and mortality ratios were also highest in males compared to females.

- The total cost of diabetes mellitus to the Queensland health system was estimated to be $163.8 million in 1999/2000.

INTRODUCTION

Diabetes is an endocrine disorder characterised by elevated levels of glucose in the blood due to the absence (type 1) or limited availability (type 2) of insulin. Type 1 diabetes usually has an acute onset generally during childhood or adolescence. The more prevalent type 2 diabetes is often associated with obesity, tends to have an insidious onset later in life[1] and is responsible for most of the burden of disease attributable to diabetes. Gestational diabetes is defined as glucose intolerance of various degrees of severity first recognised during pregnancy.

Diabetes mellitus is a major cause of chronic disability and premature death in Australia. In Queensland in 1996 to 1998, diabetes was the 8th leading cause of mortality, directly responsible for an annual average of 526 deaths (2.4% of all deaths), 5332 years of life lost (2.2% of all years of life lost), and 8084 years lost due to disability (3.8 % of all years lost due to disability)[i] (see Appendix for further discussion on Burden of Disease.

Common diabetes symptoms (frequent urination, excess thirst, unexplained weight loss, frequent skin infections) can go unrecognised, resulting in under diagnoses[2].

Complications frequently accompany the disease and depend on the duration and severity of the condition. These complications include among others: cardiovascular disease, cerebrovascular disease, cataract, blindness, diabetic foot, kidney disease, sensory loss, impotence and bladder dysfunction[3]. Some of these complications are preventable through early detection and management programs, particularly renal disease[4-8] and eye disease[9-18].

The recognised risk factors for diabetes are age over 40 years, obesity, family history of adult-onset diabetes, current high blood pressure, low level of physical activity, dietary factors, regular smoking and high alcohol intake[2,3].

Diagnostic criteria established in 1985[19] included "the presence of symptoms and a fasting plasma glucose (FPG) of at least 7.8mmol/L or 2-hour post-prandial plasma glucose of at least 11.1mmol/L". Since 1997, however, the new diagnostic criteria adopted in European countries and Australia lowered the threshold for FPG to 7.0mmol/L[20] and ignored the post-prandial glucose level. The obvious implication is an "increase" in incidence and prevalence (up to 13.2%)[21] as more people previously diagnosed as having impaired glucose tolerance may now be classified as having diabetes.

Impaired Glucose Tolerance (IGT) is defined as a state between normal glucose metabolism and diabetes diagnosed by fasting plasma glucose levels between 6.1mmol/L and 7.0 mmol/L. Persons with IGT are at high risk of developing type 2 diabetes[23] and also have a substantially increased immediate risk of heart disease[24].

This information circular describes the prevalence (measured and self-reported), hospital morbidity and mortality attributable to diabetes, and estimates the cost to the health system in Queensland. Details on the methodology are provided in the Appendix.

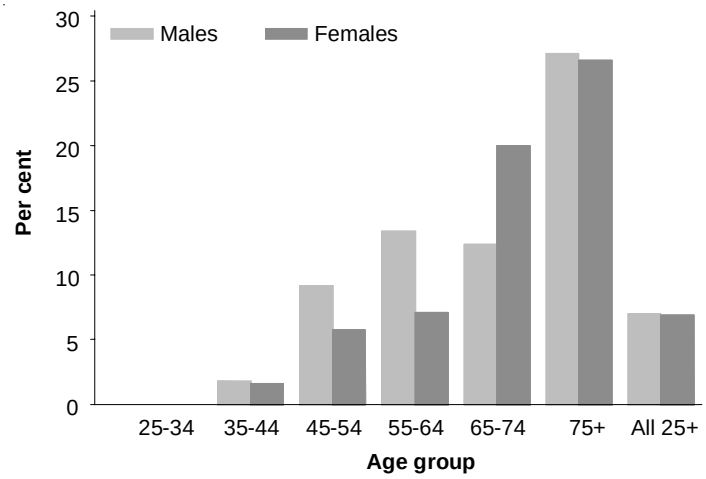
[i] Years of life lost or YLLs is based on the annual average of 1996 to 1998 data. Years lost due to disability or YLDs was estimated based on a proportion of YLDs for Australia in 1996. Note: When other conditions attributable to diabetes were analysed for Australia (such as ischaemic heart disease and stroke), it was found that diabetes was responsible for 4.9% of total years lost due to disability or DALYs in 1996[22].

DIABETES PREVALENCE

Prevalence by Age and Sex

Prevalence data based on blood glucose levels have only recently become available for Queensland through the AusDiab study. Figure 1 provides the prevalence of diabetes by age and sex for adults who participated in the Queensland AusDiab study. The data indicate that the overall prevalence is 7.0%, that diabetes increases dramatically with age and is similar among males (7.0%) and females (6.9%).

Figure 1: Diabetes prevalence by age and sex based on blood glucose levels - Queensland 2000



Data Source: The Australian Diabetes, Obesity and Lifestyle Study (AUSDIAB)

The AusDiab study also reported that 17% of adults (16% of males and 18% of females) suffer some form of impaired glucose metabolism, either impaired glucose tolerance (IGT) or impaired fasting glycemia (IFG). These rates are particularly alarming because both IGT and IFG have been found to be highly predictive of subsequent development of type 2 diabetes[25] and are also considered important risk factors for cardiovascular disease[26].

The data collected in the AusDiab study may need to be interpreted with caution due to the low response rate. Approximately 30% of the estimated number of adults who were eligible for the study participated in the examination. There may be an under estimation of the true prevalence of diabetes due to methodological considerations as discussed in the Appendix.

Reports from many industrialised countries suggest that diabetes has increased substantially over the past few decades. Table 1 provides the prevalence of diabetes based on self-reported data from face to face surveys in Australia from 1980 through 2000. These figures reveal a dramatic rise in the proportion of people who reported that they had been told by a doctor or nurse that they had diabetes. This finding may be due to an increase in awareness of diabetes in the community and also by an increase in screening levels. However, this probably also partly reflects an increase in the incidence of diabetes over the past two decades.

The recent self-reported prevalence in the AusDiab home interview survey, 2000 (Table 1) is higher than that in the AusDiab study which was based on blood glucose levels. This discrepancy may be due to: (a) an under estimation of diabetes prevalence in the AusDiab study based on blood glucose levels, (b) an increase in awareness of diabetes in the community and increase in screening by general practitioners, and/or (c) individuals who have IGT reporting that they had been told they have diabetes (or high blood sugar).

Table 1: Prevalence of diabetes in Australia and Queensland based on face to face self-reported survey data (1983-2000)

YEAR	Survey	Population in sample	Sample size (total)	Prevalence (%) Females	Prevalence (%) Males
1980	National Heart Foundation * (NHF, 1980)[27]	Capital cities, Australia	8375	1.4	1.4
1983	National Heart Foundation † (NHF, 1983)[28]	Capital cities, Australia	7615	1.8	2.0
1989	National Heart Foundation † (NHF, 1990)[29]	Capital cities, Australia	9279	2.1	2.3
1995	National Health Survey Qld ‡ (ABS, 1995)[30]	Queensland	4120	6.5	4.5
2000	AusDiab - home interviews Queensland § (Dunstan et al, 2001)[31]	Queensland six urban centres	3294	11.4	9.0

Based on the response to questions:

* *Have you ever been told you have any of the following*: (diabetes listed as one of 7 conditions).
† *Have you ever been given advice or treatment for diabetes or sugar trouble?*
‡ *Have you ever been told by a doctor or nurse that you have diabetes (or high sugar levels in your blood or urine)?*
§ *Have you ever been told by a doctor or nurse that you have diabetes (or high blood sugar)?*

A population telephone survey of Queenslanders aged 18 years and over conducted in 2000[32], revealed that 6.0% had been told they were diabetic and an additional 3.4% had been told they had high blood sugar or a "touch of sugar". These self-reported telephone survey rates are similar to those self-reported among those in the face-to-face AusDiab home interviews, but higher than the prevalence measured by blood tests. The higher rates reported in the 2000-telephone survey may well have included people with IGT who report a "touch of sugar".

In another telephone survey of 1,030 people who said they had the condition confirmed with a blood test, 5% were type I diabetes, 85% were type 2, and 10% had had gestational diabetes mellitus[33].

A 1998 telephone survey conducted in Queensland revealed that knowledge about diabetes was suboptimal, with only 63.4% of women and 55.4% of men able to describe the disease and its complications[34].

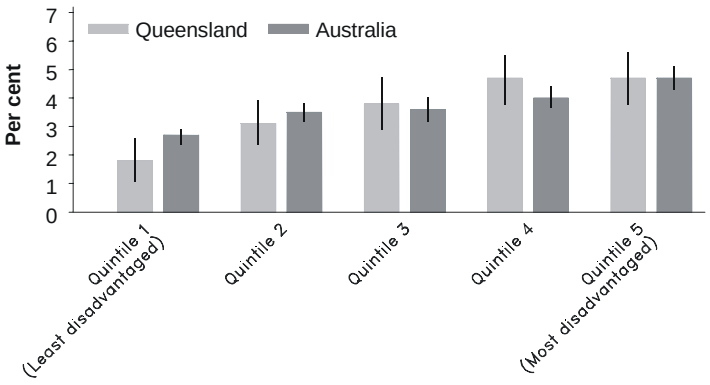
Gestational Diabetes

In 1999 3.6% of pregnant mothers in Queensland had gestational diabetes, and 0.4% had pre-existing diabetes. When neonatal morbidity was examined in the same year 0.5% of Queensland babies had 'syndrome of infant of mother with diabetes'. Gestational diabetes is a known predictor of type 2 diabetes in later life[35] and may be an early manifestation of the metabolic (insulin resistance) syndrome[36]. Since most women have repeated contact with the health care system during pregnancy, there are opportunities for screening, treatment and education geared at preventing the subsequent development of type 2 diabetes[36].

Socio-economic Status

Self-reported prevalence from the 1995 National Health Survey (NHS)[30,37] indicated that diabetes is more common in the most disadvantaged groups in the population (Figure 2). This could be an underestimate as people in lower socio-economic groups may be less aware of their diabetes status due to lower level of education, and they may have limited access to diagnostic health services. The 1998 Queensland telephone survey found that those who were the most disadvantaged were less likely (55%) to know about their disease than those least disadvantaged (65.8%). This means that the prevalence of self-reported diabetes amongst people living in the most disadvantaged areas may be under-reported, and therefore the socio-economic differential may be more than what is reported.

Figure 2: Percentage of population reported to have diabetes in Queensland and Australia in 1995 by socioeconomic disadvantage



Data Source: 1995 National Health Survey
Note: Measure of socioeconomic disadvantage is based on Socioeconomic Indexes for Areas (SEIFA)

Indigenous Communities

During the 1980s, the prevalence of both diabetes and (IGT) based on blood glucose levels was reported to be higher in Aboriginal populations[38]. The prevalence of diabetes reported in Indigenous communities as measured by blood glucose levels is shown in Table 2. Although most of these studies used the 1985 WHO[19] classification of diabetes, estimates are not directly comparable because different methodologies were used. Several states provided a range for overall prevalence, other studies provided rates for males and females separately.

Table 2: Prevalence of diabetes in Indigenous communities in Australia[38] and Queensland[39] by locality

YEAR	State or Locality	Prevalence (%) Persons	Prevalence (%) Females	Prevalence (%) Males
Published data in 1986, 1987	New South Wales	7.8 - 15.6		
Published data in 1992	Victoria		7.2	8.8
Published data in 1989, 1991	Central Australia (NT)	9.1 - 16.5		
Published in 1979, 1982	Western Australia		2.8 - 19	6.5 - 15
1998 - 2001	Cape York - Qld	14		
1998 - 2001	Mt Isa - Qld	21		
1998 - 2001	Torres Strait - Qld	22		

The estimates from Queensland communities are derived from screening studies measuring fasting blood glucose among 2,200 people aged 15 years or more living in 12 remote communities using comparable methodology but with response rates ranging from 51% to 92%[39].

There is also strong evidence, indicating that diabetes type 2 occurs at a younger age in Indigenous peoples than in the non Indigenous population[40].

In addition to inappropriate diet and physical inactivity, social, cultural and economic issues can contribute to the higher prevalence of diabetes in Indigenous groups. For instance, healthy nutritional choices can be seriously limited by low incomes and remoteness which affect the quality, variety and cost of fresh food, especially among the Aboriginal and Torres Strait Islanders populations[40].

Other social factors influencing the pathways affecting the health of Aboriginal and Torres Strait Islander peoples are education, quality of housing, food preparation and storage areas, community cohesion, perceived level of control over one's life and discriminatory practices[41].

RISK FACTORS FOR DIABETES

Although some risk factors for diabetes such as age, sex, family history and genetic susceptibility are unable to be altered, there are many risk factors that can be modified. These modifiable risk factors contribute a large component of the death and disability associated with diabetes and include overweight and obesity, current high blood pressure, poor diet, physical inactivity, cigarette smoking and alcohol intake.

Overweight and Obesity

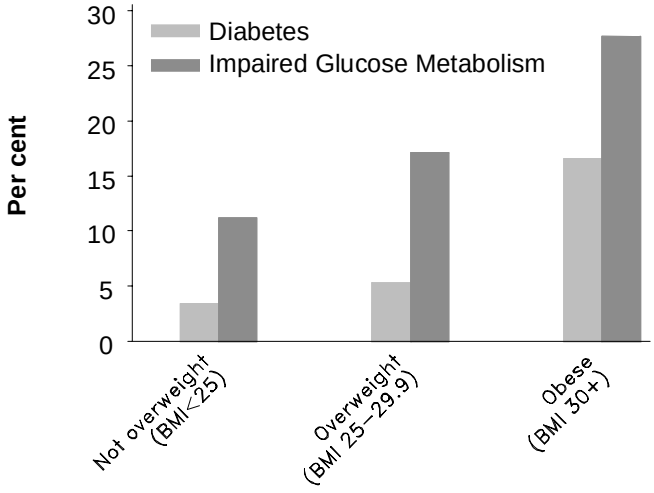
Overweight and obesity are considered the most significant contributing factors to the escalating prevalence of diabetes in most developed countries of the world today.

The prevalence of overweight and obesity is increasing rapidly in Australia[42]. From 1983 to 1995, the mean BMI increased from 25.5 to 27.2 for men, and from 24.3 to 26.8 for women aged 25–64[43,44], and the proportion of the population classified as obese doubled from 9% to 18%[45]. In Queensland, the estimated proportion of overweight or obese females has increased from 46% in 1995[46] to 51% in 2000[31], while the proportion of overweight or obese males, although considerably higher than for females has remained relatively stable (67% in 1995 and 66% in 2000).

Of considerable concern is the escalating prevalence of overweight and obesity among Australian children. Recent reports from several large surveys indicate that 19 to 24% of Australian school-age children are either overweight or obese and these figures have more than doubled in the 12 to 14 year age group between 1985 to 1995[47].

Based on the Queensland AusDiab study (Figure 3), the prevalence of diabetes is almost twice as high in those individuals classified as overweight and four times as high among those classified as obese compared with those with a BMI less than 25. The prevalence of impaired glucose metabolism is also approximately twice as high among overweight and obese adults compared with persons with Body Mass Index (BMI) in acceptable ranges[31].

Figure 3: Prevalence of diabetes and impaired glucose metabolism by weight status* - Queensland 2000



Data Source: Health Information Centre

* Weight status classified by Body Mass Index (BMI kg/m^2)

Given the scope of the obesity problem and the need to institute appropriate prevention strategies, a regular systematic monitoring and surveillance program needs to be implemented. This would determine the rates and trends of overweight and obesity among both children and adults in Queensland.

Dietary Factors

Both ecologic and migrant studies suggest a role of environmental factors, including diet, in the aetiology of type 2 diabetes[48,49].

A recently reported study of 42,504 male health professionals in the United States[50] evaluated the role of total diet in the development of type 2 diabetes. This long-term prospective cohort study found a reduced risk of diabetes (RR 0.84; CI 0.70 – 1.00) among males who reported the highest quintile prudent diet score (characterised by high consumption of vegetables, legumes, fruit, whole grains, fish and poultry) compared with the lowest quintile. Those in the highest quintile western diet score (characterised by high consumption of red meat, processed meat, refined grains, French fries, high fat dairy products, sweets and desserts, high sugar drinks and eggs) had higher risk of developing diabetes (RR 1.59; CI 1.32 – 1.93) compared with those in the lowest quintile western diet score. The most dramatic increase in risk was among those who reported both a high western diet score and obesity — a remarkable 11 times the risk of developing diabetes. (RR 11.2, CI 8.07 – 15.6). Care needs to be taken in interpreting these findings in the Australian context, because studies based on male health professionals in the US may not be generalizable to the Australian population.

In Australia in 1995, reported total fat intake contributed approximately 33% of total energy in the diet[46]. Although this proportion has decreased (by 6% for males and 4% for females) since 1983[51] this consumption is still relatively high by world standards. The contribution from saturated fat in 1995 was approximately 12.5% of energy for adults. Recent guidelines[52] recommend a reduction of total fat intake to 20 to 25% of energy for anyone overweight and a population intake of not more than 10% of energy from saturated or trans fatty acid intake.

Although there is a reported decrease in the proportion of total fat in the Australian diet from 1983 to 1995, total energy has increased by 3% and 4% in males and females respectively, and carbohydrate has increased by 17% and 16% in males and females respectively[44]. This increase in total energy and carbohydrate is even more striking in children. Total energy increased by 15% among adolescent boys and 11% among girls. Reported carbohydrate increased by 22% and 18% among boy and girls respectively. When examined by food groups, the increased energy and carbohydrate intake was mainly due to increased consumption of cereal-based foods (including cakes, biscuits, pies, pizza and some desserts), confectionary and sugar-sweetened drinks[44].

Recent large intervention trials conducted in China[53], New Zealand[54], Finland[55], Sweden[56] and most recently, the Diabetes Prevention Program in the United States[57] have shown that lifestyle interventions (diet and exercise) can be effective in preventing type 2 diabetes in persons with IGT. These studies which focused on a lower fat diet and increased physical activity have shown a reduced risk of developing diabetes by 31% to 58%. In the US trial, lifestyle interventions were more effective in reducing the onset of diabetes than metformin (a hypoglycaemic drug to treat maturity onset diabetes when not controlled by diet).

Physical Inactivity

Several studies have shown that physical activity plays a protective role against the development of diabetes[58,59,60]. Analysis of the Queensland AusDiab study[31] found that 39.7% of people who had been newly diagnosed with diabetes or who had IGT/IFG engaged in sufficient levels of physical activity. This compares with 53.1% of people with normal glucose levels. Also, more people with known diabetes (34.8%), or newly diagnosed diabetes/IGT/IFG (25.8%) reported sedentary levels of physical activity than those with normal glucose levels (17.4%). However, these differences were not statistically significant.

The 1999 National Physical Activity Survey[61] reported that less than half of Australian adults get sufficient physical activity to confer a health benefit and that this proportion has declined since 1997. Both men and women have followed this trend, with the greatest decline observed among those aged 30-44 years. The report estimated that sufficient levels of physical activity could potentially prevent 30-50% of new cases of type 2 diabetes in Australia[61].

Metabolic Syndrome

Metabolic syndrome, also referred to as Syndrome X, is a cluster of conditions occurring in the same individual[62]. Although there is no universally accepted definition of the syndrome, it is generally agreed that the combination includes:

- Obesity (particularly central obesity)
- Insulin resistance (abnormal glucose tolerance)
- Abnormal lipids (elevated triglycerides or low HDL cholesterol)
- High blood pressure.

These factors in combination signal a very high risk for diabetes and ischaemic heart disease for the individual.

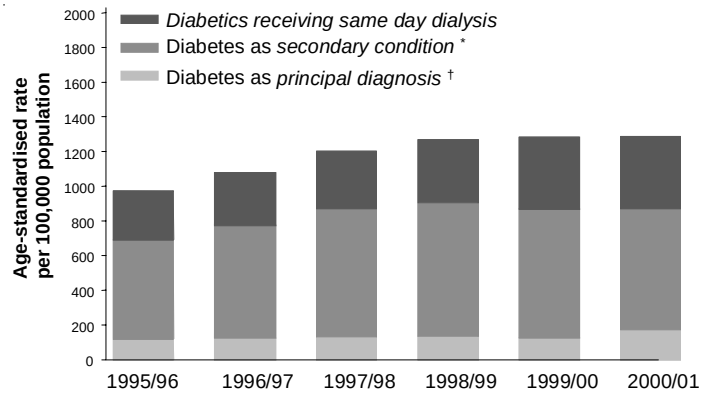
At present there are no reports on the prevalence of the Metabolic Syndrome in Queensland or in Australia. Current data from the AusDiab study suggests that the prevalence may be significant, given the high rates of each of the above conditions in the populations studied.

THE IMPACT OF DIABETES ON HOSPITAL MORBIDITY

Trends over time

Figure 4 shows trends over time for the total impact of diabetes on hospital morbidity indicating the cumulative effect of diabetes as *principal diagnosis*, as a *secondary condition* (with a diabetes-related principal condition) and for *diabetics receiving same day dialysis*.

Figure 4: Age-standardised hospital separation rates for diabetes in Queensland between 1995/96 and 2000/01



Data Source: Queensland Hospital Admitted Patient Data Collection

*Also, where a known diabetes-related condition is the principal diagnosis, and same day dialysis has been excluded.

† Same day dialysis has been excluded.

Total hospital separation rates due to diabetes increased between 1995/96 and 2000/01 from 972.8 per 100,000 persons to 1287.4 per 100,000 persons.

Most of the observed increases in total hospital morbidity among patients with diabetes over the six-year period were due to the increasing hospital separation rates for *same day dialysis* and for diabetes as a *secondary condition.*

The rates for diabetes as *principal diagnosis* remained fairly stable between 1995/96 to 1999/00, and then increased significantly in 2000/01. For diabetes as a *secondary condition* the hospital separation rate increased between 1995/96 to 1997/98, and then remained fairly stable over the next two years, to decline significantly in 2000/01.

The differences noted between 1999/00 and 2000/01 can be explained by changes in coding practices for diabetes and diabetes-related complications.

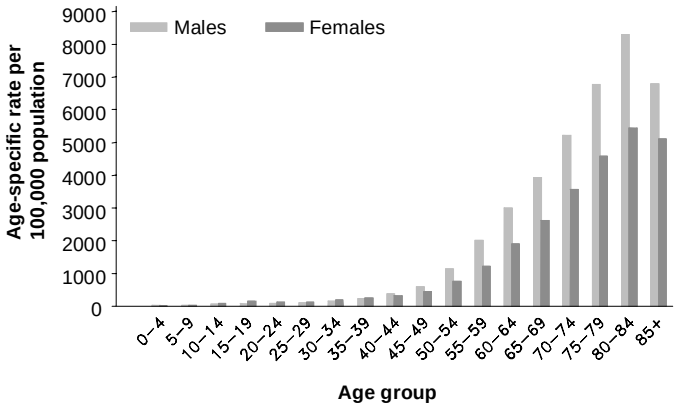
The separation rate for diabetes as *principal diagnosis* or *secondary condition* increased from 691.9 per 100,000 persons in 1995/96 to 871.6 per 100,000 persons in 2000/01. In each year, the rates for *secondary condition* were three to four times higher than the rate observed for diabetes as *principal diagnosis* only, suggesting that the majority of hospitalisations were for complications associated with diabetes.

There are several possible explanations for these observed increases. (1) There has been a true increase in the incidence of disease. National surveys report an increase in self-reported prevalence over time[63] and the laboratory testing from the recent AUSDIAB Study appears to support this[24]. (2) The increase in separation rates may be due to a reduced fasting glucose level criteria for diagnosis, resulting in increasing numbers of people being diagnosed. (3) Coding practices for diabetes may have improved over time[20]. (4) Patients may be experiencing a longer duration of the disease resulting in more complications and thus have more frequent admissions to hospital. (5) There may be changes in admission and readmission policy for people with diabetes, with doctors perhaps being more cautious by admitting patients with diabetes more frequently.

Age-sex Specific Rates

Figure 5 shows average age-specific hospital separation rates for diabetes as *principal diagnosis* or *secondary condition* by sex for 1999/00 and 2000/01. This shows that rates increased with increasing age up until 80-84 years and that from ages 40-44 years men were more likely than women to be admitted to hospital with diabetes as *principal diagnosis* or *secondary condition*. Differential hospital separation rates for males and females may possibly reflect a higher prevalence or higher rates of re-admission among men, or earlier detection and better self-management among women.

Figure 5: Average annual age-specific hospital separation rates for diabetes, by sex - Queensland, 1999/00 - 2000/01



Data Source: Queensland Hospital Admitted Patient Data Collection
Note: Diabetes as either principal diagnosis or secondary condition. Same day dialysis has been excluded.

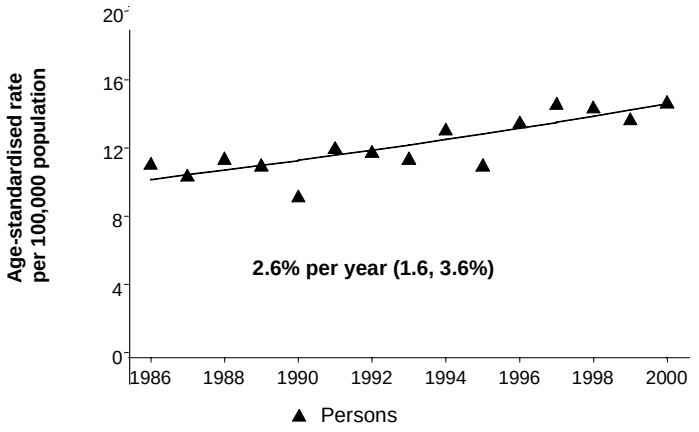
A recent diabetes management survey found that females with diabetes were more likely to have an acceptable knowledge of diabetes, than males with diabetes[64]. Yet, on many other indicators of diabetes management there were no significant sex differentials.

THE IMPACT OF DIABETES ON MORTALITY

Trends over time

Mortality rates for diabetes as principal cause of death have increased by 2.6% per year between 1986 and 2000 as shown in Figure 6.

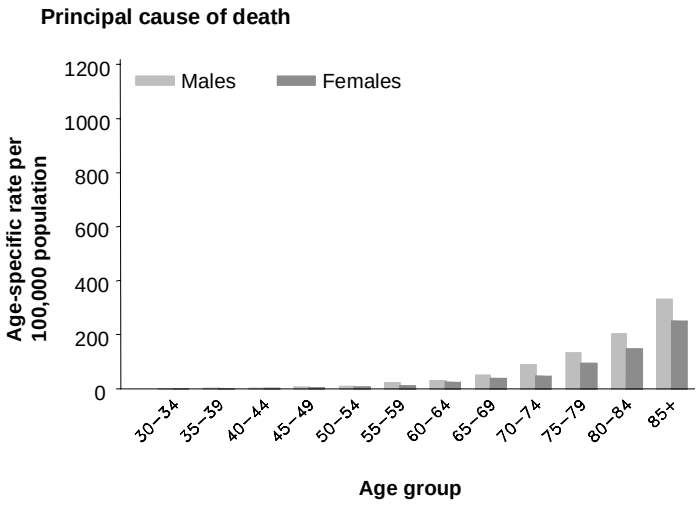
Figure 6: Age standardised mortality rates due to diabetes as principal cause of death - Queensland, 1986 - 2000*



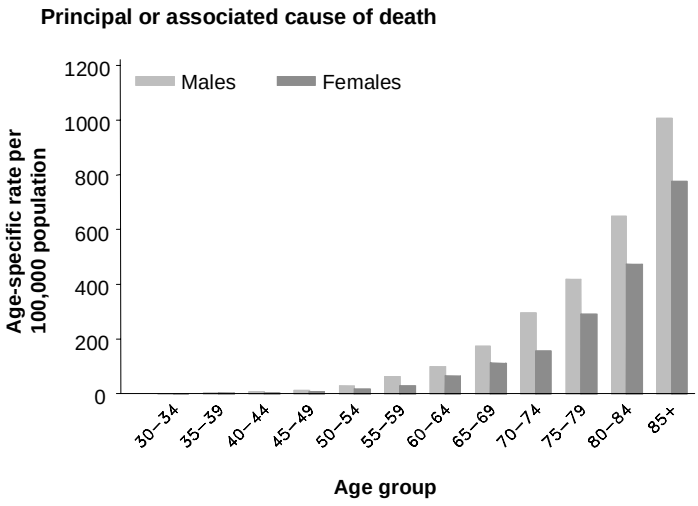
Data Source: ABS Cause of Death
*A comparability factor has been applied to data for 1997 to 2000.

Several potential contributors to explain this growing trend include the increasing prevalence of some risk factors such as an aging population, obesity, physical inactivity, dietary factors, etc, and increased incidence of diabetes complications in the past few years[3]. Given the improvements in detection and treatment available to the population and the increased awareness of the condition the improved reporting of diabetes as a cause of death may partly explain the increase in mortality rates. It is important to note that diabetes related death rates were three times higher when associated cause of death were considered (available only since 1997) (Figure 7)[65].

Figure 7: Average annual age-specific death rates for diabetes, by sex - Queensland, 1997-2000



Data Source: ABS Cause of Death



Data Source: ABS Cause of Death

Age-sex Specific Rates

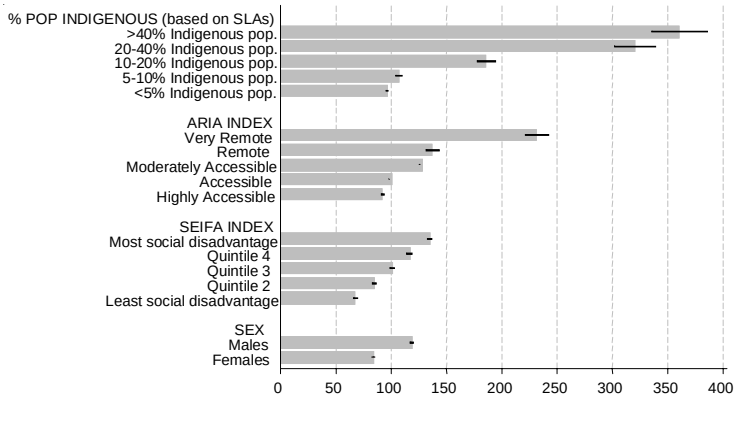
Mortality rates increased with age in the time period between 1997 and 2000, and the rates for males were higher than for females at all ages (Figure 7). The difference in mortality rates for diabetes as a principal or an associated cause of death between males and females increased as age increased from 55-59 years. The number of diabetes deaths among people aged less than 30 years were negligible (not represented in the graph).

THE IMPACT OF DIABETES ON POPULATION GROUPS

Indigenous People

While the identification of Indigenous people in hospital separation and mortality data has improved over the past decade it is still not complete. Therefore, an alternative measure of the impact of diabetes on the Indigenous population is to measure hospital separation and mortality ratios by the percentage of the population identified as Indigenous in a particular geographic area (based on Statistical Local Areas (SLAs)). The hospital separation ratio for areas with the highest proportions of people who identified as Indigenous (Figure 8) was four times higher than areas with the lowest proportion identifying as Indigenous during 1999/00 and 2000/01. This pattern was also found for mortality due to diabetes as the underlying or an associated cause of death between 1998 and 2000 (Figure 9). The mortality ratio in areas where more than 40% of residents were Indigenous was six-and-a-half times higher than in areas with less than 5% Indigenous population.

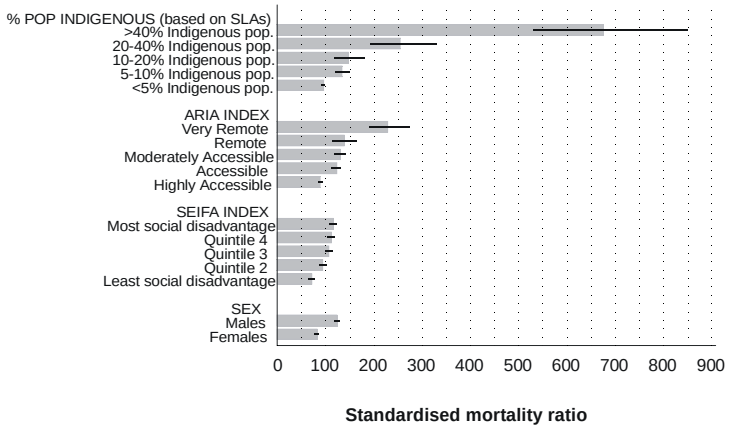
Figure 8: Standardised hospital separation ratios for diabetes by selected population groups - Queensland, 1999/00 and 2000/01



Data Source: Queensland Hospital Admitted Patient Data Collection

Note: Diabetes as either principal diagnosis, or as secondary condition for known diabetes-related condition. Same day dialysis has been excluded.

Figure 9: Standardised mortality ratios for diabetes by selected population groups - Queensland, 1998-2000

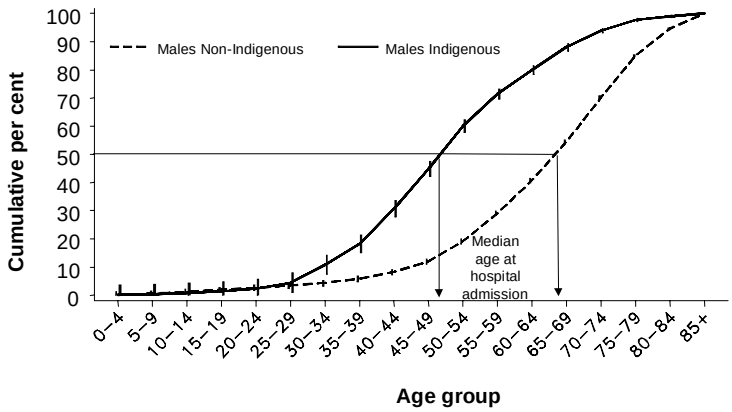


Data Source: ABS Cause of Death

Note: Diabetes as either principal or associated cause of death.

When diabetes was examined as *principal diagnosis* or *secondary condition,* Indigenous patients admitted to hospital tended to be younger than non-Indigenous patients. The median age at hospital admission for Indigenous males was 51 years, compared to a corresponding figure of 68 years for non-Indigenous males (Figure 10).

Figure 10: Queensland Hospital Admissions, cumulative percentage age at admission for diabetes by Indigenous and non-Indigenous status, for males (1998/99 to 2000/01)

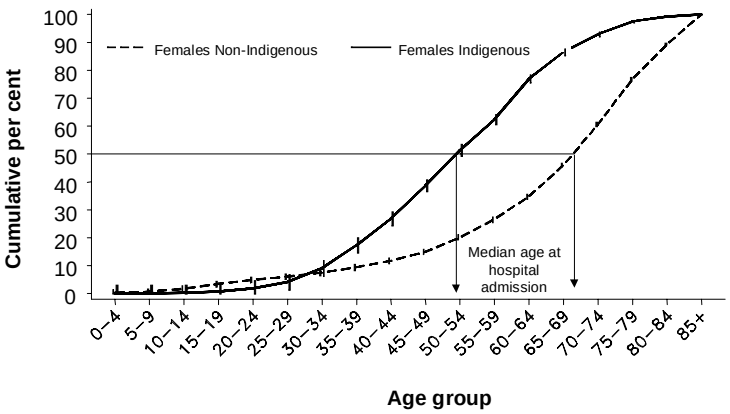


Data Source: Queensland Hospital Admitted Patient Data Collection

Note: Diabetes as either principal diagnosis, or as secondary condition for known diabetes-related condition.

Likewise, Indigenous females tend to be admitted to hospital at younger ages than their non Indigenous counterparts: the median age at hospital admission for Indigenous females was 54 years compared to 71 years for non-Indigenous females (Figure 11).

Figure 11: Queensland Hospital Admissions, cumulative percentage age at admission for diabetes by Indigenous and non-Indigenous status, for females (1998/99 to 2000/01)



Data Source: Queensland Hospital Admitted Patient Data Collection

Note: Diabetes as either principal diagnosis, or as secondary condition for known diabetes-related condition.

Urban/rural Differences

Standardised hospital separation and mortality ratios for diabetes in 'Very Remote' areas were significantly higher compared to other areas (Figure 8 and 9). For example, the hospital separation ratio in 'Very Remote' areas was two times the ratio for 'Highly Accessible' areas for diabetes as *principal diagnosis* or *secondary condition*. Again, these findings largely reflect the impact of the high proportion of Indigenous people living in remote areas (28.9% in 'Very Remote' areas versus 1.4% in 'Highly Accessible' areas).

Socioeconomic Status

Hospital separation and mortality ratios were also higher in the most disadvantaged groups (Figures 8 and 9). The hospital separation ratio for diabetes in the most socially disadvantaged areas was twice that in the least socially disadvantaged areas.

Male/female Differences

The hospital separation ratio for diabetes as *principal diagnosis* or *secondary condition* for males was significantly higher than for females (Figure 8). Similarly, the mortality ratio for diabetes as the underlying or associated cause of death was significantly higher for males compared to females (Figure 9).

THE COSTS OF DIABETES

Costs to the Health System

At a national level, the total cost of diabetes mellitus to the health system (including costs of hospitals, medical costs, pharmaceuticals, allied health services and research costs) has been estimated to be $881 million in 1999/2000. Assuming equal cost per population, the cost of diabetes to the Queensland health system was estimated to be $163.8 million (see Appendix on cost of diabetes to the health system).

Based on Queensland estimates of the use of health services from the 1995 NHS[30] persons with self-reported diabetes were more likely (38.4%) than those without diabetes (21.4%) to have visited a GP in the past 2 weeks ($p<0.0001$). Persons with diabetes (1.7%) were also twice as likely as those without (0.8%) to have been admitted to hospital for at least one night ($p<0.0001$) in the previous two weeks. Those without diabetes were 4 times more likely (7%) than those with diabetes (1.8%) to have visited an emergency department ($p<0.0001$)[30].

Costs to the Community

In addition to health costs, diabetes is also a source of cost in terms of loss of life and loss of productivity in the community. Diabetes (as principal and secondary cause of death) was responsible for 15,225 potential years of life lost in 1997-1998 in Queensland[66].

Queensland adults aged 20-29 and 60-69 years with diabetes were 4 and 3 times (respectively) more likely to have reported days of reduced activity (time off work/study) than those without diabetes in the same age group[30].

One measure of the burden of disease is Disability Adjusted Life Years (the sum of years of life lost due to mortality and years lost due to disability) or DALYs. Diabetes was responsible for 3.0% of total DALYs in Queensland during 1996 to 1998. The burden of disease extends further as diabetes is also a risk factor for increased cardiovascular and cerebrovascular diseases[22]. The contribution of type 1 Diabetes to DALYs was very small, and most of the diabetes DALYs are due to type 2 diabetes.

Costs to the Individual

Needless to say, the greatest burden of diabetes is born by the individual with the disease. A person with diabetes faces the ever-increasing burden of higher medical expenses, more frequent medical visits, more

frequent hospitalisations, as well as increased risk of loss of eyesight, lower limb amputation, kidney failure or heart disease. Preventing just one person from one year of dialysis would save the health system over $65,000[67]. However, this is a low estimate of the cost based on DRGs and it does not take into account the costs for overheads, attendant time, equipment and consumables.

CONCLUSION

The above data indicate the urgent need in Queensland to face the dilemma of escalating rates of diabetes and the accompanying life threatening complications. This needs to be addressed on several fronts. First, by initiating, and expanding existing prevention programs to address the increasing problems of obesity (particularly childhood obesity), inappropriate diet, and physical inactivity. Interventions focusing on lifestyle risk factors are a cost effective way of decreasing the mortality and DALYs associated with type 2 diabetes. For example, a recent Australian study found that interventions that result in a weight loss of 5 kg in all Australians who are overweight or obese would reduce the health care costs associated with Type 2 diabetes by $18.6 million per year[68].

Second, there will need to be evidence-based screening and early detection programs in place for the prevention of complications and treatment programs. Third, there also will need to be facilities to manage the increasing prevalence of complications of the disease.

Fourth, there needs to be continued monitoring and research regarding risk factors which are central to the development of the disease, and interventions that target these issues. Also, the over-representation of diabetes in Indigenous people and in the most socially disadvantaged areas needs to be addressed to reduce health inequalities.

APPENDIX

AusDiab Survey

The Queensland phase of the AusDiab was conducted in six randomly selected urban communities between October and December 2000[31]. A total of 1634 adults, aged 25 years and over received study examinations which included fasting blood glucose and 2-hour oral glucose tolerance, blood lipids as well as extensive anthropometric, dietary, and lifestyle information.

It is suggested that the AusDiab data based on blood glucose levels be interpreted with caution. HIC unpublished reports suggest that individuals with type 1 diabetes or those who were aware of their diabetes were less likely to come for the examination and the study population may also have been more health conscious, both of these factors may result in an under estimation of the true prevalence of diabetes.

METHODOLOGY

Calculating the Burden of Disease and Injury in Queensland

Burden of disease is measured in terms of Disability-Adjusted Life Years (DALY), which combine the impacts of fatal and non-fatal health outcomes from incident cases of disease and injury, into a single measure.

One DALY is one lost year of 'healthy' life. DALYs for a disease or health condition are the sum of the years of life lost due to premature death in the population (YLL) and the years lived in a state of ill-health or years of life lost due to disability (YLD).

- Average annual YLL for diabetes were calculated from the 1996-98 ABS deaths data for deaths due to diabetes in Queensland.
- Assuming incidence and prevalence for diabetes was similar for Queensland and Australia, YLD for Queensland were estimated from the 1996 Australian YLD published in the Burden of Disease and Injury in Australia Report[22]. Estimated YLD for Queensland were calculated by multiplying the Australian YLD by the ratio of the Queensland and Australian populations, taking into account differences in the age and sex distribution of the two populations. A detailed explanation of this methodology may be found in the report *Quantifying the burden of disease and injury in Queensland 1996-1998* produced by the Health Information Centre.

Hospital Morbidity

Conventionally, the principal diagnosis has been used in statistical reports of hospital morbidity but it is clear that this produces an underestimate of the burden of diabetes.

For this report, hospital morbidity for diabetes was examined using three approaches:

(1) diabetes as the *principal diagnosis*;
(2) diabetes as a secondary condition with a diabetes-related principal condition;
(3) diabetics receiving same day dialysis.

1. Diabetes as Principal Diagnosis

The following codes were used for diabetes as *principal diagnosis*:

ICD9-CM for pre 1999/2000 :	250 to 25099
ICD10-AM Version 1 for 1999/2000:	E10 to E1499
ICD10-AM Version 2 for 2000/2001:	E10 to E1499

2. Diabetes as a Secondary condition with a diabetes-related principal condition.

Diabetes as *secondary condition* was analysed by selecting all those hospital separations where:

- diabetes was a *secondary condition*; and
- the *principal diagnosis* was one for which diabetes was "known" as a risk factor, such as retinopathy; and
- same day hospital separations where the principal procedure was dialysis were also excluded.

Known diabetes-related conditions used for the pre-1999/2000 data included the following ICD-9-CM codes:

038, 053, 117, 241, 250, 255, 274, 276, 277, 278, 280, 285, 290, 293, 342, 354, 366, 379, 401, 410, 411, 413, 414, 421, 424, 425, 426, 427, 428, 432, 433, 434, 435, 436, 437, 440, 443, 444, 447, 453, 456, 458, 459, 482, 485, 486, 490, 491, 496, 507, 511, 514, 518, 519, 531, 552, 558, 560, 567, 571, 572, 577, 584, 585, 590, 592, 594, 596, 598, 599, 600, 604, 607, 648, 680, 682, 686, 707, 715, 721, 730, 731, 780, 781, 785, 786, 788, 820, 924, 962, 996, 997, 998

Equivalent ICD-10 codes for the above conditions were derived using the South Australian Version of the National Centre for Classification in Health (NCCH) concordance (Version 1 and Version 2 for 1999/00 and 2000/01 data respectively).

3. Diabetics receiving same day dialysis

Although significant numbers of patients receiving dialysis have diabetes, diabetes is significantly under-reported in the hospital separations data collection. For example, for each financial year between 1995/96 and 2000/01 less than 1.0% of hospital separations for same day dialysis were coded as being for diabetics.

The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) 23rd Annual 2000 Report[69] estimated that 17% of same day dialysis was for patients with diabetes. This figure was used to calculate age standardised hospital separation rates for dialysis as a principal procedure for diabetics. Because this calculation was used to estimate dialysis for patients with diabetes, same day dialysis was excluded for diabetes as a *principal diagnosis* or *secondary condition*.

The following principal procedure codes were used for dialysis:

ICD9-CM:	3995, 5498
ICD10-AM Version 1:	1310000 to 1310008
ICD10-AM Version 2:	1310000 to 1310008

Mortality data

1. Changes in mortality coding

The mortality data coded by the ABS has undergone three significant changes in recent years. The first two changes were the change from a manual to an automated coding system which commenced in Australia in 1997, and the introduction of multiple cause coding in the same year. Until 1997, the ABS produced causes of death statistics, according to WHO recommendations where each death was assigned to a single underlying cause. The third change was from the ICD-9 to ICD-10 coding system which commenced in 1999. These changes will impact on time series analysis.

Conventionally, the *principal diagnosis* or cause of death has been used in statistical reports but it is clear that this produces an underestimate of the burden of diabetes. Diabetes as an associated cause of death could not be presented in the time series analysis, as multiple coding was not available until 1997.

The following codes for diabetes were used:

ICD-9: 250 to 2509 (pre-1999)
ICD-10: E10-E14 (for 1999 and 2000)

A comparability factor of 0.94 was applied to data for 1997 to 2000, which meant that mortality rates for diabetes were multiplied by 1.06 (for 1997 to 2000 data). Joinpoint analysis was used to assess trend patterns.

2. Joinpoint analysis

Joinpoint analysis is a statistical method that describes changing trends over successive segments of time and the amount of increase or decrease within each. Joinpoint analysis chooses the best fitting point, called joinpoints, at which the rate of increase or decrease changes significantly.

Age-standardised rates were used in the modelling process. The analysis began with the assumption of constant change over time (ie. no joinpoint). Up to three joinpoints were tested in each model. The final model was the simplest one (ie. the least number of joinpoints) that the data supported.

3. Annual percent change or APC

The APC is the average rate of change per year. The 2.6% per year figure presented in Figure 9 represents the APC for diabetes mortality rates between 1986 to 2000. A negative APC describes a decreasing trend, and a positive APC describes an increasing trend. A trend is said to be statistically significant if the 95% confidence interval does not include 0.

Cost of Diabetes to Health System

The estimation for Australia was based on an AIHW publication[70] examining health system costs of cardiovascular diseases and diabetes. The report cited that the total national cost to the health system[ii] attributable to diabetes mellitus and diabetes-related complications (including costs of hypoglycaemia and hyperinsulinism) was $681.1 million in 1993/94.

A weight was applied to estimate this expenditure for 1999/2000 for Queensland. The weight was based on the ratio of total health services expenditure (constant prices) in 1999/2000 relative to 1993/1994[71]. Thus the following calculation was done:

- $681.1 * 1.294= $881 million 1999/2000 Australia

In 1999/2000 the estimated total cost to the Queensland health system attributable to diabetes and diabetes-related complications equalled the national figure multiplied by 18.59% (18.59% equals the proportion of the Queensland population relative to the Australian population for 1999 and 2000). Thus:

- $163.8 million 1999/2000 Queensland

[ii] Total health system costs include costs of hospitals, medical costs, pharmaceuticals, allied health services and research costs.

REFERENCES

1 Griffiths E, Williams K. Diabetes: a refresher on signs and complications. Community Nurse 1998:24-27

2 Phillips P, Wilson D, Beilby J, et al. Diabetes complications and risk factors in an Australian population: how well are they managed? Int J Epidemiology 1998;27:853-859.

3 Commonwealth Department of Age and Health Care, Australian Institute of Health and Welfare. National Health Priority Areas Report: Diabetes Mellitus. AIHW Cat. No. PHE 10, ISBN 0 64239401 6, Canberra, 1998.

4 Lewis EJ, Hunsicker LG, Bain RP, Rohde R. The effect of angiotensin-coonverting enzyme inhibition on diabetic nephropathy. New Engl J Med 1993;329:1456-1462.

5 Siegel JB, Krolewski AS, Warram JH, Weinstein MO. Cost-effectiveness of screening and early treatment of nephropathy in patients with insulin-dependent diabetes mellitus. J AM Soc Nephrol 1992;3:S111-S119.

6 Ravid M, Savin H, Jutrin I, et al. Long-term stabilizing effect of angiotensin-converting enzyme inhibitor on plasma creatinine and on proteinuria in normotensive type 2 diabetic patients. Ann Intern Med 1993;118:577-581.

7 Borch-Johnsen K, Wenzel H, Viberti GC, Mogensen CE. Is screening and intervention for microalbuminuria worthwhile in patients with insulin dependent diabetes? BMJ 1993;306:1722-1725.

8 Kiberd BA, Jindal KK. Screening to prevent renal failure in insulin dependent diabetic patients: an economic evaluation. BMJ 1995;311:1595-1599.

9 Savoleinen EA, Lee QP. Diabetic retinopathy: need and demand for photocoagulation and its cost-effectiveness. Evaluation based on services in the United Kingdom. Diabetologia 1982;23:138-140.

10 Javitt JC, Canner JK, Sommer A. Cost-effectiveness of current approaches to the control of retinopathy in type 1 diabetics. Ophthalmology 1989;96:255-264.

11 Javitt JC, Canner JK, Frank RG, et al. Detecting and treating retinopathy in patients with type 1 diabetes mellitus. A health policy model. Ophthalmology 1990;97:483-495.

12 Dasbach EJ, Frybach DG, Newcomb PA, et al. Cost-effectiveness of strategies for detecting diabetic retinopathy. Med Care 1991;29:20-39.

13 Javitt JC, Aiello I, Lloyd PA, et al. Detecting and treating retinopathy in patients with type 1 diabetes: savings associated with improved implementation of current guidelines. Ophthalmology 1991;98:1565-1574.

14 Hendrick AM, Javitt JC, Chiang YP. Cost-effectiveness of screening and treatment of diabetic retinopathy: what are the costs of underutilization? Int J Technol Assess Health Care 1992;8:694-707.

15 Drummond ME, Davies LM, Derris FL. Assessing the costs and benefits of medical research: the diabetic retinopathy study. Soc Sci Med 1992;34:973-981.

16 Javitt JC, Aiello I, Chang YP, et al. Preventative eye care in people with diabetes is cost saving to the federal governnmment. Diabetes Care 1994;17:909-917.

17 Matz IJ, Falk M, Gottinger W, Kieselbach G. Cost-benefit analysis of diabetic eye disease. Ophthalmologia 1996;210:348-353.

18 Fonseca V, Munshi M, Merrin LM, Bradford JD. Diabetic retinopathy: a review for the primary care physician. South Med J 1996;89:839-850.

19 World Health Organisation. Diabetes Mellitus: Report of a WHO Study Group. Diabetes Mellitus. Technical report series 727:10-12, Geneva,1985.

20 Colman PG, Thomas DW, Zimmet PZ. New classification and criteria for diagnosis of diabetes mellitus. Position Statement from the ADS, NZSSD, RCPA, AACB. MJA 1999;170:375-378.

21 DECODE Study Group. Will new diagnostic criteria for diabetes mellitus change phenotype of patients with diabetes? Reanalysis of European epidemiological data. BMJ 1998;317:371-375.

22 Mathers C, Vos T, Stevenson C. The burden of disease and injury in Australia. AIHW Cat. No. PHE17. Canberra, 1999.

23 Commonwealth Department of Health and Aged Care and Australian Institute of Health and Welfare. National Health Priority Areas Report: Diabetes Mellitus 1998. AIHW Cat. No. PHE 10. HEALTH and AIHW, Canberra, 1999.

24 Dunstan D, Zimmet P, Welborn T, et al. Diabetes and Associated Disorders in Australia 2000; The accelerating epidemic. Australian diabetes, Obesity and Lifestyle report. International Diabetes Institute, Melbourne, 2001.

25 Alberti KGGM. The Clinical implications of impaired glucose tolerance. Diabetic Medicine 1996;13:927-937.

26 Barzilay JI, Spiekerman CF, Kuller LH, et al. Prevalence of clinical and isolated subclinical cardiovascular disease in older adults with glucose disorders: the Cardiovascular disease in older adults with glucose disorders: the Cardiovascular Health Study. Diabetes Care 2001;24(7):1233-1239.

27 National Heart Foundation of Australia. Risk Factor Prevalence Study Report No. 1 – 1980, 1980.

28 National Heart Foundation of Australia. Risk Factor Prevalence Study Report No. 2 – 1983, 1983.

29 Risk Factor Prevalence Study Management Committee. Risk Factor Prevalence Study: Survey No.3 1989. Canberra: National Heart Foundation of Australia and Australian Institute of Health, 1990.

30 Health Information Centre QH. (Unpublished) Queensland subset data of 1995 NHS data set, 2001.

31 Dunstan D, Cameron A, deCourten M, Coyne T, et al. The Australian diabetes, obesity and lifestyle study (AusDiab) data report: 2001 Queensland, 2001.

32 Health Information Centre QH. Diabetes Management Survey, Preliminary results, 2000.

33 Queensland Health HIC. Chronic Diseases Surveys: Diabetes Management Survey, 2000.

34 Queensland Health HIC. Statewide Health Survey, 1998.

35 Aberg AE, Jonsson EK, Eskilsson I, et al. Predictive factors of developing diabetes mellitus in women with gestational diabetes. Acta Obstet Gynecol Scand 2002 Jan; 81(1):11-16

36 Tamas G, Kerenyi Z. Gestational diabetes: current aspects on pathogenesis and treatmment. Exp Clin Endocrinol Diabetes 2001; 109 Suppl 2:S400-411.

37 Australian Bureau of Statistics. 1995 National Health Survey: Diabetes. Canberra: ABS, 1997.

38 Guest CS, O'Dea K. Diabetes in Aborigines and other Australian populations. AJPH 1992;16(4):340-349.

39 Tropical Public Health Unit Network QH personal communication. Well Person's Health Check, 2001.

40 Broomehead L, Whaleboat D, Williams A. Queensland Aboriginal and Torres Strait Islander Food and Nutrition Strategy. Prepared by the Indigenous Health Program and Nutrition Program, Australian Centre for International and Tropical Health and Nutrition, The University of Queensland for Queensland Health, 1995.
41 Southern Public Health Unit Network, Queensland Health. Social Determinants of Health – The Role of Public Health Services, 2001.
42 Health Priority Area Committee. Health of Australians: the first report on national health priority areas, 1996. Canberra, AIHW, 1997.
43 NHMRC. Acting on Australia's weight: a strategic plan for the prevention of overweight and obesity. Cat. No. 96 0928 8. Canberra, NHMRC, 1997.
44 Cook T, Rutishauser I and Seelig M. Comparable data on food and nutrient intake and physical measurements from the 1983, 1985 and 1995 National Nutrition Surveys. Brisbane, Australian Food and Nutrition Monitoring Unit, 2001.
45 SIGNAL. Eat Well Australia: An agenda for action for public health nutrition 2001-2010. Canberra, National Public Health Partnership, 2001.
46 Australian Bureau of Statistics. National Nutrition Survey: Nutrient Intakes and Physical Measurements, Australia 1995. ABS Catalogue No. 4805.0. Commonwealth of Australia , Canberra, 1998.
47 Health Information Centre, Queensland Health. Towards healthy growth and development: issues of overweight, obesity and under-nutrition among children in Queensland. Information circular no. 58. Queensland Government, August 2001.
48 Mann JI. Diet and diabetes. Diabetologia 1980;18:89-95.
49 Feskens EJ, Virtanen SM, Tuomilehto J, et al. Dietary factors determining diabetes and impaired glucose tolerance. A 20-year follow-up of the Finnish and Dutch cohorts of the Seven Countries Study. Diabetes Care 1995;18:1104-1112.
50 van Dam RM, Rimm EB, Walter C, et al. Dietary Patterns and Risk for Type 2 Diabetes Mellitus in U.S. Men. Annals of Internal Medicine 2002;136(3):201-209.
51 Australian Food and Nutrition Monitoring Unit (Unpublished results). Based on analysis of comparable samples from the 1983 national Dietary Survey of Adults, the 1985 National Dietary Survey of School Children and the 1995 National Nutrition Survey.
52 NHMRC. Dietary Guidelines for Australians (draft). Canberra, NHMRC, 2001.
53 Pan XR, Li GW, Hu YH, et al. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: the Da Qing IGT and diabetes study. Diabetes Care 1997;20:537-544.
54 Swinburn BA, Metcalf PA, Ley SJ. Long-term (5 year) effects of a reduced-fat diet intervention in individuals with glucose intolerance. Diabetes Care 2001;Apr;24(4):613-614.
55 Tuomilehto J, Lindstrom J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. New Engl J Med 2001;344:1343-1350.
56 Eriksson KF, Lindgarde F. Prevention of type 2 (non-insulin-dependent) diabetes mellitus by diet and physical exercise. The 6-year Malmo feasibility study. Diabetologia 1991;Dec;34(12):891-898.
57 Diabetes Prevention Program Research Group. Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. New Engl J Med 2002;346(6):393-403.
58 Helmrich SP, Ragland DR, Leung RW, et al. Physical activity can reduce occurrence of Type 11 diabetes. New Engl J Med 1991;325:147-152.
59 Manson JE, Rimm EB, Stampfer MJ, et al. Physical activity and incidence of non-insulin dependent mellitus in women. Lancet 1991;338:774-778.
60 Perry IJ, Wannamethee SG, Walker MK, et al. Prospective study of risk factors for development of non-insulin dependent diabetes in middle aged British men. Brit Journal Med 1995;310:560-564.
61 Armstrong T, Bowman A, Davies J. Physical activity patterns of Australian adults. Results of the 1999 National Physical Activity Survey. AIHW Cat. No. CVD10, August 2000.
62 Ford ES, Giles WH, Dietz WH. Prevalence of the metabolic syndrome among US adults: findings from the third National Health and Nutrition Examination Survey. JAMA 2002;287:356-359.
63 Zimmet P, Cohen M. The diabetes epidemic in Australia: prevalence, patterns and the public health. MJA 1995;163:116-117.
64 Queensland Health HIC. 2000 Chronic Diseases Surveys: Diabetes Prevalence and Management Report, 2002 Brisbane.
65 ABS. Mortality Data Comparability Factors for multiple cause of death statistics, 1997.
66 Health Information Centre QH. Unpublished analysis of Australian Bureau of Statistics Deaths Data, 2001.
67 Health Information Centre QH. Unpublished data, 2002.
68 Marks G, Coyne T, Pang G. Type 2 Diabetes costs in Australia - the potential impact of changes in diet, physical activity and levels of obesity. Brisbane, Australian Food and Nutrition Monitoring Unit, 2001.
69 The Australia and New Zealand Dialysis and Transplant Registry. 23rd Annual 2000 Report. ANZDATA Registry, Adelaide, South Australia, 2001.
70 Mathers C, Penn R. Health system costs of cardiovascular diseases and diabetes in Australia 1993-94. AIHW cat. no. HWE 11. Canberra: Australian Institute of Health and Welfare (Health and Welfare Expenditure Series no. 5), 1999.
71 AIHW. Health Expenditure Bulletin no. 17. Australia's Health Services Expenditure to 1999-00. Health and Welfare Expenditure Series No. 12, 2001.