

6. Methodology: Using Case Studies to Link Services to Improved Diabetes Outcomes

6.1 The Importance of Understanding Health Outcomes

Historically, budgets for governmental expenditure have focused on a current year's spending and this leads to short term budgets, centring on short-term inputs and outputs, but with little impact (outcome) evaluation⁷⁰. This is also partly a manifestation of the New Zealand political infrastructure which is often governed by the three yearly election cycle rather than by the 15 to 30 year complications outcomes in diabetes.

Formal outcome studies identify the practice and results of health care interventions on populations, relate these outcomes to specific practices and suggest modifications to practice on the basis of these observations⁷¹. The Controller and Auditor General's office describes impact evaluation, another form of outcome study to be:

“ A short-hand term for a particular form of performance assessment, the purpose of which is to:

- Determine the actual outcomes from putting a policy into effect;
- Compare those outcomes with the desired outcomes when the policy was formulated; and
- Confirm or establish the causal link between the means by which policy was implemented and the actual outcomes.”

This linkage between inputs, outputs and outcomes will become increasingly important as unhealthy lifestyles lead to increasing demand for health services. Additional funding remains limited. This situation is typical of that facing New Zealand. Even conservative Ministry of Health reports indicate an increase in obesity and in Type 2 diabetes rates. Coupled with only limited economic growth expectations and an ageing population, it is unlikely that current and future Governments will be able to find significantly more overall resources to cope with expected increased health demand.

Therefore, the role of outcome (impact) studies will become more important in future funding decisions to ensure funding is used as effectively as possible. Compared to efficiency studies, which focus only on controlling costs in the short term as over the last 10 years, outcome studies are focused on containing future costs and doing it while enabling service effectiveness to improve.

⁷⁰ Controller and Auditor General of New Zealand, 2000.

⁷¹ Ellwood PM, Shattuck Lecture, 1988.

6.2 The Outcomes Methodology

The methodology applies a spreadsheet framework to describe how differences in the range and usage of services can change future outcomes. Our approach is to quantify direct government health expenditure at five year snapshots, over a twenty year period. Three scenarios are described in terms of the range and usage of services provided. These scenarios are summarised below and described in more detail in Chapter 7. The spreadsheet is used to quantify the health expenditure to those with diagnosed Type 2 diabetes and those with undiagnosed Type 2 diabetes, describing those IGT. The framework can be visually described as below:

Table 11: A framework for assessing cost effectiveness⁷²

<p><u>Quadrant 1</u> Worse outcome, higher cost</p>	<p><u>Quadrant 2</u> Better outcome, higher cost</p>
<p><u>Quadrant 3</u> Worse outcome, lower cost</p>	<p><u>Quadrant 4</u> Better outcome, lower cost</p>

Our approach is aimed at showing how diabetes treatments and care can move from quadrant 1 to 4. Under the current budget constrained (rationed) service funding and delivery strategy, in 20 years time it is likely that additional high cost severe complications from diabetes will consume a very large proportion of the total health care budget. In addition, individual health outcomes for people with diabetes will be poor and the overall direct cost to New Zealand is likely to be at least several times greater than it is now. The indirect costs in terms of lost productivity will be significantly greater than this.

In contrast, a more proactive approach to delivering diabetes related services and its related complications has the possibility of moving diabetes care into result quadrant 4 and ultimately improving the health outcomes for people with diabetes.

⁷² Laupacis A, Feeny D, Detsky A, Tugwell PX, 1992.

6.3 The Scenarios

Future outcomes are dependent on the services to more closely link into the background and conditions of those people with diabetes. Three scenarios have been developed to show the cost and outcomes of three packages of services. Two scenarios specify a preventive service approach and directly compare this to the current service delivery pattern.

Where assumptions have been used, they have been fully outlined in Appendix B.

The scenarios modelled are as follows:

Scenario One: Current services which assumes that spending on diabetes, undiagnosed diabetes and IGT remains the same as it is currently over the whole 20 year time period (Quadrant 3 – moving to Quadrant 1 in the future);

Scenario Two: Enhanced services which assumes that there is some additional spending on targeted services and research, monitoring, public health and other services aimed at identifying diabetes conditions earlier (Quadrant 2);

Scenario Three: More Optimal Services which assumes that there is an immediate increase in spending, research, targeting, monitoring and other services aimed at identifying diabetes conditions earlier. This scenario provides for the most services possible, given available resources (staff as well as funding) (Quadrant 4).

The base scenario is described in relation to the status quo, i.e. the level of current services being provided to people with diabetes, or anticipated to be provided according to the *Diabetes 2000* HFA study.

A further scenario, enhanced services, is defined in relation to international medical research⁷³, including the services required to achieve a reduction in diabetes complications through better metabolic and blood pressure management. This improvement in outcome is essentially achieved through the more timely and more effective delivery of good quality services over a long period of time available to identify people with known diabetes. As the *Diabetes 2000* report shows, many of these people do not have access to services currently available in some regional and mainly rural areas of New Zealand.

⁷³ United Kingdom Prospective Diabetes Study (various reports), 1998-2000.

The third scenario of more optimal services, estimates the costs of services configured to the possibility of a person with diabetes avoiding or delaying complications or avoiding the onset of diabetes. This avoidance is achieved by delivering targeted, personalised services depending on the particular needs of the person. These services include a greater focus on education, nutrition, podiatry and exercise, coupled with consistent self monitoring and screening of blood glucose and blood pressure levels with the best pharmacological management. While acknowledging that there is limited research to substantiate the achievement of optimal outcomes, this scenario provides an illustrative example of the goal to both the Government and the Ministry of Health that they should actively work towards, based on the research that is available. This scenario also shows the potential positive returns from investment in public health strategies. Indeed some people in New Zealand with Type 2 diabetes already maintain the standards of care for themselves.

6.4 How the Costing Model Works

- The results for the time period of 20 years are summarised into 5 year snapshots at year 1 (this is assumed to be the start year, 2001/02), year 5, year 10, year 15 and year 20.
- The model starts by taking base prevalence figures from MOH forecasts for people with diagnosed Type 2 diabetes. The number of people with undiagnosed diabetes is assumed to be 50% of those with diagnosed diabetes.
- The base prevalence figures are used in the three different scenarios to derive the new prevalence rates given the level of diabetes education, screening, research and public health. This is based on research which shows that Type 2 diabetes can be delayed with early detection and proper management.
- The model allows for the following costs:
 - **Hospital**
 - Inpatient services which are used by 90% of people with longstanding diabetes to treat severe complications such as heart disease, stroke, kidney failure or limb amputation. This may be at an average cost of \$20,000 per patient yearly or 10% for minor treatments at an average cost of \$1000. Some people with undiagnosed Type 2 diabetes need hospitalisation for another condition such as premature arterial disease which is caused by their diabetes. An average cost of \$10,000 is assumed for the treatment.
 - Outpatient services which are used as a fixed cost in all models based on the current spending of \$8.5 million for people with Type 2 diabetes

- **Primary Care** of \$593 per person with diagnosed Type 2 diabetes which is calculated based on the *Diabetes 2000* report and additional targeted primary care of \$1000 per patient for Scenarios 2 and 3.
- A cost of \$1000 per patient for treatment for glucose control is based on the UKPDS study and used in Scenario 2 for some patients and in Scenario 3 for all patients with diagnosed diabetes to effectively educate and support patients to control their glucose levels.
- **Public Health**
- **Monitoring Tools**
- **Diabetes Register**
- **Research**

with the last four points varying in cost for the different scenarios.

- Only 85% of the spending on primary care, hospital services and public health for diabetes as given in the *Diabetes 2000* report was used to calculate the cost that people with Type 2 diabetes incur. This reflects the fact that the costs in the *Diabetes 2000* report also included those with Type 1 diabetes, who are believed to be between 10% and 20% of the population of those with diagnosed diabetes.
- A percentage of people with Type 2 diagnosed diabetes that use inpatient services was calculated using the assumed average cost, the spending for people with Type 2 diabetes as calculated from the *Diabetes 2000* report and the prevalence number for people with Type 2 diabetes.
- Simmons⁷⁴ estimated the total hospital spending for people with Type 1 and Type 2 diabetes to be \$200 million instead of \$90 million. The difference was assumed to be incurred by people with undiagnosed diabetes or where the cost is not correctly attributed to diabetes. For the first year the prevention of less severe and severe complication is the same percentage for people with diagnosed and undiagnosed diabetes. The difference in cost to the total spending is used for hospitalisation for other conditions, e.g. pneumonia.
- The percentages are adjusted for the following according to scenario. For example, the number of people with diagnosed diabetes complications should decrease or remain constant under a scenario where the person with diabetes monitors his or her own blood sugar levels properly and has regular medication for high blood sugar and cholesterol or blood pressure treatment, thus decreasing their chance of developing stroke or heart disease.
- The total resultant cost is simply derived by adding the total cost of each category.

⁷⁴ Simmons D, 1996.

6.5 The Case Studies

These case studies describe six typical individuals and how they need to access health services in the management of their diabetes. It provides a perspective on the way in which an effective diabetes service should be managed to be responsive to the needs of people at different stages of diabetes and with different backgrounds.

Each case study has been selected to be representative of a person who already has diagnosed diabetes, has undiagnosed diabetes, or will develop diabetes. Frequently seen and common cases of people with diabetes have been chosen. Four of the case studies have a high number of risk factors and are therefore likely to experience unfavourable outcomes over time, including complications, and in some cases, early death.

There is a percentage of people willing to seek an optimal health outcome for themselves by managing their own health, even though they already have diabetes or IGT. They do not require substantial additional services largely because they have the education, personal resources and/or time to manage their own blood sugar conditions. The case studies thus focus on people who do not actively manage their condition effectively, whatever the reason (ethnicity, socio-economic status, lack of education about diabetes, etc). By focusing on this group of people with diabetes, it is possible to specify some of the benefits of targeted assistance.

One of the reasons for concentrating on the percentage of the diabetes population who currently do not have the means or health education to manage their own health outcomes, is that diabetes differs from other disorders in one significant respect. Raised blood sugars damaging to the tissues cannot be felt or perceived by people until it reaches three to four times the normal level. The most effective way of preventing the complications of diabetes is to test and screen blood sugar levels regularly so as to educate people on ways of keeping the blood sugar levels as close to normal as possible by maintaining a healthy lifestyle.

The person with diabetes given good quality primary and secondary care services is the only one who can do this. In many other disorders, the person actually suffering from the condition is often expected to take the medication prescribed by the physician in the correct quantity and at the allotted time. In contrast, the metabolism of a person with diabetes is affected by almost everything she/he does – or neglects to do- every minute of every day for year after year for up to 50 or 60 years⁷⁵. Once tissues have been damaged by diabetes, they never fully recover but the degree of further damage can be managed in a way that can minimise it.

⁷⁵ International Diabetes Federation IDF2(a)

In a situation where diabetes is understood and managed well by the person, the costs and usage of the health system are likely to be less compared to those people who cannot not manage their diabetes well.

Every person with diabetes will use services differently and will experience different health outcomes. Therefore prima facie, the case studies have been selected to try to incorporate the range and diversity of people who access health services.

The case studies examine the following key services available to people with diabetes:

- Screening, targeting, monitoring, auditing
- GP visits
- Education and prevention
- Self management (improved lifestyle and education to manage their own blood sugar levels through most of their own testing)
- Referral services to secondary and tertiary hospital services
- Medications
- Dialysis
- Surgical interventions
- Acute treatments
- Social Welfare benefits/ Community Services Cards/ High User Cards

Important other services such as **podiatry, counselling, occupational therapy** and **other necessary services** usually available in other countries have not been fully examined in case studies.

There are, of course, a range of other service which provide care and support for those with diabetes. By focussing on the above 10 key ones, we are able to picture how the case study examples access key services in different ways.

The mix of services can be changed to effect different outcomes. This type of analysis assists in building up an understanding of where services are lacking and the complexity of making changes to a mix of services.

To ensure that each case was in fact representative of people with both diabetes and with IGT who are currently accessing the services, extensive consultation with a wide range of health professionals and some ethnic consumer representatives as to the mix of services were used for each case. The process was as follows:

- Initial consultative meeting with steering group, including Diabetes New Zealand representatives and diabetologists
- First workshop to discuss issues facing people with diabetes
- Conference call with 5 leading New Zealand diabetologists to confirm appropriate models

- Second major workshop to further clarify the case studies and the mix of services
- Individual meetings from time to time with health professionals with relevant experience to help define each case and the way the services are or should be utilised.
- A third set of workshops were held to integrate this information into our outcome scenarios.

6.6 Challenges in Service Design

Our scenarios relate outcomes to the conditions that people with diabetes, undiagnosed diabetes and IGT will develop. Actuals or estimates in the *Diabetes 2000* report underpin the outcomes modelled for each scenario. These numbers are unaggregated, however, and obscure some important differences in behaviour. Ultimately for the most positive results to be achieved, services will need to be diagnosed to meet need.

(a) Ethnic Groups

For example, the average age of diagnosis of Type 2 diabetes is lower for Maori than for Europeans and Pacific Islanders (See Table 8). This is a factor of:

1. when the disorder is first recognised
2. the age when the impact of diet and exercise (lack of) impact
3. other possible genetic factors

Although Europeans may be on average, are quicker at seeking a diagnosis for a medical condition than the Maori or Pacific Islanders, their lifestyle means that those with diabetes develop the disorder at a later age. In contrast, it appears that while many Maori with the disorder may actually experience symptoms of diabetes earlier, on average, they only get a formal diagnosis at the age of 43. By then, some may already have had 10-15 years of high sugar and fat levels in the blood and the probability of early long term complication is increased.

Table 12: Median age of diagnosis of Type 2 diabetes

European	55
Maori	43
Pacific Islander	47

Source: Our Health, Our Future: Ministry of Health 1999

Table 12 indicates that the expected age of death at birth is lower for Maori as well. This is a result of many things but the lifestyle factors which lead to Type 2 diabetes are also likely to be contributors to the variation in the age levels of diagnosed onset of different ethnic groups.

Table 13: Expected life expectancy at birth

	Years
<i>Males</i>	
European	75
Maori	67
Pacific Islander	70
<i>Females</i>	
European	81
Maori	72
Pacific Islander	76

Source: Our Health, Our Future, Ministry of Health 1999 Table 28

The next Table indicates that Maori and Pacific Island people are particularly susceptible to blindness and cataracts, compared to Europeans.

Table 14: Self-reported prevalence of blindness and cataracts in at least one eye of people with diabetes, undertaken in South Auckland⁷⁶

	% of blindness
European	2%
Maori	7%
Pacific Island people	8%
	% of cataracts
European	6%
Maori	14%
Pacific Island people	16%

(b) Lifestyle Factors and Risk

Some of the life style factors which cause a variance for longevity are also risk factors for diabetes. Table 15 illustrates now well accepted risk factors:

1. Obesity or increasing weight
2. High animal fat intake
3. Lack of daily exercise.

A feature of these is that they relate to life style conditions which the individual could possibly modify.

⁷⁶ Simmons D, Gatland BA, Leakehe L, Fleming C, 1996.

Table 15: Risk Factors for Diabetes

<p>The three recognised modifiable risk factors for diabetes are⁷⁷:</p> <ul style="list-style-type: none"> ▪ Obesity The mean body weight of New Zealanders has increased from 71.3 kg to 74.5 kg and central obesity has also increased from 27.4% to 41.4% in the NZ population. Of the total NZ population 35% is now overweight while 17% of the population are considered obese. The <i>Diabetes 2000</i> Report states that the risk of diabetes could be reduced 50-75% by controlling obesity and 30-50% by increasing physical activity. ▪ Diet (high in saturated fats, sugars and low fruit and fibre) The 1997 National Nutrition Survey found that the NZ population continues to have a high fat diet (35% of dietary energy). Saturated fat intake contributes 15% of energy, setting NZ among the highest in the world. ▪ Lack of exercise The 1996/97 Health Survey⁷⁸ found that 61% of adults in NZ were physically active. About 42% of Maori and 50% of Pacific people were considered inactive. ▪ Smoking In one National Health survey it was shown that 45% of people with diabetes still smoke.

(c) **Limitations of General Practice**

A way of engaging people about the health risks of their lifestyle or at the very least, diagnosing IGT or diabetes at an early stage is through general practitioners (GPs). Table 16 records the proportion of people who visit their GPs each year at different age groups and by gender. There is no age group where 100% of the cohort visit their GPs.

⁷⁷ Bennett PH, 1997.

⁷⁸ *Diabetes 2000*; Ministry of Health, 1999.

Table 16: Proportion of Adults who visited a GP at least once in 1997/98, by age and sex (source Ministry of Health)

%	15-24	25-44	45-64	65-74	75+
Male	69	66	75	90	95
Female	86	80	84	95	96

Source: Ministry of Health

Because there is no national data collection, we do not know how many people go to their doctor or how many times they go with diagnosed diabetes in a year. The ‘free check’ campaign for people with diabetes now available is a progressive step, but even with this, it is not yet promoted by all doctors.

Further, even when people see their GP, it is most commonly for a short-term condition. To link up with Maori, it will be necessary to either motivate doctors to undertake regular testing when people are in for short visits or find a way of motivating more patients to undertake routine check ups, including finger-prick blood sugar testing every time.

Table 17: Reasons for Adults’ most recent GP visit in 1997/98 by sex

%	Short term condition	Disability / long term condition	Routine check up	Injury or poisoning	Immunisation	Contraception	Cervical Smear	Maternity
Male	37	27	23	20	4	1	0	0
Female	36	26	19	8	3	11	10	4

Source: Ministry of Health

(d) Complications

Given the low level of early notice of diabetes and pre-diabetes conditions, it is not surprising that many of those with Type 2 diabetes do go on to experience end-stage complications. The exact number should be but is not known in New Zealand.

Simmons has further developed our understanding that the nature of diabetes in New Zealand by researching the prevalence rates of health complications experienced by those with diagnosed diabetes, analysed by ethnicity. Although Maori have a slightly lower propensity for blindness, in his study they have higher rates for heart attack and foot disease. European rates for foot disease is only slightly lower than Maori and the propensity for heart attack is greater. Both Maori and Pacific Islanders experience a significantly higher risk of renal failure than Europeans. As well as exercise and diet, smoking is a risk factor for complications in Type 2 diabetes. Here, the Maori smoking rates are by far the highest.

Table 18: Prevalence rates of complications in people with known diabetes by ethnicity⁷⁹

	Maori %	Pacific Island %	European %
Smoking rates (whole population)	45.5	27.7	23.2
Blindness	7	8	2
Heart attack	11	6	11
Renal failure	4-8 x increased risk for Maori and Pacific Islander with Type 2		
Diabetic foot disease	42.0	29.0	37.0

Source: Diabetes 2000; Simmons D, 1996.

Overseas evidence is required to look more closely at what the implications are for serious complications.

Table 19: Complication rates of people with Type 1 and Type 2 diabetes in USA

	Rate higher than people without diabetes
Heart Disease	2 – 4 times
Stroke	2 – 4 times
High blood pressure	60 – 65 %
Kidney disease	40% of all new cases
Nervous system disease	60-70%
Amputations	Over 50%
Complications of pregnancy	Up to 10%
Death of new born	2–5 % with diabetes 1.5 % without diabetes

Source: Diabetes statistics – NIDDK National Diabetes Information Clearinghouse – US data, 1999

⁷⁹ Statistics were sourced from *Diabetes 2000*; Simmons D, 1996 (with the exception of smoking rates which were obtained from Ministry of Health, 1999).

Table 20: Disability Adjusted Life Years (“DALYs”) lost by top 10 specific causes, 1996

Rank	Cause	DALY
1	IHD	73,804
2	Stroke	30,115
3	Chronic Obstr. Airways Dis.	27,848
4	Diabetes	21,263
5	Depression	20,497
6	Asthma	18,800
7	Anxiety disorders	17,930
8	Lung Cancer	17,919
9	Road traffic injury	17,634
10	Colorectal cancer	16,262

Source: Our Health, Our Future, Ministry of Health

Note: Diabetes contributes to IHD and strokes.

From inspection of hospital records, it is clear that those with a primary cause classified as ischaemic heart disease or stroke may have developed this condition directly as a result of poorly treated lipid and blood pressure profiles in known or previously undetected diabetes⁸⁰.

International evidence, from a variety of sources, indicates that there are strategies to reduce complications. Some of the key strategies of the International Diabetes Federation are listed in the left-hand column below. As the far right column indicates, the potential reductions in Type 2 diabetes complications are very high (and particularly high for the severe complications).

⁸⁰ Davies MJ, Ammari F, Sheriff C et alia, 1999; Diabetes & Nutrition Group of the EASD, 1995.

Table 21: Percentage reduction of the risk of diabetic complications shown in recent studies

Strategies	Type 1 Diabetes	Type 2 Diabetes
<i>Improved blood glucose control</i>		
- retinopathy	Reduction by 27%-76% ^A	Reduction 40%-65% ^B
- nephropathy	Reduction by 34%-57% ^A	Reduction 70% ^B
- neuropathy	Reduction 60% ^A	
- cardiovascular & peripheral vascular disease		Reduction 54% ^B
- myocardial infarction		Reduction 16% ^C
- All diabetes related complications		Reduction 12% ^C
<i>Improved blood pressure control</i>		
Microvascular disease		Reduction 37% ^C
Cardiovascular disease		Reduction 51%
Heart failure		Reduction 56% ^C
Stroke		Reduction 44% ^C
All diabetes related complications		Reduction 24% ^C
Diabetes related deaths		Reduction 32% ^C
<i>Improved lipid control</i>		
Total mortality in people who have had a heart attack		Reduction 43% ^E
Coronary heart disease (CHD) mortality		Reduction 34% ^F -36% ^E
Major CHD event		Reduction 33% ^F -55% ^E
Any atherosclerotic event		Reduction 37% ^E
Cerebrovascular disease event		Reduction 62% ^E

(Source: Diabetes Health Economics, International Diabetes Federation)

^A Diabetes control and Complications Trial (DCCT, 1993); ^B The Kumamoto Study (1995)

^C United Kingdom Prospective Diabetes Study (UKPDS), many references, 1998-2000

^D Hypertension Optimal treatment (HOT) Randomised Trial; ^E The 4S study, Sweden; ^F The Helsinki Heart Study

6.7 Conclusion

In the absence of strategies to reduce complications, people with Type 2 diabetes can require expensive treatments in the latter part of their life. Our methodology uses evidence about services to project the possible costs of complications in future years.