PRICEWATERHOUSECOOPERS

Diabetes New Zealand

Type 2 Diabetes – Outcomes Model Update

May 2007

PRICEWATERHOUSECOOPERS

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Sarah Thomson
Diabetes New Zealand
PO Box 12441
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4 May 2007

Dear Sarah

We are pleased to present our final report, as per our engagement letter dated 10 October 2006.

As agreed, we have updated the 2001 Type 2 Diabetes Outcomes Model, revising the underlying projections of people with Type 2 diabetes (based on earlier Ministry of Health projections) by incorporating the recently published 2006 diabetes prevalence data produced by the Ministry.

Please note our disclaimer attached as Appendix A: Important Note.

If you have any questions regarding our report, or require further information, please do not hesitate to contact me.

Yours sincerely

Suzanne Snively
Partner

PRICEWATERHOUSECOOPERS

Table of Contents

1 Summary of Findings

Scope

1.1 This project was commissioned by Diabetes New Zealand Inc. The purpose is to provide an indication of the potential level of government spending on health services for Type 2 diabetes under different assumptions about preventative interventions.

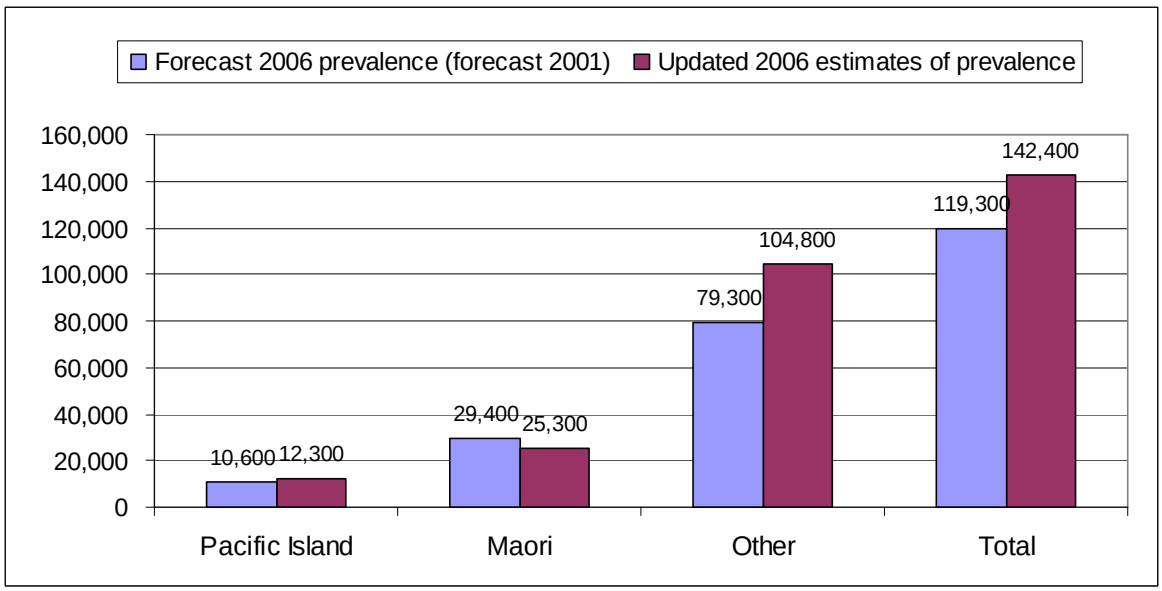
1.2 We have calculated these cost projections by updating the calculations in the 2001 report *Type 2 Diabetes: Managing for Better Health Outcomes* ("the 2001 Report"), published by Diabetes New Zealand and prepared by PricewaterhouseCoopers, using the latest Ministry of Health (MoH) diabetes prevalence data.

1.3 Please note our disclaimer attached as Appendix A: Important Note.

Prevalence of Type 2 Diabetes

1.4 MoH has released new diagnosed Type 2 diabetes prevalence data for 2006. These prevalence rates are higher than the Ministry's previous forecasts, as shown in Graph 1.

Graph 1: Ministry of Health Type 2 Diabetes Prevalence Estimates for 2006 by Ethnicity – Comparison of 2001 Forecasts and 2006 Estimates.



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.

Updated Cost Projections

1.5 We have used the MoH's 2006 prevalence data to update the cost forecasts calculated by the Type 2 diabetes outcomes model developed for the 2001 Report. It is important to note that although the Ministry has updated its prevalence projections for diabetes, it has not updated its diabetes services and treatment cost estimates and as such, the cost assumptions in the model have not been revised.

1.6 The outcomes model produces three scenarios of future government spending on services (treatment and prevention) for Type 2 diabetes under different assumptions about the level of preventative interventions. Scenarios 1 and 2 are intended to estimate the upper and lower range for existing Diabetes services.

- **Scenario 1: 2000 Service Level.** Forecasts based on services and treatments as described in the *Diabetes 2000* report from the former Health Funding Authority;
- **Scenario 2: Enhanced Services.** Forecasts the effect of additional funding (of $20 – 40 million per year) for diabetes prevention, detection and treatment services; and
- **Scenario 3: Optimal Services.** Assumes a significant, immediate increase (of approximately $60 million per year) in funding for diabetes prevention, detection and treatment services. The key focus of this scenario is the use of prevention initiatives.

1.7 The following table presents the forecast cost of Type 2 diabetes health services under the three scenarios based on prevalence data produced by the MoH in 2006.

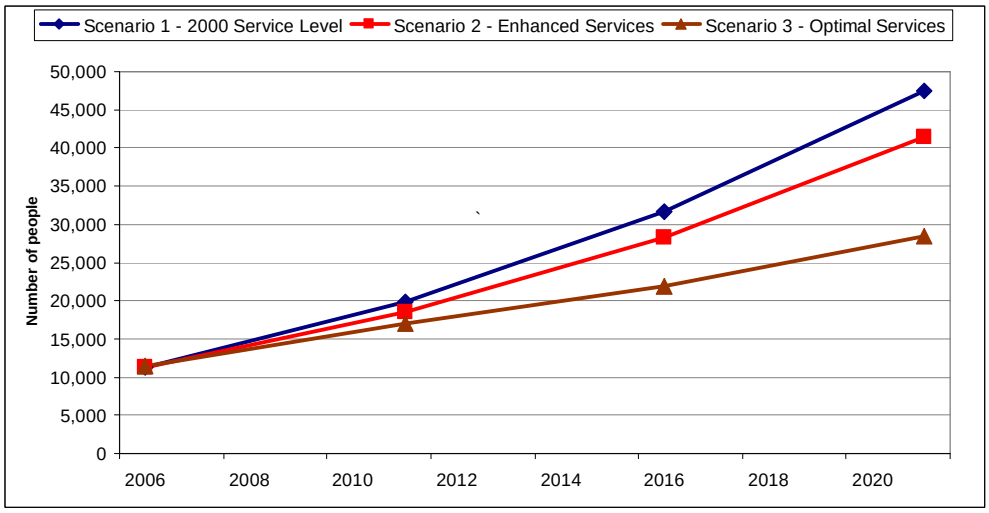
Table 1: Updated Forecast Cost of Type 2 Diabetes Using 2006 Prevalence Data (2006 dollars)

Cost of Type 2 Diabetes	2006/07 ($m)	2011/12 ($m)	2016/17 ($m)	2021/22 ($m)
2000 Service Level	540	840	1,240	1,780
Enhanced Services	570	850	1,200	1,660
Optimal Services	590	830	1,080	1,410

Source: PricewaterhouseCoopers modelling (2007) based on Ministry of Heath Diabetes prevalence data.

1.8 The results show that if MoH were to fund diabetes services (treatment and prevention) to a level envisaged under Scenario 3: Optimal Services, it could result in a cost saving against Scenarios 1 and 2. The key driver of this cost saving is the forecast reduction in the number of people with diabetes who develop serious complications as a consequence of these interventions. Graph 2 shows the forecast number of people with serious complications, caused by Type 2 diabetes, under the three scenarios.

Graph 2: Forecast Number of People with Type 2 Diabetes who Develop Serious Complications – Comparison of Scenarios.



Source: PricewaterhouseCoopers (2007) and Ministry of Health 2006 Type 2 diabetes prevalence estimates.

Conclusion

1.9 Based on the model assumptions, an increased investment of $60 million a year (in 2006 dollars) in prevention, self-management and early detection services for Type 2 diabetes has the potential to reduce the government's health expenditure by as much as $370 million in 2021, while at the same time improving the health and wellbeing of New Zealanders.

1.10 Over the last five years, MoH has implemented a number of diabetes focused programmes, such as the Get Checked programme, aimed at improving the health and wellbeing of people with Type 2 diabetes. The MoH's update of prevalence estimates has provided the opportunity to review what is known about the impact of these programmes on future health expenditure.

1.11 Under all three scenarios modelled, expenditure on health services for Type 2 diabetes services rises significantly over the forecast period. The results demonstrate the benefits of the MoH leading a focused National Diabetes Strategy that addresses key issues including:

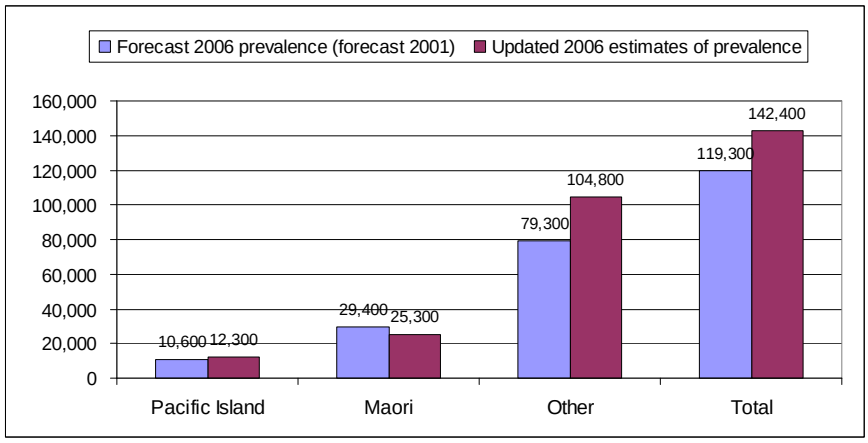
- annual updates of the prevalence of Type 2 diabetes (by age, ethnic group and DHB) by way of a national register;
- programmes for Primary Health Organisations to identify those in their populations with undiagnosed diabetes and engage them in appropriate care, including enrolment in the Get Checked programme;
- up-to-date and reliable data on utilisation rates and costs of health services and treatments for people with Type 2 diabetes, using an outcomes model to monitor the implications; and
- New Zealand-based research into the effectiveness of interventions and population-based programmes to prevent and manage Type 2 diabetes.

2 Prevalence of Type 2 Diabetes

Updated Ministry of Health Prevalence Data

2.1 MoH released new diagnosed Type 2 diabetes prevalence estimates for 2006 in February 2007. These prevalence rates are higher than the Ministry's previous projections, as shown in Graph 3.

Graph 3: Ministry of Health Type 2 Diabetes Prevalence Estimates for 2006 by Ethnicity – Comparison of 2001 Forecast and 2006 Estimates.



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.

Forecast Total Population of People with Type 2 Diabetes

2.2 It is also important to take into account the number of people with undiagnosed Type 2 diabetes. People with undiagnosed Type 2 diabetes miss out on PHO preventative and self-management health care. As a result, these people have a much higher chance of developing serious complications, which can result in costly tertiary hospital care.

2.3 It is possible that the increased prevalence rate published by MoH for Type 2 diabetes reflects higher detection rates and that the proportion of people with undiagnosed Type 2 diabetes is reducing. The implication of this is that government funded expenditure for Type 2 diabetes over the next 15 years would increase at a slower rate.

2.4 The number of people with undiagnosed Type 2 diabetes has been estimated using the assumptions of the relationship between diagnosed and undiagnosed cases in the 2001 Report. These assumptions are based on data from New Zealand surveys[1] and are conservative by international standards (i.e. a relatively low ratio of diagnosed to undiagnosed). Graphs 4 and 5 presents the estimated number of people with diagnosed and undiagnosed Type 2 diabetes in 2006 and 2021 respectively.

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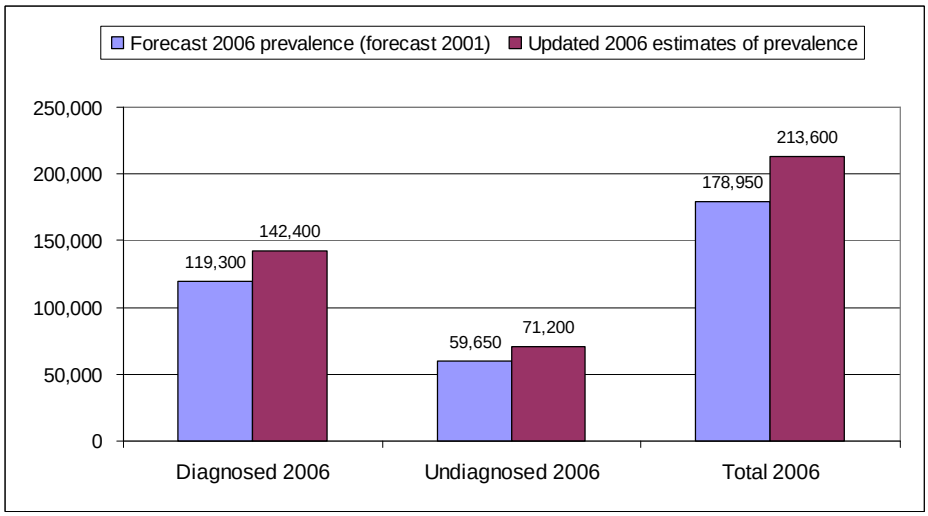
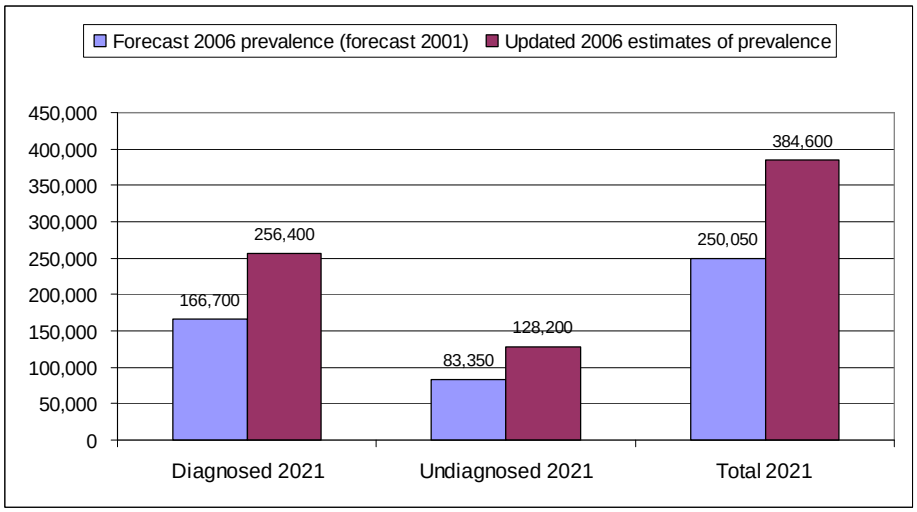
[1] Baker, J. et al (1988) *Fructosamine concentrations in general population of Kawerau*. Diabetes Care 1998; 11:240-245.
Schaaf, D. et al (2000) *Cardiovascular risk factor levels of Pacific people in NZ multicultural workforce*. New Zealand Medical Journal 2000; 1:3-5.

Graph 4: Implications of the Ministry of Health Type 2 Diabetes Prevalence Estimates for 2006 – Comparison of 2001 Forecasts and 2006 Estimates of the Numbers of Diagnosed and Undiagnosed.



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.
Key Assumptions: 2:1 diagnosed to undiagnosed ratio.

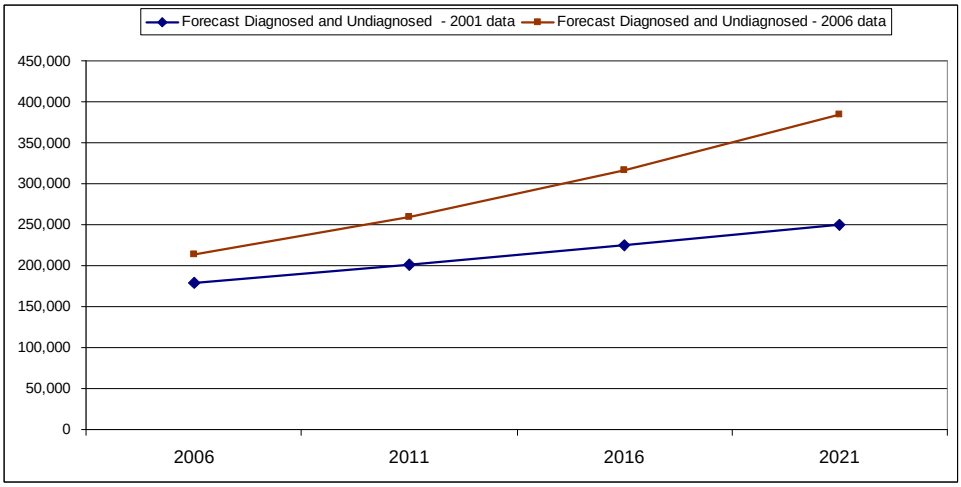
Graph 5: Implications of the Ministry of Health Type 2 Diabetes Prevalence Estimates for 2021 – Comparison of 2021 Forecasts and 2006 Estimates of the Numbers of Diagnosed and Undiagnosed.



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.
Key Assumptions: 4% p.a. growth in the number of people with Type 2 Diabetes; 2:1 diagnosed to undiagnosed ratio.

2.5 When the 2001 Type 2 diabetes prevalence forecasts are compared with the updated 2006 projections, we can see prevalence is expected to be significantly higher than originally estimated – by 2021 the total number of people with Type 2 diabetes (combining diagnosed and undiagnosed) is predicted to be approximately 380,000, more than 100,000 higher than the prediction based on the MoH 2001 prevalence projections, as shown in Graph 6.

Graph 6: Forecast Type 2 Diabetes Prevalence Numbers 2006 - 2021 – Comparison of 2001 Forecasts and 2006 Estimates.



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.
Key Assumptions: 4% p.a. growth in the number of people with Type 2 Diabetes; 2:1 diagnosed to undiagnosed ratio.

3 Basis of the Cost Projections

3.1 MoH's 2006 Type 2 diabetes prevalence data has been used to estimate government spending on health services for Type 2 diabetes. This has been done by updating the prevalence assumptions in the Type 2 diabetes outcomes model that was developed for the 2001 Report.

3.2 This section provides an overview of the model and summarises the key assumptions. Further information about the structure and assumptions behind the model can be found in the 2001 Report.

Basis of the Model

3.3 As developed in the 2001 Study, there are two key underlying assumptions driving the scenarios that are modelled:

- the onset of Type 2 diabetes and its complications can be delayed and in some cases are preventable; and
- additional expenditure on preventive services will result in higher detection and lower later complication rates.

Limitations

Validation of the 2001 Model

3.4 There is limited data available to validate the accuracy of the 2001 model forecasts. It is assumed that the model produces reasonable forecasts of the government health costs of Type 2 diabetes.

Updating Cost Inputs

3.5 There is also limited data available on the current costs of diabetes services. We have not updated the cost assumptions other than to inflate the cost assumptions in the 2001 Model to 2006 dollars using Statistics New Zealand's Health Group CPI for 2001 to 2006, which is 28.85%.

Base Assumptions

3.6 The following table summarises the base assumptions in the model.

Table 2: Base Case Assumptions

Description	Value
Number of people with Type 2 diabetes as a % of total diabetes population	85%
Number of people with undiagnosed Type 2 diabetes as a % of diagnosed	50%
% of people with Type 2 diabetes who develop serious complications per annum	3.0%
% of recorded diabetes hospital costs attributable to serious complications	90%
% of people with Type 2 diabetes who develop other complications per annum	6.6%
% of recorded diabetes hospital costs attributable to other complications	10%
Hospital Care	**$000**
Average cost per patient of treating serious complications	$25.6
Average cost per patient of treating other complications	$1.2
Average cost per patient of specialist diabetes services	$1.2
Average cost per patient of hospitalisation due to undiagnosed diabetes	$12.3
Primary Care	**$m**
Estimated total primary care costs for diabetes	$89
Estimated total hospital costs for diagnosed diabetes	$110
Estimated total inpatient costs for diabetes	$98
Estimated total outpatient costs for diabetes	$12
Estimated total hospital costs for undiagnosed diabetes	$135

Please note: All costs are in 2006 dollars.
Source: PricewaterhouseCoopers (2001) Type 2 Diabetes: Managing for Better Health Outcomes – based on the available literature and workshops with experts on Type 2 diabetes.

Scenarios

3.7 The model estimates potential government spending on services for Type 2 diabetes under three scenarios:

- **Scenario 1: 2000 Service Level**
  This describes the base-line services and treatments consumed by people with Type 2 diabetes, on average, and is based on the *Diabetes 2000* report from the former Health Funding Authority.

- **Scenario 2: Enhanced Services**
  Incorporates the effect of additional funding ($20 million per year from 2007 rising to 40 million by 2021) for diabetes prevention, detection and treatment services.

3.8 These two scenarios are intended to estimate the upper and lower range for existing diabetes services.

- **Scenario 3: Optimal Services**
  Assumes a significant, immediate increase (of approximately $60 million per year from 2007) in funding for diabetes prevention, detection and treatment services. The key focus of this scenario is the use of prevention initiatives.

3.9 The following table outlines the assumptions used in the three scenarios.

Table 3: Scenario Assumptions

Description	2006/07	2011/12	2016/17	2021/22
Scenario 1: 2000 Service Level				
% of new diagnosed - screening	5%	5%	5%	5%
% increase in serious complications	2.5%	2.5%	2.5%	2.5%
% increase in other complications	2.0%	3.0%	0.5%	0.0%
% specialist diabetes services	13.4%	15.4%	17.4%	19.4%
Base diabetes primary care ($m)	11	11	11	11
Scenario 2: Enhanced Service Level				
% of new diagnosed – screening	5%	10%	15%	20%
% increase in serious complications	2.5%	1.8%	1.8%	1.8%
% increase in other complications	2.0%	0.9%	0.8%	0.7%
% specialist diabetes services	18.4%	23.9%	27.1%	33.4%
Primary care per new diagnosis ($)	1,000	1,000	1,000	1,000
Base diabetes primary care ($m)	23	29	29	29
Scenario 3: Optimal Services				
% of new diagnosed – screening	30%	50%	70%	85%
% increase in serious complications	2.5%	1.0%	0.5%	0.3%
% increase in other complications	2.0%	0.0%	0.0%	0.0%
% specialist diabetes services	18.4%	33.9%	47.1%	63.4%
Primary care per new diagnosis ($)	1,000	1,000	1,000	1,000
Base diabetes primary care ($m)	49	49	49	49

Please note: All costs are in 2006 dollars.
Source: PricewaterhouseCoopers (2001) Type 2 Diabetes: Managing for Better Health Outcomes – based on the available literature and workshops with experts on Type 2 diabetes.

4 Updated Cost Estimates

4.1 Table 4 presents the forecast cost of Type 2 diabetes, updated for the MoH's 2006 prevalence data.

Table 4: Updated Forecast Cost of Type 2 Diabetes Using 2006 Prevalence Data (2006 dollars)

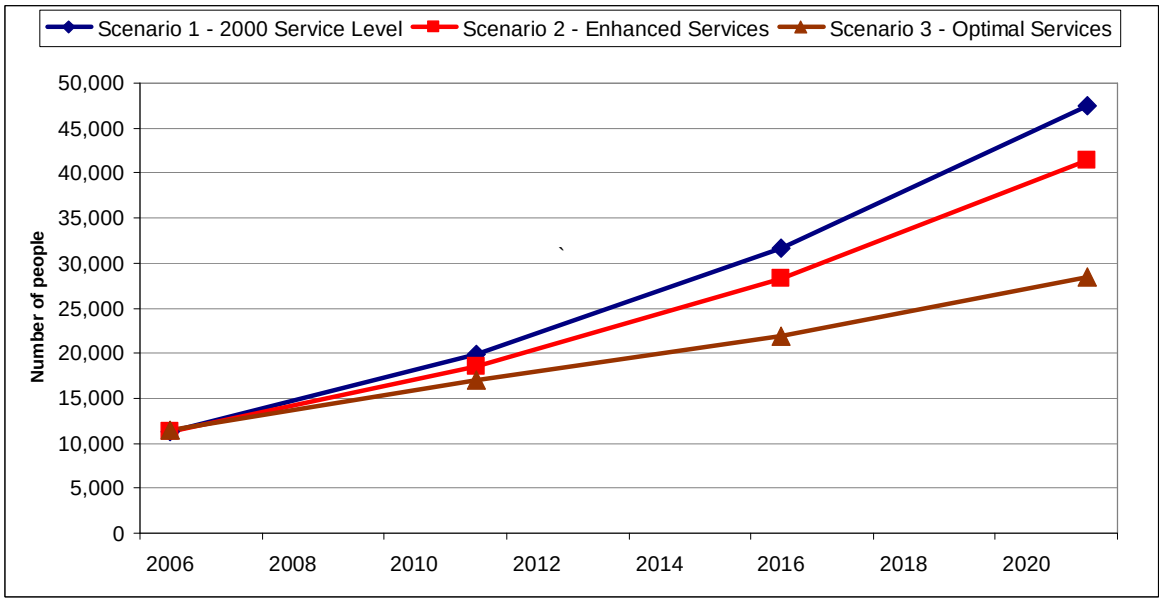
Cost of Type 2 Diabetes	2006/07 ($m)	2011/12 ($m)	2016/17 ($m)	2021/22 ($m)
2000 Service Level	540	840	1,240	1,780
Enhanced Services	570	850	1,200	1,660
Optimal Services	590	830	1,080	1,410

Source: PricewaterhouseCoopers modelling based on Ministry of Heath Diabetes prevalence data.

4.2 The results show that if MoH were to fund diabetes prevention services to a level envisaged under Scenario 3: Optimal Services, it could result in a cost saving against the Scenario 1 and 2 cost forecasts.

4.3 The key driver of this cost saving is the forecast reduction in the number of people with Type 2 diabetes who develop serious complications as a consequence of prevention services. Graph 7 shows the forecast number of patients with serious complications, caused by Type 2 diabetes, under the three scenarios.

Graph 7: Forecast Number of People with Type 2 Diabetes who Develop Serious Complications – Comparison of Scenarios.

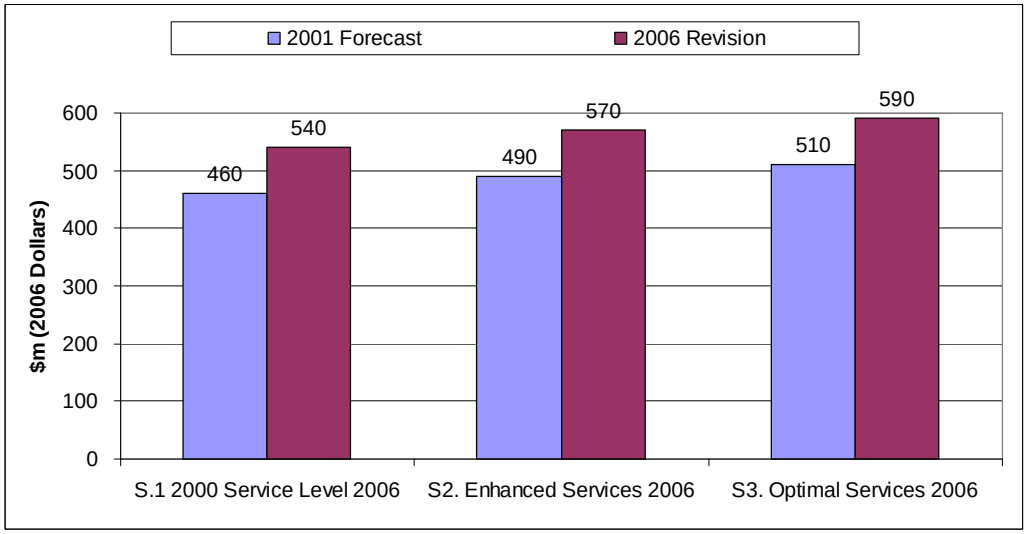


Source: PricewaterhouseCoopers (2007) and Ministry of Health 2006 Type 2 Diabetes prevalence estimates.

5 Comparison with 2001 Forecasts

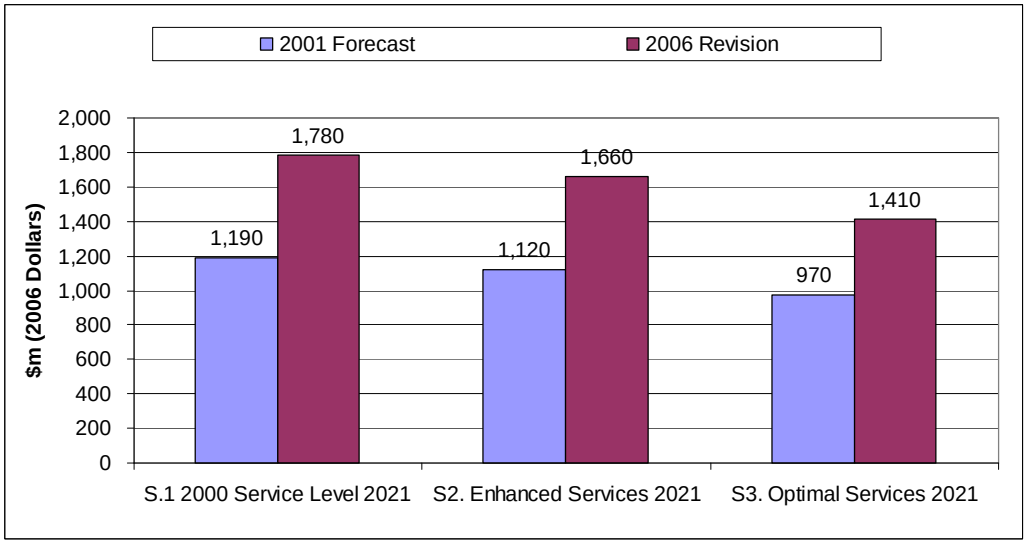
5.1 The higher Type 2 diabetes prevalence rates in 2006 have significantly increased the Type 2 diabetes cost estimates above the level forecast in the 2001 Study. The following graphs present the forecast cost of Type 2 diabetes based on prevalence data produced by the MoH in 2001 and the updated cost of Type 2 diabetes based on Ministry of Health 2006 prevalence data for 2006/07 and 2021/22.

Graph 8: Forecast Cost of Type 2 Diabetes in 2006 – Comparison of 2001 Forecast and 2006 Estimates (2006 Dollars).



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.

Graph 9: Forecast Cost of Type 2 Diabetes in 2021 – Comparison of 2001 Forecast and 2006 Estimates (2006 Dollars).



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.

6 Sensitivity Analysis

6.1 We have reviewed the impact on the results of our modelling of the following changes in key assumptions:

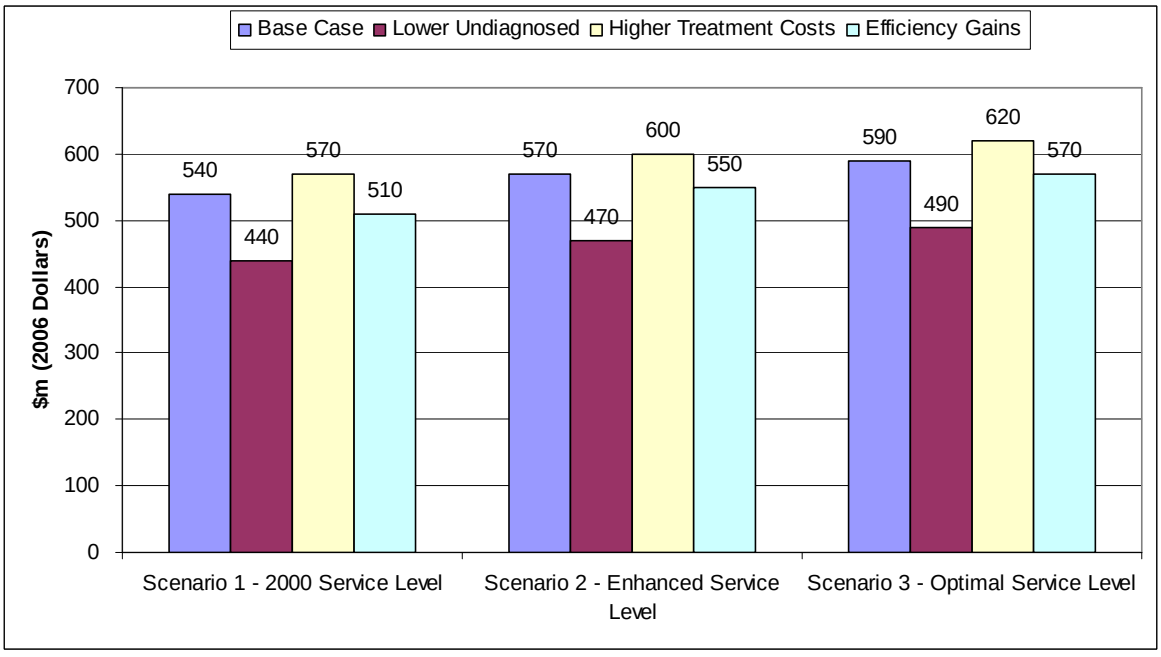
- **Lower Undiagnosed:** Assumes the total population of people with Type 2 diabetes (diagnosed and undiagnosed) was accurately forecast in 2001 Report, and that higher prevalence rates in 2006 reflect higher detection rates from diabetes focused programmes, hence reducing the number of undiagnosed cases.

- **Higher Treatment Costs:** Assumes the introduction of new treatment methods, drugs or equipment which, on average, increases the cost of diabetes health services by 5%. This sensitivity uses the base case prevalence assumptions, which is based on the updated 2006 prevalence data.

- **Efficiency Gains:** Assumes the introduction of more efficient treatment methods and less hospitalisations which, on average, decreases the cost of diabetes health services by 5%. This sensitivity uses the base case prevalence assumptions, which is based on the updated 2006 prevalence data.

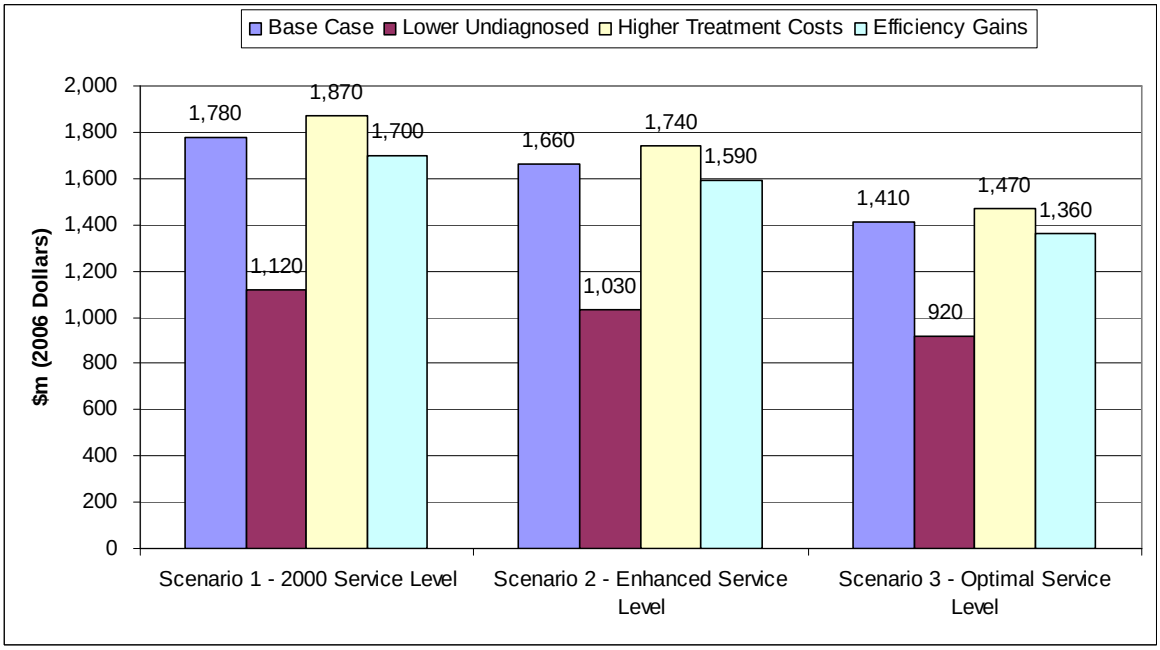
6.2 The following figures present the effect of these sensitivities for each scenario in 2006 and 2021 respectively.

Graph 10: Figure 3: Forecast cost of Type 2 Diabetes in 2006 – Sensitivity Analysis



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.

Graph 11: Forecast cost of Type 2 Diabetes in 2021 – Sensitivity Analysis



Source: Ministry of Health 2001 – 2021 Prevalence Projections and Ministry of Health 2006 Updated Prevalence Projections.

6.3 The sensitivity analysis indicates that changes in the actual prevalence of Type 2 diabetes (diagnosed and undiagnosed) have the greatest impact on the estimated cost of diabetes health services. Therefore, initiatives that are successful in reducing the prevalence of people with Type 2 diabetes have the potential to deliver huge cost savings against the status quo.

6.4 The implication of the sensitivity analysis is that there would be considerable benefit from further research to understand the profile of the population of people with Type 2 diabetes in New Zealand. Based on that research, analysis could be undertaken to understand what services and treatments are most effective at preventing Type 2 diabetes and its complications.

7 Conclusions

7.1 The modelling undertaken for this assignment suggests that the implications of the MoH's updated prevalence estimates are that there is potential for government (DHB) expenditure on services and treatments for people with Type 2 diabetes to rise even more steeply than previously projected. This is likely to be the case if the status quo, where there is limited focus on preventive strategies, is maintained.

7.2 Scenario 3: Optimal Services shows that increased funding for prevention strategies has the potential to provide significant benefits. Some symptoms of Type 2 diabetes and its complications are preventable or can be delayed. Services designed to prevent or delay the onset of Type 2 diabetes and its complications could deliver cost savings in terms of health costs and improved health and well-being for New Zealanders.

7.3 The implications of the MoH's new Type 2 diabetes prevalence projections are:

- Government health spending to treat Type 2 diabetes could increase to approximately $1,600 – $1,800 million per annum (scenarios 1 and 2) over the next 15 years (2006 dollars), in the absence of any further prevention initiatives.

- If the resources required to provide health services to people with Type 2 diabetes rise to this level, diabetes treatment costs will represent approximately 15% of Vote Health (compared with 3% of Vote Health in 2006), potentially crowding out other government funded health treatments and services.

7.4 An increased investment of $60 million a year (in 2006 dollars) in prevention, self-management and early detection services for Type 2 diabetes has the potential to reduce the government's health expenditure by as much as $370 million in 2021, while at the same time improving the health and wellbeing of New Zealanders.

7.5 Over the last five years, MoH has implemented a number of diabetes focused programmes, such as the Get Checked programme, aimed at improving the health and wellbeing of people with Type 2 diabetes. The MoH's update of prevalence estimates has provided the opportunity to review what is known about the impact of these programmes on future health expenditure.

7.6 Under all three scenarios modelled, expenditure on health services for Type 2 diabetes services rises significantly over the forecast period. The results demonstrate the benefits of the MoH leading a focused National Diabetes Strategy that addresses key issues including:

- annual updates of the prevalence of Type 2 diabetes (by age, ethnic group and DHB) by way of a national register;

- programmes for Primary Health Organisations to identify those in their populations with undiagnosed diabetes and engage them in appropriate care, including enrolment in the Get Checked programme;

- up-to-date and reliable data on utilisation rates and costs of health services and treatments for people with Type 2 diabetes, using an outcomes model to monitor the implications; and

- New Zealand-based research into the effectiveness of interventions and population-based programmes to prevent and manage Type 2 diabetes.

Appendix A: Important Note

In preparing this report and forming our views, we have relied upon, and assumed the accuracy and completeness of all information available to us from public sources, or furnished to us by Diabetes New Zealand and the Ministry of Health. We have evaluated that information through analysis, inquiry and review but have not sought to verify the accuracy or completeness of any such information.

The diabetes outcomes model ("2001 Model"), which is used to forecast the health costs of Type 2 diabetes in this report, was developed for the 2001 report *Type 2 Diabetes: Managing for Better Health Outcomes* ("the 2001 Report"), published by Diabetes New Zealand and prepared by PricewaterhouseCoopers. The model's approach to estimating diabetes health costs, assumptions and inputs are set out in detail in the 2001 Report.

We have tested the updated 2001 Model by performing a number of checks to assess the reasonableness of the calculations. However, it is not practical to test a computer model to an extent whereby it can be guaranteed that all errors have been detected, and accordingly we give no such guarantee. If you wish to rely upon the information derived from the 2001 Model you do so entirely at your own risk. Regardless of the form of action, whether in contract, in tort or otherwise, in no event will PricewaterhouseCoopers be liable to any third party for any direct, indirect, special, consequential, or other loss or damages resulting from the use of or the inability to use the 2001 Model, even if PricewaterhouseCoopers has been informed of the possibility of such loss or damages.

In addition, we will not accept responsibility to any other party other than to Diabetes New Zealand, to whom our report is addressed, unless specifically stated to the contrary by us in writing. We will accept no responsibility for any reliance that may be placed on our report should it be used for any purpose other than that for which it is prepared.

The statements and opinions expressed in this report have been made in good faith and on the basis that all relevant information for the purposes of preparing this report is true and accurate in all material aspects and not misleading by reason of omission or otherwise. Accordingly, neither PricewaterhouseCoopers nor its partners, employees or agents, accept any responsibility or liability for any such information being inaccurate, incomplete, unreliable or not soundly based, or for any errors in the analysis, statements and opinions provided in this report resulting directly or indirectly from any such circumstances, or from any assumptions upon which this report is based proving unjustified.

We reserve the right, but are under no obligation, to revise or amend our report if any additional information (particularly as regards the assumptions we have relied upon) which exists on the date of our report, but was not drawn to our attention during its preparation, subsequently comes to light.