

List of Contributors

The DiabCo\$t Australia project is a joint venture between the following organisations:

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- Diabetes Australia
- Eli Lilly Australia
- M-TAG

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Foreword

Type 2 diabetes places significant burdens on our society – in personal, social and economic terms.

The recent AusDiab study, funded by the Australian Government, reveals a national diabetes prevalence of 7.4%. Half of the people with diabetes are yet to be diagnosed.

Australia has previously used costing data from a variety of sources to derive an estimate of the financial burden associated with diabetes. However, country to country variations between health system configurations, service delivery models, and financing arrangements dictate the need for local data to accurately inform our efforts to better understand and manage health care costs.

The DiabCost study addresses these issues in the Australian context. It adds significantly to our knowledge and understanding about the cost of Type 2 diabetes by providing comprehensive and previously unavailable large scale national data. DiabCost also provides useful data on the impact of diabetes on the individual. In addition, it provides the first information in Australia on the support provided by carers to persons with Type 2 diabetes.

I congratulate the co-investigators – the Australian Centre for Diabetes Strategies, Diabetes Australia, M-Tag and Eli Lilly, for this work and look forward to using this data in efforts to address and reduce the burden of diabetes in Australia.

A handwritten signature in black ink, appearing to read 'Tony Abbott'.

Tony Abbott MP
Minister for Health & Ageing

December 2003



From the President of the International Diabetes Federation

The recently released IDF Diabetes Atlas, 2003 highlights the magnitude, distribution and social and cost burden of diabetes.

Diabetes affects people of all ages, from all walks of life and from all the nations of the world. Its global cost is immense and growing.

Governments and other health care funders all over the world are seeking ways to reduce these health and financial costs. These efforts must be underpinned by sound baseline information on diabetes costs against which progress can be measured. With diabetes predicted to increase globally by around 160% by the year 2025 to a total prevalence of around 300 million, the need to systematically describe the associated financial burden is imperative.

As one of the largest and most comprehensive primary cost of illness studies on diabetes ever undertaken, DiabCo\$t Australia adds substantially to the pool of knowledge about the economics of diabetes internationally.

I applaud the work of the DiabCo\$t Australia Consortium in describing the economic burden of diabetes in Australia and adding to the global understanding of its economic impact.

I commend the Report to you.

A handwritten signature in black ink that reads "Pierre Lefebvre". The signature is written in a cursive style and is underlined with a single horizontal line.

Professor Pierre Lefebvre
President, International Diabetes Federation

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Executive Summary

As evidenced by its inclusion as a national health priority area, diabetes is a significant and growing health problem in Australia and, indeed, the world. While the associated health and psychological burden is increasingly well documented, previous estimates of the financial burden of diabetes in Australia have generally been extrapolated from overseas studies.

Accurate information on diabetes costs is vital to inform and guide resource allocation decisions and to provide baseline information for future comparisons and evaluations of the effect of public health policies and interventions. With Type 2 diabetes accounting for some 85-90% of all diabetes in Australia, by sheer volume of numbers, it also accounts for the greater proportion of diabetes costs. The DiabCo\$t Australia study was the first large scale cost of illness study on diabetes undertaken nationally to describe the personal and public financial cost of diabetes. DiabCo\$t focused exclusively on Type 2 diabetes and aimed to provide comprehensive Australian data on:

- direct costs to the health system
- out-of-pocket expenses borne by people with Type 2 diabetes and their carers
- community resources used by people with diabetes
- the impact of diabetes on quality of life.

DiabCo\$t was conducted by means of a national paper based survey mailed to 25,000 randomly selected adults with Type 2 diabetes across Australia. Participants were randomly selected from the National Diabetes Services Scheme register with appropriate permission and compliance with privacy regulations. The respondents were anonymous to both the study investigators and the administrators of the scheme. A further validation study of 5,000 people was conducted after the primary study, which corroborated the representativeness of the sample.

The survey comprised of two structured, self-administered questionnaires, one for individuals with diabetes and another for their carers, which were designed to elicit information on costs incurred over the previous 3 months. In addition, quality of life for respondents with Type 2 diabetes was assessed using the EQ-5D.

Over ten and a half thousand questionnaires were returned, a response rate of 42.6%. The mean age of respondents was 65 years and 10% reported that they had a carer. For purposes of cost analysis, respondents were grouped according to their complications status eg:

- none
- microvascular complications (eye problems, kidney damage or foot or leg ulcers)
- macrovascular complications (heart attack, stroke or amputation)
- both microvascular and macrovascular complications.



Overall, 22% of respondents reported microvascular complications, 2% reported macrovascular complications and 9% reported both.

More than 200 individual prices were used to assess costs. Cost was determined by multiplying the unit price with resource utilisation.

The average annual cost per person with Type 2 diabetes was \$5360, of which \$5325 was from direct costs and \$35 was indirect costs.

Health care costs contributed 79% of the direct costs, or an annual average of \$4260 per person. Hospitalisation, ambulatory services and medications each accounted for approximately 30% of these costs. Insulin and oral hypoglycaemic agents accounted for only 21% of the medication costs, with the majority coming from non-diabetes medication such as lipid lowering and blood pressure lowering agents.

Non-health care costs contributed 21% of the direct costs, or an annual average of \$1065 per person, with the main contributors being home support and special foods. Indirect costs were relatively small at \$35 per person annually, due to the population being relatively elderly.

Complications were the main driver of all types of diabetes costs. The annual cost for people without complications was \$4025, increasing to \$7025 for people with only microvascular complications, \$9055 for people with only macrovascular complications and \$9645 for people with both microvascular and macrovascular complications.

Respondents with Type 2 diabetes reported significant effects on health related quality of life, particularly in the 'mobility' and 'pain/discomfort' dimensions. Respondents also reported significant levels of anxiety and depression. Quality of life scores were decreased in those who reported any type of complication.

With an overall Australian diabetes prevalence of 7.4% the total annual cost for people with Type 2 diabetes is estimated to be \$2.2 billion. If the cost of carers is included this rises to \$3.1 billion. People with Type 2 diabetes also receive an average of \$5540 per year in Commonwealth benefits, increasing the total annual cost of diabetes to \$6 billion.

This study estimates all health related costs for a person with Type 2 diabetes. The estimated excess cost attributable directly to diabetes in Australia is approximately \$1 billion.

The cost of diabetes as shown in the DiabCo\$t Australia study is considerably higher than previous Australian estimates but is consistent with similar overseas reports, such as T²ARDIS and the CODE-2 UK cohort. These findings have far reaching implications for policy and service delivery. For example, given the role of complications as a cost driver, DiabCo\$t adds yet further weight, from yet another evidence source, to the case for early detection of Type 2 diabetes and for access to appropriate standards of care to prevent or delay the onset of complications.

1. Introduction

Almost 1 million Australians have diabetes. Globally, Type 2 diabetes is one of the commonest non-communicable diseases and is increasing exponentially with a predicted prevalence of 300 million globally by the year 2025 (King et al, 1998). Although the adverse outcomes of diabetes can be prevented, delayed or ameliorated, if diabetes is undiagnosed or poorly controlled its complications can be devastating to the individual and costly to the community. For example, diabetes can result in both microvascular disease (renal failure, visual impairment, blindness and erectile dysfunction) and macrovascular disease (heart disease, stroke and lower limb amputation).

Type 2 diabetes accounts for 85 to 90% of all people with diabetes and has a long pre-clinical phase causing many people to remain undiagnosed until some degree of diabetes related complications are discernable at diagnosis. The personal suffering and cost of diabetes to the health system and the community are immense and the cost multiplies in the presence of diabetes complications. However, researchers worldwide are working towards prevention and cure of Type 1 diabetes and we now have irrefutable evidence from international studies that the onset of Type 2 diabetes can be prevented or, at least, significantly delayed.

The Australian Government has flagged its recognition of the public and personal burden of diabetes by maintaining diabetes on the list of national health priority areas since 1996 and through the development and implementation of a national diabetes strategy which is soon to be updated in the form of a national services framework. The AusDiab Study (Dunstan et al, 2002) which found a national diabetes prevalence of 7.4%, has confirmed the wisdom of this focus by providing a measure of the extent of the diabetes problem in Australia. AusDiab also identified that a high proportion of Australians aged 25 years and over have significant risk factors for developing diabetes and that 50% of all people who already have diabetes are not yet diagnosed and so are at very high risk of developing irreversible complications by the time they are diagnosed.

An additional cost of diabetes is the psychosocial burden. The peer reviewed medical literature increasingly documents significantly higher rates of depression and anxiety in people with chronic diseases. Some of this literature is specific to diabetes (Anderson et al, 2001; Lustman et al 1997).

To have an economic and social impact on the burden of diabetes, resources need to be allocated efficiently and effectively to offset costs in other areas. To inform this decision making, comprehensive estimates of the costs, who bears the costs and the attribution of these costs needs to be established.

Although there have been various attempts to estimate the financial burden of diabetes in Australia, prior to DiabCo\$t there had been no large scale primary studies to comprehensively describe these costs and Australia has previously had to rely heavily on costing data from

overseas studies to estimate the local financial burden associated with diabetes. However, between country variations in socio-political and financial systems, health care funding arrangements and service configurations cast doubt on the applicability of health costing data from other countries to the Australian context. Further, health economics is a relatively recent science and its methods are still evolving. Variations in the methodology used can make the validity of comparisons between studies difficult. For example, cost of illness studies attempt to measure the total costs of illness to society but there is currently no standard for estimating this.

Design issues

There are two major approaches to the collection of data on health costs:

- a 'top down' approach in which the total health budget is apportioned to disease and to cost per patient; and
- a 'bottom up' approach which involves tracking expenditure from the individual patient and extrapolating out the total costs to society.

Individual cost (or bottom up) estimates are generally higher than those based on national health expenditure.

There are three main types of costs measured in cost of illness studies:

Direct costs (resources used)

Indirect costs (potential resources lost)

Intangible costs (eg. quality of life)

Direct costs are divided into health care and non-health care costs. Methods of assessing direct health care costs vary but usually include items that make up significant health care expenditures for a particular disease. For example, for Type 2 diabetes this includes hospitalisation, pharmaceuticals, GP visits and the cost of testing equipment. Direct non-health care costs are an assessment of the social cost of disease. These include transport to medical services, child-care and other non-medical resources used to manage an illness.

Indirect costs measure the present and future impact of opportunities lost to an individual as a consequence of the disease in question. These include the costs of morbidity, disability and premature mortality. The methods of estimating indirect costs vary widely between studies. Most studies include an estimate of permanent retirement from work but may not include estimates of restricted activities or changes in work settings consequent to the illness (Williams et al, 2000 b).

Measurement of *intangible costs* has only been included in cost of illness studies relatively recently, and most studies do not translate these costs into monetary values. Intangible costs are commonly measured through quality of life assessments. It is worth noting that quality of life may impact on resource use since the person's perception of their own health state may be related to their use of resources (Badia et al, 1998).

Previous national and international studies on the cost of diabetes

Previous Australian attempts to quantify the cost of diabetes in Australia have predominantly estimated direct health system costs. The Australian Institute of Health and Welfare (AIHW) adopted a 'top-down' approach to estimate direct health care costs associated with Type 2 diabetes in 1993-94 (Mathers and Penm, 1999). The study took known aggregate expenditures on health care and apportioned these to disease categories from a number of data sources (casemix, hospital morbidity, the Pharmaceutical Benefits Scheme (PBS) and two national health surveys). Direct health system costs were estimated to be \$372 million in 1993-94, of which Type 2 diabetes was estimated to account for \$217 million (58%). Of the total cost, 26% was for pharmaceuticals, 27% for hospital care and 17% for medical services. When complications of diabetes were taken into account, the total health system costs of diabetes were estimated to be around \$681 million annually, corresponding to approximately \$1730 per person for males and \$2120 per person for females. While this study provided a useful estimate of the impact of diabetes relative to other national health priority diseases, the authors acknowledged the limitations of the study in describing total disease burden.

The Rise and Rise of Diabetes in Australia (McCarty et al, 1996) which reviewed diabetes statistics, trends and costs also took a 'top down' approach to examining all direct health system costs associated with diabetes (eg prescription medications, visits to GPs and specialists, home and clinic testing and public and private hospital separation data). In addition, this study estimated premature mortality and indirect costs of lost production, using previously published prevalence, morbidity and mortality data. This study estimated the annual direct costs of diabetes as \$516 million (1995). The largest contributor to this cost was in-patient costs, of which the greatest contributor was costs associated with vascular disease. Insulin represented 5% of the total cost and oral hypoglycaemic agents 2%. Indirect costs (morbidity and premature mortality) were estimated as \$418 million in 1995. Total costs were estimated at around \$1 billion annually, or at least \$2,774 per year for each Australian with diagnosed diabetes.

Recent international studies have attempted to use innovative 'bottom-up' methods to estimate costs associated with Type 2 diabetes. The 1998 Cost of Diabetes in Europe study, or CODE-2, analysed direct health care costs in eight European countries simultaneously (Belgium, France, Germany, Italy, the Netherlands, Spain, Sweden and the United Kingdom). The method of participant selection varied between countries but the same data items were collected and the same methods used for translating health care use into costs. Data were collected via 2 questionnaires on resource use over the previous 12 months: general practitioners were asked to complete a questionnaire based on medical record review (clinical, economic and demographic data) and corresponding patients completed a questionnaire on direct and indirect non-medical use of resources and quality of life (Jonsson, 2002). Over 7000 patients were studied.

Total annual costs of diabetes for the eight countries were estimated to be 29 billion euros (A\$52 billion), corresponding to a cost per patient of 2834 euros (A\$5044). On average, 3% of the population with diabetes accounted for 5% of the total health care expenditure.



Hospitalisation accounted for the greatest proportion of costs (55%). The cost of medications accounted for 27% of the total health care costs, but of these cardiovascular and lipid-lowering agents accounted for 42%, oral hypoglycaemic agents 13% and insulin 11%. Of note, 60% of patients were taking oral anti-diabetic agents, but these accounted for only 4% of the total health care costs.

Complications were shown to have a substantial impact on the costs of managing Type 2 diabetes (Williams et al, 2002). Costs for people with macrovascular complications were twice as high as people with no complications, and people with both microvascular and macrovascular complications had a 3.5 fold increase. Assessment of quality of life found that average scores were lower than the general population, and were significantly affected by the presence of complications, particularly for people with both macrovascular and microvascular complications (Koopmanschap, 2002). Quality of life was also significantly reduced in people requiring insulin.

The second study conducted in the UK only was the 1999 T²ARDIS study (Type 2 Diabetes-Accounting for a Major Resource Demand in Society in the UK). This study collected direct, indirect and intangible (quality of life) costs for people with Type 2 diabetes and their informal carers in the UK. A random sample of people registered with Type 2 diabetes at 7 treatment centres were mailed questionnaires and asked to report on costs related to their diabetes in the preceding 3 months. Data on clinical outcomes (glycaemic control, lipid levels and blood pressure) were also collected. A total of 1578 participants were studied. The study found that on average a person with Type 2 diabetes in the UK incurred direct costs of over 2000 pounds (\$A5370) per year. More than 80% of costs were incurred within the National Health Service (NHS), 13% through private expenditure and the remainder via social services. Type 2 diabetes was estimated to account for 4.7% of the total NHS spending (2 billion pounds (A\$5.4 billion) in 1998).

T²ARDIS analysed costs by presence of complications, finding that complications increased overall NHS costs by more than five fold, increased social service costs by four fold, increased personal expenditure by three fold and doubled the need for a carer (Williams, 2000 a). In addition, people with diabetes reported a significantly poorer quality of life than the general population in almost all age groups and those with diabetes complications reported an even poorer quality of life. Further, loss of earnings for both people with diabetes and their carers were significantly associated with diabetes complications. Overall, the T²ARDIS study found that the presence of complications was the major driver of costs in Type 2 diabetes and that the future management of Type 2 diabetes should place greater emphasis on the prevention of complications rather than their treatment.

The different methodologies and results from the above studies are summarised in Table 1.1.

Table 1.1 Comparison of recent cost of illness studies

	AUSTRALIAN STUDIES		INTERNATIONAL STUDIES	
	AIHW	RISE & RISE	CODE-2 EUROPE	T ² ARDIS
Year of analysis	1993/94	1995	1998	1999
Costs	Direct health care	Direct health care Indirect (premature mortality, lost production)	Direct health care Indirect Quality of life	Direct health care Direct non-health care Indirect Quality of life Carer
Methods	Health care expenditure apportioned to disease categories	Direct costs measured from national data collection systems	Patient questionnaire* and GP questionnaire based on medical records	Patient questionnaire (including clinical outcome data)
Estimated total health system costs per person	A\$1925	A\$2774	2834 euros (A\$5044)	2000 pounds (A\$5370)

* In five countries

Costs for people with Type 2 diabetes and their carers

People with diabetes are more likely to consult a health professional or use health services, whether they are aware that they have diabetes or not (Ramsey et al, 1999). The higher rate of use is related to need for treatment and metabolic control as well as to treatment related to associated complications. Due to the management and monitoring associated with insulin therapy, people with Type 1 diabetes are likely to use health services more often than those with Type 2 diabetes (Nichols et al, 2000). However, once a person with Type 2 diabetes commences on insulin therapy, their interaction with the health system increases and the annual cost difference disappears (Goertz et al, 1999; Brown et al, 2001).

People with Type 2 diabetes are, on average, older than those with Type 1 diabetes. Older people are more likely to have co-morbidities which complicate the management of their diabetes and impact on their need to utilise health services. A number of studies have shown a sharp increase in costs in the presence of diabetes complications. In addition, older people



with co-morbidities are more likely to require the assistance of a carer to maintain adequate self-care. In this situation, it is common for carers to incur personal costs associated with travel, time off work, and sundry or incidental costs. However, to date, few cost of illness studies include assessment of the costs of diabetes to carers.

Aim of the DiabCo\$t Australia study

DiabCo\$t was initiated in 2001 in response to the pressing need for information on the cost of diabetes to the community, for the individual with diabetes and for people who care for others with diabetes. Given the issues already detailed, the evidence about the rapidly rising national prevalence of diabetes (AusDiab) and the status of complications rates (ANDIAB, 2003), the need to describe the cost of diabetes and explore the factors that influence and drive them in the Australian context was easily identified.

The DiabCo\$t Australia study focused exclusively on Type 2 diabetes and aimed to provide comprehensive Australian baseline data on the cost of illness associated with Type 2 diabetes including:

- direct costs to the health system
- community resources used by people with diabetes
- out-of-pocket expenses borne by people with diabetes and their carers
- impact of diabetes on an individual's quality of life.

2. Methodology

Research design and study population

The DiabCo\$t study was performed by a retrospective self-reported survey of people with Type 2 diabetes. The study sample was recruited through the National Diabetes Services Scheme (NDSS). The NDSS provides subsidised access to non-pharmaceutical products for people with diabetes. It is estimated to encompass 95% of all people diagnosed with diabetes, of whom approximately 80% have Type 2 diabetes. Therefore, registrants on the scheme can be considered broadly representative of the population with Type 2 diabetes in Australia.

For this study, names and addresses of people registered with the scheme were randomly generated by an independent person and sent to a mailing house. Specification by type of diabetes was not possible at the time the survey was undertaken. Therefore, to limit the sample as much as possible to people with Type 2 diabetes, participants selected were over the age of 40 years. The sample was stratified by State or Territory to ensure nation-wide coverage.

A total of 25,000 surveys were posted within one working week in November 2001. A telephone hotline for questions about the survey operated for business hours during the survey period.

To validate the first survey, a second survey using similar methods as the first was sent 6 months after the initial survey to 5,000 people who were not sampled in the first round.

Ethics

The South Eastern Sydney Area Health Service (Eastern Sector) Research Ethics Committee approved the study. All participants were informed that participation in the survey was voluntary and anonymous and consent was assumed by return of a completed survey. Confidentiality was maintained throughout the study process and none of the study partners had access to the list of registrants.

The DiabCo\$t survey instrument

The DiabCo\$t survey instrument was designed to collect direct and indirect health care and non-health care costs for people with Type 2 diabetes, costs to carers and an assessment of the impact of Type 2 diabetes on individual quality of life. The survey measured total health costs for this population: it was not possible to separate health care costs attributable to diabetes and those incurred through non-diabetic conditions.

Respondents were asked to report on costs incurred over the previous 3 months. The questionnaire was modelled on the UK T²ARDIS study questionnaire and was piloted with people with diabetes attending an urban diabetes centre.

The survey included collection of the following information:

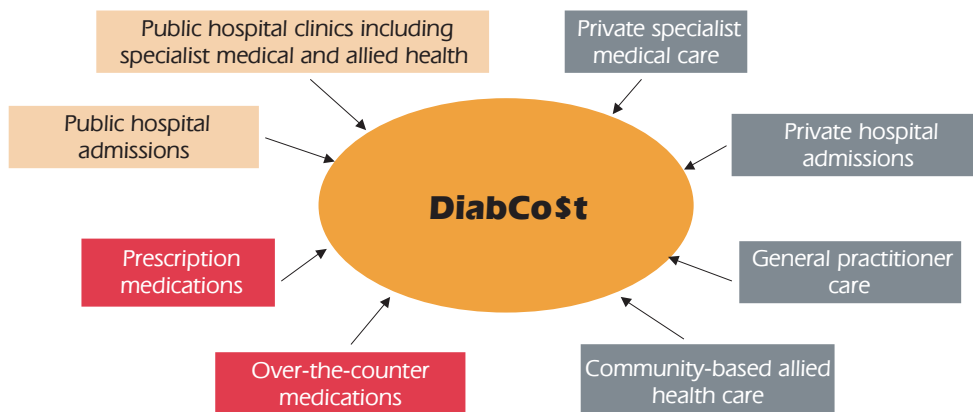
Demographic data

Information was collected on gender, age, age at diagnosis of diabetes, Aboriginality, postcode, sources of income, smoking status and independent living status. Carers were also asked to provide demographic information including employment status and relationship to the person with diabetes.

Direct health care costs

Direct health care costs were assessed by asking respondents to record all public and private health care encounters and use of prescription and non-prescription medications in the preceding 3 months. Public health care encounters included attendance at hospital based diabetes clinics and hospital admissions. Private health care services included visits to private specialists, private hospital admissions and allied health services, including dietitians, podiatrists and optometrists. General practitioner visits were costed separately. This assessment is conceptualised in Figure 2.1.

Figure 2.1 Direct health care costs assessed in the DiabCoSt survey



Direct non-health care costs

Other direct costs associated with caring for diabetes but not included as health costs were assessed. These included transport, home support and purchase of special diabetic food.

Indirect costs

The measurement of indirect costs was limited to impact on productivity (annual lost wages) and as such may represent an underestimate of the indirect costs of Type 2 diabetes. The survey did not evaluate the impact of disability. The impact of Type 2 diabetes on premature mortality could not be assessed using a self-reported questionnaire.

Quality of Life

Quality of life was assessed using the EQ-5D. The EQ-5D is a two-part validated questionnaire

that has been widely used internationally, including in the T²ARDIS and CODE-2 studies, and is suitable for assessment of generic health related quality of life in chronic disease states (Hawthorne et al, 2001; EuroQol group, 1996; Badia et al, 1998; Kind et al, 1998). The EQ-5D uses a basic 'common core' of health related quality of life characteristics which most people are known to value highly (NSW Health, 2000). While most dimensions of the DiabCo\$t survey instrument asked the respondent to report on costs incurred in the preceding three months, the EQ-5D asked respondents to report on their health 'today'.

The EQ-5D has five dimensions: mobility, self-care, usual activity, pain/discomfort and anxiety/depression. Within each dimension there are three possible responses: no problem, some problem and extreme problem. Each dimension can be presented as a profile or converted into a single weighted index score. A combination of these categories defines 243 theoretically possible health states.

In addition respondents are asked to rate their overall health on a visual analogue scale (VAS) ranging from 1 (best imaginable health state) to 0 (worst imaginable health state).

Carer costs

If respondents had a nominated non-professional carer, the carer was asked to complete the second section of the questionnaire. Carers were asked about direct and indirect costs associated with caring for the person with diabetes.

A copy of the survey instrument is available in the 'health economics' section on the Australian Centre for Diabetes Strategies website: www.diabetes.net.au.

Sample size determination

As cost data are typically skewed, methods of calculating sample size based on normal distribution assumptions are generally not valid. In this study, sample size estimation needed to account for differences in cost between complications groups.

The sample size was determined using results from the UK T²ARDIS study as a model. The observed cost difference from the T²ARDIS study, stratified by complication category, was used to simulate a tentative cost distribution for the DiabCo\$t study. 'Subjects' assigned to a particular complication category were allocated the average expenditure cost for a T²ARDIS subject in that category.

To allow estimation of an average cost of any complications subgroup to within \pm \$200, it was estimated that a minimum sample size of 1600 was required. This was increased arbitrarily to 2500 to compensate for attenuated variances resulting from the sample size estimation method. Given an expected response rate of 10%, 25,000 questionnaires were sent out.

Data management

Data entry was conducted at the Global Data Management Centre (GDMC). A study specific data management strategy was implemented. This included extensive data cleaning, double

entering of all data, data validation to check consistency of various respondent answers and specific field level checks in the database. Data were entered into an Oracle database application (CT-FAST). In general, a convention of conservative editing was adopted, where data were excluded, set to 0, or included in a way that would incur minimum cost when the value of a data item was uncertain. All operations were tracked and time-stamped in an audit trail.

Analytical methods

All data reported are based on evaluable questionnaires only and were analysed using the Stata statistical package (Stata Corporation, 2001). A p value of less than 0.05 was considered to indicate significance.

Costing methods

The approach taken in the analysis was to assume that the costs incurred for the 3 months preceding the survey would be representative of costs incurred on an annual basis. All costs for each three month period were then multiplied to represent a 12 month period of care. In most cases this represented a multiplication by a factor of four.

For some items, the annual estimate was a fraction of a unit cost. This was the case for some accommodation support items, for example. In the case of items deemed to be non-recurring, an estimated cost was calculated as a one-off item. This calculation was rare: even occasional expenses such as purchase of a blood glucose meter were included as a pro-rata cost, assumed to be renewed every 2.5 years.

Extrapolation of service use was based on typical patterns for people with Type 2 diabetes. For example, specialists' visits were estimated at 2 per 12 month period. Therefore, if a person nominated a visit to a medical specialist in the preceding 3 months, this was multiplied by two. Any hospital admissions reported were assumed to be unique events.

The resource utilisation captured from the survey was multiplied by the unit price to determine the cost. Estimated total costs for different item groups were calculated by summing the estimated yearly costs of relevant items.

Medication doses and frequency of treatment were standardised to produce a total number of standard 'units' of the medication. In order to estimate the total amount of any medication used, care was taken to determine whether the treatment was for a chronic or acute condition, based on the information provided by the individual respondents, and using the product information found in MIMS (E-MIMS, v 4.0, © 2001) and on the Australian Government Schedule of Pharmaceutical Benefits website (<http://www1.health.gov.au/pbs/>). For most chronic treatments it was assumed the respondents were maintained on the treatment for the full twelve months. Non-prescription and prescription medications were also screened for misclassification. Costs of medical treatments were based on the total costs of the medicine or device and were not divided into government subsidised costs and costs to the person.

Estimated average costs across the respondents were obtained in the usual way, by summing up the respective total for each individual and dividing by the total number of individuals. Confidence intervals for averages were calculated using the ‘bootstrap technique’ (Efron and Tibshirani, 1993). Bootstrapping is a re-sampling approach that produces confidence intervals which do not rely on distributional assumptions. Bootstrapping provides a way of deriving confidence intervals for the difference in mean costs between two groups in circumstances where costs are not normally distributed and confidence intervals from standard methods may not be valid (Kirkwood and Sterne, 2003).

Sources of costing data

More than 200 individual prices were used in the analysis. Unit prices were sourced from publicly available sources for transparency and ease of future updating. The prices used were a mixture of costs and charges. The seven broad categories of costs and sources are shown in Table 2.1. The most recent price was established and the Australian Institute of Health and Welfare (AIHW) health price deflator was used to update costs to 2001 values.

Table 2.1: Examples of sources of prices

Medical services and diagnostics	Medicare Benefits Schedule and Australian Medical Association prices
Drugs	Pharmaceutical Benefits Scheme prices
Diabetes consumables	Diabetes Australia- NSW prices
Hospitals	AR-DRG 4.1 (Casemix)
Lost work time	Average weekly earnings
Carer time	Centrelink allowances
Pensions and allowances	Current Centrelink payments

Categories analysed

Respondents were grouped according to complications status – none, microvascular complications, macrovascular complications and both microvascular and macrovascular complications. Individual complications were assigned as macrovascular or microvascular as shown in Table 2.2.

Table 2.2: Complications groups used in DiabCoSt study

Macrovascular	Microvascular
Heart attack	Eye problems
Stroke	Kidney damage
Amputation	Foot or leg ulcers

In some studies, including the T²ARDIS study, amputation is considered as a microvascular complication of Type 2 diabetes. However, in the present study it was considered that while foot ulcers should be considered a microvascular complication, amputation was more accurately classified as a macrovascular complication.

Treatments for Type 2 diabetes were categorised using a 'steps of care' approach:

- no pharmacological treatment (diet and exercise only)
- oral hypoglycaemic monotherapy
- oral hypoglycaemic combination therapy
- injectable insulin therapy (alone or in combination with an oral hypoglycaemic agent)

Prescription medicines were grouped as:

- oral hypoglycaemic agents (metformin, sulphonylureas, others)
- insulins
- prescription medicines not for the control of blood glucose (eg lipid lowering agents, anti-hypertensive agents)
- non-prescription medicines

3. Results

Demographics

Summary of respondent characteristics

The number of evaluable questionnaires returned was 10,652, a response rate of 42.6%. A summary of respondent characteristics, with comparison to the T²ARDIS and CODE-2 UK studies, is given in Table 3.1. Compared to the other two populations, respondents in the DiabCo\$t study were less likely overall to have any complications, particularly heart attacks, but relatively more likely to have foot or leg ulcers or amputation. DiabCo\$t respondents were more likely to have their diabetes controlled with diet and exercise alone and less likely to be using insulin.

Table 3.1: Respondent demographics

VARIABLE	DIABCO\$t	T ² ARDIS	CODE-2 UK
Respondent characteristics			
Number of people evaluable	10652	1578	749
Response rate (%)	42.6	53	-
Male (%)	49.8	56	61
Mean age in years (SD)	65.2 (10.4)	66 (11)	63 (12)
Smoker (%)	8.7	16	19
Respondents with a diabetes carer (%)	10.0	32	n/a ¹
Mean time since diagnosis in years (SD)	5.4 (5.7)	8 (8)	8 (7)
Treatment regimes			
Number of respondents evaluable	10533		
Diet and exercise only (%) ²	32.7	19	17
Oral hypoglycaemic agents only (%)	59.6	59	60
Insulin alone or in combination (%)	6.7	20	23
Prevalence of individual complications (%)			
Number of respondents evaluable	8536		
Stroke	6.9	6	6
Foot or leg ulcers	9.0	5	6
Amputation	4.9	1	2.5
Eye problems	26.6	26	19 ³
Heart attack	8.9	14	14
Kidney damage	10.4	n/a	10
Prevalence of complication groups (%)			
Number of respondents evaluable	8536		
None	66.8	57	24
Microvascular only	21.8	24	31
Macrovascular only	2.2	12	9
Both	9.3	7	36

1 Not applicable/not asked for

2 Calculated for 10652 respondents

3 Retinopathy only

Respondent characteristics by State/Territory and Aboriginality

The characteristics of respondents by State or Territory are given in Table 3.2.

Table 3.2: Study population by State/Territory

Characteristic	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Number ¹ (%) ³	192 (1.8)	3747 (35.4)	52 (0.5)	1547 (14.6)	1104 (10.4)	331 (3.1)	2495 (23.6)	1115 (10.5)
Mean age (SD)	64.9 (10.0)	65.0 (10.4)	60.9 (9.5)	64.5 (10.3)	66.2 (10.0)	66.4 (10.3)	65.0 (10.6)	65.9 (10.1)
% Male	52.1	48.9	59.6	49.5	48.3	53.7	50.1	51.4
Number of carers ² (%) ³	17 (8.9)	354 (9.4)	2 (3.8)	123 (8.0)	91 (8.2)	28 (8.5)	240 (9.6)	91 (8.2)
Treatment regime %³								
Diet and exercise only	33.3	30.3	35.3	30.2	35.5	28.1	35.9	36.8
Oral hypoglycaemic agents only	60.9	61.8	56.9	62.3	59.5	63.9	57.6	57.5
Insulin only	1.6	2.9	2.0	2.2	1.7	2.1	2.6	1.4
Insulin and OHAs	4.2	4.3	5.9	5.3	3.3	5.8	4.0	4.3
Complications type %								
Total evaluable ⁴	156	2998	39	1231	898	278	1994	894
None	70.5	66.5	53.9	64.2	69.4	66.9	68.6	65.8
Microvascular	18.6	21.4	18.0	22.6	20.4	18.7	21.5	25.2
Macrovascular	1.9	2.0	2.6	2.7	1.9	2.5	2.2	2.0
Both	9.0	10.1	25.6	10.6	8.4	11.9	7.8	7.1

1 State of residence derived from postal code – only 10583 were available.

2 Based on a returned total of 946 valid carer questionnaires.

3 % of State total.

4 Total number with valid complication type and postal code.

Overall, 1.2% of respondents self-identified as Aboriginal or Torres Strait Islander, ranging from 0.7% in Victoria to 11.5% in the Northern Territory (Table 3.3).

Table 3.3: Aboriginal/Torres Strait Islander status by State/Territory

State/Territory	Aboriginal/ TSI respondents (%)	Total respondents
ACT	3 (1.6)	190
NSW	45 (1.2)	3678
NT	6 (11.5)	52
QLD	24 (1.6)	1525
SA	10 (0.9)	1082
TAS	5 (1.5)	324
VIC	16 (0.7)	2466
WA	12 (1.1)	1096
Total	121 (1.2)	10413

Validation Survey

To validate the findings of the survey and to collect further information about prescription medications use, the DiabCo\$t questionnaire was mailed to a further 5000 people not originally sampled. The demographic details of the 1984 respondents to the validation survey did not differ significantly from the findings of main survey. A summary of the findings is provided in Table 3.4.

Table 3.4: Comparison of characteristics between DiabCo\$t 1 and DiabCo\$t 2

	DIABCO\$t 1	DIABCO\$t 2
Demographics		
Mean age (yrs)	65.2	65.7
% of men	49.8	49.4
Mean duration of diabetes (yrs)	5.4	6.3
Treatment (%)		
Diet and exercise only	32.7	26.8
Oral hypoglycaemic agents only	59.6	63.3
Insulin with or without OHA	6.7	8.5
Prevalence of individual complications (%)		
No complications	66.8	57.3
Stroke	6.9	6.3
Foot or leg ulcers	9.0	7.5
Amputation	4.9	4.2
Eye problems	26.6	21.6
Heart attack	8.9	8.1
Kidney damage	10.4	10.0

Resource and medication use

Resources used by people with Type 2 diabetes in the DiabCo\$t study are shown in Table 3.5, with the results for the T²ARDIS and CODE-2 UK studies provided as comparison. Results were generally similar across the three populations, although the DiabCo\$t respondents had on average more visits to GP surgeries and shorter stays in hospital when admitted, and were less likely to be using insulin.

Table 3.5: Resource use

AVERAGE ANNUAL RESOURCE USE PER RESPONDENT	DIABCO\$t	T ² ARDIS	CODE-2 UK
Ambulatory care	Mean (SD)		
GP visits (surgery)	10.5 (11.6)	5.2 (6.8)	5.7 (3.9)
GP visits (home)	0.4 (2.9)	0.8 (5.0)	3.4 (3.3)
Outpatient visits	1.1 (4.3)		1.7 (1.3)
Emergency ambulance	0.1 (1.0)	< 0.1	0
Emergency admission to casualty	0.3 (1.6)	< 0.1	1.2 (0.5)
In-Hospital setting	Mean (SD)		
Inpatient nights (public and private) ¹	2.0 (12.8)	2.4 (16.1)	1.9 (7.6)
Inpatient nights in respondents admitted to hospital ²	23.2 (37.8)	38.8 (52.4)	38.0 (59.9)
	Number (%)		
Respondents admitted ³	910 (8.6)	100 (6.0)	156 (20.8)
Drug use – Anti-diabetic therapies	% Patients		
Metformin	44.0	28	42
Sulphonylurea	39.7	28	52
Insulin with or without oral hypoglycaemic agents	6.7	20	23

1 All respondents, includes both public and private hospitals.

2 For respondents with at least 1 admission, includes both public and private hospitals.

3 Admissions to hospital emergency departments + nights spent in public hospitals + nights spent in private hospitals

The study found that overall 33% of respondents were using no medication, 20.8% were using metformin only, 17.8% were using a sulphonylurea only, 20.4% were using metformin and a sulphonylurea, 2.4% were using insulin only and 1.3% were using insulin and metformin and a sulphonylurea (based on 10533 respondents with an evaluable treatment group).

Overall, 712 respondents (6.7%) had used some form of social service in the preceding 3 months. Social services included home help, Meals on Wheels, day centres and others. A small proportion of respondents had lived in a nursing home, hostel or independent supported unit in the previous 3 months (Table 3.6).

Table 3.6: Respondents using social services and supported accommodation

Respondent group	Number of respondents	Proportion (%)
Respondents using nursing home accommodation	38	0.4
Respondents using hostel accommodation	58	0.5
Respondents using independent unit accommodation	84	0.8

Resource use was similar across all Australian States and Territories except for the Northern Territory (Table 3.7). Although the sample was small, respondents from the Northern Territory were:

- less likely to have a carer;
- less likely to be admitted to hospital but had longer stays when they were admitted;
- less likely to visit a GP surgery but more likely to visit an outpatient clinic;
- less likely to be using any anti-diabetic therapy; and
- more likely to have diabetic complications, particularly both microvascular and macrovascular disease.

Table 3.7: Resource use by State/Territory

MEAN ANNUAL RESOURCE USE PER RESPONDENT (SD)	ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Ambulatory care	Mean (SD)							
GP visits (home)	0.2 (1.3)	0.5 (3.2)	0	0.2 (2.0)	0.5 (3.2)	0.5 (3.3)	0.4 (3.0)	0.3 (2.0)
GP visits (surgery)	9.1 (8.5)	11.2 (12.1)	7.3 (9.0)	11.0 (13.1)	9.5 (8.8)	10.3 (9.6)	10.3 (11.2)	9.7 (12.1)
Outpatient visits	1.1 (4.0)	1.0 (4.4)	3.1 (7.7)	1.1 (3.7)	1.3 (4.7)	1.2 (4.2)	1.0 (3.6)	1.2 (5.0)
Emergency ambulance	0.02 (0.3)	0.1 (1.0)	0.1 (0.6)	0.1 (1.0)	0.2 (1.5)	0.2 (2.3)	0.1 (0.7)	0.1 (0.9)
Emergency admission	0.3 (1.5)	0.3 (1.6)	0.1 (0.6)	0.3 (1.4)	0.4 (2.2)	0.3 (1.7)	0.2 (1.3)	0.4 (2.1)
In-hospital setting	Mean (SD)							
Inpatient nights (public and private) ¹	1.5 (7.3)	1.9 (12.5)	1.7 (11.7)	1.7 (9.4)	1.8 (13.3)	3.2 (20.1)	2.2 (13.6)	2.1 (12.5)
Inpatient nights in patients admitted to hospital ²	23.7 (19.1)	31.0 (41.3)	44.0 (56.6)	25.5 (27.1)	29.3 (45.5)	42.4 (61.9)	34.2 (42.6)	29.6 (38.7)
	Number (%)							
Respondents admitted ³	17 (8.9)	289 (7.7)	2 (3.9)	119 (7.7)	91 (8.2)	32 (9.7)	201 (8.1)	105 (9.42)
Drug use – Anti-diabetic therapies	% Patients							
Metformin	49.0	45.8	36.5	44.9	43.3	43.2	41.1	43.5
Sulphonylurea	33.9	39.2	32.7	41.3	42.4	45.6	37.6	40.1
Insulin with/out OHAs	5.7	6.8	5.8	7.2	4.7	7.6	5.7	4.9

1 All respondents, includes both public and private hospitals.

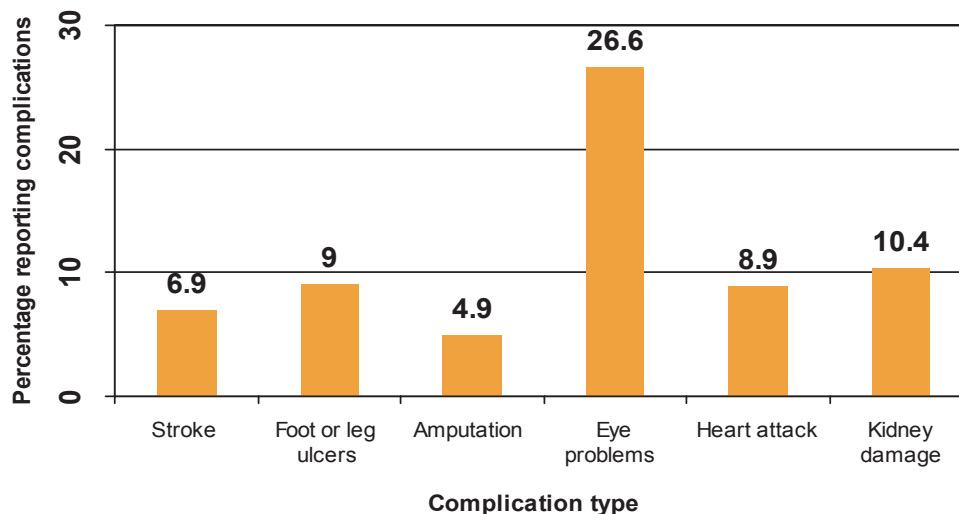
2 For respondents with at least 1 admission, includes both public and private hospitals.

3 Admissions to hospital emergency departments + nights spent in public hospitals + nights spent in private hospitals

Complications

The prevalence of any complication across the DiabCo\$t study respondents was 33.2%. Of these, two thirds (67%) had microvascular complications only, 6% had macrovascular complications only and 28% had both microvascular and macrovascular complications. The percentage of individual complications is shown in Figure 3.1.

Figure 3.1: Complications in DiabCoSt respondents



The presence of complications had a significant impact on resource use, receipt of government benefits and the likelihood of having a carer. With increasing severity of complications there was an increase in GP, outpatient and emergency department visits. While respondents with macrovascular complications were more likely to be admitted to hospital than the other groups, those with microvascular complications spent longer in hospital once admitted. The number of nights in hospital for those with both microvascular and macrovascular complications was 3.7 times higher than for people without complications (Table 3.8).

Table 3.8: Impact of complications on resource use

AVERAGE ANNUAL RESOURCE USE PER RESPONDENT	COMPLICATIONS GROUP			
	None	Micro	Macro	Both
Ambulatory care	Mean (SD)			
GP visits (surgery)	9.5 (10.2)	12.7 (13.3)	12.2 (9.9)	14.4 (16.7)
GP visits (home)	0.2 (2.0)	0.6 (3.5)	1.0 (4.3)	1.1 (5.0)
Outpatient visits	0.8 (3.3)	1.7 (5.5)	1.6 (5.3)	2.4 (7.7)
Emergency ambulance	<0.1 (0.7)	0.1 (1.0)	0.4 (1.3)	0.4 (2.4)
Emergency admission to casualty	0.2 (0.3)	0.5 (2.3)	0.7 (1.8)	0.7 (2.6)
In-Hospital setting	Mean (SD)			
Inpatient nights (public and private) ¹	1.2 (9.6)	2.6 (15.4)	4.2 (14.8)	4.4 (17.6)
Inpatient nights in patients admitted to hospital ²	19.4 (34.7)	24.1 (40.7)	19.2 (26.8)	25.8 (35.6)
	Number (%)			
Respondents admitted ³	340 (6.0)	203 (10.9)	41 (22.0)	136 (17.2)
Drug use – Anti-diabetic therapies	% Respondents			
Metformin	40.8	51.6	49.5	54.5
Sulphonylurea	34.8	49.1	49.5	48.2
Insulin with or without OADs	4.5	10.6	13.3	15.4

1 All respondents, includes both public and private hospitals.

2 For respondents with at least 1 admission, includes both public and private hospitals.

3 Admissions to hospital emergency departments + nights spent in public hospitals + nights spent in private hospitals

Quality of life

Quality of life scores for the 5 dimensions compared to the T²ARDIS respondents are shown in Table 3.9. Respondents generally reported less problems than the T²ARDIS respondents. Both groups reported problems most often in the 'mobility' and 'pain/discomfort' dimensions. There were also significant levels of anxiety/depression reported.

Table 3.9: EQ-5D_{PROFILE} Percentage of respondents reporting problems

EQ-5D	DIABCO\$t	T ² ARDIS
Mobility		
Some problems	32.3%	47.2%
Extreme problems	0.6%	0.4%
Self-care		
Some problems	6.5%	14.8%
Extreme problems	1.2%	1.2%
Usual activities		
Some problems	26.5%	35%
Extreme problems	3.4%	6.6%
Pain/Discomfort		
Some problems	38.4%	40.9%
Extreme problems	4.9%	7.7%
Anxiety/Depression		
Some problems	30.3%	34.7%
Extreme problems	3.4%	5.3%

People with diabetes in the 36-50 year and 51-65 year age brackets reported poorer quality of life compared to other Australians in the same age brackets. Increasing age lowered the quality of life scores overall but tended to level the difference between people with diabetes and the general community (Table 3.10).

Table 3.10: Overall health assessment by age

Age	General population*	DiabCo\$t
36-50	0.88	0.83
51-65	0.84	0.80
66+	0.79	0.78

* Hawthorne et al, 2001

The presence of complications decreased quality of life scores, both for the index scores assessing the five dimensions reported and the visual analogue scale (VAS) completed by respondents (Table 3.11).

Table 3.11: EQ-5D scores by complications category

EQ-5D scores	No complications	Microvascular complications	Macrovascular complications	Micro+Macro complications
Index Mean (SD) n=9576	0.85 (0.21)	0.69 (0.30)	0.65 (0.31)	0.63 (0.35)
VAS Mean (SD) n=9902	77.7 (16.0)	67.6 (19.0)	69.1 (18.3)	65.1 (19.6)

Quality of life scores were also affected by treatment category, with insulin therapy being associated with decreasing overall index scores.

Table 3.12: EQ-5D scores by treatment category

EQ-5D scores	Diet	Tablets	Insulin	Insulin + tablets
Index mean (SD) n=9492	0.83 (0.23)	0.78 (0.27)	0.68 (0.32)	0.66 (0.32)

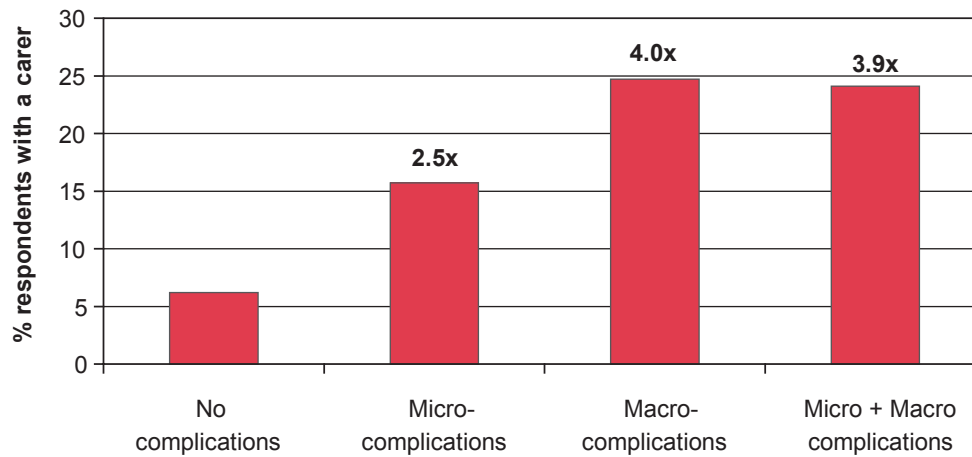
Carers

Ten percent of respondents reported that they had a carer. The majority of carers were spouses or partners of the person with diabetes (75%), 19% were other relatives and 1.9% were friends or neighbours. Although carers did not include services provided by local authorities (eg local councils), they did include people paid by the person or family to provide the caring. One percent of carers nominated themselves as 'professional paid carers'.

The mean time the carer had been caring for the person with diabetes was 4.9 years, with a range from 1 month to 40 years. The mean number of hours per week caring for the person with diabetes was 36 hours, with a range from half an hour to 70 hours. Of the carer respondents, 11.7% were receiving Carer Payment and 14.2% were receiving Carer Allowance. While 19% of respondents were in full-time or part-time employment, the majority (62.9%) were receiving a pension.

More than half the carers indicated that time spent as a carer was also due to other long term illnesses suffered by the person with diabetes. Of these, 42% were still diabetes related and 20% were due to problems with mobility. The likelihood of a person with diabetes having a carer was significantly associated with the presence of any complications, up to a factor of 4 for those with macrovascular complications (Figure 3.2).

Figure 3.2: Presence of complications and likelihood of having a carer

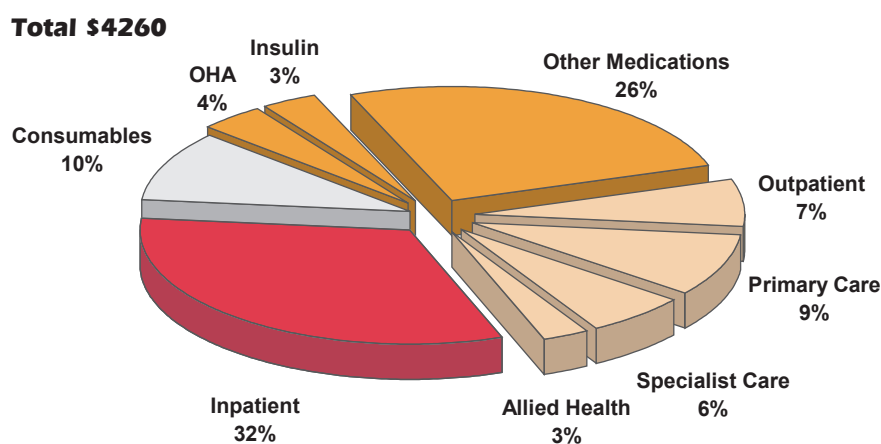


Cost of diabetes

Direct health care costs

The average annual cost per person with Type 2 diabetes was \$5360 of which \$5325 was from direct costs and \$35 was indirect costs. Health care costs contributed 79% (\$4260) of the direct costs. The various components of direct health care costs are shown in Figure 3.3.

Figure 3.3: Direct health care costs



Hospitalisation, ambulatory services and medications each accounted for approximately 30% of direct health care costs with consumables such as blood glucose testing and insulin administering equipment accounting for 10%. Insulin (3%) and oral hypoglycaemic agents (4%) accounted for only 21% of the total cost of medications with the majority of medication costs coming from non diabetes medication such as lipid lowering and blood pressure

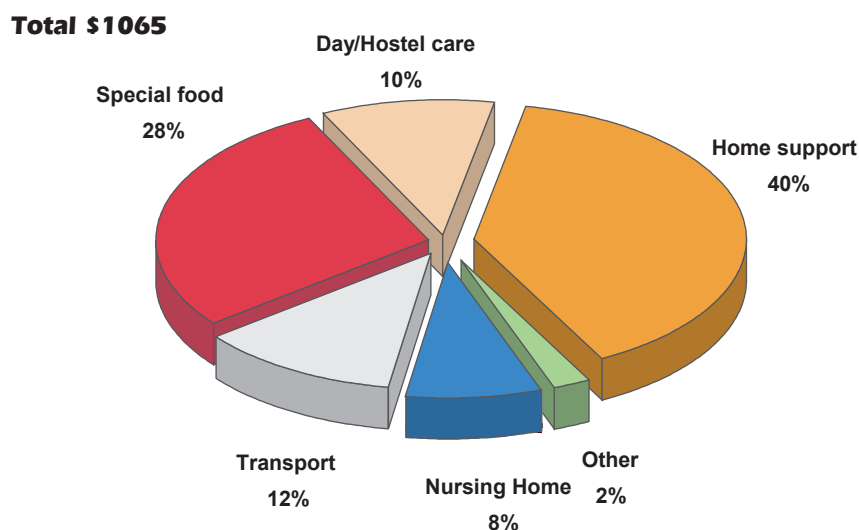
lowering agents, non-steroidal anti-inflammatory drugs and anti-depressant agents.

Ambulatory service costs were derived from attendance at hospital outpatient clinics (7%), primary care (9%) and specialist services (6%) with attendance for allied health professionals contributing 3%.

Direct non-health care costs

Direct non-health care costs totalled \$1065 annually with the main contributors being home support and special foods (Figure 3.4).

Figure 3.4: Direct non-health care costs



Indirect costs

Indirect costs made only a relatively small contribution, averaging \$35 per person per year. The only information on indirect costs collected in the DiabCo\$t survey was income lost from days in which people were unable to work. Estimates for annual lost wages per patient and carer by complication category are demonstrated in Table 3.13. Lost wages for carers were significantly impacted by the presence of macrovascular complications.

Table 3.13: Annual lost wages (\$) per person with diabetes by complications group

	None	Micro	Macro	Both	Total
Lost wages (gross) people with diabetes	33.36	33.68	70.31	36.55	32.22
Lost wages (gross) carer	23.52	83.32	256.12	85.12	61.65

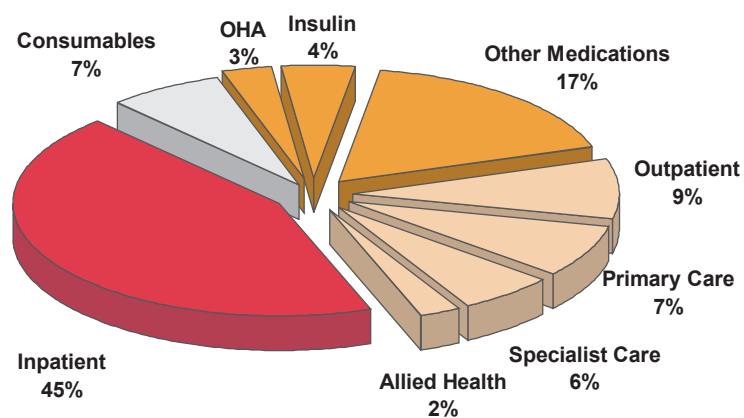
People participating in the DiabCo\$t survey were elderly (mean age 65 years) and consequently relatively few were employed. The major contributor to indirect costs in other cost of illness studies relates to lost productivity resulting from premature death. Information on this component of indirect costs could not be collected by the DiabCo\$t survey.

Costs by complications

Complications were a significant driver of diabetes costs, especially macrovascular complications. The annual cost for people without complications was \$4025, increasing to \$7025 for people with only microvascular complications, \$9055 for people with only macrovascular complications and \$9645 for people with both microvascular and macrovascular complications. This increase in costs was due to an increase in direct health related costs and was predominantly due to increased costs associated with hospitalisation. For example, 45% of costs were due to hospitalisation in people with both microvascular and macrovascular complications (Figure 3.5).

Figure 3.5: Direct health care costs for people with both microvascular and macrovascular complications

Total \$7250



Total of all costs

In addition to the total average cost of \$5360, each person with Type 2 diabetes also received on average \$5540 in Commonwealth benefits from pensions (sickness allowance, aged pension etc). Adding these costs raises the total of all costs for a person with Type 2 diabetes to \$10,900 per year. A summary of mean annual costs per person by complication type is provided in Table 3.14.

Table 3.14: Summary of mean annual costs per person (\$)

Cost	Overall	Complications			
		None	Micro	Macro	Both
Total	5360	4020	7020	9055	9625
Direct	4260				
Indirect	35				
Government subsidies	5540	5075	6200	5985	6225
Total of all costs	10900	9095	13200	15040	15850

4. Summary

The DiabCo\$t Australia Study is the most comprehensive cost of illness and burden of disease study in people with Type 2 diabetes undertaken in Australia. The study provides information on health resource utilisation, the non-medical costs associated with managing Type 2 diabetes, the impact of diabetes on quality of life and the costs borne by people caring for a person with diabetes.

Total costs for diabetes in Australia

The average annual costs for each person with Type 2 diabetes was \$5360 of which \$5325 was from direct costs and \$35 from indirect costs. These data can be used to calculate the total costs of diabetes in Australia each year.

The recent AusDiab study (Dunstan et al, 2002) showed that the current prevalence of diagnosed diabetes in people aged 25 years and over in Australia is 3.7%. Including people who were undiagnosed doubles the prevalence to 7.4%.

Table 4.1 shows the estimated total annual costs for Type 2 diabetes in Australia. Considering only the costs for people with Type 2 diabetes aged over 40 years, the annual cost is \$2.2 billion. In addition 10% of people have carers and including this cost increases the annual total to \$3.1 billion. People with Type 2 diabetes also receive an average of \$5540 in Commonwealth benefits each year increasing the total annual cost of diabetes to \$6 billion.

Table 4.1: Total annual costs for Type 2 diabetes in Australia

	Annual Cost (\$)
Total costs for people with Type 2 diabetes	2.2 billion
Total costs including carers costs	3.1 billion
Total costs including Commonwealth benefits	6.0 billion

The actual cost of diabetes to society in Australia is likely to be even higher since the real indirect costs are higher than could be ascertained by the DiabCo\$t study. As indicated above there is general agreement that indirect costs should also include lost productivity from premature mortality. A recently published study of the economic costs of diabetes in the USA (ADA, 2003) estimated that indirect costs of days lost through illness and premature death accounted for 30% of diabetes costs. Applying this proportion to the Australian data suggests that the total costs of diabetes (including carers and Commonwealth benefits) is \$7 billion.

Excess cost due to diabetes

Clearly people with diabetes would incur health care costs even if they did not have diabetes and therefore an attempt has been made to calculate the excess costs associated with having diabetes. In the absence of Australian data, international data have been used for this calculation. One US study using data collected through organised managed care on over 82,000 people with diabetes and age and sex matched controls reported the excess costs of diabetes to be 142% (Selby et al, 1997). Another study from Helsinki, Finland, compared 14,000 people with diabetes and a matched control group and reported that the excess costs in people with Type 2 diabetes were 85% (Kangas et al, 2000). Assuming that people with Type 2 diabetes incur costs which are 100% more than people of the same age and sex without diabetes, the excess annual costs in Australia attributable to direct diabetes costs are approximately \$1 billion. These costs could potentially be reduced by strategies to minimise the impact of diabetes complications through improved care, early detection and prevention of Type 2 diabetes.

Impact of complications

Chronic complications are the major cause of the increased morbidity and premature mortality in people with diabetes. These complications include higher rates of cardiovascular disease (heart attack, stroke), amputations, kidney failure and blindness.

The DiabCo\$t survey clearly demonstrated that complications are the major driver of all types of costs in diabetes care. This is in line with the findings of CODE-2 and T²ARDIS. It is clear that strategies to minimise the development or progression of diabetes complications will reduce the burden of diabetes on the health system, individuals with diabetes and their carers.

Effect of age on costs

The effect of age on diabetes costs is shown in Table 4.2, which compares costs for people aged 50-59 years and people aged 70-79 years in the DiabCo\$t study. Total costs were 26% higher in older people due to an increase in direct health care costs, which accounted for \$1145 of the \$1225 increased costs.

Table 4.2 Total annual costs according to age group (\$)

Age Group (years)	50-59	70-79
Total Costs	4730	5955
Direct Health Costs	3670	4815
Direct Non Health Costs	815	1085
Indirect Costs	245	55

Comparison with previous estimates of diabetes costs

Previous Australian studies only allow meaningful comparison of direct health care costs associated with diabetes. In the Rise and Rise of Diabetes (McCartney et al, 1995) the mean direct costs per person with diabetes were estimated to be \$1600 per year. The Australian Institute of Health and Welfare cost of illness study calculated that direct costs for Type 2 diabetes in 1993 were \$1900 per year (Penn and Mathers, 1999).

The annual costs derived from the DiabCo\$t study are considerably higher than previous estimates. Two main factors for this are:

- differences in methodology in which previous estimates have not captured all the costs associated with diabetes; and
- differences in current monetary value compared to the years in which the previous surveys were performed.

As the DiabCo\$t study was modelled on and uses similar methodology to the UK T²ARDIS study, meaningful comparison between the two countries is possible. The mean annual direct costs reported from T²ARDIS were \$4830, similar to the DiabCo\$t findings of \$4260. In the CODE-2 Europe study, annual direct costs per person were \$5170, ranging from \$2330 in Spain to \$6385 in Germany. In both studies, costs and health service utilisation were also shown to be driven by the presence of complications.

The comparisons suggest that the results of the DiabCo\$t are plausible and accurately reflect the costs associated with Type 2 diabetes in Australia that are able to be determined at the present time.

Quality of life assessment

The DiabCo\$t study has shown that health related quality of life is an important issue in Type 2 diabetes. While there appears to be only a mild impact on quality of life for people with Type 2 diabetes without complications compared to the general population, the presence of complications results in markedly reduced quality of life scores. This is consistent with the findings of T²ARDIS and CODE-2 (Holmes et al, 2000; Redekop et al, 2002), and emphasises the need to ensure that diabetes complications are delayed for as long as possible.

The study also confirmed previous reports that anxiety and depression may play a significant role in the life of people with Type 2 diabetes. Past studies have demonstrated that fatigue, loss of enjoyment, reduced leisure pursuits and feelings of restriction associated with complying with treatment strategies and self-monitoring requirements correlate positively with the presence of Type 2 diabetes (Hornquist et al, 1995). Diabetes may have social and family implications, such as increased withdrawal, isolation and lack of acceptance, which are likely to worsen with the presence of any complication (Koopmanschap, 2002). Maintenance of social function has been demonstrated to prevent psychological disorders such as depression. The presence of anxiety and depression in Type 2 diabetes and the implications of these for both health outcomes and costs are important areas for further research.

In the future, the utility values calculated in the DiabCo\$t study could be used as part of an economic evaluation to estimate the cost per quality adjusted life year (QALY) for a diabetes intervention. This would allow the cost-effectiveness of diabetes treatment to be compared with the cost-effectiveness of treatment in other therapeutic areas.

Impact of diabetes on carers

DiabCo\$t demonstrates that the majority of carers are unpaid spouses or partners of people with diabetes. Consistent with the chronicity of the condition, many people had been carers for a lengthy period. The cost of carers tends to be obscured by the way the social security system operates, in that many carers are aged pensioners in their own right. The DiabCo\$t study suggests that Type 2 diabetes imposes a significant burden on carers, much of which is borne privately.



5. Conclusion

The responsibility of meeting increasing demands for health care and prevention services, whilst simultaneously containing costs, weighs heavily on health systems everywhere. Having access to accurate and comprehensive data on all aspects of disease burden is essential to underpin efforts to provide accessible, effective and affordable health care and prevention services.

In Australia, we are fortunate to have current and comprehensive prevalence and risk factor data on diabetes from the AusDiab study. These data are of vital value in guiding efforts to monitor and address diabetes in the Australian context. Systematically derived information that describes the associated financial burden to the community and to individuals with diabetes and their carers is equally important. Data describing this burden are central to achieving an understanding of how costs might be better managed and modified. This understanding requires baseline knowledge about what are the costs, who pays, and what are the key cost drivers. Without this information it is not possible to accurately assess overall progress or to evaluate the relative effectiveness of public health and clinical interventions.

The DiabCo\$t Study marks an important phase in the history of diabetes in Australia and provides another major piece of evidence to add to our understanding of the burden it imposes on the individual and the community. For the first time we have local data, specific to our health system and services, available to inform and guide resource allocation and to provide a baseline and benchmark for future cost of illness assessment and economic analyses of diabetes.

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