
# AUSTRALIAN PRIMARY HEALTH CARE RESEARCH INSTITUTE

## SOUTHERN HIGHLANDS DIVISION OF GENERAL PRACTICE DIABETES PROGRAM

## REPORT ON IMPLEMENTATION

**KAREN GARDNER**
**BEVERLY SIBTHORPE**
**IAN MCRAE**
**DHIGNA RUBIANO**

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**ANU COLLEGE OF MEDICINE & HEALTH SCIENCES**

Australian Primary Health Care Research Institute (APHCRI)
ANU College of Medicine and Health Sciences
Building 62, Cnr Mills and Eggleston Roads
The Australian National University
Canberra ACT 0200

T: +61 2 6125 0766
F: +61 2 6125 2254
E: aphcri@anu.edu.au
W: www.anu.edu.au/aphcri

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| | |
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| Ms Jill Snow | Southern Highlands Division of General Practice |
| Dr Warwick Ruscoe | Southern Highlands Division of General Practice |
| Dr Simon Grant | Endocrinologist, Bowral and District Hospital |
| Ms Lisa McGlynn | Australian Government Department of Health and Ageing |
| Professor Jim Butler | Australian Centre for Economic Research on Health |
| Mr Ian McCrae | Australian Primary Health Care Research Institute |
| Dr Beverly Sibthorpe | Australian Primary Health Care Research Institute |
| Ms Digna Rubiano | Australian Primary Health Care Research Institute |
| Ms Karen Gardner | Australian Primary Health Care Research Institute |

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# 1. EXECUTIVE SUMMARY

## Aim and Overview

A number of Divisions of General Practice, including the Southern Highlands Division of General Practice (SHDGP), have implemented diabetes programs, but there is little evidence concerning their effectiveness and efficiency. We undertook an exploratory study of the implementation and costs and benefits of the SHDGP program. The results of the cost effectiveness component of the study are being published separately. This is the *Report on Implementation*.

## Method

The study was time and budget-limited. It involved discussions with key Divisional personnel and members of the program steering committee, extensive analysis of program data for the period to December 2005, and analysis of published and unpublished data from Medicare Australia and the Australian Government Department of Health and Ageing. Access to patient data was covered by the original patient consent. General Practitioner (GP) consent was obtained by the Division. Ethical approval for the study was obtained through The Australian National University Human Research Ethics Committee.

## Description of Region and Division

The SHDGP is a small Division headquartered in Bowral, NSW and covering the Wingecarribbee Shire including the urban centres of Bargo, Bowral, Mittagong and Moss Vale, Bundanoon and Robertson. The estimated population of 48,431 is served by 50 GPs located in 16 practices.

## Program Delivery

The SHDGP Diabetes Program is an integrated program of diabetes care, involving the Division and the Area Health Service, including the Bowral District Hospital. It operates under the auspices of an Memorandum of Understanding (MOU) between these key providers and is supported by a program steering committee. The program aims to support GPs to provide a comprehensive service in accordance with Guidelines for Diabetes Management. This involves GP registration of consenting diabetics, periodic recall and review, referral to medical and allied health services and exercise physiology, transfer of patient data to the Division and feedback to the GPs of summary data and recall reminders. The program is estimated to reach around 94 per cent of all diabetics in the area.

The program is managed by a Diabetes Educator, located in the Division, who provides diabetes education and is responsible for the coordination, monitoring, evaluation and development of the program. She is supported in her role by a Program Steering Committee and works closely with GPs to support them in their role providing clinical care and referral in accordance with Guidelines for Diabetes Management. Other providers include the endocrinologist, hospital, practice nurses, dieticians, podiatrists and physiotherapists as well as exercise physiology which is provided through a diabetes exercise program at the gym. In the GP practice, practice staff have a key role in data entry, recall, audit and transfer to the Division of patient information. Practice nurses play an important role in providing patient self care education.

## Information Management

Good information management is essential to effective operation of the program. The data management system, CARDIAB, enables the collation and management of GP collected patient related data, providing: patient and GP registration, patient recall and follow-up, risk factor management and information on adherence to Diabetes best practice care. Patients enrolling in the program are registered onto the CARDIAB database and provide consent to the transfer and use of their data for patient management and secondary research purposes.

Six types of patient data are used by the program - patient characteristics, routine reviews and tests, treatment, referrals, clinical measures/risk factors and outcomes/complications data. There were varying levels of data completeness with significant gaps relating to complications and drugs data and under-reporting of review and clinical measures data.

Our review of the cost effectiveness of the program used a mixed approach, drawing on data from a range of sources as well as modelling, using the United Kingdom Prospective Diabetes Study (UKPDS Number 08) model, to estimate costs impacts, impacts on outcomes and cost utility. Seventy-four program clients were included in the cost modelling exercise.

## Key System Lessons for Transferability and Sustainability

The SHDGP Diabetes Program is a best practice program that operates across the seven dimensions of structured care found to improve the quality of care for people with chronic disease (WHO 2003). These are:

- a population orientation;
- a delivery system with comprehensive and multidisciplinary care;
- a mechanism for coordinating the components of care;
- active client/patient management using health education, empowerment and self-care;
- evidence based guidelines;
- IT for knowledge management and system solutions; and
- a continuous improvement process.

These program elements may provide a template for the development of similar programs in other settings and for estimating capacity and costs associated with implementation.

Key features of the SHDGP program are GPs as central providers, a multidisciplinary approach supported through formal agreements, and a ‘one-stop shop” approach for patients that provides comprehensive services including access to a subsidised exercise program. The Division is well placed to provide this program because of its capacity to develop a regional approach and to foster rapport with GPs; provide data supports for the operation of CARDIAB; and develop system linkages that individual GPs would not otherwise have time to develop.

Information Management and Information Technology issues are critical to sustainability. Strategies to enhance and maintain data completeness of such programs are needed. This program needs to focus in particular on recording exact drug treatment data and review data including HbA1C, cholesterol and blood pressure data. One measure per year, every year, is the minimum requirement for estimating cost and impact. The program would benefit from

extraction tools and statistical and epidemiological support to undertake population based analyses.

# 2. AIM AND OVERVIEW

There is strong interest within Australia in the management of diabetes in primary health care. A number of Divisions of General Practice have implemented diabetes programs, but there is little evidence concerning their effectiveness and efficiency. In response to interest from the Department of Health and Ageing (DoHA), the Australian Divisions of General Practice (ADGP) and the Southern Highlands Division of General Practice (SHDGP), we undertook a time and budget-limited exploratory study of the implementation and costs and benefits of the SHDGP's Diabetes Program.

We have produced two documents:

- A Report on Implementation.
- A paper for publication in the peer reviewed literature on costs and benefits

This is the *Report on Implementation*. We begin with a review of the relevant national and international literature on Diabetes burden of disease, guidelines-based care, guidelines adherence, regional approaches to diabetes management in Australia and the cost and cost-effectiveness of guidelines-based approaches (Section 3). We then provide a brief description of our methods, including consent and ethical approval (Section 4). This is followed by an overview of the region and the Division (Section 5). We then discuss program delivery, including program components and underlying philosophy, program coverage, and stakeholder roles and responsibilities (Section 6). Following this, we address issues of information management, including data for program management and data for assessment of costs and benefits (Section 7). Study limitations are briefly examined (Section 8) before we discuss the key system lessons for transferability and sustainability (Section 9).

# 3. REVIEW OF NATIONAL AND INTERNATIONAL LITERATURE

We undertook a comprehensive review of the national and international literature relating to diabetes and diabetes care, the latter focusing on health system approaches. In this section we summarise the key findings of this review relating to burden of disease (3.1), health system responses - guidelines-based care (3.2), guidelines adherence (3.3), regional approaches to diabetes management in Australia (3.4) and cost and cost-effectiveness of guidelines-based approaches (3.5).

In addition, there are three appendices that provide more detail on: interventions to improve guideline dissemination and implementation (Appendix 1), the effectiveness and efficiency of diabetes guidelines dissemination and implementation strategies (Appendix 2) and diabetes management costs (Appendix 3).

## 3.1 Burden of disease

Type 2 diabetes is a metabolic disease characterised by resistance to insulin's action and impaired insulin production by the pancreas (Dunstan et al 2001, p. iii). This chronic condition can result in disability and early death and is a major risk factor for microvascular (blindness, kidney damage, foot or leg ulcers) and macrovascular complications (heart disease, stroke, amputations). The AusDiab report (Dunstan et al 2001, p. 1) states that in both health and economic terms diabetes mellitus is Australia's most costly disease given the upward trend in new cases and impacts. About 580,668 persons (2.9 per cent of the population) in 2004-05 have been diagnosed with type 2 diabetes (ABS 2006, p. 6). Further, the AusDiab report (Dunstan et al 2001) found that for every known case of diabetes there was one undiagnosed, so the estimated population with the disease could be well over one million people. The Australian Government made diabetes a National Health Priority in 1996 and three years later the Health Ministers endorsed the National Diabetes Strategy 2000-2004 by signing the Diabetes Declaration (Dunstan et al 2001).

The burden of diabetes in terms of health outcomes is well documented in Australia. A study on health outcomes in people with type 2 diabetes found that a large proportion of diabetic patients suffer from serious co-morbidity both pre- and post-diagnosis and their hospital admission rate is higher than the average population (Brameld et al 2002, p. 1). Similarly, diabetes-related deaths accounted for 5.4 per cent of all deaths registered over the period 2001-2003 which explains why the disease has been one of the top 10 underlying causes of death in Australia for a number of years (Dixon and Webbie 2005, p. 1). The average annual diabetes-related death rate was over one and-a-half times greater for males than females and 680 times higher for people aged 85 years and over compared to those aged under-35 years (Dixon and Webbie 2005, p. 1). Aboriginal and Torres Strait Islander people were four times more likely than other Australians to die from diabetes-related causes in the period (Dixon and Webbie 2005, p. 1).

Literature also emphasises the substantial financial burden of diabetes in Australia. The DiabCo$t study estimated the total health care bill from type 2 diabetes to be around A$6 billion, after adding up: A$2.2 billion of direct and indirect medical costs, A$900 million of carers costs and A$2.9 billion in Commonwealth Government benefits (Colagiuri et al 2003, p. 2). The average cost per person for the medical expenditure component was found to be A$5,360 (p. 1). The study confirmed that complications were the main driver for all types of diabetes costs, the average annual medical costs when both micro and macro vascular complications appear was found to be A$5,605 higher per patient than when there are no complications (p. 27). Other estimates of cost for diabetes care are provided in the recently published Australian Institute of Health and Welfare report *Costs of Diabetes in Australia 2000-2001* which identified A$1,469 per known case of diabetes.

From the health system viewpoint, the rising trend in diabetes prevalence and its largely preventable nature seem to make a strong case " …for early detection of type 2 diabetes and for access to appropriate standards of care to prevent or delay the onset of complications" (Colagiuri et al 2003, p. 2). Not surprisingly then, governments are increasingly interested in finding ways to support improvements in the management of diabetes and other chronic diseases, particularly as their incidence continues to rise in Australia and other parts of the world.

### 3.2 Health system response - Guidelines-based care

The World Health Organisation (WHO) states that improving quality of care is based on developing evidence-based clinical practice guidelines and performing health technology assessments (WHO 2003, p. 5). Clinical practice guidelines have the potential to improve care by supporting interventions which research has proven beneficial, while discouraging ineffective interventions (Grimshaw et al 2004, p. ix).

In Australia, the National Evidence-based guidelines for type 2 diabetes are being produced by the Diabetes Australia Development Consortium under contract to the Commonwealth Government (ADEA 2006). Expert working groups comprising medical and non-medical clinicians, representatives from relevant national non-government organisations, general practitioners and consumers are providing input into the development of various related guidelines (ADEA 2006). These guidelines cover primary prevention, case detection and diagnosis, diagnosis and management of hypertension, prevention and treatment of macrovascular disease, identification and management of diabetic foot disease, lipid control, renal disease, blood glucose control, among others. About half of these guideline components have already been endorsed by the National Health and Medical Research Council (ADEA 2006).

The guidelines for diabetes management are primarily based on the United Kingdom Prospective Diabetes Study (UKPDS Number 08), which established the key role of intensive Diabetes control in reducing the risk of complications such as retinopathy, neuropathy and nephropathy (NIH 2002). The UKPDS Number 08 and other subsequent efforts showed cardiovascular events are reduced in patients with type 2 diabetes through rigorous control of blood pressure and LDL-cholesterol (NIH 2002). From a general practitioner's point of view, basic follow up in accordance with diabetes guidelines "…consists of ensuring tight glycemic and blood pressure control, minimising other macrovascular risk factors including hyperlipidemia and smoking, and screening for microvascular and macrovascular complications" (Bouldin et al 2002, p. 199).

Griffin et al 1998 conclude from the literature that contributing factors to the increased involvement of general practice in diabetes care since 1970 are "...overcrowding in hospital clinics, better training for primary care and nurses, easier access for patients in primary care and trends in governmental policy" (p.2). Subsequent research has proven that computerised central recall with patient and doctor prompting mechanisms are able to deliver care with similar or superior standards to hospital outpatient care (Griffin et al 1998, p. 2). Thus, evidence supports provision of continued review and surveillance of people with diabetes by general practitioners once suitable organisational arrangements are in place to warrant regular follow up (Griffin et al 1998, p. 2).

Disease management has emerged as an approach to chronic disease that incorporates knowledge management, a delivery system with coordinated care components and a continuous improvement process. A systematic literature review performed by WHO (2003) found key elements of Disease Management Programs (DMP) are:

- comprehensive care: multiprofessional, multidisciplinary, acute care prevention and health promotion
- integrated care (coordination of different components)
- population orientation (defined by a specific condition)
- active client-patient management (health education, empowerment, self-care

- evidence-based guidelines, protocols, care pathways
- information technology, system solutions
- continuous quality improvement

The same review concludes that DMPs improve the quality of care of people with chronic disease as measured by performance indicators (p. 10). A study suggests that the implementation of structured care (diabetologist, patient registration system, dietician, diabetes nurse educator and guideline-based) in primary care results in sustained good glycemic control in the majority of type 2 diabetes patients (Sonnaville et al 1997, p. 1334). A modelling exercise based on the findings of Sonnaville and colleagues (1997), in addition to other primary data, found that structured primary care was not only cost-effective when compared against regular primary care at a cost of about €6000 to €7000 per QALY gained, but that diabetes control in primary care is more cost-effective than in secondary care per unit HbA1c reduction (Niessen et al 2003, p. 361). The study acknowledges, however, that expenses from guideline implementation strategies are not included and that this may impact on the results obtained.

## 3.3 Guidelines adherence

Despite acknowledgment of clinical practice guidelines (CPGs) role in the care of diabetes patients their implementation has remained suboptimal in many of the countries where diabetes prevention and control lie largely in primary care structures. Internationally, studies have shown that few patients receive care consistent with clinical practice guidelines for the management of diabetes (see Appendix 1 - Review of the International Literature on Guideline Adherence). In Australia, the Centre for General Practice Integration Studies (CGPIS) has collated aggregated data on adherence to diabetes guidelines from Divisions of General Practice (DGP). The results of a paper-based collection between 1998 and 1999 (Bonney et al 2000, p. ES-ii) and a subsequent compilation of Division-based and cardiovascular disease (CVD) registers for 2002 (Georgiou et al 2004a, p. 18) suggests the following level of adherence.

**Table 1. Guideline Adherence in Australian Divisions of General Practice1**

| | Assessed | per cent | Within target | per cent |
|---|---|---|---|---|
| Key guideline area | 19992 | 20023 | 19992 | 20023 |
| Glycaemic control | 48 | 46 | 49 | 61 |
| Blood Pressure | 56 | 53 | 61 | 26 |
| BMI | 58 | 45 | 43 | 16 |
| Lipids | 60 | 42 | 58 | 52 |
| Microalbumin level | 36 | 27 | 78 | 77 |
| Eye status | 51 | 32 | - | - |
| Foot status | 35 | 42 | - | - |

1. Sources: Bonney et al 2000; Georgiou et al 2004a.
2 Median across 27 Divisions, the overall population of these being 13,000 patients approximately. Between 69-99 per cent of the group are Type 2 diabetes patients.
3 Proportion of patients having assessment in a 12-month period for the 16 Divisions where registers were ongoing and active. Data from 15,294 patients.

It is worthy of note that the 1999 data presented marked variation due to the differing methods for data collection (Bonney et al 2000).
Importantly, the guideline targets for cholesterol, blood pressure and BMI were reduced between 1999 and 2002.

Three systematic reviews of interventions to improve guideline dissemination and implementation have been found. Their findings are summarised in Appendix 2 (Review of Three Systematic Reviews of the Effectiveness and Efficiency of Diabetes Guidelines Dissemination and Implementation Strategies).

## 3.4 Regional approaches to diabetes management in Australia

Divisions of General Practice (Australia's version of organised primary health care) provide a platform for systematic, regional program approaches to diabetes management. The literature identifies the following characteristics of Division diabetes programs: accreditation, practice IT systems, utilisation of practice nurses, register/recall systems, Enhanced Primary Care payments (implemented alongside with Service Incentive Payments) and support to practice nurses and practice managers (Yu et al 2005, p. 3). The approach to implementing these programs by Divisions is a multi-faceted one, including: GP education, community awareness and register recall systems (Yu et al 2005, p. 3). Evidence of the relationship between features of these organisational arrangements and greater guideline implementation success in the Australian context appears insufficient. A paper on GP Service Incentive Payments (SIPs) indicates the frequency of these claims correlate positively with practice size and divisional IT support. That finding, according to the authors, emphasises the importance of practice organisation and systems in the provision of good care for diabetes in general practice (Georgiou 2004b, p. 757). SIPs claims are a Commonwealth Government initiative intended to encourage GPs to complete the annual cycle of diabetes care.

Information technologies developed for diabetes management in primary care build on Electronic Medical Record (EMR) systems to provide for registry, reminder, education and decisions support systems as well as medication adjustments. While computer aided systems for health information management are known to enhance process measures for diabetes care, the link between the use of information technologies and improvements in patient outcomes is less clear (Renders et al 2000, Li et al 2004, Garg et al 2005).

## 3.5 Cost and cost effectiveness of guidelines-based approaches

Official data on the cost of guidelines is not available from the Australian Federal Government. From a health manager's perspective, aspects to consider regarding the guidelines are cost effectiveness and overall cost. Costing guidelines include: development and adoption, the latter encompassing dissemination/implementation and treatment. A small fraction of studies perform economic evaluations of diabetes guidelines as a whole or of various guideline components combined ("sub-guidelines"), a lesser number attempt to calculate total cost impact of guideline adoption. A suggested approach to costing guidelines is to use primary data for dissemination and implementation effects and costs and leave to modelling the calculation of treatment expenses and outcomes (Grimshaw et al 2004). A few recent studies on diabetes appear to follow to some extent Grimshaw and colleagues' recommendation, namely those by Niessen et al (2003), Gray et al (2002), van Os et al (2000), Ortegon et al (2004) and Eddy et al (2005).

These analyses use primary data from other studies conducted in the same country or a comparable location to perform the modelling of the overall costs and/or cost-effectiveness of treatment in accord with diabetes guidelines from the health system or the society's perspective. None of these seem to cost all the

elements of guideline adoption. Nevertheless, the study that assesses the guidelines for diabetes as one intervention from the health system's viewpoint (Niessen et al 2003) concludes that these are cost-effective (US$6,875 per QALY gained), a notion consistent with papers that evaluate guidelines partially.

Regarding the overall cost of guideline adoption, Beilby et al (2001) calculated that in Australia the divisional costs would be around A$150,432, while marginal patient costs would be some A$1,153. If these figures were extrapolated to the Australian population with diagnosed type 2 diabetes the overall cost of guideline adoption would be about A$688 million.
"Sub-guidelines" for diabetes also investigated in three papers are: a) those relating to blood glucose and blood pressure, b) those dealing with nephropathy and c) those dealing with foot care and glycemic control. The first study (Gray et al 2002) found the overall cost of adoption of blood glucose and blood pressure guidelines to be US$156 million in England. The next paper found nephropathy guidelines to be cost effective at a ratio of US$14,600 per QALY attained (van Os et al 2000). Guideline-based foot interventions were found by Ortegon and colleagues (2004) to be cost-effective, the cost/QALY ratio for the combined foot care and glycaemic contol being US$12,165. When looking at guideline-based clinical interventions individually, a review (Klonoff and Schwartz 2000) observed that eye care is cost effective as well. Subsequent studies found lifestyle interventions (Eddy et al 2005) are cost-effective at a cost/QALY ratio of US$24,523 when applied to those patients with Fasting Plasma Glucose (FPG) levels greater than 5.3 mm/L. Again if findings of this study were applied to the US population with type 2 diabetes, annual expenditure would near US$40 billion.
More detail on the literature relating to costs is at Appendix 3.

# 4. METHOD

We undertook a time and budget-limited exploratory study of the SHDGP's Diabetes Program. Our understanding of program delivery is based on discussions with the Division and members of the program and study steering committees - we did not undertake primary data collection with general practices or other providers in the region. We did undertake detailed analysis of an extract of program data for the period to December 2005 provided to us by the diabetes patient information system used by the SHDGP Diabetes Program (see below). We also examined a range of non-program data including published data from Medicare Australia and unpublished data on hospital separations in New South Wales obtained from the Department of Health and Ageing.

Access to patient data was covered by the original patient consent for participation in the SHDGP Diabetes Program. General Practitioner consent to access patient data for the purposes of this study was obtained by the Division. Ethical approval for the study was obtained through The Australian National University Human Research Ethics Committee.

# 5. DESCRIPTION OF REGION AND SHDGP

The SHDGP is located in Bowral in the Southern Highlands region of NSW, a rural region comprising Wingecarribbee Shire and the urban centres of Bargo, Bowral, Mittagong and Moss Vale. The population is estimated to be 48, 431 (2001 Census data) and is serviced by 50 GPs located in 16 practices. There is a relatively low level of GP services compared to the national average with 3.7 GP services per head of population in the Southern Highlands compared to 4.7 for Australia as a whole (PHIDU 2006). The region has a public and private district hospital and various community health services provided privately and by the Area Health Service.

The SHDGP was established in 1994 and is one of the smallest Divisions in Australia, comprising: a part time CEO, one full-time administration officer, three full-time program officers, two part-time program officers, and five part-time clerical officers. The Division has achieved membership of all 50 GPs in the area. A number of the GPs are Visiting Medical Officers (VMOs) who have active roles in the hospital, including in obstetrics, anaesthetics and surgery. The Division also has a strong relationship with the Area Health Service which includes a formal agreement and two shared care programs. In addition to the Diabetes Education and Management Program, the Division runs an aged care program, a mental health program and a number of smaller projects on immunisation, IT and cardiovascular disease.

# 6. PROGRAM DELIVERY

In this section we provide a description and assessment of program delivery in relation to program components and underlying philosophy (6.1), program coverage (6.2) and stakeholder roles and responsibilities (6.3). In 6.3 we examine the roles and responsibilities of the program coordinator, program steering

committee, practice staff, other providers, the hospital and endocrinologist and wider linkages.

## 6.1 Program components and underlying philosophy

The SHDGP Diabetes Program is an integrated program of diabetes care that involves the Division and the Area Health Service, including the Bowral District Hospital. The program model originated in the Macarthur Division in 1994 and was established a year later in Bowral by the SHDGP as an innovative program response to the results of a Division needs assessment in which GPs identified diabetes care as an area of need.

The program operates under the auspices of a Memorandum of Understanding (MOU) between the key providers: the Division, the Area Health Service and the Bowral District Hospital and is supported by a program steering committee comprising the key stakeholders.

The program aims to support GPs to provide a comprehensive diabetes program that:

- identifies people at risk of developing diabetes;
- provides diabetes education to people with diabetes referred by GPs;
- monitors the on-going care of people with diabetes;
- identifies people with diabetes whose data indicate they are at special risk of developing complications, and recommends to the GPs that a Care Plan be developed; and
- encourages people with diabetes to undertake physical activity programs.

Patients in the program are identified and recruited by GPs who aim to provide all clients with a medical assessment and referral, in the first instance to the Diabetes Educator - for an education session - and to the nutritionist. The education session includes information about appropriate lifestyle interventions such as exercise. Thereafter patients are reviewed every three to six months and provided with an annual check that includes ophthalmology and podiatry. This GP-coordinated process of care is undertaken in accordance with the NHMRC Guidelines for Diabetes Management.

There is now universal acceptance of the program by the GPs in the area and over time the program has expanded to include new initiatives that enhance aspects of patient care. We have concluded that the program operates across the seven dimensions of disease management identified by the WHO as best practice (WHO 2003) (see Section 10).

## 6.2 Program coverage

The SHDGP is defined as a set of six postcodes including the towns of Mittagong, Bowral and Moss Vale, and including the Wingecarribee Shire (ADGP website). Using postcode population data from the 2001 Census and the Ausdiab prevalence rates and crude adjustments for increases in diabetes prevalence and population, we reached an indicative estimate of 1,525 people with type 2 diabetes in the Wingecarribee Shire in 2005.

The SHDGP database from 1995 to 2005 shows 1,658 patients with type 2 diabetes who have provided information at some time during that period, with 1,216 providing information in 2005.
In addition, there were currently 220 “unconsented” patients who had been identified as having type 2 diabetes but for whom data had not been transferred to the Division because they had not signed the program consent form. Adding the 1,216 patients for whom data are available to the 220 un-consented patients gives

a total of 1,436. Given our indicative estimate of 1,525 diabetics in the Division's area, the program has identified a high proportion of the diabetics in the area – somewhere in the region of 94 per cent. Unless there are reasons that the Division has less diabetic patients than the averages in other areas, there are likely less than 100 people with diabetes who either have not been identified or have not wanted to be part of the program.

## 6.3 Stakeholder roles and responsibilities

### 6.3.1 Program Coordinator

The main driver of the program is the Program Coordinator who is a diabetes educator employed by the Division. Her role involves working at both the system level, overseeing the development of the program, and at the patient level, providing diabetes education to patients. Key aspects of this role are using the program database to identify at risk patients, and working alongside GPs as they coordinate patients' care in accordance with the Guidelines for Diabetes Management. Patient education is done in close collaboration with the GPs, using health education, self care and empowerment techniques. She visits newly diagnosed patients in hospital or those with diabetes who are admitted for other reasons, as well as patients with gestational diabetes who are referred by the obstetrician, and provides direct referral back to the GP. The Program Coordinator believes the key to program success is its underlying philosophy and day-to-day operation to support GPs to deliver good patient care. The program is visible to patients as part of the care being provided to them by their GP.

At the system level, the Program Coordinator is responsible for the coordination and development of the program involving management, monitoring and evaluation. She links initiatives into the program and works with other stakeholders to develop new initiatives that enhance patient self care or that support GPs in the management of patient care. For example, in collaboration with a local private podiatrist, a foot care program was developed for use by GPs. An exercise program has also been established at the local gym, partially funded by the Division (A$35,000 per year), to which patients with a wide range of conditions – cardiac, mental health, diabetes – are referred. Subsidised places are provided for patients on low incomes through referral by the GP to a fitness assessment and a three-month program tailored to meet individual need. The exercise program is overseen by the Diabetes Educator and provides a safe exercise regime for diabetic patients over three sessions per week. At the conclusion of the three-month period, clients are reviewed by the GP against a set of clinical markers to assess benefit. Some clients continue in the subsidised program, others continue at the gym at their own expense and a few clients pull out of the program, due mainly to physical problems. At any one time there are between 90 and 100 subsidised places available. Based on client and GP feedback about clinical value, the coordinator believes that exercise is a critical component of the management of diabetes, as well as cardiac, mental health and other chronic conditions. She sees a future in which health care services are centred around (co-located with) exercise and fitness facilities and the two are interwoven.

### 6.3.2 Program Steering Committee

There is a program steering committee comprised of key stakeholders. They provide advice on the program's key directions and development, and assist with problem solving where required. The committee operates as a sounding board for

identifying solutions to program development within a multidisciplinary program environment. It is an important source of support for the Program Coordinator.

### 6.3.3 Practice staff

At the practice level, the practice receptionist, practice nurse or practice manager undertake data entry, recalls, audits and transfer of patient information. The majority use electronic systems, but some are still paper based. As these practices progress towards electronic transfer of information, the work appears to be less time consuming. Eight or nine practices have practice nurses who assume responsibility for practice level diabetes data.
They are also beginning to play an important role in providing self-care education for patients and this is a key practice nursing role with scope for further development into the future. Additional support and training for practice nurses in diabetes care has been facilitated by the program coordinator through the Division Practice Nursing Program.

### 6.3.4 Other providers

A variety of other providers contribute to the comprehensive, multidisciplinary care provided by the program. These include podiatry, dietetic, exercise physiology, physiotherapy and endocrinology services which are accessed either privately or through Area Health Service community health services. Under the MOU with the Area Health Service, agreed amounts of dietetic and podiatry services are provided to patients in the program. The recently listed Medicare Enhanced Primary Care (EPC) items for chronic disease have increased patient access to private services.

Communication between providers within the program is essential. Arrangements for facilitating communication have been tailored to the ways in which individual providers like to be contacted (eg. fax, email). Email communication has been facilitated by a locally developed IT system which allows for encrypted messaging between professionals. This has proved to be a successful way of sharing diabetes patient care plans. These involve physiotherapists, pharmacists, the exercise program, GPs and the Program Coordinator in her role as Diabetes Educator.

### 6.3.5 Hospital and endocrinologist

The hospital and endocrinologist also play key roles in the program. The hospital refers all newly-diagnosed diabetic patients to their GP for diabetes care. The endocrinologist provides input into the program through his role on the steering committee and provides important specialist input into matters relating to patient care.

### 6.3.6 Wider linkages

Liaison with established diabetes networks and through research conferences is undertaken to ensure the program is continually informed by new developments in diabetes management.

A yearly Diabetes Day is held for consumers and providers in the Southern Highlands program to ensure up-to-date clinical, self care and other information is made available.

# 7. INFORMATION MANAGEMENT

Good information management is essential to effective operation of the SHDGP Diabetes Program. In the process of undertaking extensive analyses of program data, we learned about its strengths and limitations that are of wider system interest. As noted in Section Two, we have also done a study of program costs and benefits, the results of which are being submitted for publication in the peer reviewed literature. In that process we learned about data requirements relevant to the wider application of such methodologies. Summarised in this section are our findings in relation to the role and function of CARDIAB (7.1), patient registration (7.2), data capture and reporting (7.3), data completeness (7.4) and acquiring data for assessing costs and benefits (7.5).

## 7.1 Role and function of CARDIAB

The program uses the CARDIAB system for managing diabetes patient related information. A data management system, CARDIAB, focuses on diabetes and cardiovascular disease management within the primary health care system. It was developed by the CARDIAB Alliance1, based on the Macarthur Division's Diabetes Database, under the Commonwealth funded National Divisions Diabetes Project. Designed specifically for Divisions of General Practice, it enables Divisions to provide support to GPs participating in Division programs to achieve better patient outcomes through program monitoring. The system enables the collation and management of GP collected patient-related data, providing patient and GP registration, patient recall, and follow-up, risk factor management and information on adherence to diabetes best practice. CARDIAB has over 30 in-built reports that allow Divisions to define report dates and set time periods.

The CARDIAB program was made generally available to Divisions of general practice in 1999 and is currently used by at least six Divisions. It has also been used previously by Diabetes Outpatient Clinics in collaboration with Divisions. While the database is designed for patient management, the data can also be analysed to explore the progress of the patient group overall, and potentially as a basis for considering program costs and benefits.

## 7.2 Patient registration

The SHDGP Diabetes Program registers all consenting diabetic patients onto the CARDIAB database. Information on patient progress, including their ongoing pathology and other test results, referral to specialist or other allied health care, complications and risk factors, is collected by practices and transferred, either manually or electronically, to the Division. The data are compiled and analysed in CARDIAB and regular reports are provided back to GPs on how well their patients are progressing vis-a-vis the Guidelines for Diabetes Management, and compared with the patients of other GPs in the program.

Patients provide consent to the transfer and use of their data and this is obtained by the GP at the time of recruitment. Current patient consent covers the use of data for patient management and for secondary research purposes. Patients for whom there are no consent forms do not have data in CARDIAB. There are currently 220 patients for whom there are no signed consent forms and therefore no data in the system.

The Division believes that ownership by the GPs and patients of the program data is critical to GP and patient engagement. General Practitioners are not paid for transferring clinical data to the Division but benefit from the regular clinical feedback they receive.

## 7.3 Data capture and reporting

The types of patient data collected by practices and transferred to the Division for entry into CARDIAB are shown in Table 2. They cover five main areas:

- patient characteristics such as age, sex, indigenous status;
- routine reviews/tests;
- treatment, including pharmaceuticals;

[1] Macarthur Division of General Practice, Centre for General Practice Integration Studies University of NSW, Intouch Consultancy Pty Ltd, The Pharmaceutical Alliance (GlaxoSmithKline, Merck Sharp and Dohme, Eli Lilly), National Heart Foundation

- referrals;
- clinical measures/risk factors such as HbA1c levels; and
- outcomes/complications such as loss of eyesight, renal failure etc.

**Table 2. Types of patient data collected for the SHDGP Diabetes Program**

| Demographics | Routine Reviews | Treatment | Referrals | Clinical measures/ Risk factors | Outcomes/ Complications |
|---|---|---|---|---|---|
| Age<br>Sex<br>Indigenous status<br>Postcode | Blood sugar<br>Lipids<br>Renal function<br>B/P<br>Eye check<br>Foot check<br>Weight & height<br>Smoking<br>Alcohol<br>Physical activity | Diet only<br>Diet and drug therapy<br>Oral hypoglycaemics<br>Insulin<br>ACE inhibitors<br>Lipid lowering drugs | Dietitician<br>Podiatrist<br>Opthamologist<br>Endocrinologist<br>Exercise program | HbA1c1<br>Cholesterol1<br>Triglycerides<br>BMI1<br>Blood Pressure1<br>Creatinine<br>Albumin ratio<br>Smoking status1 | Loss of eyesight<br>Peripheral vascular disease (incl. ulcers, amputation)<br>Renal failure<br>Ischaemic heart disease<br>Stroke |

1. Required for modelling outcomes and cost impacts using UKPDS Number 08 outcomes model.

The program draws on these data to generate six-monthly reports for GPs about their patient group. Reports include patient summaries and group data as follows:
Patient summaries:

- Full summary of patient information for each patient
- Total diabetes history
- Twelve month comparison of progress over time on clinical measures for each patient
  Group data:
- The percentage of patients who have been reviewed
- The percentage of patients who have received the guidelines treatment
- Comparison of GP achievement against all GPs in the program
- Glycaemic control results for individual GPs and the Division as a whole
- HbA1c trends for individual patients (difference between original HbA1c and most recent)
- Provision of a measurement of the average trend for each GP and the Division

Reports can also be generated to each GP listing the data currently missing for each of their patients.

## 7.4 Data completeness

Review of the patient data in the SHDGP database showed varying levels of data completeness, summarised in Table 3 and described in more detail below. The main gaps related to complications data and drugs data and there was also considerable under-reporting of review and clinical measures data.

**Table 3. Data completeness in the SHDGP Diabetes Program**

| Data Type | Main Issues |
|---|---|
| Demographics | Age, sex and postcode well recorded, very few indigenous status records |
| Routine reviews/tests | Reasonable recording for most categories, weight and height not well captured over time, smoking and alcohol data very poor. |
| Treatment | Diabetes medications well recorded but most OHAs listed as “other”; anti-hypertensives under-recorded. |
| Referrals | Data on referrals and referred consultations poor (though test results for clinical measures arising from referrals well recorded) |
| Clinical measures/risk factors | Completeness differed for different measures; HbA1c data most complete; data on smoking and alcohol use very poor; errors in microalbumin data. |
| Outcomes/complications | Substantially under-recorded. |

### 7.4.1 Demographics

Age, sex and postcode data is complete. There are very few records for Aboriginal and Torres Strait Islander origin. While the extent of completeness for these data is not known, program staff are of the view that it is likely this data is under-reported.

### 7.4.2 Routine review/test data

At 30 June 2005, 72 per cent of patients were recorded as having had a routine review, while for 28 per cent review data were missing. The Program Coordinator was able to interrogate the database to find explanations for the missing review data. It was found, for example, that among patients with missing data, 58 per cent had appointments pending, 16 per cent were seen but paper work had not been completed, 10 per cent had left the area, and 16 per cent had not attended the appointment. Some of the omissions related to the difficulty of obtaining complete data from patients who chose not to comply fully with the prescribed number of routine checks. For example, some patients were recorded as being "active" in the program which meant they remained as participants but they were not attending for their regular reviews. Of the available data, blood sugar, lipids, renal function and blood pressure data were reasonably good, as were foot and eye checks. Weight and height were generally well recorded at first consultation but poorly recorded over time. Smoking status was poorly recorded and alcohol consumption not recorded. Review of physical activity was recorded for less than 10 per cent of clients in 2004 but had improved in 2005 to 17 per cent of clients.

### 7.4.3 Treatment data

Diabetes medications were recorded in the broad categories of oral hypoglycaemic agents (OHAs), insulin, and insulin plus tablets, diet only, diet and drug therapy. These appeared to be well reported but it was not possible to tell which OHAs had been prescribed, with most recorded as "other" (a problem for assessing costs as these vary widely - see below). Anti-hypertensive medications appeared to be highly under-reported and recorded.

### 7.4.4 Referral data

There were significant gaps in referral data. While test results arising from referred consultations were well recorded, the referrals themselves and the consultations were poorly recorded. There are very few referrals for diet and exercise. For example, in 2005 there are six referrals recorded for diet.

### 7.4.5 Clinical measures/risk factor data

The completeness of clinical outcome/risk factor data is summarised in two different ways in Table 4. The second column shows the percentages of patients (n=1,216) with data in all possible years, for each measure (ie: if they had been in the program from 2000 to 2005, they had a valid score for each of those years, for the relevant measure). The third column shows the percentages of potential person years data that were collected, for each measure. For the 1,216 patients over 11 years a maximum of 5,771 person years of data could have been collected. The amounts actually collected vary by measure.

**Table 4. Total patient years for which data could be collected 1996 - 2005**

| Measure and target level | per cent of patients with data in all possible years per cent (patient n=1,216) | per cent of potential person years data collected per cent (person years n=5,771) |
|---|---|---|
| HbA1c | 52.6 | 72.9 |
| Systolic Blood Pressure | 51.9 | 70.4 |
| Diastolic Blood Pressure | 51.9 | 70.4 |
| Total Cholesterol | 42.3 | 65.5 |
| HDL Cholesterol | 29.2 | 53.2 |
| LDL Cholesterol | 24.2 | 37.8 |
| Triglycerides | 40.7 | 64.5 |
| BMI | 42.0 | 62.2 |
| Microalbumin | 23.9 | 44.5 |
| Smoking | 13.5 | 18.1 |

HbA1c data were available for 73 per cent of possible patient years. Cholesterol data were less complete. Microalbumin data contained errors and was not easily interpretable. There are problems with the way GPs have reported these data and this has been identified by the Division as an area for further investigation. In addition, the data has been under-reported. This is an historical problem, as GPs were not convinced during the early years of the program that Microalbumin data was important. The program coordinator has been working with GPs over time to improve the collection of microalbumin data and reported that it was more consistently captured in the last five years than previously.

Body Mass Index (BMI) has not been entered into the database because the software required height and weight values which were not routinely reported by GPs. Likewise, smoking data were not yet routinely collected or updated. It may be possible to modify the database to generate a flag every three to four years to trigger confirmation of tobacco consumption.

### 7.4.6 Outcomes/complications data

There was very little data on outcomes/complications such as loss of eyesight, cardiac events, renal failure or amputations, except where these existed at registration, when the data were reported by the Division to be reasonably good. Subsequent outcomes/complications were poorly reported by GPs.

## 7.5 Assessing costs and benefits

### 7.5.1 Overall approach

Given the gaps in program data, we took a mixed approach to assessing the costs and benefits of the SHDGP Diabetes Program which involved using:

- data from a range of sources to estimate program costs and cost impacts; and
- modelling to estimate cost impacts, impacts on outcomes, and cost utility.

The modelling, which was undertaken using the UKPDS Number 08 model (Clarke PM et al 2004), required data at different time points as follows:

- demographic and risk factor data for a group of individuals at the time of diagnosis of type 2 diabetes; and
- at a later time risk factor data (including smoking status) and scores for clinical measures

### 7.5.2 Availability and Sources of data for assessing costs and benefits

The sources of data we used for assessing costs and benefits are summarised in Table 5. As can be seen, some of the gaps in program data could be filled from other sources – eg; Medicare Australia data for GP consultations and pharmaceuticals, and hospital separation data for outcomes/complications. Notable gaps were for specialist and allied health referrals.

**Table 5. Availability and Sources of data for assessing costs and benefits**

| Data type | Data Source |
|---|---|
| Division costs<br>- included costs of employing Program Manager/Diabetes Educator, data entry, administration and IT costs | Data provided by SHDGP |
| Practice costs<br>- varied according to whether practices used paper-based (more expensive) or electronic systems | Estimates provided by SHDGP |
| Patient Demographics | UKPDS Number 08 required ethnicity, gender, age. (Gender and age available from database, ethnicity assumed uniform) |
| GP consultation costs | Estimated based on SIPS payments to GPs in catchment area for diabetes cycle of care; data available online from Medicare Australia |
| Treatment costs (1)<br>- dietician<br>- exercise program | Data for services provided as part of the program provided by SHDGP; costs for other/private services not available |
| Treatment costs (2)<br>- pharmaceuticals | Estimated based on prescription data for patients with postcodes in the catchment area; data available online from Medicare Australia |
| Referrals<br>- specialist and allied health | Unable to estimate – no data available |
| Clinical measures/risk factors<br>- review/test results for HbA1c, cholesterol, blood pressure, BMI, microalbumin, smoking, alcohol use, height, weight, duration of diabetes | UKPDS Number 08 required smoking, HDL cholesterol, systolic blood pressure, HbA1c; available from SHDGP - incomplete but adequate for modelling purposes (see below) |
| Outcomes/complications | UKPDS Number 08 required Atrial fibrillation and Peripheral Vascular Disease experience - data not available; in modelling assumed no. Costs of outcomes/complications estimated using hospital separations for patients with postcodes in the catchment area with ICD 9/10 diabetes codes for primary diagnosis; data for secondary diagnoses considered unreliable; data obtained from Department of Health and Ageing. |

### 7.5.3 Impact of data completeness on sample selection for modelling

Data for modelling were selected from an extract of information relating to the period 1996 to 2004. The total number of people ever listed in the database was 1372. Of these, it was possible to include 74 in the UKPDS Number 08 model. The following discussion describes the data issues which led to this being the number who could be included in the modelling exercise.

The main losses in number of cases were due to the requirement for data at or near time of diagnosis, and so that the “before and after” effects of the program can be tested, patients must also have data available for relevant parameters at least five years apart. Therefore, in order to have data at or close to diagnosis, only patients who record nil or one year duration of diabetes at registration in the program can be included. Those without data at the five year data collection points are also excluded. This reduces the sample considerably, as those commencing in the program after 1999 are not eligible for inclusion in the study sample. These are structural factors in the register and do not reflect in any way on data quality.

Other factors of importance include data for height and weight and smoking status. The UKPDS Number 08 model requires data for height and weight at time of diagnosis. If not available at that time these weight data were taken from the first available time, subject to it being within two years of registration, and height data taken from any time. Likewise, data for smoking was required at registration and at current time. If these scores were not available, other scores were used; in particular any score of "never smoked" was taken as applying to all periods. Other scores were taken as applying to other periods if there is no reason to do otherwise. However, for a significant number of patients, smoking was scored as "not known". These were excluded from the sample.

Table 6 shows the data requirements for the UKPDS Number 08 model and the numbers of clients that could be included in the sample at each step in the process of selection.

**Table 6. Process for selecting sampling for modelling**

| Criteria | Total number of patients (n=1372) |
|---|---|
| • with diagnosis in registration year or one year before | 646 |
| • registered before 2000 | 212 |
| • have an HbA1c score before 2000 | 172 |
| • also have an HbA1c score on or after 2000 | 141 |
| • have these HbA1c scores 5 years or more apart | 117 |
| • have systolic bp score within 2 years of initial HbA1c | 115 |
| • have systolic bp score within 2 years of final HbA1c | 113 |
| • have cholesterols (total and hdl) within 2 years of initial HbA1c | 95 |
| • have cholesterols (total and hdl) within 2 years of final HbA1c | 93 |
| • have height score, and have weight within 2 years of initial HbA1C | 87 |
| • have valid smoking score | 74 |

# 8. STUDY LIMITATIONS

This is a preliminary investigation of program delivery and information management, including the availability of routinely collected data in the SHDGP Diabetes Program for assessing cost effectiveness. The study involved extensive examination of the Division database and lengthy discussions with key Divisional staff as well as interaction with members of the program steering committee. It did not, however, involve interviews with other providers involved in the program such as the GPs. Their perceptions of strengths and weaknesses of the program would likely have shed additional light on the strengths and weaknesses of data management and program delivery.

# 9. KEY SYSTEM LESSONS FOR TRANSFERABILITY AND SUSTAINABILITY

## 9.1 Program delivery

The SHDGP Diabetes Program is a best practice program that reaches 94 per cent of the diabetic population and incorporates the seven dimensions of structured care found to improve the quality of care for people with chronic disease (WHO 2003). These are:

- a population orientation;
- a delivery system with comprehensive and multidisciplinary care;
- a mechanism for coordinating the components of care;
- active client/patient management using health education, empowerment and self-care;
- evidence based guidelines;
- IT for knowledge management and system solutions; and
- a continuous improvement process.

It is feasible that these dimensions could be replicated in other Divisions, and in other settings such as large general practices or other regional programs. They also provide a useful tool to assess capacity and potential costs associated with implementation of such programs within the Divisions network.

Divisions are well placed to develop regional diabetes programs like the SHDGP program because they are able to foster a rapport with GPs and provide the data supports needed for the operation of IT systems, like CARDIAB, as well as to develop system linkages that individual GPs would not otherwise have the time to develop.

The Southern Highlands experience suggests if GPs are to be the central providers for ongoing coordination and monitoring of diabetes management, then GPs need to identify diabetes as a local issue needing attention.

A multi-disciplinary approach is essential, best supported by formalised agreements with key agencies. Area Health, specialist and hospital involvement have been critical to the success of the Southern Highlands program.

A key success factor has been that the program explicitly supports GPs and practices in patient care. The Program Coordinator/Diabetes Educator does not maintain a separate caseload, but works closely with GPs to support them in their role as care coordinators.

For patients, the program operates as a “one-stop shop” whereby comprehensive services are accessed as part of the process of regular review. As all GPs in the Southern Highlands participate in the program, all patients potentially have access to it.

The exercise program is a key feature of the Southern Highlands Diabetes Program. The coordinator believes exercise programs are a crucial component of the management of diabetes. Her view is based on the known impact on the progression of diabetes and prevention in the case of pre-diabetes, as well as its positive impact on mental health and from client and GP feedback about its clinical value. She believes there is further scope for the development of exercise physiology and the involvement of fitness trainers in future diabetes care. This is

consistent with the Australian Government's increasing interest in risk factor reduction in chronic disease, most recently demonstrated in the 2006 Budget funding allocated to the Lifescripts program and other initiatives.
There is the potential for expansion of Division subsidised or otherwise supported exercise and other risk reduction programs as a core component of patient care and population risk reduction. This would have cost and other implications for the Department and the Divisions Network.

The SHDGP Diabetes Program highlights the importance of the practice nurse role, particularly in relation to the development of this role to include education on patient self-care. With the predicted increases in diabetes, especially in younger age groups, this role is likely to have increasing importance over time. This raises issues about training and support for practice nurses if they are to have an expanded role in diabetes management in future.

The SHDGP Diabetes Program is continually developing new program components and linkages. Program flexibility is a key issue. As diabetes prevalence increases and the age structure of the diabetic population changes (younger onset), as risk reduction receives greater emphasis, as self-care gains in importance and as general practice develops (practice teams change, IM/IT capacity increases), regional diabetes programs will have to change in order to maintain their relevance and value for money. This requires organisational flexibility and capacity to encompass and seek solutions to change.

Program leaders who have a system orientation as well as a clinical support orientation, and the ability to seek out and work effectively with local champions and other stakeholders are critical. From a network perspective, identification of and support for leadership training for programs leaders may be needed if best practice programs like this one are to be taken up more widely.

## 9.2 Information management

Information management and information technology issues are critical to sustainability. Strategies to enhance completeness of key data are needed and would be an ongoing requirement for any Division running such a program. Focusing investment on completeness of the key data needed for clinical feedback to GPs as well as to undertake modelling of cost impacts and outcomes should be considered. With respect to this, the following areas are identified as needing further attention:

- Drugs data – it is imperative that the exact drug, rather than the drug type, is recorded in the database. This is because there are significant differences in the costs of particular drugs, within the same categories.
- Review data need to be recorded at least annually. Measures for clinical monitoring are currently collected quarterly according to best practice guidelines. The most important measures for impact assessment are HbA1C, cholesterol and blood pressure. One measure per year, every year, is the minimum required for comprehensive program review. Smoking status and weight are also important as they impact on the development of the disease process. Regarding HbA1C, it is imperative that a baseline measure is available.

The program would benefit from data extraction tools and statistical and epidemiological expertise to undertake population-based analyses. Further discussion needs to occur about how and at what level such epidemiological support could be provided.

In multidisciplinary teams where coordinated care is a program goal, communication between providers is essential. This program tailors communication arrangements to individual provider preferences (such as fax and email) and has developed and implemented an encrypted messaging system for care planning between providers. Such electronic systems are likely to be of increasing importance in future.

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# APPENDICES

## Appendix 1 – Review of the International Literature on Guideline Adherence

Despite the acknowledgment of the role of clinical practice guidelines (CPGs) in the care of diabetes patients, their implementation has remained suboptimal in many of the countries where diabetes prevention and control lie largely in primary care structures.

The National Institute for Health (NIH) asserts that "…less than two per cent of adults with diabetes [in the US] receive the level of care that has been recommended by the American Diabetes Association (ADA)" (NIH 2002, section 2). Patient outcome measures seem to further support the lack of adherence to evidence-based clinical practices. The average HbA1c level for over 13,000 diabetic patients reported in US studies after 1997 was 8.6 per cent while there was still one-quarter to one-third of patients above 9.5 per cent (Davidson 2003, p. 1608). Similarly, Davidson (2003) indicates that other studies found "only three per cent of diabetic patients met the combined ADA goals for glycemia, lipids, and blood pressure at urban academic medical centres" (p. 1608).

More encouraging outcomes for care processes and patients are reported in Canada. Harris et al (2003) found that glycemic control was documented in 84 per cent of randomly sampled patients cared for by family physicians, the mean HbA1c level being 7.9 per cent. Yet, the extent of screening for microvascular and macrovascular disease by physicians in the group was diverse. Blood pressure was documented in 88 per cent of patients, lipid profiles in 48 per cent, microalbuminuria was in 28 per cent, and diabetes foot conditions in 15 per cent of patients. The study, however, highlights the difficulty in comparing these results with other similar papers because of "varying audit time frames, patient eligibility criteria, location of practices audited, and year of the chart review" (Harris et al 2003, p. 782). A comparison between studies cited by Harris et al and the one he carried out is presented below (2003, p. 782):

| Location | HbA1c documentation (at least once per year) | Audit Time Frame | Medication | Year of publication of the study |
|---|---|---|---|---|
| Canada, five county areas | 84 per cent | 12 months | On medication | 2003 |
| UK, representative sample of practices | 87 per cent | 14 months | On medication | 2002 |
| Canada, urban and rural practices | 53 per cent | 12 months | Not stated | 1997 |
| US, rural practices | 15 per cent | 36 months | Not stated | 1996 |
| US, an Urban Health Maintenance Organisation | 69 per cent | 24 months | On medication | 1995 |
| US, urban primary clinics | 64 per cent | 16 months | Not stated | 1994 |
| UK, urban practices | 87 per cent | 12 months | Not on insulin | 1993 |
| UK, urban practices | 32 per cent | 24 months | Not on insulin | 1991 |

When the adoption of clinical practice guidelines (CPGs) or other care management processes (CMPs) is assessed, adherence levels still remain low —

about 25 per cent of the US physician organisations studied do not use any CMPs at all and 22 per cent use only one of these (Li et al 2004, p. 2315). Besides CPGs, other CMPs studied were case management, performance feedback and disease registries.

Barriers influencing the implementation of diabetes guidelines and research into clinical practice can be conceptually classified by attributes of the guidelines and the methods employed for their dissemination/implementation, the provider, the patient, and the health care system (Gimenez-Perez et al 2004).

| Attributes of | Factors |
|---|---|
| Clinical Practice Guideline | Recommendation action, characteristics of the guideline, effect on daily work, goals of clinical practice guideline developers |
| Physician | Area of clinical practice, attitudes, beliefs & individual factors, previous practice habits, optimal learning style, perceived lack of support from society and the health care system for efforts to control diabetes, time, education and training in medical school, reimbursement |
| Context | Health care system (limited resources, acute/treatment versus health promotion/chronic care delivery), practice organization, clinical setting |
| Patient/Society | Concordance of the patient, perceptions/beliefs & values/demands of the patient, perceived severity of the disease and its complications, access to care |
| Method of Dissemination | Peer-led/small group, educational outreach, method of teaching, audit feedback |
| Method of Implementation | Prompting/reminder systems, patient database/registry, practice organization changes, shared care |

(Gimenez-Perez et al 2004, section 2.5)

A number of papers upon which the above summary is based highlight that some factors have greater relevance. Larme and Pugh (2001) state that “contextual factors are more important barriers to optimal diabetes care than physicians knowledge and attitudes” (p. 1728). Contextual factors are:

- Time constraints and practice economics in the private practice setting;
- Low awareness and low socio-economic status among patients;
- The need to maintain referral relationships and misdistribution of professionals in the practice community; and,
- Lack of access for low-income patients, low reimbursement and insufficient focus on prevention in the US health care system” (p. 1728)

A previous qualitative study (Harris et al 2002) defined barriers to CPG implementation as being patient, physician or system-related and states that each of these factors influences, and in turn is influenced by the barriers and facilitators specific to the others.

A self-reported survey of GP’s awareness, attitudes and use of Diabetes Management Guidelines conducted in Australia in 1996 (Faruqi et al 2003, p. 572-573) found that:

- 86 per cent of GPs found the guidelines ‘very useful’ or ‘useful’.
- Less than 25 per cent thought these oversimplified medicine or could diminish GP satisfaction.
- Perceived effective implementation strategies were educating patients (88 per cent), patient reminders (82 per cent), GP feedback (72 per cent) and academic detailing (66 per cent).

Organisational factors of primary care settings seem to be positively correlated with CPG implementation.

Physician organisations in the US that are subject to reporting and receive incentives for high quality of care, use computerised clinical information systems and are owned by a health maintenance organisation or hospital system are more likely to adopt CPGs for diabetes (Li et al 2004). Similarly, Ward et al (2004) analysed Veterans Administration Medical Centres (VAMCs) in the US to describe organisational characteristics affecting both provider adherence and patient outcome measures for diabetes. Increased adherence to CPGs by VAMCs can be explained by more frequent feedback on diabetes quality care, nomination of a guideline champion, prompt implementation of care-process adjustments, and greater acceptance of guideline applicability. Better patient outcomes were attained by VAMCs that "had more effective communication between physician and nurses, used educational programs and Grand Round presentations to implement diabetes guidelines…" (p. 840). Another paper (Mohiddin et al 2006) deals with primary care professionals' satisfaction with access to, communication with and management advice from other members of the diabetes team. The satisfaction levels reported were generally low and although these were not linked to the organisation of diabetes care, they can affect quality care. A possible cause of dissatisfaction could be the "…lack of clarity regarding the roles and responsibilities of different members of the multidisciplinary diabetes care team" (Mohiddin et al 2006, p. 17).

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## Appendix 2 – Review of Three Systematic Reviews of the Effectiveness and Efficiency of Diabetes Guidelines Dissemination and Implementation Strategies

Three systematic reviews have been analysed. These reviews report that studies more consistently assess improvements in processes of care than patient outcomes. Interventions investigated generally show improvements in process measures and although only one review (Grimshaw et al 2004) defines a framework for qualifying effects, interventions appear to result in modest to moderate guideline implementation improvement. The multifaceted intervention that the three reviews seem to highlight as highly effective is provider education (especially academic detailing), structured record or reminders with audit and feedback. The next most successful combination of interventions includes patient-oriented strategies which may be coupled with organisational interventions (nurses) or structured records. Further, the reviews identify decision support mechanisms (reminders, structured records, a central computer system) as key interventions since these are associated with improvements in care across a wide range of settings and targeted behaviours.

Frommer et al (2000, p. 22) found the following implementation strategies in the examined studies:

- Professional interventions:
  - Decision support mechanisms: structured records, reminders, algorithms/flowcharting, guideline-based computerised prompts, computer generated reports on patient results;
  - Provider education: academic detailing, lectures, interactive education, explanatory letters, conferences, problem-based learning (local consensus processes);
  - Patient education: clinics, educational modules, small groups, behavioural contracts, follow-up leaflets, monitoring of self management, access to educator;
  - Audit and feedback (any summary of performance of healthcare over a period, which may include recommendations for clinical action);
  - Arrangement for clinician access to ongoing specialist advice;
- Organisational interventions: Employment of additional staff which may require specific training; and;
- Financial interventions: Continuing Medical Education (CME) points and financial benefits.

Grimshaw et al (2004, p. 8) and Renders et al (2000) used the Cochrane Effective Practice and Organisation of Care (EPOC) taxonomy to classify implementation strategies for the studies reviewed. The EPOC classification has the following professional interventions in addition to those listed by Frommer at al (2000):

- Educational materials: Distribution of published or printed recommendations for clinical care, including clinical practice guidelines, audiovisual materials and electronic publications.
- Local opinion leaders: use of providers nominated by their colleagues as “educationally influential”.
- Patient-mediated interventions: new medical information collected directly from patients and given to the provider (e.g. depression scores for an instrument). This may include patient financial incentives.
- Marketing: use of personal interviewing, group discussions or survey of targeted providers to identify barriers to change and subsequent design of interventions to address these.
- Mass Media: (1) varied use of communication that reached great number of people (TV, radio, newspapers, etc.) alone or in conjunction with other interventions; (2) targeted at the population level.

The systematic review by Grimshaw et al (2004) seems to have an advantage against the other two analyses as it attempts to measure the magnitude of improvement (the effect size) derived from implementation strategies individually and across the selected studies. This in contrast with the other two reviews where the use of voting-counting techniques may lead to overlooking unit of analysis errors (Grimshaw et al 2004, p. 63). About eight per cent of the studies included in the systematic review by Grimshaw et al (2004) relate to diabetes and 28 per cent to chronic disease. It is of note that the reviews by Fommer et al (2000) and Renders et al (2000) deal exclusively with diabetes care.

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| Review | Findings | Methods | Characteristics of studies |
|---|---|---|---|
| Systematic review of evidence-based strategies for dissemination and implementation of diabetes recommendations (Frommer et al 2000, p. 20-26) | The majority of studies showed significant improvements on at least one measure by using a package of implementation strategies.<br>Sixty per cent of studies measured patient/surrogate outcomes, 50 per cent of these reported improvement.<br>Studies using decision-support mechanisms as part of the package were more likely to improve patient outcomes and guideline adherence.<br>Best results in adherence came from (1) academic detailing with structured record prompts and CME points; (2) structured records/flow-sheet and patient education.<br>Best results in patient outcomes came from (1) problem-based learning, algorithm/road map and audit/feedback; (2) nurse trained in decision support techniques to glycaemic control.<br>Studies focussing on one aspect of diabetes care were more successful than those with multiple aspects in promoting provider behavioural change and patient outcomes.<br>In terms of provider adherence, implementation strategies were most effective for monitoring of metabolic control, foot-care and retinopathy and least successful for blood pressure monitoring. As for patient measures, implementation strategies were most effective for metabolic control and least successful in lowering blood pressure and weight. | Selection Criteria:<br>Implementation of consensus and/or evidence-based diabetes care recommendations in samples with Type 2 diabetes people.<br><br>No. studies selected:<br>30.<br><br>Outcomes:<br>Measures of provider behaviour and/or patient outcomes. | Time and place of studies:<br>1976 – 1999. About 67 per cent were published in the last five years. Most are US studies (67 per cent), and from the UK (25 per cent). None was Australian.<br><br>Design:<br>Same proportion used control groups and pre-and post intervention design.<br><br>Clinical Setting:<br>Mostly Primary Care.<br><br>Clinical focus:<br>Twenty per cent focussed on a single aspect and the remainder assessed multiple aspects of diabetes care. |
| Effectiveness and efficiency of guideline dissemination and implementation strategies (Grimshaw et al 2004, p. ix – 42) | The majority of comparisons reporting process outcomes (87 per cent) observed improvements in care (i.e. greater guideline adherence).<br>Effect size of evaluations of single interventions:<br>Reminders and audit and feedback: Both had moderate effect, 14.1 per cent and 7 per cent respectively.<br>Educational Meetings: There were few evaluations. The effects are likely to be small.<br>Studies that examined other professional and organisational interventions had a potential unit of analysis error but largely suggested that improvements in care were attained.<br>Effect size of evaluations of multifaceted interventions against a no-intervention control group:<br>Modest improvements: Educational outreach in conjunction with other interventions (6 per cent); and, combined educational materials and audit and feedback (7.4 per cent).<br>Small improvements: Combined educational materials, educational meetings and audit and feedback (3 per cent); combined educational materials and educational meetings (1.9 per cent—although evidence is sparse and of poor quality); and, combined educational materials, educational meetings and organisational interventions (1 per cent).<br>Results of evaluations of multifaceted interventions against an intervention control group:<br>Educational outreach seems more effective than educational materials in three of four comparisons and audit and feedback in two of two comparisons.<br>Educational material and reminders combined appear more effective than educational materials alone. | Selection Criteria:<br>Types of participant:<br>Medically qualified health care professionals.<br>Types of intervention:<br>guideline dissemination and implementation strategies.<br>No. studies selected:<br>235.<br>Outcomes:<br>Objective measures of provider behaviour and/or patient outcomes.<br><br>Size of the effect:<br>Dichotomous process measures (e.g. per cent receiving appropriate treatment) were used as the primary effect size for each | Time and place of studies:<br>Between 1966 and 1998.<br>Of these 71 per cent were conducted in the US; 11 per cent in the UK; 6 per cent in Australia; and 15 per cent in other.<br>Design:<br>Randomised controlled trials (RCT 59 per cent); controlled clinical trials (CCT 7 per cent); controlled before and after studies (CBA 17 per cent); and, interrupted time series (ITS 17 per cent).<br>Clinical Setting:<br>The setting for 39 per cent was Primary Care, 19 per cent inpatient settings, and 19 per cent generalist outpatient or ambulatory care settings (all undertaken in the US and may be equivalent to Primary Care). |

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| | Educational meetings and reminders seem more effective than educational meetings alone. No relationship was found between the number of component interventions and the effect of multifaceted interventions. | comparison.<br>Effect size is the absolute difference across post-intervention measures: small 5 per cent; modest >5 per cent and 10 per cent; moderate >10 per cent and 20 per cent; and, large > 20 per cent. | Clinical focus:<br>In 28 per cent of studies, the focus was on a single implementation strategy; 72 per cent on multifaceted interventions. The most common single intervention was reminders (13 per cent). The strategy most frequently used in multifaceted interventions was educational materials (48 per cent), followed by educational meetings (41 per cent) and reminders (31 per cent). |
| **Review** | **Findings** | **Methods** | **Characteristics of studies** |
| Systematic review interventions to improve the management of diabetes mellitus in primary care, outpatient and community settings (Renders et al 2000, p. 1-13) | Professional intervention vs. usual care: Postgraduate education together with reminder, audit and feedback, educational outreach visits or combinations of these interventions increased process outcomes in all studies where care at baseline was poor.<br>Organisational intervention vs. usual care: Variations to medical record systems improved process outcomes, as did intensive follow-up in terms of scheduled visits and rates of eye examinations. In the short term, telephone calls for rescheduling visit failures in conjunction with patient education proved more effective than delivering multiple reminders. Case management delivered by a multidisciplinary team in addition to patient education seemed to enhance process and patient outcomes.<br>Professional in combination with organisational interventions vs. usual care: Provider education was included in most studies, which seemed to add to the effectiveness of the intervention. Computerised reminders, audit and feedback or a combination of both seem to improve process outcomes. Similarly, a centrally organised computerised database to arrange follow-up, track patient appointments and generate reminder card for patients improved process outcomes. When patient outcomes were assessed, greater nurse involvement reported positive effects on patient outcomes, as did inclusion of patient education in the interventions.<br>Patient-oriented intervention combined with professional and/or organisational interventions: Generally led to improvements of patient outcomes next to improvements in process measures.<br>Revision of professional roles: When physicians were partly replaced by nurses in providing care, the studies generally showed a positive impact on glycaemic control.<br>Financial interventions: No studies were identified.<br>The effect of interventions on patient outcomes remained less clear as these were seldom assessed. | Selection Criteria:<br>Types of participant; Health care professionals, including physicians, nurses and pharmacists.<br>Types of intervention; professional, financial and organisational strategies aimed at improving care for Type 1 and Type 2 diabetes.<br><br>No. studies selected:<br>41.<br>Outcomes:<br>Objective measures of provider performance, patient outcomes and self-report measures with known validity and reliability.<br><br>Size of the effect:<br>Differences in guidelines and methods as well as reference values to assess glycated haemoglobin hindered between-studies comparisons of effect size. | Time and place of studies:<br>Between 1966 and 1999.<br>Of these, 58 per cent were conducted in the US; 22 per cent in the UK; 5 per cent in Australia; and 15 per cent in other.<br><br>Design:<br>Randomised controlled trials (RCT 66 per cent); controlled before and after studies (CBA 29 per cent); and, interrupted time series (ITS 5 per cent).<br><br>Clinical Setting:<br>The setting for 66 per cent were community settings, 27 per cent outpatient settings, and 7 per cent combination of both settings.<br><br>Clinical focus:<br>All studies presented multifaceted interventions. 29 per cent of the studies evaluated professional interventions alone; most included educational materials (22 per cent) or educational meetings (17 per cent) jointly with other interventions. The studies of 22 per cent |

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| | | | were implemented interventions only directed at the organisation of care, most of which included patient education (12 per cent). |

## Appendix 3 – Review of the Literature on Costs and Cost Effectiveness of Guidelines- Based Approaches

### Cost or cost-effectiveness of guidelines?

In Australia, the National Health and Medical Research Council (NHMRC) states that "at the commencement of the Type 2 diabetes Guidelines project, analysing the cost implications of recommendations was not a specific NHMRC requirement..." but that it intends to include an economic analysis when new editions of the guideline are produced (NHMRC 2001, p. 5). Since there are no officially validated data on guideline costing, literature was reviewed to find which analyses were more useful to decision making on health care resource allocation. Gray et al (2002) maintain that health service managers when confronted with the adoption of a new intervention need to know not only the cost effectiveness of that intervention but also the overall cost of implementing it (2002, p. 860). Those two elements of guideline costing have been looked for further in the literature, particularly in papers attempting to assess guidelines as a whole (as opposed to the some parts of these combined or individual guideline clinical recommendations).

### What costing guidelines involves

Grimshaw et al (2004) gather from literature that the three stages to be considered in economic evaluations of guideline development and adoption are:

- development of the guideline,
- dissemination and implementation of the guideline,
- treatment effects and costs as a consequence of behaviour change (p. 43).

Based on these stages, a framework for Performance Assessment in Primary Health Care (Sibthorpe 2004) and a study of cost-effectiveness of diabetes treatment (Niessen et al 2003) the following outline for the assessment of costs and effects of guideline development and introduction seems to emerge:

| Stage | Object | Costs to be measured | Effects to be measured |
|---|---|---|---|
| 1. Development of the guideline | Synthetise best practice in clinical prevention and management | Development of protocols/procedures; and, identifying, appraising and synthesising the evidence | Processes of care; and, intermediate and health outcomes for patients |
| 2. Dissemination and implementation of the guideline | Assist change in clinical practice underpinning quality care for clinicians and patients according to best practice | Organisational structures and processes required for implementation interventions (a) | Processes of care (adherence to guideline) and intermediate outcomes for patients (achievement of guideline goals for management) |
| 3. Clinical interventions (treatment) as a consequence of behaviour change | Deliver treatment conducive to improved patient outcomes | Processes of care required for treatment (b); patient costs; and, cost savings from the slowed progression to complications (as a negative value). | Intermediate and health outcomes for patients (e.g. complication free years, quality adjusted life years (QALYs)). |

a) Implementation interventions (or strategies) can be professional (structured records, reminders, academic detailing, patient education, audit and feedback, etc), organisational (a practice nurse), financial or regulatory (Grimshaw et al 2004, p. 8).
b) Extra care following guidelines: GP visits; various diabetes specialists; medication and self-control; and, laboratory (van Os 2000, p. 141).

### Costing guideline development and adoption

After reviewing 235 studies, Grimshaw et al (2004) found that only 63 (29 per cent) reported cost analyses or economic evaluations of guideline implementation.

Grimshaw and colleagues (2004) concluded that none "… gave reasonably complete information on the estimation of cost and covered all three relevant stages". Nevertheless, four studies had data robust enough for consideration; these revealed that the cost of local guideline development could be substantial if clearly assessed. A suggestion the authors draw from literature is for primary studies to concentrate on evaluating behavioural change and cost of development, dissemination and implementation of the guideline and use modelling to determine whether the guideline is efficient at the level of behaviour achieved or desired (Grimshaw et al 2004, p. 51). It is of note that about eight per cent of the studies included in the systematic review by Grimshaw et al (2004) relate to diabetes and 28 per cent to chronic disease.

Regarding the exclusion of development expenditure from the costing of guidelines, it seems legitimate that when guideline development occurs centrally and at a point in time prior to the economic evaluation being performed, the outlays of this stage be regarded as a sunk cost. Guideline adoption expenditure, namely dissemination, implementation plus the treatment itself, should in principle be included in studies attempting to perform a cost analysis.

### Costing guidelines as a whole

Niessen et al (2003) performs an analysis of two types of care: type 2 diabetes control and the treatment of complications at current level and alternatively according to guidelines (p. 355). This study is conducted in the Dutch setting where primary care physicians are the gatekeepers for secondary care facilities and about 80 per cent of type 2 diabetes patients are treated in primary care, only temporarily referring them to secondary care consultation (e.g. eye screening). Results indicate that guideline-based clinical interventions may reduce the cumulative incidence of blindness, lower-extremity amputation, and end-stage renal disease (ESRD) by 70 per cent or more in primary care. All primary care guidelines together (control and treatment of complications) add 0.8 QALYs per lifetime and cost about €6000 to €7000 per QALY gained (US$6,350 to US$7,400). The study acknowledges, however, that expenses from guideline implementation strategies are not included and that this may impact on the results obtained. No attempt at calculating overall guideline cost is made.

An Australian paper by Beilby et al (2001) aims to determine diabetes guideline adoption costs per practice and patient from a societal perspective but does not carry out a formal cost-effective analysis. The quasi-experimental before-and-after study was conducted over a two-year period based on three Divisions of General Practice (DGP) in South Australia. Guideline implementation strategies are divided into establishment costs and ongoing costs. Activities falling in the former category for Divisions are planning and promotion of the program, production of materials, setting up registers/databases and or/recall systems, fixed-assets, and external evaluation and/or consultancy whereas for practices the major cost driver is the time of GPs. Divisions incurred in costs of A$33,732 to set up their diabetes programs. At the practice level, the establishment cost averaged A$812 (p. 5). These establishment costs for Divisions and GPs amortised over three years would average A$453 per GP p.a (p. 4). Ongoing costs of guideline implementation exclusive to Divisions are promotion and administration tasks. Other implementation interventions generating periodic expenses to Divisions and practices alike are register/recall and database maintenance, provision of clinics, clinical liaison and case conferencing and finally ensuring quality and evaluation (CME, audits).

These ongoing costs annually amounted to A$116,700 per Division and A$4,763 per practice, which together average A$2,720 per GP p.a (p. 5). The incremental cost at the patient level was a mean of A$832 due to greater pharmaceutical costs and other

out-of-pocket costs. An approximate number for the overall cost of guideline implementation from a societal perspective, which is not attempted by the authors, would be A$688m2, about 4.3 per cent of the increase in the Australian Health budget in 2001-05 (DoHA 2002, 2004, 2006). Adherence to clinical guidelines and intermediate outcomes for patients improved significantly with systematic care. The average improvements in adherence fluctuated from one per cent to 10 per cent, the largest increases being in foot checks (25 per cent), micro albumin checks and weight recording (both 15 per cent) (p. 32). As for intermediate patient outcomes, important improvements were a 3.3 per cent decrease in mean HbA1c and a 5.8 per cent increase in HDL (p. 73). As mentioned before a cost effectiveness analysis was not carried out so there is no calculation of a cost/QALYs ratio as a result of guideline-based interventions supported by systematic primary care structures.

### Costing two or more guideline interventions combined

In addition to treatment expenses, the study by Gray et al (2002) includes as the only cost of guideline implementation a practice nurse. The study aims to calculate overall costs and builds on previous UKPDS Number 08 findings that these two interventions are cost-effective (p. 865). The authors (2002) estimate that the incremental net annual cost of healthcare intensive control of blood glucose and blood pressure to all people with type 2 diabetes in England is around £100.5 million (€159 million, US$156 million). This amount is equated to less than one per cent of the proposed additional annual expenditure on the NHS in 2001-2005.

Van Os et al (2000) performs a cost-effectiveness analysis of guidelines for prevention of nephropathy in diabetes type 1 and 2 in the Netherlands. Nephropathy in diabetes is "… a gradual process with distinct stages of micro-and macro-albuminuria, before ESRD might develop" (p. 136). The study found type 2 diabetes patients gain 0.2 complication-free life years at a cost-effectiveness ratio of 31,000 Dutch guilders (about US$ 14,600) per QALY from guideline-based treatment. Further, the authors assert that guideline adoption is cost-effective; intensive blood glucose control is found to be cost-effective and use of ACE-inhibitors cost saving. A telephone consultation from a diabetes nurse seems to be the single implementation intervention considered in the guideline-based treatment case. There is no calculation of total cost of guideline implementation.

A recent study dealing with foot interventions by Ortegon et al (2004) indicates that "management of diabetic foot according to guideline-based care improves survival, reduces diabetic foot complications and is cost-effective and even cost-saving compared with standard care" (p. 901). This study includes some costs of implementation strategies such as educations of patients and staff, identification of the high-risk patients (perhaps by using structure records), and a multidisciplinary approach (p. 904).

The study evaluated the effect of the clinical treatment of the diabetic foot as per guidelines with and without guideline-recommended glycemic control. Both cases were found to be cost effective; exclusive foot care would have a cost/QUALY ratio of US$22,812 whereas that treatment coupled with tight glycemic control would be cost-effective at a ratio of US$12,165.

2 The rough estimate of AUD 688m results from adding to marginal patient costs divisional costs. Beilby et al (2001, p. 73) indicate that marginal patient costs (MPC) per annum (p.a.) are AUD 1,153, which includes practice costs, medical services, pharmaceuticals and other out-of-pocket and imputed costs. Patient costs would total AUD 670m, resulting from multiplying the MPC p.a. by the estimate number of people with type 2 Diabetes in Australia (580,668 people; ABS 2006). Divisional costs would amount to AUD 18m and are calculated as the number of DGPs in Australia in 2004 (120; Kalucy et al 2005) by the costs of establishing and running a guideline-based program, which is estimated by Beilby et al (2001) to be AUD 150,432.

### Costing individual guideline interventions

The literature review by Klonoff and Schwartz (2000) exclusively focus on the cost-benefit relationship of various components of the diabetes guideline.
The scale used for categorising interventions was:
1. Clearly cost saving (one robust study finds savings > cost of the intervention),
2. Clearly cost-effective (one robust study finds costs ≤ US$25,000 per QALY gained),
3. Possibly cost-effective (three studies conclude intervention to be cost-effective or cost saving),
4 .Non cost-effective (one robust study finds costs > US$25,000 per QALY gained), and
5. Unclear (less than three robust studies describe economic impact).

The study found eye care for type 2 diabetes patients not requiring insulin to be clearly cost saving and for those requiring insulin to be clearly cost-effective. Improved glycemic control and tight blood pressure control (in the addendum section) was also found clearly cost-effective. A possibly cost-effective clinical intervention was nephropathy prevention (van Os et al found it to be clearly cost-effective). Clinical interventions of unclear cost-effectiveness were foot care (Ortegon et al subsequently found it to be clearly cost-effective), lipid control, smoking cessation, exercise and weight loss among others. No intervention was found to be non cost-effective. As only some aspects of guideline-based care, calculation of total guideline adoption costs is not attempted.

A study by Eddy et al 2005 which uses data from a 27-centre randomised controlled trial in the context of a program called 'Diabetes Prevention Program' (DPP) suggests that lifestyle interventions could reduce a high-risk person's chance of getting diabetes by 11 per cent (in a 30 year period), the chances of a serious complication by eight per cent, and the chances of dying from a complication by 2.4 per cent compared with a no intervention program scenario. Lifestyle interventions are found to be cost-effective if implemented after Fasting Glucose Plasma (FGP) levels are greater than 5.3 mm/L at a cost of about US$24,500 per QALY gained. The overall guideline expenditure could be calculated if the marginal increase in cost per person of US$3,066 with the lifestyle program was extrapolated to the US population with type 2 diabetes although this is not performed in the article. A rough estimate for the overall cost of the lifestyle interventions suggested by the DPP would be about US$39,858 million as about 13 million people in the US have diagnosed type 2 diabetes (NDIC 2006), figure that represents about 20.3 per cent of the increase in the US health budget from 2002 to 2007 (HHS 2004, 2006). Guideline implementation strategies considered in the costing were among others structured records; educational materials; patient education; a case manager; audit and feedback; and provider training (DPP research group 2002).

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