Complications of diabetes: Human and healthcare costs

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Introduction

The development of diabetes complications has a huge impact on the health service provider and the individual's quality of life. Investment in clinical systems to improve diabetes care may benefit both providers and patients. Intensive education in diabetes self-management, use of intensive insulin regimens, and adoption of the empowerment approach to diabetes management have been cited as preventative solutions to the development of complications. This article examines the prevalence, healthcare costs and human costs of complications in the light of the current diabetes epidemic, where deaths attributable to complications are also rising rapidly (World Health Organization/International Diabetes Federation, 2004).

Improved blood glucose control to prevent diabetes complications has been highlighted since the release of results from the Diabetes Control and Complications Trial (DCCT; DCCT Research Group, 1993). These results represented the largest randomised longitudinal study of the effects of glycaemic control ever conducted. Two groups of participants were involved in the study, with one group using 'conventional' methods (one or two insulin injections per day and one or two blood glucose tests) and the other using 'intensive' methods (frequent blood glucose monitoring and daily adjustment of food and insulin to regulate blood glucose to as near normal as possible). Nearly half the intensively treated group used continuous subcutaneous insulin infusion (insulin pump therapy) to achieve levels of control that are optimum.

The DCCT Research Group (1993) clearly demonstrated that those individuals achieving improved blood glucose control (a 2% lower HbA_{1c} value on average) had a tremendous decrease in their risk of long-term complications of diabetes, and an increased quality and length of life. Risk of diabetic eye disease decreased by 76%, with reductions to the risk of kidney and nerve damage being 60% and 56% respectively. These results were so significant that the DCCT Research Group was compelled to end the study 1 year early. This gave the conventionally treated patients the opportunity to have the benefits of intensive diabetes management.

With the evidence that high blood glucose levels increase the risk of developing complications of diabetes, tight blood glucose control has become the benchmark for successful diabetes management (Diabetes UK, 2000; DCCT Research Group, 1993).

Prevalence

People with diabetes can expect a shorter life span because of the long-term complications of hyperglycaemia. In 2003, 3.2 million people worldwide died from complications associated with diabetes (World Health Organization/International Diabetes Federation, 2004). And in countries with high diabetes prevalence, such as those in the Pacific and the Middle East, as many as one in four deaths in adults aged between 35 and 65 years are due to diabetes (World Health Organization/International Diabetes Federation, 2004).

Diabetes has become one of the major causes of premature illness and death in most countries, mainly through increased risk of cardiovascular disease, which is responsible for between 50%

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1 Diabetes complications can be reduced or prevented with appropriate patient education.

2 Prevention or delay of complications can be achieved with support for diabetes self-management and with intensive treatments for those it will benefit.

3 The cost to health services of treating complications can be reduced with appropriate self-management education and treatments.

4 The individual's quality of life is significantly increased when complications are minimised.

5 Patient empowerment allows individuals to be the master of their condition, which fosters motivation for self-management and an improved quality of life.

KEY WORDS

- **Diabetes complications**
- **Self-management**
- **Quality of life**
- **Education**
- **Empowerment**

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1 The burden of premature deaths from diabetes is similar to that of HIV or AIDS.

2 Stringent glycaemic control is the only way to reduce diabetes complications and healthcare costs.

3 More intensive diabetes care and patient education can improve glycaemic control.

and 80% of deaths in people with diabetes (World Health Organization, 2002). Diabetes is also the leading cause of blindness, amputation and kidney failure in the world (Gilmer et al, 1997; Eckman et al, 1995). These complications account for much of the social and financial burden of diabetes.

Although diabetes is sometimes considered a condition of developed nations, the loss of life from premature deaths among people with diabetes is greatest in developing countries. The burden of premature deaths from diabetes is therefore similar to that of HIV or AIDS, but the problem is largely unrecognised (World Health Organization/ International Diabetes Federation, 2004).

Stringent glycaemic control is the only way to reduce complications and healthcare costs for people with diabetes (Gilmer et al, 1997).

Healthcare costs

Research has highlighted that more intensive diabetes care and thorough patient education can result in improved glycaemic control, leading to fewer microvascular complications in people with type 1 and type 2 diabetes (Dose Adjustment For Normal Eating [DAFNE] Study Group, 2001; Gray et al, 2000; Gilmer et al, 1997). Costs of improving diabetes control are substantial and may include intensive therapies, closer monitoring and increased patient education; however, they are outweighed by reduced incidence of complications and an improved quality of life for the individual (Skyler, 2000; Jacobson et al, 1994).

The DCCT Research Group showed that an increase in treatment costs would provide positive net benefits after 5–7 years by reducing future

Table 1. Cost of treating complications of diabetes (costs taken from www.dh.gov.uk [accessed 22.04.05]).

Procedural cost	National average cost (£)
Removal of cataract	847
Laser treatment for retina	504
Kidney dialysis	10249
Heart bypass surgey	4956
Angiogram	1097
Angioplasty	978
Lower-limb amputation	4835
Fitting of prosthetic limb	4000
In vitro fertilisation (one course)	572
Viagra for males with diabetes (one course)	23
Cost of 1 night's hospital stay	330
Cost of 1 week's hospital stay	840

The cost of anti-rejection drugs following transplant surgery varies according to the transplant centre. All procedural costs assume that the patient was a non-emergency in-patient or day case. Hospital stay assumes low-impact nursing with minimal consumable costs.

microvascular complications and thus overall healthcare costs (DCCT Research Group, 1995). Other studies have also indicated that modest investments in diabetes care can improve glycaemic control (Skyler, 2000; O'Connor et al, 1996; Eckman et al, 1995).

Although investments in diabetes care are expensive (see *Table 1*), the economic costs of not improving diabetes care may also be high. This can be seen in the direct and indirect costs of treating the rising levels of diabetes and heart disease.

For most countries, the largest single factor in diabetes expenditure is hospital admission for the treatment of long-term complications such as heart disease and stroke, kidney failure and foot problems (World Health Organization, 2002; O'Connor et al, 1996; Eckman et al, 1997). Many of these are potentially preventable given effective patient and professional education and comprehensive long-term care (Diabetes UK, 2000).

Human costs

The extent to which diabetes and its complications affect the individual's quality of life is also vitally important. Diabetes-specific measures of quality of life report a loss of valued activities with the onset of chronic complications (Jacobson et al, 1994), and for both type 1 and type 2 diabetes, quality of life declines as the number and severity of complications increases (Wilson and Cleary, 1995).

Because of the chronic nature of diabetes, the severity of its complications, and the methods required to control them, diabetes is a disease with substantial human costs for the affected individual and his or her family; these costs affect people everywhere. Intangible costs of diabetes and secondary complications such as pain, anxiety and inconvenience have an impact which is large but also difficult to quantify (Wilson and Cleary, 1995; Jacobson et al, 1994).

Preventing complications: Possible solutions

The DAFNE model is a skills-based patient education programme for people with type 1 diabetes to learn how to adjust insulin dosage to suit their choice of food – rather than having to adjust their lives around insulin dosages. This enables them to lead as normal a life as possible while controlling blood glucose levels and minimising long-term complications. This education programme has been developed over 20 years of rigorous research, including a randomised controlled trial in Northern Europe and an economic analysis in the UK. A major finding was that the DAFNE programme pays for itself in 4 years (DAFNE Study Group, 2001). The DAFNE programme has also been shown to be associated with an increased quality of life (in terms of wellbeing and treatment satisfaction) for the individual with diabetes, and a net cost saving over 10 years of £2679 to healthcare budgets (National Institute for Clinical Excellence, 2003).

For people who have a high risk of developing complications of diabetes, intensive diabetes management using multiple daily injections or insulin pump therapy may help prevent or delay them. Coupled with intensive education and empowerment to promote diabetes self-management, people can achieve improved diabetes control, a more flexible lifestyle and a better quality of life (Diabetes UK, 2000; Jacobson et al, 1994). Empowering people to self-manage their diabetes depends on education, without which people with diabetes have been shown to be four times more likely to develop major complications of the disease (Diabetes UK, 2000).

Using intensive treatment regimens can also allow stabilisation of existing complications through an improvement in glycaemic control (O'Connor et al, 1996). This can be employed for people who would benefit from it, with the cost of providing the treatment offset by the resulting health improvements (Skyler, 2000). In addition, the United Kingdom Prospective Diabetes Study (Gray et al, 2000) found that the reduced cost of treating complications in hospital after initiation of intensive management regimens counterbalanced the increased

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1 Quality of life declines as the number and severity of complications increases.

2 Human costs such as pain, anxiety and inconvenience are difficult to quantify.

3 Empowering people to self-manage their diabetes depends on education.

4 The use of intensive treatment regimens can stabilise existing complications.

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1 Preventing or delaying complications and achieving optimum glycaemic control means long-term healthcare savings.

2 The benefit to the individual with diabetes in terms of preventing or delaying complications is immeasurable.

cost of treatment, resulting in insignificant differences in total cost between the two approaches.

Conclusion

Diabetes places a considerable burden upon the individual, society and the economy, and the rising prevalence of the condition, and therefore healthcare costs, is a cause for concern. Preventing or delaying complications and achieving optimum glycaemic control therefore means tremendous healthcare savings in the long term. Improvement in the individual's quality of life due to a reduction in the effects of complications is also achievable with an improvement in glycaemic control, accompanied by diabetes education that tackles complex diabetes management issues. This benefit to the individual with diabetes in terms of preventing or delaying complications is immeasurable. ■

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