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Barriers to good glycaemic control: the patient's perspective

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Diabetes currently affects at least 120 million people worldwide, and this figure is rising steadily. Intensive treatment improves outcome in terms of morbidity from late diabetic complications and quality of life, but in order for patients to reap such benefits, they must commit to major, long-term changes in lifestyle. The physician's concept of diabetes is often very different from the patient's; and the implementation of a treatment plan acceptable to both is only possible when open communication fosters discussion and patient autonomy, and treatment is seen as logical, acceptable and feasible within the daily life of each patient.

Barriers that impair patients' ability to achieve good glycaemic control include those relating to lifestyle, education, psychology and their environment. An appreciation of barriers to good glycaemic control from the patient's perspective underlies the ability to minimise obstacles and improve outcome in terms of quality of life and metabolic control.

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Is diabetes the same disease for doctor and patient?

Diabetes currently affects at least 120 million people worldwide, and by 2010 this number is estimated to have reached 220 million.[1] With per capita diabetes-related expenditure running at four-times that for non-diabetics in the USA,[2] and total costs accounting for 28% of the annual healthcare budget allocated to the over 65-y-olds,[3] the cost in human and financial terms is immense. Large epidemiological studies have shown that intensive treatment significantly reduces morbidity from late diabetic complications.[4–7] The challenge is to make it possible for the physician and patient to achieve the best outcome in terms of metabolic control, while ensuring a good quality of life for the patient.

A diagnosis of diabetes poses very different challenges to the patient and physician. The physician begins the process of advising on dietary change, exercise, weight control and the most appropriate choice of medication where necessary. He/she will explain the serious nature of the disease, the potential for dangerous long-term complications and the necessity of maintaining tight blood glucose control at all times. The patient hearing a diagnosis of 'diabetes' receives a litany of advice and guidelines, all of which necessitate dramatic changes in every realm of their life. They may have heard of diabetes because a relative became blind or had a limb amputated as a result of the disease. To some, diabetes will have connotations of eating healthy food or buying diabetic sweets. To others it may signify early death. Whatever the initial image, when presented with the broad-ranging and life-long changes required, the likelihood is that 'diabetes' conjures up a very different picture for physician and patient.

High-quality diabetes care requires physician and patient to share an understanding of the distinct but complementary roles each will fulfil. Each party approaches the medical consultation with a different agenda, but like any negotiation, success rests on both parties participating in the decision-making process. Basic disease pathology, natural history and the need for active self-management are concepts that the physician must make accessible to the patient before satisfactory glycaemic control is possible.

Diabetes: a life-long self-management issue

The diagnosis of diabetes confers on the individual a life-long requirement to modify their lifestyle, monitor their disease and control their blood glucose via various treatment modalities. The disappointing standards of blood glucose control stand witness to the difficulty of this task: recent data from three countries indicated that $\geq 60\%$ of patients with Type 2 diabetes have $HbA_{1c} > 7.5\%$ (as discussed by Nattrass in this publication[8]).

In order for the daily routines of diabetes care to be effectively implemented, 'diabetes-related' tasks must make sense to the patient and be acceptable and realistic at a personal and cultural level. The targets that we set for diabetic patients include some that

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other patient groups have experienced as near impossible: the act of remembering to take medication is a burden even for the young, whose memories are reliable and who are spurred on by an awareness of the investment they are making for their future health; obese patients attempting to lose weight struggle with their undertaking despite specialist advice, medication, and even sometimes surgery. The tasks set for diabetic patients include both daily medication-taking and losing weight, but to this are added dietary changes, the aspect of self-management, which is generally found most difficult by patients,[9] smoking and alcohol restrictions, and home blood glucose monitoring, among others. Taking medication has been found less burdensome than some other tasks,[9] perhaps reflecting deeply ingrained beliefs in society about the patient's responsibilities when taking on the 'sick role'.

As is the case with other chronic diseases, the prospect of treatment can seem more punishing than the disease itself. The potential for long-term diabetic complications may appear less real than the restrictions placed on eating and the daily self-injecting with insulin for those who require it. Blood glucose monitoring does not in itself improve diabetes, and yet adds to the array of 'diabetes-related' practices required on a daily basis.

Factors that influence successful patient self-management were investigated using a 41-question questionnaire.[10] Five factors were found to relate significantly to glycaemic control as measured by HbA_{1c}: (1) practical self-management skills; (2) emotional adjustment; (3) perceived goals; (4) perceived self-efficacy; and (5) cost-benefit analysis. These results should engender optimism since, unlike fixed demographic variables accounting for risk, all these factors can be altered. From the patients' point of view, targets in this study appeared to fall into two broad categories: those relating to blood glucose control (medical goals) and those concerning living with diabetes. Individual patients ascribe different degrees of importance to each target. A role of the physician is to facilitate individual goals, with the aim of improving glycaemic control and psychological adjustment to life with diabetes.

Diabetes and quality of life

'Quality of life', measured by scales including QALYs (Quality Adjusted Life Years), is seen by some as a scientific measure of the value of daily life, others regard it as a nebulous assessment of general well-being. Diabetes-related quality of life (QoL) includes measures of symptom distress, emotional well-being, functional limitations, cognitive performance and social relationships. Tools for the measurement of QoL include generic scales (such as the SF-36, GHQ-12, NHP and SIP) and those measuring diabetes-specific variables:

1. DQOL (psychosocial impact of disease)
2. DHP (distress, barriers and eating restraints)
3. PAID (diabetes-related distress)
4. DSC-2 (diabetes-related symptoms)

QoL is a useful surrogate marker for a multitude of factors and gives some idea of how well a patient is coping with diabetes overall. Few would deny that a patient whose life is dominated by diabetes-related restrictions is not a 'diabetes success', no matter how good their metabolic control. Conceptualising the disease from the patient's perspective requires an understanding of the factors that contribute to quality of life.

Achieving good metabolic control: hurdles and hoops

The maintenance of blood glucose concentration within recommended limits is a task that requires patients to juggle numerous responsibilities. Barriers to achieving the desired outcome can be divided into the following categories, between which there is significant overlap:

- Lifestyle
- Educational
- Psychological
- Environmental

Lifestyle barriers. The lifestyle limitations imposed on diabetic patients originate partly from the disease itself and partly from the treatment. Traditional long-acting oral hypoglycaemic agents (OHAs) including the sulphonylureas stimulate pancreatic insulin production from their onset of action until renal or hepatic metabolism inactivates the drug, which is then excreted. Duration of action of drugs is variable, but for the longer-acting preparations there are periods when a relative excess of insulin increases the danger of hypoglycaemia. The commonest risk periods are between meals and during the night, when insulin action is unopposed by food intake.

Between-meal snacks are recommended to offset the long duration of action of some OHAs and reduce the chance of hypoglycaemia. Since one-third of all hypoglycaemic episodes requiring hospital admission in people taking sulphonylureas are caused by missed meals (as discussed by Nattrass and Lauritzen[11] in this publication), and missed or delayed meals are common,[12] the risk of hypoglycaemia is not insignificant. Over-zealous glucose reduction following mismatched treatment/exercise and food intake also compromise stable glycaemic control. Fear of precipitating hypoglycaemia results for many in a fearful tightrope walk between hyper- and hypoglycaemia. Despite warnings from the physician about the dangers of elevated glucose, many patients would rather err on the side of hyperglycaemia than risk the consequences of an unexpected 'hypo'. Anxiety from family members intensifies the patient's fears, increasing the pressure to walk this fine line precisely.

Although frequent snacking helps avoid hypoglycaemia, it increases the potential for weight gain in a

population already struggling to counteract the anabolic effects of insulin produced by the secretgogue action of OHAs. The UKPDS study group investigated weight gain with antidiabetic therapies and found increases varied from 2.5 kg with diet treatment alone to 7.5 kg with chlorpropamide, over the 15-y study period.[7] The weight gain induced by glibenclamide and insulin fell between these levels. In all cases, weight gain began soon after initiation of treatment. In no cases did weight remain unchanged and no weight loss was observed. As weight increases, patients lose the physiological opportunity to improve glycaemic control by weight moderation. Feelings of failure and despondency can jeopardize further attempts to lose weight, resulting in a spiral of deteriorating glycaemic control.

The reality of daily obstacles to good metabolic control was investigated in an observational study of 123 non-insulin-dependent patients.[12] Quantitative data on lifestyle, eating habits and diabetes information resources were gathered from focus groups of 8-10 members drawn from Europe and the USA. Qualitative data were gathered from questions and questionnaires at screening and during focus group discussions. Results showed widespread dissatisfaction with the lack of information provided to diabetic patients: only 20% were satisfied with the amount they received. There was uniform disappointment at the emphasis on restrictive diet and lifestyle changes rather than diabetes as a disease. US patients tended to be more satisfied with the information received, praising the quality of resources provided by the American Diabetes Association, whereas 91% of Spanish patients were frustrated by lack of resources. Food recommendations were felt to be restrictive and poorly adapted to individual needs, and compliance with dietary advice was difficult for all. Despite recognising the importance of regular meals, only 28% were able to comply with this (18% in the USA). In addition, healthcare providers were frequently experienced as unsupportive when discussing difficulties in adhering to meal-related advice.

Educational barriers. Educational barriers to good metabolic control include lack of knowledge and practical skills. Inadequate information about basic diabetes pathophysiology precludes an understanding of the rationale for treatment; improved glycaemic control is then thwarted by misconceptions and inappropriate behavioural modifications.[12] One of the commonest misconceptions is that eating regularly is a part of diabetes *treatment*, rather than a compensatory behaviour necessitated by the long-acting OHAs.[12] This can work against attempted weight loss and cause confusion and subsequent demotivation.

To a newly diagnosed patient the grave long-term risks seem far removed from real life. Added to this, difficulty carrying out practical self-management skills such as diet planning, home blood glucose monitoring, record-keeping and injection technique foster resentment and can reduce compliance and commitment to learning. One skill with important implications is the detection of incipient hypoglycaemia, a task made more difficult by defective physiological warning mechanisms.

Hypoglycaemic unawareness: a specific physiological barrier. Tight glycaemic control is constrained by the requirement to protect the brain from the devastating effects of hypoglycaemia at all costs. Type 1 diabetic patients are at greater risk of hypoglycaemia, but Type 2 diabetic patients experience it with increasing frequency and severity over time and duration of illness.[7,13] Were the sequelae not so severe, current treatments could lower blood glucose levels and reduce long-term complications extremely effectively. However, hypoglycaemic episodes are dangerous: in the short-term, seizures, coma and death are possible, and mortality rate from sulphonylurea-induced hypoglycaemia is as high as 10%. In the longer term, 5% of survivors of a sulphonylurea-induced hypoglycaemic episode will have permanent neurological sequelae.[14] Treatment strategies must anticipate and minimise these risks.

Unfortunately, asymptomatic hypoglycaemic episodes are common. Unawareness of the warning signs of hypoglycaemia results from reduced secretion of insulin, glucagon and adrenaline seen in Type 1 diabetes[15] and impaired response to adrenaline.[16] Diminished adrenaline response to reduced glucose concentration, a phenomenon termed 'defective glucose counter-regulation', is responsible for loss of the autonomic warning signs of hypoglycaemia known as 'hypoglycaemic unawareness'.[17] The increased incidence of severe hypoglycaemia during intensive treatment of Type 1 diabetic patients[16] is also attributable to this. It is suggested, but not yet confirmed, that the same mechanisms contribute to these phenomena in Type 2 diabetes.

Both hypoglycaemic unawareness and the adrenaline deficit in defective glucose counter-regulation follow recent iatrogenic hypoglycaemia,[15,18–20] which itself further reduces autonomic warning signs of low blood glucose.[15,16] Physiological defences against developing hypoglycaemia are impaired and a vicious circle of recurrent hypoglycaemia is set up (Figure 1). This can be broken, with restoration of full awareness, if hypoglycaemia is avoided for just two weeks.[18,19] Training in recognition of early warning signs of reduced blood glucose can reduce fear and increase confidence, and can go some way towards reducing this particular barrier to good glycaemic control.

Psychological barriers. Every chronic disease challenges the patient with a new identity over which they

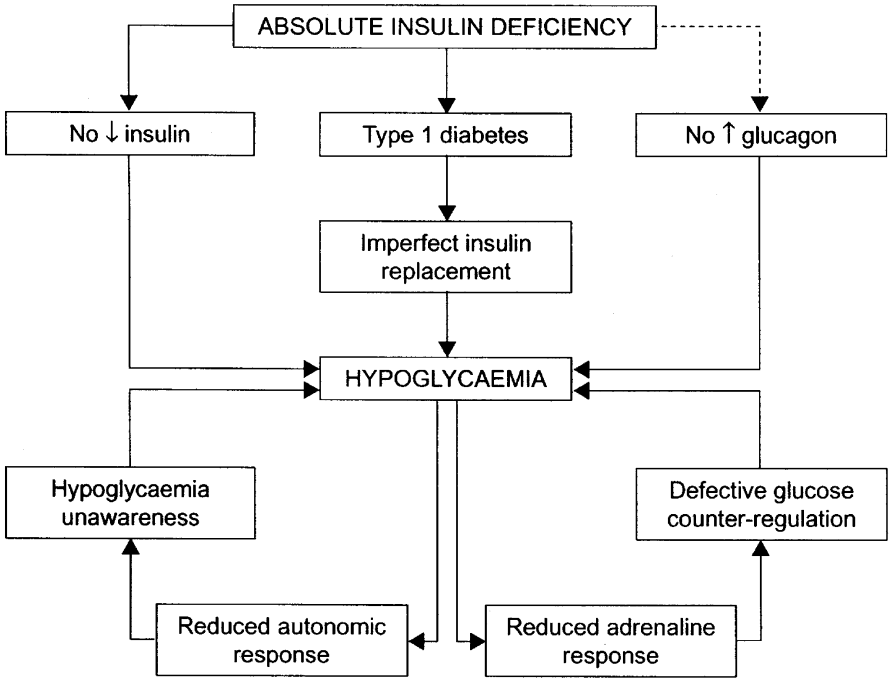

Figure 1 Schematic diagram of the concept of hypoglycaemia-associated autonomic failure in diabetes, and the role of iatrogenic hypoglycaemia in the pathogenesis of hypoglycaemic unawareness and defective glucose counter-regulation.[20]

have no control, but by which their lives are defined in some way. Despite statements that equal opportunities guide employment decisions and that we should look beyond the disease to the individual, chronic diseases still carry stigma. Fear, anger, frustration and countless additional emotions can afflict the patient with a lifelong disease. The psychological demands can seem overwhelming and psychological aspects of diabetes care are important in improving quality of life.

In addition to coping with the psychological difficulties presented by any chronic disease, attaining specific diabetes-related targets is a daily struggle. The perceived inability to alter outcome in any obvious way can remove any sense of potency. For some, the changes required and the difficulty in achieving set goals becomes more handicapping than having diabetes in the first place.

Up to 33% of people with diabetes suffer an episode of major depression during their lifetime, a figure significantly greater in statistical terms than that for the general population.[21] Major depression has significant impact on morbidity, all-cause mortality, functional disability, absenteeism from work and increased healthcare expenditure. Depression in diabetes is generally severe and recurrent, and $\leq 10\%$ who achieve remission remain symptom-free for the subsequent five years.[21] Women are affected more frequently, as in the non-diabetic population, but no difference in incidence between Type 1 and Type 2 diabetes has been shown.

Depression has a complex physiological relationship with diabetes and *vice versa* (Figure 2). Prospective and cross-sectional studies have linked depression to glucose dysregulation, with a significant 1.8% increase in HbA_{1c} being directly attributable to depression.[22] Depression worsens glucose control directly as well as via obesity, physical inactivity and treatment non-compliance. In turn, animal studies have shown hyperglycaemia to alter mood via disruption of hypothalamic-pituitary-adrenocortical (HPA) axis activity[23] and 5-HT (serotonin) sensitivity.[23] 5-HT deficiency is a known risk factor for depressive disorder and disrupted HPA responsiveness that is reported in diabetes may be responsible for the increased reactivity to stress seen in diabetic subjects.[24]

Depression is an independent risk factor for increased diabetic complications, particularly macrovascular disease[22,26] and retinopathy.[27] Other independent correlates such as time spent in poor glycaemic control and duration of diabetes are additive risks.[27] Predictors of response to treatment for

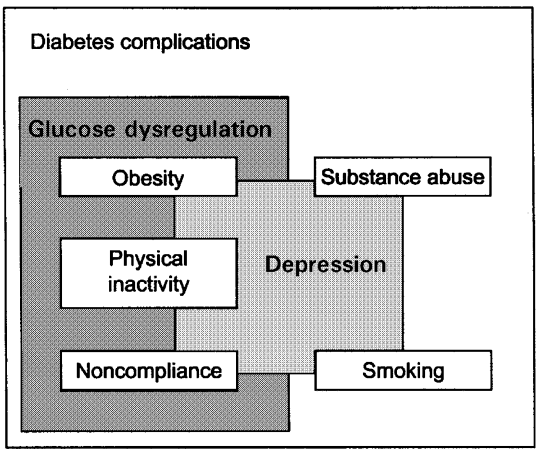

Figure 2 The relationship between behavioural and medical factors in diabetes. All intersecting boxes are statistically significant associations.[25]

depression were tested in a randomised clinical trial of cognitive behavioural therapy (CBT) in which a total of 42 Type 2 diabetic patients took part.[21] Non-remission of depression was associated with poorer compliance with blood glucose monitoring, higher HbA_{1c} and weight, and previous treatment for depression. In the group receiving CBT, diabetic complications and poor compliance with blood glucose monitoring were significant independent predictors of poor response. Such evidence suggests that factors relating to the medical illness impact negatively on prognosis for recovery from depression.

Sadly, many patients and physicians subscribe to the belief that depression is the natural response to a diagnosis of diabetes and to the effects of hyperglycaemia. Certainly hyperglycaemia can produce similar symptoms to depression (headaches, exhaustion). It can also worsen the prognosis for recovery from depression by masking symptoms, improvement and adverse drug interactions. However, treatment that focuses purely on glycaemic control fails to target depression. The composite evidence suggests that depression should be treated as part of the medical illness, with psychoactive medication accompanying efforts to improve glycaemic control.

If an antidepressant is required, the choice should take into account potential interactions with any aspect of diabetes or its treatment. Many psychotropic agents directly elevate or reduce blood glucose levels. A double-blind, placebo-controlled trial of nortriptyline in depressed, poorly-controlled diabetic patients demonstrated significant, sustained elevations in blood glucose that were not accounted for by the tendency of tricyclic antidepressants to induce weight gain.[28] Patients with generalised anxiety disorder (GAD) have benefited from the direct hypoglycaemic effect of alprazolam on glucose levels, independent from the effect on GAD.[29] These studies amongst others highlight the need to consider the effects on blood glucose of any psychoactive agent being considered.

Environmental barriers. Good glycaemic control relies on patient commitment to self-management, but this can and should be strengthened by external support. Even devout efforts to improve metabolic control can be defeated by negative judgements and lack of practical and emotional support from family, friends, employers and healthcare providers. Scarce personal finances or lack of institutional resources can also compromise outcome. Provision of high-quality, patient-centred care requires support in all these arenas: personal, financial and organisational.

Overcoming the barriers

Education can improve outcome

In order to provide useful, pertinent information to patients it is necessary to know the degree of understanding the patient has, and where there is room for improvement. Presenting information in an acceptable format that shows sensitivity to cultural and dietary customs is likely to improve the chance of agreeing a mutually acceptable treatment plan.

Successful educational interventions take various forms, from information leaflets and weekly lectures to intensive inpatient workshops. It has been suggested that four main outcomes should be used in evaluating the success of an educational intervention:[30]

- Patient knowledge (about diabetes)
- Patient behaviour (including self-management skills)
- Patient attitude (emotional aspects of living with diabetes)
- Patient control of blood glucose

To investigate the effectiveness of patient education in improving diabetic outcomes, Brown performed a meta-analysis of 82 studies evaluating the effects of adult diabetes education on knowledge, self-care behaviours, psychological outcomes and metabolic control (Figure 3).[31]

Diabetes patient education was found to have a moderate to large effect on improving both general and diet-specific knowledge. Despite a three-fold increase in self-reported dietary compliance, weight was only minimally improved. This may be explained by the lag time between diet alteration and weight change, and by the inevitable inaccuracy of self-reported data. Practical self-care skills improved minimally to moderately overall, with urine-testing skill showing greater improvement than insulin injection technique. Measures of metabolic control benefited moderately. Glycosylated haemoglobin showed the greatest improvement, and insulin dose (an indirect measure of metabolic control) the least. Psychological outcome benefited little from educational interventions, probably reflecting the lack of specific counselling or therapy among most of the studies included.

The theory behind educating patients is that long-term prognosis can be improved if patients understand the need for, and methods involved in, maintaining tight glucose control. However, knowledge and behaviour are notoriously poorly correlated[32] and improved knowledge following educational intervention does not always translate into improved metabolic control.[33] Korhonen and colleagues[34] demonstrated highly significant improvement in diabetic control following intensive patient education, but on 18-month follow-up no difference from the control group could be observed. Good control correlated not with education, but with a low score for anxiety and depression at intake, and a high score for self-confidence. However, in the Diabetes Education Study (DIABEDS),[35,36] a randomised controlled trial of patient and physician education, greater and statistically significant reductions in fasting blood glucose, HbA_{1c}, body weight and blood pressure were seen in the patient education group 11-14 months after inter-

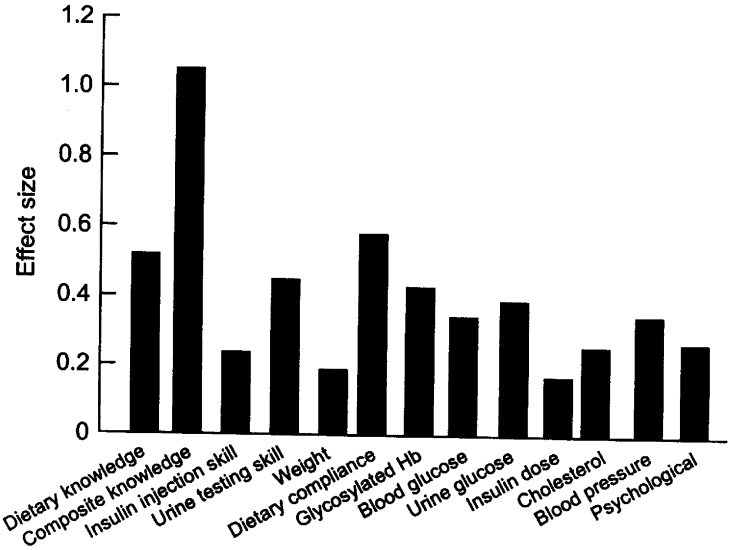

Figure 3 Results of an 82-study meta-analysis. The effect of patient education on knowledge, self-care behaviours, metabolic control and psychological outcomes. (Data are weighted mean effect sizes: 0.2 = small effect size; 0.5 = medium; 0.8 = large).[31]

vention, despite poor knowledge retention. The identical intervention for clinicians resulted in significant reductions in patient fasting glucose, HbA_{1c} and body weight. The greatest improvements in overall outcome followed combined physician and patient education.

The specific needs of the elderly. The greater challenge of altering learning and behaviour in the elderly is highlighted by the inverse relationship between age and acquisition of new knowledge.[31] This underlines the need for age-appropriate education, but also reveals a more general theme concerning specific barriers to improving metabolic control in the elderly. Psychological and physiological changes threaten good control in this population. While increasing ill health necessitates poly-pharmacy, declining hepatic and renal function favour drug accumulation and toxicity. Prescribing certain medications becomes unwise. The requirement for multiple drugs complicates the patient's daily routine and the physician's attempts to simplify treatment.

Many measures of cognitive performance are slowed or reduced as age increases. Remembering to take tablets, inject insulin or make an appointment to see the chiropodist become a supreme effort, sometimes compounded by anxiety not to burden younger relatives with requests for help. Good glycaemic control is more elusive as age advances and the motivation to change is undermined by thoughts such as, 'What's the point? I may not live to see the benefits anyway'. In an era when sophisticated medical treatments allow increasing longevity, it is crucial that the specific needs of the elderly are addressed.

Structure of care

Integration of education and clinical care facilitates high-quality diabetes management across the age spectrum. In an integrated care structure: teaching and counselling support clinical aspects of treatment; newly learned skills and attitudes are explored in a supportive environment; and nurse educators, dieticians, psychologists and chiropodists work alongside physicians. In this setting significant decreases in rates of hospitalisation and acute complications are possible.[37]

The benefits of integrated care were demonstrated in Ipswich, UK, following the opening of a purpose-built diabetes centre in which the role of the diabetes specialist nurse was strengthened.[38] A progressive, sustained and statistically significant improvement in glycaemic control was seen in all patients attending the clinic, including the elderly. Annual admission rates for ketoacidosis and hypoglycaemia fell in a highly significant manner. In addition, fewer patients failed to attend appointments, suggesting increased patient satisfaction, possibly relating to reduced waiting times. It was possible to cut waiting times because nurses agreed to see those patients who did not require physician input. Purpose-built diabetes inpatient and day centres, in which diabetes specialist nurses play a key role, have become increasingly common in recent years. They are a valuable resource for a population in which the prevalence of disease is increasing[1] and routine hospital-based care for all is not a practical option.

Current practice in many countries is for diabetes care to be either general practitioner (GP)/community-based, hospital-based or shared between the two. Inefficient or inaccessible care provision is undoubtedly a barrier to patients who seek to improve their metabolic control. General measures that improve efficiency and patient outcome in all care settings include the 3 Rs—registration, recall and regular review (audit).[39] The success of shared care schemes has been shown to depend on a centralised prompting

system for patient appointments and a structured checklist for the GP. Structured GP care comprising systematic recall of patients, and adherence to a standard protocol carried out by a GP with a special interest in diabetes, can provide comparable, sometimes superior care to hospital practice.[39] Once a satisfactory care structure has been set up, patient knowledge, skills and confidence can be enhanced and targets achieved more easily.

Empowering patients

It has been said that 95% of diabetes management is carried out by the patient.[40] In recent years 'empowerment', 'the process by which people gain mastery over their own affairs',[41] has become an increasingly applied alternative to the physician-led, patient-compliance model.[42] The empowerment model, applicable in many healthcare situations including diabetes, emphasises personal strengths, shared goals, shared decision-making and self-generated solutions to problems. The patient identifies individual problems and needs, and learns strategies to allow maladaptive behaviours to be challenged and newer, healthier ones implemented. As confidence increases, a feeling of mastery boosts the motivation to succeed. The empowerment model offers advantages for the healthcare provider too, reducing the burden of responsibility and power, and shifting the focus towards shared care.

The value of empowerment in diabetes care is highlighted by the superior outcomes achieved over traditional, more paternalistic approaches. When taught how to negotiate with and ask questions of their physician, patients become more assertive and able to elicit information. They experience fewer functional limitations, including days lost from work, and can achieve significant reductions in HbA_{1c} (Figure 4).[43] Physician support for patient autonomy increases feelings of competence and motivation to take prescribed medication[44] and correlates with improved HbA_{1c}.[31,43,45] In contrast, nurses perceived as controlling and directive in their communication are associated with patients with poorer metabolic control ($P < 0.01$).[45]

Empowerment, like any model of care, can have limitations. Patients who find it difficult to take responsibility for other areas of their lives may find it no easier to do so with their health. While empowerment respects individual decisions concerning approaches to treatment, it does not prohibit physicians from questioning or challenging seemingly irrational decisions. Nor does it remove from them the responsibility to give constructive, supportive advice and prescribe the treatment that their professional training indicates is appropriate. Patient decisions should be discussed within the framework of goals and values, needs, health beliefs and culture, which the patient brings to the consultation. Exploring difficulties in this manner can reveal socio-cultural attitudes that fully explain a choice that seemed foolish or illogical at first glance.

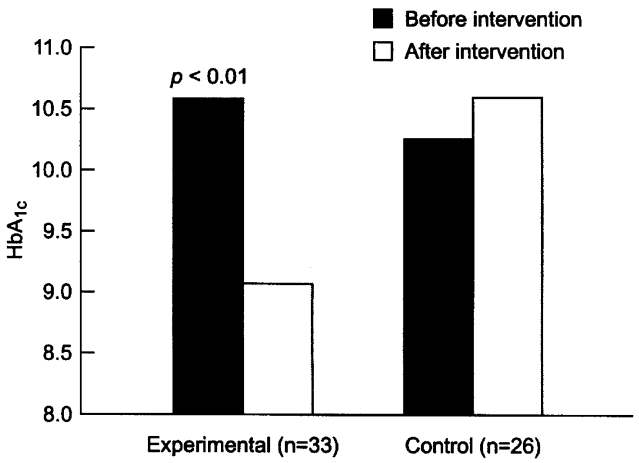

Figure 4 Effects of patient participation in care on glycosylated haemoglobin.[43]

The relevance of rational drug treatment

Whichever model of care an individual's treatment is based on, drug therapy is likely to be an important aspect at some stage. By reducing the extent to which diabetic treatments impose undesirable routines and side-effects the ideal drug would reduce several important barriers to good glycaemic control.

Ideally the patient's meal pattern would dictate treatment and not *vice versa*. As well as increasing lifestyle flexibility this would make it easier to remember to take medication. If a drug could recreate a physiological pattern of insulin release, tailoring availability to need, the risk of hypoglycaemia would be reduced. The avoidance of iatrogenic hypoglycaemia would then lessen hypoglycaemic unawareness and reverse defective glucose counter-regulation. By limiting insulin availability to times of need, the body would be exposed to the anabolic effects of insulin for less time, making weight control easier to achieve. A short-acting prandial insulin profile would also improve metabolic control by restoring insulin sensitivity through weight loss achieved by the reduced need for snacking.

The challenge of achieving good glycaemic control with minimal risk of hypoglycaemia and weight gain may be met by a new class of antidiabetic drug: the prandial glucose regulators. Studies of flexible mealtime dosing with one such drug, repaglinide, demonstrate improved metabolic control with non-significant or absent weight gain over 16 weeks.[46] Variable meal patterns (two, three or four meals/day) are also consistent with improved metabolic control and weight loss of up to 2.4 kg ($P < 0.03$).[46] Four one-y comparative double-blind studies showed hypoglycaemia with repaglinide to be reduced compared with sulphonylureas ($P < 0.03$). Omission of the lunchtime meal caused no severe hypoglycaemic episodes with repa-

glinide, but glibenclamide was associated with 24% severe hypoglycaemic events.[47]

Prandial glucose regulation is a promising new approach to diabetic drug treatment and has produced a valuable addition to the existing formulary. Perhaps repaglinide will be the first of many contenders for the coveted title, 'The patient's choice of therapy in diabetes care'.

Conclusions

The barriers to achieving tight control of blood glucose are numerous but not insurmountable. Factors relating to lifestyle, education, physiology, psychology and environment all contribute to the way in which an individual copes with disease. In trying to reduce the obstacles met by patients, it is effective to integrate appropriate education into structured clinical care, prescribe thoughtfully and rationally, and strive to empower patients by supporting their autonomy.

Quality of life is an important endpoint in itself but also plays a part in improving glycaemic control. If diabetes does not restrict the lives of patients but becomes a challenge met with enthusiasm and determination, both patient and physician will reap the benefits.

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