# Screening for type 2 diabetes in primary care: Is it feasible?

## Minesh Patel

**There are more than 1.75 million people with type 2 diabetes in the UK, and the number of people diagnosed with type 2 diabetes is set to rise dramatically over the next decade. The UK Prospective Diabetes Study (UKPDS) provided evidence to support early active treatment of type 2 diabetes in order to reduce the risk of future complications (UKPDS Group, 1998). This article assesses the feasibility of screening for type 2 diabetes at the GP practice level.**

Standard 2 of the National Service Framework (NSF) for diabetes (Department of Health [DoH], 2001) relates to the development and implementation of strategies to identify people with diabetes. The aim is to ensure that people with diabetes are identified as early as possible. Moreover, the NSF concludes that population-wide screening would not be cost-effective, and instead recommends screening sub-groups with multiple risk factors. Diabetes UK also supports the introduction of a screening programme, recommending systematic and opportunistic screening of people with two or more risk factors every 3 years (Diabetes UK, 2002).

It would seem to be a sensible step forward, then, to actively screen for diabetes, but how practical is this in primary care? The National Screening Committee (http://www.nsc.nhs.uk/ [accessed 23.09.2005]) has been asked to research the feasibility of a screening programme and is due to report later this year.

### The scale of the problem in the UK

More than 100 000 people are diagnosed with diabetes every year (which is roughly one person every 5 minutes; Diabetes UK, 2004). Furthermore, rising levels of obesity (Chan et al, 1994), trends towards more sedentary lifestyles and an ageing population are all likely to increase the numbers rapidly. And the much talked about 'missing million' is likely to be an underestimate of the number of people who remain undiagnosed.

The National Health Service (NHS) currently spends more than £10 million a day on diabetes-related care (Diabetes UK, 2004); put another way, around 5 % of total NHS resources are used for the care of people with diabetes.

### Prevention is better than cure

Insulin resistance is now widely recognised as the common underlying link between environmental and genetic factors that give rise to type 2 diabetes (Turner and Clapham, 1998). It precedes clinical development of the condition by 10–20 years. During this period, many people will have developed impaired glucose tolerance (IGT), which is a 'pre-diabetic state'.

Fuller et al (1980) have shown that people with IGT are at an increased risk of developing cardiovascular disease and that IGT is an independent risk factor for coronary heart disease. Subsequently, Lundblad and Eliasson (2003) have also demonstrated that IGT is associated with electrocardiogram findings indicating silent myocardial infarction in women in a middle-aged general population in northern

**Article points**

1. The current obesity time bomb is likely to substantially increase the burden of type 2 diabetes over the coming decade.
2. There is no trial-based evidence to support population-wide screening for type 2 diabetes.
3. Screening sub-groups with multiple risk factors for diabetes is a more effective use of resources.
4. Detecting impaired glucose tolerance and intervening at this stage may help to reduce the cardiovascular risk and the risk of developing diabetes.

**Key words**

- Detection
- Impaired glucose tolerance
- Targeted screening
- Resources

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**Page points**

1. More than 50 % of people with newly diagnosed diabetes will already have evidence of some form of complication.
2. The National Screening Committee has requested further evidence that would support the introduction of a screening programme.

Sweden. The results persisted even after adjusting for known risk factors.

Twenty to fifty per cent of people with IGT go on to develop diabetes over a 10-year period (Alberti, 1998). There is evidence, however, that lifestyle intervention (Tuomilehto et al, 2001; Ryan and the Diabetes Prevention Program Research Group, 2003) and drug treatment with metformin (Knowler et al, 2002; Diabetes Prevention Program Research Group, 2003) can significantly reduce the risk of going on to develop diabetes.

## Early detection of diabetes

More than 50 % of people with newly diagnosed diabetes will already have evidence of some form of complication (*Figure 1*). Harris et al (1992) demonstrated that the onset of type 2 diabetes occurs at least 4–7 years before clinical diagnosis. Detecting the condition at an early stage or during the pre-diabetes phase of IGT may reduce the burden of these complications.

## Criteria for a screening test

The National Screening Committee has requested further evidence that would support the introduction of a screening programme. Below is a summary of the core criteria by which a potential screening programme could be evaluated. It is by no means an exhaustive list of all the criteria that would be applied.

### *The condition should be an important health problem*

There is little doubt about this point. Nationally collated Quality and Outcomes Framework data (Health and Social Care Information Centre, 2005) indicate a known prevalence of diabetes in England of 3.3 %. The prevalence of undiagnosed cases is of a similar order to previously known prevalences (Forrest et al, 1986; Williams et al, 1995). The prevalence of the condition increases with age (Williams 1995) and is higher in certain ethnic groups (Hamman, 1992). The condition itself results in a significant burden of premature morbidity and mortality, with attendant costs to the individual and society as a whole. For example, 21 % of people with newly diagnosed diabetes have evidence of retinopathy and 18 % have evidence of nephropathy at the time of diagnosis (UK Prospective Diabetes Study Group, 1990; *Figure 1*). Holmes et al (2003) demonstrated the significant impact in terms of finance and quality of life of diabetes on those with the condition.

### *The epidemiology and natural history of the condition should be understood*

Population studies have identified the incidence of the condition and risk factors for progression to diabetes (e.g. Hamman, 1992). Köbberling and Tillil (1982) calculated that the lifetime risk of diabetes for someone with a parental history of diabetes was as high as 40 %. Morris et al (1989)

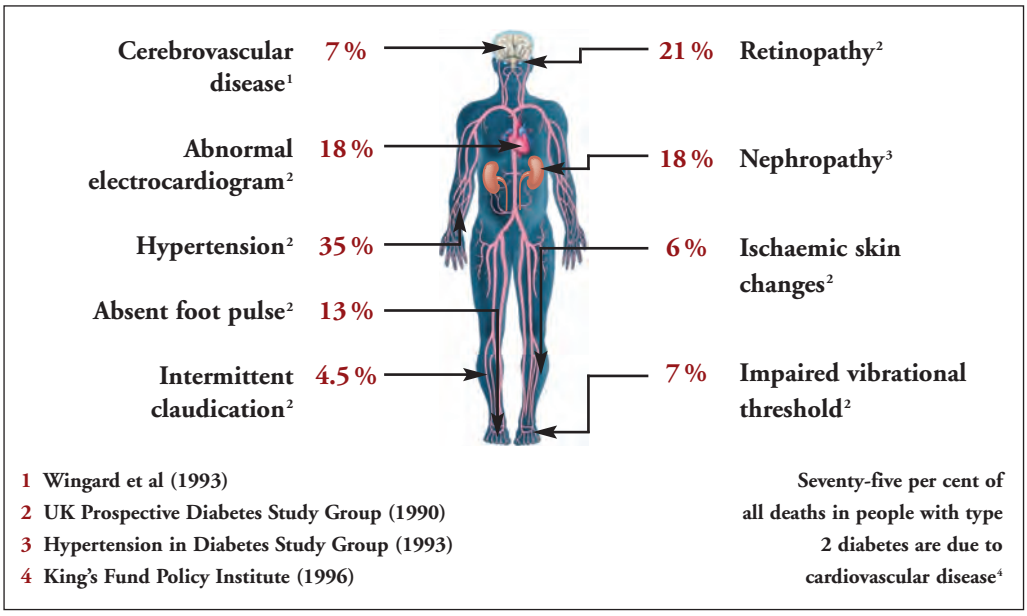


*Figure 1. The burden of type 2 diabetes: complications present at diagnosis.*

showed that this is affected by other factors, including a sedentary lifestyle and obesity. The natural history of the condition is now well understood, with several established risk factors such as a history of IGT and obesity. Up to 5 % of people with IGT will progress to diabetes every year. Diabetes is also strongly associated with metabolic disturbances such as insulin resistance (which is seen in 92 % of people with type 2 diabetes) and dyslipidaemia, as shown by Haffner et al (1990).

***There should be an identifiable latent period or early symptomatic stage***

As is already known from Harris et al (1992), many people with diabetes remain asymptomatic and undiagnosed for a number of years. At diagnosis, around 50 % will have some evidence of a complication. Eriksson and Lindgarde (1991) showed that in at-risk groups such as those with IGT – which, as mentioned earlier, can be considered a pre-diabetic state – lifestyle interventions (including diet modification and exercise) reduced the incidence of progression to type 2 diabetes by over 50 %.

***There should be an acceptable safe and reliable screening test available***

Several tests could be employed, including random and fasting plasma glucose levels, $HbA_{1c}$ levels, dipstick urinalysis and the glucose tolerance test (GTT). Andersson et al (1993) showed that urinalysis for glycosuria has a high specificity (proportion of true negatives; 96–100 %) but a low sensitivity (proportion of true positives; 16–43 %). Random blood glucose testing was also shown to be specific but non-sensitive.

McCance et al (1994) compared fasting glucose, $HbA_{1c}$ and the 2-hour post-challenge GTT and found that they all predicted the future risk of microvascular complications and potentially have a role in both screening and diagnosis. The tests appear to be acceptable to the patients using them, as reflected in the high uptake of testing in some of the screening studies undertaken. Diagnostic criteria have been quite clearly set out by Alberti and Zimmet (1998) in the World Health Organization consultation document on the definition, diagnosis and classification of diabetes mellitus and its complications.

Several trials have looked at the utility in screening of $HbA_{1c}$ specifically. Rohlfing et al (2000) found a cut-off $HbA_{1c}$ of 6.1 % to be highly specific (97.4 %) but the sensitivity was noted to be only 63.2 %. Kilpatrick et al (1998) questioned the use of $HbA_{1c}$ as a screening test because of inter- and intra-individual assay variability. At present, the sensitivity and specificity of $HbA_{1c}$ alone offers no advantage over other methods for screening for type 2 diabetes.

***There should be clear evidence-based guidance for directing the treatment of people found to have the condition through a screening programme***

There is an accumulating evidence base for the various interventions that can be applied, including reduction of macrovascular and microvascular complications by achieving control of hyperglycaemia as well hypertension and hyperlipidaemia. Although it remains a challenge to improve care for people who already have diabetes, careful consideration should be made of resource expansion of services as an ever-increasing number of people are diagnosed with the condition. Disease management targets within the Quality and Outcomes Framework of the new General Medical Services (DoH, 2004) contract have given the impetus, as well as the resources, to provide organised evidence-based care for patients on practice diabetes registers.

***There should be evidence from high-quality randomised controlled trials that the screening programme is effective in reducing morbidity and mortality***

At present, there is no evidence from trials that a screening programme would be effective.

***The cost of case finding by screening and subsequent treatment is acceptable and economically balanced in relation to health expenditure as a whole***

There is no evidence from any trials on screening programmes, although some evidence from observational studies has been used to model cost-effectiveness. As these are based on certain assumptions and reach differing conclusions it is difficult to base the case for a screening programme on this evidence (Hoerger et al, 2004).

**Page points**

1. Many people with diabetes remain asymptomatic and undiagnosed for a number of years.
2. Fasting glucose, $HbA_{1c}$ and the 2-hour post-challenge glucose tolerance test all predict the future risk of microvascular complications and potentially have a role in both screening and diagnosis.
3. Diagnostic criteria for type 2 diabetes have been quite clearly set out by Alberti and Zimmet (1998).

## Targeted screening

Currently, there appears to be good evidence to support early case finding and treatment but there is no evidence to support a population-based screening programme. Various studies have looked at developing risk scores (e.g. Griffin et al, 2000) or questionnaires (e.g. Ruige et al, 1997) to identify patients for further screening. These have been found to be relatively specific (55–72 %) and sensitive (59–77 %), depending on the system used in study populations.

There is some evidence to support targeted screening aimed at people with multiple risk factors. Lawrence et al (2001), for instance, looked at a general practice population who were over 45 years old and not known to have diabetes. They found that prevalence of diabetes in patients with age as a sole risk factor was 0.2 %, while prevalence of diabetes in patients with age and one or more other risk factors (hypertension, obesity or a family history of diabetes) was 2.8 %.

A recent observational study was undertaken by Greaves et al (2004) across 16 GP practices in Devon and Somerset to investigate the feasibility and performance of a practical method for identifying patients with type 2 diabetes and impaired fasting glycaemia (IFG). The practices were asked to sample 100 patients, 25 from each of four groups with different entry criteria relating to body mass index (BMI) and age (BMI ≥33 kg/m$^2$ and age >70 years; BMI ≥31 kg/m$^2$ and age >65 years; BMI ≥29 kg/m$^2$ and age >60 years; BMI ≥27 kg/m$^2$ and age >50 years). Selection of patients within the practices was done randomly. Those with previously diagnosed diabetes were excluded, and only Caucasians were screened, which left 1287 patients across the 16 practices. Fasting plasma glucose was measured in the local NHS laboratory and repeated if abnormal to determine the prevalence of new cases of diabetes or IFG in each group.

The response rate from the 1287 patients was 60 % and the prevalence of new cases of type 2 diabetes was 4.7 % (95 % confidence interval [CI], 2.8–7.7 %), 5.7 % (95 % CI, 4.0–8.2 %), 3.8 % (95% CI, 2.4–6.0 %) and 2.6 % (95 % CI, 1.4–4.7 %), in the groups ranging from highest BMI and age cut-offs to lowest cut-offs. An additional 5.2–8.4 % had IFG. The number needed to test to find one new diagnosis of diabetes or IFG in any of the four patient groups was low (7–13 people).

These screening strategies discovered significant numbers of people with previously undiagnosed type 2 diabetes: undiagnosed rates were about 2.0 % of the level of diagnosed rates.

This example demonstrates that targeted screening can be relatively simple and effective. Practices could choose what criteria they might wish to adopt based on perceived workload and on the resources available. Lower age and BMI criteria could be employed to identify people earlier, so that lifestyle changes may be more effective, especially in those with IFG.

## In the author's practice

In 2004, it was decided in the author's practice to actively find cases of type 2 diabetes (*Table 1*). From the patient list of 12 400 individuals, a search was carried out for adults aged 35–75 years with a BMI above 28 kg/m$^2$ recorded in the last 12 months. Patients with diabetes (n=332) and IGT or IFG (n=47) were excluded; 384 patients were identified. It was felt that this was too large a group of patients to screen for diabetes at one time.

From this group a search was conducted for patients with concurrent hypertension or hypercholesterolaemia and identified 82 individuals. (It was noted that 122 patients did not have a blood pressure measurement recorded in the last 5 years and 197 did not have a cholesterol measurement recorded). Of the 82 people identified for screening, 25 were excluded from screening for clinical reasons (terminal illness or clinical inappropriateness, as determined by the patients' GPs).

Fifty-seven patients were invited for screening and 47 patients (82 % uptake) went on to have a laboratory fasting blood glucose test, of which 17 were abnormal (two patients did not respond to the invitation for screening and eight declined). Of the 17 patients with abnormal results, 13 had repeat fasting blood glucose tests because of a raised fasting blood glucose level over 7.1 mmol/l. Glucose tolerance tests were arranged for four people with a fasting blood glucose level of above 6.1 mmol/l but below 7.1 mmol/l; these were people who might have had IGT but for whom diabetes could not be excluded. Three patients had two fasting blood

**Page points**

1. Currently, there appears to be good evidence to support early case finding and treatment but there is no evidence to support a population-based screening programme.
2. There is some evidence to support targeted screening aimed at people with multiple risk factors.

glucose tests and a GTT because of repeat borderline fasting test results.

Seven patients (15 % of those screened) were found to have type 2 diabetes; this is equivalent to 2.1 % of our existing diabetes register. A further six (13 % of those screened) were found to have IGT.

This simple approach enabled the practice to handle the screening procedure without an unmanageable increase in workload. The entire process took 3 months to complete. It was not taken into account that those patients without recorded hypertension or hypercholesterolaemia may have had either of these conditions if measurements had been taken. The number of people in the target group would also rise with 100 % recording of BMI. This amply illustrates the point that a high-quality targeted screening programme relies upon high-quality data recording.

The aim is to repeat the process in stages to screen all adult patients over 35 years old with a BMI greater than 28 kg/m$^2$. A protocol for managing people with IGT is also being developed.

## Conclusion

An explosion in the number of people with type 2 diabetes is beginning to be seen as the population ages and more sedentary lifestyles with richer diets are adopted. There are many people with the condition who remain undiagnosed. There exists a dual challenge of improving the care of those who have already been diagnosed with type 2 diabetes as well as detecting those who have not been diagnosed at a stage where early intervention may prevent future complications. The health economy will need to evaluate the clinical effectiveness and cost-effectiveness of screening for diabetes before further guidance is published.

Primary care can adopt pragmatic approaches to screening based on existing resources and perceived workload. Targeted screening appears to be practical and has the support of Diabetes UK. ■


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**Table 1. Numbers of patients in the author's practice.**

| Category | Number | Proportion of n |
|---|---|---|
| Patient list | 12 400 | |
| Patients with diabetes (N) | 332 | |
| Age 35–75 years (on 12 December 2004) | 384 | |
| Age 35–75 years, BMI >28 kg/m$^2$ and either hypertension or hypercholesterolaemia | 82 | |
| Invited for screening (n) | 57 | |
| Did not respond or declined | 10 | |
| Screened | 47 | 82 % |
| New diagnosis of type 2 diabetes | 7 | 15 % |
| New diagnosis of IGT | 6 | 13 % |

*'Primary care can adopt pragmatic approaches to screening based on existing resources and perceived workload.'*


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