

Use of HbA1c in diagnosing diabetes and identifying individuals at a high risk of diabetes.

Guidance to GP practices in Leicester and Leicestershire.

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Introduction

Diagnosis of diabetes has been traditionally based on plasma glucose measurement including the oral glucose tolerance test (OGTT)¹.

The fasting glucose test (FPG) is often used on pragmatic grounds. However FPG involves inconvenience of overnight fasting and has modest sensitivity compared to the OGTT and can miss diagnosis of diabetes or impaired glucose regulation (IGR).² The OGTT although considered as 'gold standard' has poor repeat-test reproducibility, is time consuming and costly.²

We discuss the new diagnostic criteria³ for Type 2 diabetes using HbA1c and provide algorithms for interpretation of HbA1c results.



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HbA1c as a new diagnostic test for diabetes

In 2011 WHO has recommended use of glycated haemoglobin (HbA1c) alone as an alternative diagnostic test suggesting an HbA1c level of $\geq 6.5\%$ (≥ 48 mmol/mol) as a cut-off for diagnosing diabetes.³ The WHO has not recommended HbA1c for diagnosing IGR. However an international expert committee has described an HbA1c of between 6.0 to 6.4% (42 to 47 mmol/mol) as 'high risk' and the equivalent of IGR.

In comparison to measurement of plasma glucose, HbA1c is a better indicator of chronic hyperglycaemia and long term complications. HbA1c levels are least affected by any short term, illness-related changes in plasma glucose levels. Measurement of HbA1c is more standardised and show minimum inter-test variability. The HbA1c test can be done in a non-fasting state and maybe more convenient.

How to use HbA1c in: diagnosing diabetes in clinical situations; and screening for undiagnosed diabetes and high risk individuals

Our team of diabetes researchers led by Professors Davies and Khunti at the University of Leicester has carried out significant work, in this area and have developed diabetes risk assessment scores^{2,4-8}. This work has influenced a recent guidance by an UK expert group on implementation of new HbA1c diagnostic criteria⁹ and an upcoming NICE guidance on identification and intervention of individuals at a high risk of diabetes.¹⁰

We have developed simple algorithms which provide practical stepwise advice on interpretation of HbA1c results and further care.

Algorithm A is to be followed when an individual presents with suspected diabetes. **Algorithm B** should be used while considering systematic screening in a general practice population for undiagnosed diabetes or high risk individuals. Please see the algorithms for further details.

Practical issues in using the HbA1c criteria:

There is discrepancy in type 2 diabetes (T2DM) diagnosed by HbA1c and glucose tests. Confirmation of diabetes using glucose tests therefore is needed when HbA1c is $< 6.5\%$ (< 48 mmol/mol) but a strong clinical suspicion of diabetes remains. Certain clinical situations and conditions preclude using HbA1c for diagnostic purpose and warrants use of glucose tests. Please refer to the algorithm and accompanying notes for more information. Importantly HbA1c must not be used in diagnosing:

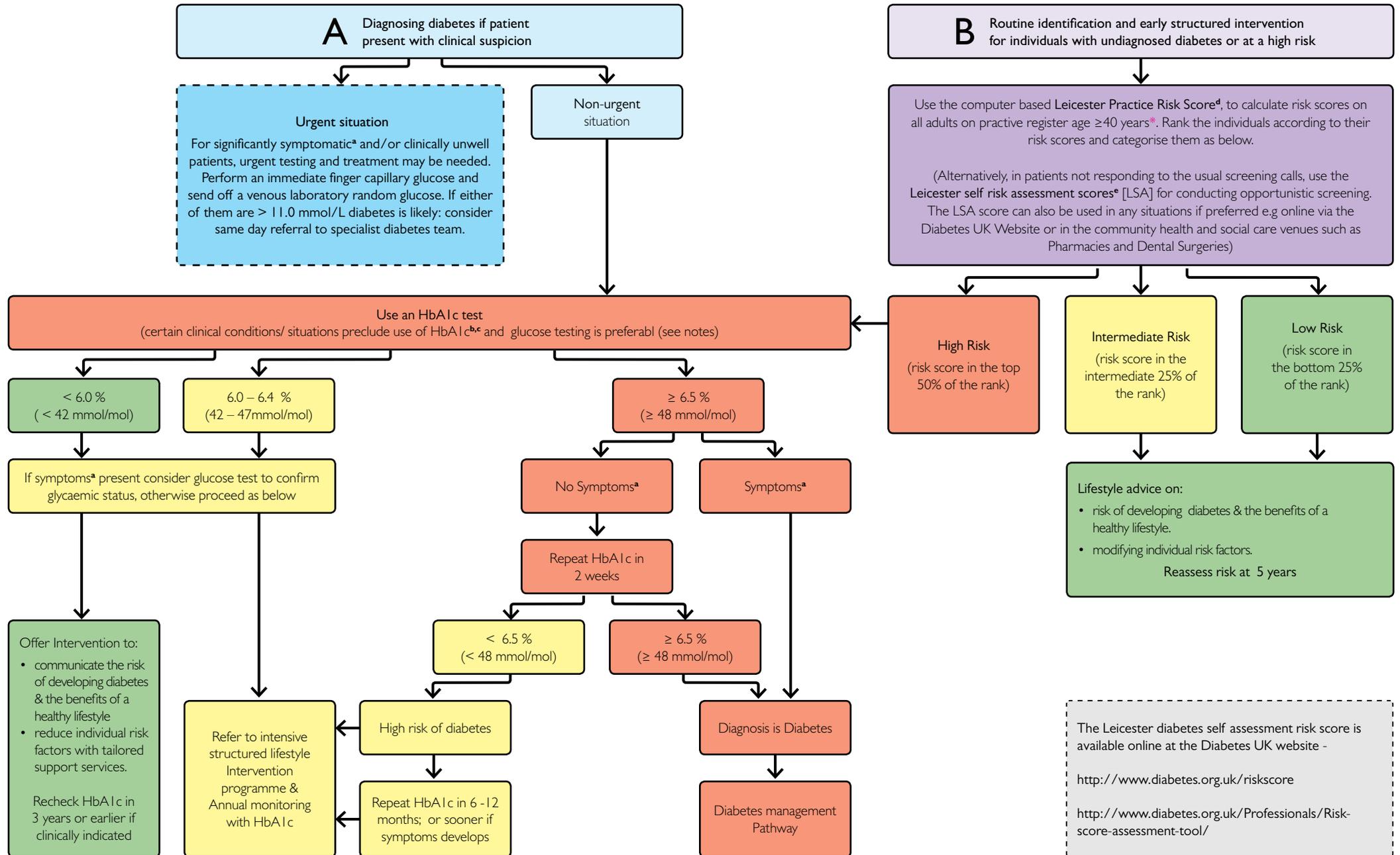
- Gestational diabetes,
- Suspected type 1 diabetes.

It is also essential that for diagnosis an HbA1c measured on a venous blood sample in the laboratory is used. The point-of-care HbA1c tests may not be accurate and should be avoided for diagnostic purpose.

Conclusions:

Approach to use of HbA1c as a primary diagnostic test for diabetes seems pragmatic and may improve early diagnosis leading to improved outcomes. It is important that clinicians remain aware of some of the practical issues in using the HbA1c criteria.

Leicester algorithm for using HbA1c in diagnosing diabetes or identifying people at high risk of diabetes



Note a. Symptoms of diabetes include:

Increased thirst; polyuria; extreme fatigue; unexplained weight loss OR blurred vision

Note b. Clinical situations where HbA1c must not be used as a sole test to diagnose diabetes.

- Pregnancy
- All symptomatic children and young people (< 18 years)
- Symptoms, suggestive of Type 1 diabetes (any age)
- Short duration of diabetes symptoms for less than 2 months.
- Medication use that may cause rapid glucose rise: e.g. corticosteroid, antipsychotics
- Acute pancreatic damage/pancreatic surgery

Note c. Exclude conditions that may preclude accurate measurement of HbA1c

- Anaemia / Haemoglobinopathies (check Haemoglobin and Mean Corpuscular Volume)
- Chronic renal /liver failure (check Urea & Electrolytes / Liver function tests)
- Hypertriglyceridaemia (check lipid profile)
- Use of drugs - Erythropoietin / antiretroviral drugs / Chronic Opiate use or Chronic Alcoholism (take drug history)

There are no specific cut-points defined for these haematological and biochemical tests that preclude the use of HbA1c. Clinicians need to look at each case individually and discuss with local laboratory. In case of uncertainties plasma glucose should be used to diagnose diabetes as advised

Note d. Leicester Practice Risk Score

The Leicester Practice Risk score is calculated using routinely available information in the general practice computer databases and incorporates variables including age, sex, BMI, ethnicity, family history, BP tablets and history of CVD.

To implement screening strategies in a cost effective manner, a pragmatic approach is to rank people from high to risk score and allocate the top 50% of this rank to high risk category.⁷

Note e. Leicester Self Assessment Risk Score

Leicester Self Assessment Risk Score is intended for use by lay persons where individuals calculate their own risk and then attend the GP practice for further action. Variables include age, sex, BMI, waist circumference, smoking, alcohol, fruit/ vegetable intake, BP/ cholesterol tablets, physical activity, family history, other conditions. Instructions are given on how to calculate Body mass index and waist circumference.

* In alignment with the NHS Health Check programme Age \geq 25 years in people of South Asian, Chinese, Afro-Caribbean, black African and other high-risk black and minority ethnic group.

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