

Information for  
**Health Care Professionals**  
regarding **Diabetes**



international change to  
**HbA<sub>1c</sub> results**

Supported by the Diabetes Federation of Ireland



**100** mmol/mol  
11.3%

**90** mmol/mol  
10.4%

**80** mmol/mol  
9.5%

**70** mmol/mol  
8.6%

**60** mmol/mol  
7.6%

**50** mmol/mol  
6.7%

**40** mmol/mol  
5.8%

## What is HbA<sub>1c</sub>?

Haemoglobin A1c (HbA<sub>1c</sub>) is a minor component of total haemoglobin A (HbA), which is the oxygen-carrying protein that gives blood its red colour and is the predominant protein in red blood cells. HbA<sub>1c</sub> is formed when glucose binds to a specific part of the haemoglobin molecule following a complex chemical reaction.

The HbA<sub>1c</sub> level is proportional to the weighted average blood glucose concentration in the preceding 6-8 weeks. So, the more glucose there is in the blood, the more glucose is attached to the haemoglobin and the greater the amount of HbA<sub>1c</sub>. Individuals without diabetes usually have HbA<sub>1c</sub> levels that are less than 6%.

## What does it measure?

The HbA<sub>1c</sub> concentration reflects blood glucose concentration over the preceding 6-8 weeks. The higher the blood glucose concentration has been and the longer it has been raised, the higher the level of HbA<sub>1c</sub>. The results of the HbA<sub>1c</sub> test are widely used to monitor how well the blood glucose is controlled in people with diabetes and in the management of diabetes.

## What does it not measure?

HbA<sub>1c</sub> is not a measure of blood glucose at a particular time, as you would obtain when using a blood glucose meter. Instead, it indicates how blood glucose has been controlled over the previous 6-8 weeks.

## What does it tell us?

The importance of HbA<sub>1c</sub> was not fully recognised until the completion of the US Diabetes Control and Complications Trial (DCCT, 1993) for people with Type 1

diabetes and the UK Prospective Diabetes Study (UKPDS, 1998) for people with Type 2 diabetes. Both showed that the risk for development and progression of the complications of diabetes increases as HbA<sub>1c</sub> increases.

Studies have shown that the complications of diabetes can be delayed or prevented if the HbA<sub>1c</sub> level is well controlled. Targets for HbA<sub>1c</sub> and blood glucose must be appropriate to the circumstances of the person with diabetes.

## How often is it measured?

This will depend on what is required for the management of the individual with diabetes. In general it is measured every six months or so but may be more frequent if indicated, for example during pregnancy or in children.

## What are the limitations of HbA<sub>1c</sub> measurement?

HbA<sub>1c</sub> results will be misleading in certain situations for example in haematological conditions where there is abnormal red cell turnover, or an abnormal haemoglobin, or in renal or liver disease. In pregnancy, HbA<sub>1c</sub> may be slightly lower.

In the presence of abnormal haemoglobin or in conditions with altered red cell survival rates, HbA<sub>1c</sub> results may not be reliable. In a patient with a haemoglobinopathy, HbA<sub>1c</sub> results are affected by the method of analysis and the particular abnormal haemoglobin. In these situations, HbA<sub>1c</sub> results can be used to follow trends in an individual's glycaemic control rather than for target setting.

## What are the traditional HbA<sub>1c</sub> units and why change?

Traditionally HbA<sub>1c</sub> was reported as a percentage of total haemoglobin. The International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) has established a new reference measurement system for the worldwide standardisation of HbA<sub>1c</sub>. The IFCC recommends that HbA<sub>1c</sub> concentration be reported in mmol of HbA<sub>1c</sub> per mol of haemoglobin (mmol/mol). This will make comparing HbA<sub>1c</sub> results from different laboratories and clinical research trials throughout the world much easier. These developments are supported by the international diabetes organisations and came about because the HbA<sub>1c</sub> assay systems used in both the DCCT and UKPDS trials were not specific for HbA<sub>1c</sub> and were not calibrated in the manner that is now required.

## What are the IFCC units and how will HbA<sub>1c</sub> be reported?

The IFCC has recommended that "HbA<sub>1c</sub>" is the official test name for what has been in the past referred to as glycohaemoglobin, A1c, etc. and the unit for reporting HbA<sub>1c</sub> concentration is mmol/mol. The range of HbA<sub>1c</sub> values for people without diabetes will be 20 to 42 mmol/mol. The HbA<sub>1c</sub> values will be higher in people with diabetes depending on their degree of glycaemic or blood glucose control.

For a period of time, the HbA<sub>1c</sub> (IFCC, mmol/mol) result will be accompanied by the familiar HbA<sub>1c</sub> (DCCT, %) result. This is called **dual reporting**.

**For example a HbA<sub>1c</sub> report might read as follows:**

HbA <sub>1c</sub> (IFCC)	53 mmol/mol
Ref. Interval	(20 - 42)
HbA <sub>1c</sub> (DCCT)	7.0 %
Ref. Interval	(4.0 - 6.0)

## How do DCCT and IFCC units relate?

The following short table illustrates how the results will change as we move from the familiar DCCT-style results to the new IFCC results.

HbA <sub>1c</sub> (DCCT) (%)	HbA <sub>1c</sub> (IFCC) (mmol/mol)
6.0	42
6.5	48
7.0	53
7.5	59
8.0	64
8.5	69
9.0	75

The fact that the IFCC number is higher than the DCCT number does not mean there has been more glucose in an individual's blood or that the diabetes was more poorly controlled. It is just a different way of expressing the same level of diabetes control. The IFCC HbA<sub>1c</sub> values are very different from blood glucose concentration values and this should reduce the risk of people with diabetes confusing both these results.

## When will this change happen?

In Ireland, from **1st July 2010**, all HbA<sub>1c</sub> results will be reported both as HbA<sub>1c</sub> (IFCC) in mmol/mol and as the familiar HbA<sub>1c</sub> (DCCT) in percentage (%). This dual reporting will continue until the end of 2011.