Simple solutions for complex matters: Understanding HbA$_{1c}$

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It became apparent to healthcare professionals working with children and young adults attending the Ipswich Diabetes Centre that there was a general misunderstanding of what HbA$_{1c}$ results meant and their relationship with glycaemic control. An audit of the clinics for young people and young adults with diabetes suggested that the level of understanding of HbA$_{1c}$ among this age group was an area that required further education in order for each individual to be able to relate their daily glycaemic control to the HbA$_{1c}$ result given and discussed in clinic. This article describes the development of new educational materials that are now successfully used by the Ipswich Diabetes Centre and the local community settings.

It is well recognised in the field of diabetes that good glycaemic control has been proven to minimise the risk of developing microvascular complications (The Diabetes Control and Complications Trial [DCCT] Research Group, 1993; UK Prospective Diabetes Study [UKPDS] Group, 1998).

The International Society for Pediatric and Adolescent Diabetes (ISPAD; 2000) recommends that blood and urine testing equipment should be provided to young people with diabetes and frequent, accurate self-monitoring is to be encouraged to enable optimal glycaemic control. Thus, it is now standard at diagnosis of type 1 diabetes for a blood glucose meter to be provided in order for capillary blood glucose to be self-monitored. It is this tracking and understanding of diabetes and blood glucose levels that should dictate any changes to the amount of insulin administered and is therefore vital to the good management of type 1 diabetes.

The National Service Framework (NSF) for diabetes (DoH, 2001) states in Standard 5:

'All children and young people with diabetes will receive consistently high-quality care and they, with their families and other involved in their day-to-day care, will be supported to optimise the control of their blood glucose and their physical, psychological, intellectual, educational and social development.'

Further to this are the National Institute for Health and Clinical Excellence (NICE; 2004) guidelines for the diagnosis and management of type 1 diabetes in children, young people and adults. This document states:

'Use frequent self-monitoring of blood (not urine) glucose... Offer [a] blood glucose

Article points

1. People with diabetes can mistake HbA$_{1c}$ results for an average blood glucose reading.

2. Improving an individual's understanding of HbA$_{1c}$ could improve motivation to achieving good glycaemic control.

3. People with an improved knowledge of their HbA$_{1c}$ would be in a stronger position to be able to negotiate a goal that they see as attainable.

4. Simple visual aids promote the effective learning of a complex subject across a whole range of ages and aptitudes and can standardise education provision across different clinical settings.

Key words

- HbA$_{1c}$
- Education
- Young people

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1. Self monitoring of blood glucose and understanding of HbA_{1c} has become an integral part of the curriculum for a number of educational programmes.

2. Staff had reported concern over a general misunderstanding among clinic attendees of what HbA_{1c} results meant and their relationship with glycaemic control.

3. 42% left the HbA_{1c} question unanswered despite having answered all of the other questions and of those that answered it only 11 used a phrase similar to 'it is a long term reading' or 'it is the overall blood sugar' with the majority (47%) regarding it as 'an average blood sugar'.

4. An average blood glucose of 10 mmol/l does not equal an HbA_{1c} of 10%.

monitor with memory and encourage use of a diary.'

During the adolescent years glycaemic control can become poor due to non-adherence to treatment regimens (Hentinen and Kyngas, 1992; Kyngas and Barlow, 1995; Pound et al, 1996). This places young people with diabetes at risk of developing complications, notably the development of microvascular changes and in particular retinopathy (Gill et al, 2001). It could be argued that a poor understanding of HbA_{1c} and its link to blood glucose monitoring is leading young people to ignore what they do not understand. Suggestions have been made that people can become disillusioned if they do not have the ability to interpret results or see the aim of monitoring (Tiley, 1992). Self-monitoring of blood glucose and understanding of HbA_{1c} has become an integral part of the curriculum for a number of educational programmes including Dose Adjustment For Normal Eating (DAFNE; DAFNE Study Group, 2002) and the Families, Adolescents and Children's Teamwork Study (FACTS; Wadham et al, 2005). This further supports the importance of the person with diabetes understanding their condition and the methods by which its management is measured.

Previous audit

A snapshot audit was carried out in June and July 2004 as part of one author's (JH-H) participation in the Warwick Certificate in Diabetes Care and was designed to assess what meters young people and young adults were using, whether they were satisfied with it or not, what they did with their readings and their understanding of HbA_{1c}. The Ipswich Diabetes Centre has a flexible approach to the transition from young person to young adult, seeing the individual's developmental stage as an indicator of readiness rather than an age (Royal College of Paediatrics and Child Health, 2003). Therefore there is a varying age at which transition actually occurs resulting in 15 to 17-year-olds being present in both clinics. All clinics are held in the diabetes centre, albeit on different days, and the staff overlap from one to the other thus enhancing and supporting the transitional process (Scott et al, 2006).

Staff had reported concerns about a general misunderstanding among clinic attendees of what HbA_{1c} results meant and their relationship with glycaemic control. 100 people (50 young people and 50 young adults; see *Table 1*) were approached and asked to complete a questionnaire (*Table 2*) while they waited for their appointment.

The return rate was 100% thanks to the participation of and encouragement from the Diabetes Centre reception staff. Surprisingly, 42% left question 10 unanswered despite having answered all of the other questions and of those that answered it only 11 used a phrase similar to 'it is a long-term reading' or 'it is the overall blood sugar' with the majority (47%) regarding it as 'an average blood sugar'. Unfortunately, an average blood glucose of 10 mmol/l does not equal an HbA_{1c} of 10%. It is this misunderstanding of such a crucial measurement of glycaemic control that was of concern.

The audit was extended to assess where HbA_{1c} information could be provided and revealed that when finger-prick blood samples were taken from the people attending clinic the laboratory staff (phlebotomist and healthcare assistant) were often asked what HbA_{1c} was. These team members

Table 1. Baseline characteristics of audit participants.

Male	47%
Female	53%
Mean age	17.3 years
Mean time since diagnosis	7.2 years

Table 2. Questions asked to clinic attendees as part of initial audit.

Male [   ] Female [   ]

AGE _____

1. How long have you had diabetes?
2. How often do you test your blood sugar and why?
3. What sort of meter do you have?
4. How long does it take to give you a result?
5. Where and when did you get it?
6. Do you test it using quality control (QC) solution?
7. Did you know that the diabetes centre supplies new meters if required?
8. What features would you find useful in a meter and do you link yours to your home computer?
9. Have you had any problems with obtaining supplies?
10. What do you understand by the term HbA_{1c}? What was your last one?

said that they found it difficult to explain as their knowledge of HbA_{1c} was inadequate and often referred the question to the clinic nurse or said that it was an 'overall reading'.

Furthermore, although not included in the audit, many other members of the diabetes centre team mentioned in conversation that they found HbA_{1c} difficult to explain to any age group and understandably there was a variety of terminology and teaching techniques being used.

As an interim measure an explanation was given by the authors to the laboratory staff in simple terms; this involved using similar terminology and pictures to that which would be used in the final educational materials (but prior to their full development and agreement). After this intervention the laboratory staff felt that they understood the subject better and the information posters that were later produced reinforced the interim teaching.

Educational material development

After the audit, education from the first point of contact with a person with diabetes became even more of a priority. The style of this education was also important so that people of all ages and cognitive abilities could understand the basic principle of HbA_{1c}.

Andragogy

Adults are assumed to need to know why they are learning something and are goal orientated (Cranton, 1992); people need to know how HbA_{1c} relates to their blood glucose in order for it to be relevant to them. It was thought that a visual comparison between the two readings could highlight the difference between them and hopefully a need to learn more.

Pedagogy

Pedagogy involves a teacher making the decisions about what will be learned and when: in other words it is teacher-directed (Conner, 1997). To some extent, this was the predominant approach for the new Ipswich education scheme as the content was decided by the nursing and medical team.

A display was designed and produced using ideas discussed by the authors and their colleagues. It comprises three sheets of laminated A4 paper and had three styles designed to appeal across all age groups. The aim was to provide information using minimal text, which is reported to guide patient behaviour when remembered properly (Hornke, 1983). The draft copies were circulated to all staff involved for their comments. Once the few alterations were made the final copies were printed in colour and laminated. In display order, the first was a large print, simple language explanation of HbA_{1c} (*Figure 1*), the second was a numerical comparison between HbA_{1c} and average blood glucose levels with pictorial support (*Figure 2*) and the third was a simplistic cartoon style picture (*Figure 3*) linking glucose, red blood cells and outcomes.

Implementation of education

Due to the integrated nature of the Ipswich Diabetes Centre it was decided that it would be impractical and unethical to restrict this information to specific clinics. It was felt
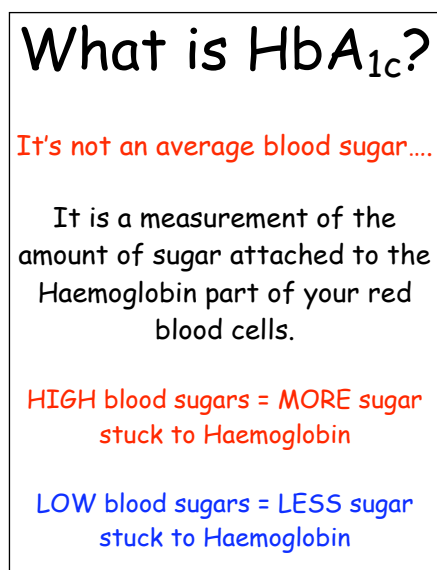

Figure 1. Poster explaining HbA_{1c}.

that this information needed to be presented to every person with diabetes and its format followed the diabetes centre's integrated ethos in that it was suited to people of all ages and aptitudes. It was agreed that the information would be used in every clinic for every age group.

Positioning the display correctly was critical so that everyone undergoing an HbA$_{1c}$ measurement would have the opportunity to read and understand the information. By sitting in the chair where finger-prick blood samples are taken

How does mine compare?

HbA$_{1c}$ %		Average blood glucose mmol/l
12	☹☹	19.5
11	☹☹	17.5
10	☹☹	15.5
9	☹	13.5
8	☺	11.5
7	☺☺	9.5
6	☺☺	7.5

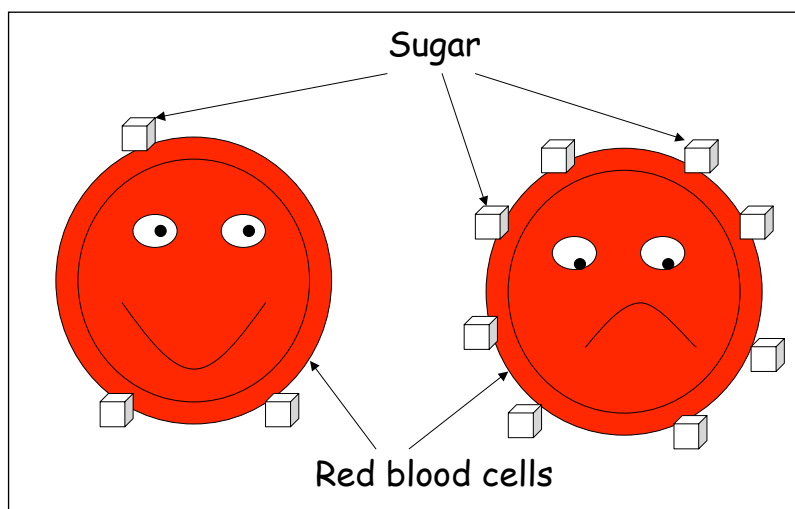*Figure 2. Poster explaining the link between HbA$_{1c}$ and blood glucose levels.*

Figure 3. Poster illustrating link between good (low) HbA$_{1c}$ readings and blood glucose.

it was possible to assess where a person's eye would naturally fall during this procedure. The display was then placed in this location.

While each healthcare professional has their own style of teaching it was essential that the core information remain the same. Copies were reduced to fit all three educational materials on a single piece of A4 paper and placed in each consulting room. Handouts containing the same information were used in teaching sessions for practice nurses: these were later taken away and are now used in general practice. Copies were left in the Diabetes Centre waiting areas and supplied for use in the antenatal clinic where women with gestational diabetes and existing diabetes are seen.

The posters were also included in the information pack provided as part of the Ipswich diabetes centre personal record pilot scheme and were supported by a chart used by patients to record their HbA$_{1c}$ readings (*Figure 4*). The personal record scheme was developed in-house to help people with diabetes to track their blood glucose and HbA$_{1c}$ levels. It was piloted among 25 people with type 1 or type 2 diabetes from children to the elderly but was never audited due to funding withdrawal. Since the PCT reorganisation the personal record has been presented to the new PCT project manager and was warmly received. It has subsequently been discussed by the PCT and the diabetes network user group and they have commenced designing a personal record which will include the HbA$_{1c}$ information and chart from the pilot record.

Results

The HbA$_{1c}$ education posters have not yet been audited (we have recently experienced DSN post cuts) but the early indications are that they are very effective: within a few weeks the laboratory staff fed back that people of all ages were commenting on how they now understood what HbA$_{1c}$ was. Additionally, where the laboratory staff had previously felt their knowledge was insufficient they now felt confident in sharing their understanding with people with diabetes.

The format was well received as staff felt confident in using it as a simple educational tool and people with diabetes find it easy to understand. The nursing and medical staff are

glad to have a useful visual aid for explaining a complicated subject to an audience of varying aptitudes. The most significant result is that everyone in the diabetes centre is now passing on consistent information about HbA$_{1c}$ and its relationship to day-to-day blood glucose levels.

Conclusion

Good glycaemic control should be one of the main aims of people with diabetes and a large proportion of diabetes service provision promotes this. The method by which glycaemic control is assessed (HbA$_{1c}$) eluded most people involved in an earlier audit in the Ipswich Diabetes Centre and could be indicative of the larger population. In the past, people with diabetes have been shown a numerical HbA$_{1c}$ percentage which they equated to average blood glucose in mmol/l, however, as demonstrated by *Figure 2*, this is not accurate. By helping people with diabetes to understand the link between blood glucose and HbA$_{1c}$, motivation to improve personal glycaemic control may increase.

Furthermore, it has been suggested that people will only change their behavioural pattern to achieve new goals if they perceive them to be attainable (Day, 2000). Individuals with an improved knowledge of their HbA$_{1c}$ would be in a stronger position to be able to negotiate a goal that they see as attainable.

The NSF for diabetes refers to HbA$_{1c}$ throughout and bases standards and recommendations around it (DoH, 2001). Thus, educating people with diabetes about HbA$_{1c}$ is vital and educational strategies such as that discussed in this article must continue so that self-management becomes a real possibility for people with diabetes. While an HbA$_{1c}$ of less than 7.4 % may not be the biggest concern for most people with diabetes it remains a fact that a lower HbA$_{1c}$ reduces the chances of further complications (DCCT, 1993, UKPDS; 1998) and therefore cannot be forgotten and must be promoted. ∎

Figure 4. Chart used in the record personal scheme to record HbA$_{1c}$ readings.

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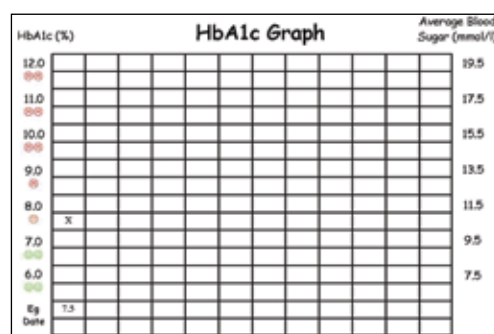
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Page points

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2. Educating people with diabetes about HbA$_{1c}$ is vital and educational strategies such as this one must continue so that self-management becomes a real possibility for people with diabetes.