

# **SELF MONITORING OF BLOOD GLUCOSE (SMBG)**

## **GUIDELINES FOR PEOPLE WITH TYPE 2 DIABETES**

## AIMS

1. To update and harmonise previous guidelines, including those developed by legacy health and social care organisations.
2. To provide a framework from which the healthcare professional may work with the person with type 2 diabetes to agree individualized patient-centred support and education in the management of self monitoring of blood glucose.
3. To optimise diabetic care through supporting healthcare staff by:
  - a. providing a consistent message to individuals with type 2 diabetes about self monitoring of blood glucose; and
  - b. targeting resources appropriately.

Contents	Page Number
Executive Summary	3
Background	4
Availability of SMBG	4
Education on SMBG <ul style="list-style-type: none"><li>- Blood glucose meter</li><li>- Steps in performing a capillary blood glucose test</li></ul>	5
Targets	5
Review of SMBG	5
Driving	6
Pregnancy (type 1, type 2 and Gestational Diabetes Mellitus)	6
Selection of blood glucose meter	6
Provision of monitoring by healthcare professionals	6
Table 1: Suggested approaches in SMBG	7
Explanatory Notes <ul style="list-style-type: none"><li>- Problem solving tests</li><li>- Post-prandial monitoring</li></ul>	8
Acknowledgements	8
References	8

## EXECUTIVE SUMMARY

1. People with poor blood glucose control are more likely to suffer from complications of diabetes and are more likely to die from a diabetes-related cause. NHS Diabetes published a report on self monitoring of blood glucose (SMBG) in non-insulin-treated type 2 Diabetes in March 2010 which can be accessed at [www.diabetes.nhs.uk](http://www.diabetes.nhs.uk).
2. People with type 2 diabetes who use **insulin** should monitor blood glucose levels as part of their *self-management programme*.
3. SMBG with *appropriate education* should also be available to people receiving other drugs with the potential to cause hypoglycaemia (**sulphonylureas, meglitinides or incretin mimetics\***) to assess glucose control and identify hypoglycaemic episodes.
4. In keeping with the recommendations contained within NICE Clinical Guideline CG87 and NHS Diabetes Working Group, *only where there is an agreed purpose or goal to testing* should SMBG be provided routinely to people with type 2 diabetes who are **not** treated with insulin, sulphonylureas or incretin mimetics\*.

SMBG should be used only within a plan of care which incorporates *appropriate education* on how results can be used to reinforce lifestyle change, adjust therapy or alert healthcare professionals. This should include regular reviews to identify and support those who find it useful, while discouraging those who gain no clinical benefit from continuing to test.

Individuals who are motivated by SMBG activity and use the information to maximise the effect of lifestyle and medication, should be encouraged to continue to monitor.

5. Targets, frequency, timing and duration of monitoring, should be agreed with the individual following discussion with a healthcare professional and documented within the clinical record.
6. A thorough assessment of SMBG should be conducted at least annually.
7. Staff training in the use of SMBG to support changes in lifestyle and self-adjustment of medications is required.

\* Incretin Mimetics – primarily during initiation and then depending on concomitant therapy.

## BACKGROUND

Self monitoring of blood glucose (SMBG) was introduced into routine diabetes care in the early 1980s and has both facilitated and revolutionised the outpatient management of diabetes. More recently, the precise indication for SMBG has come under scrutiny<sup>1-6</sup>, and debate continues as to the benefits and frequency of routine blood glucose monitoring in people treated on diet, oral hypoglycaemic agents (OHAs), and incretin mimetics. Attention has been drawn to the negative impact of SMBG on quality of life and the economic costs of inappropriate monitoring. National guidelines have been published.<sup>7</sup>

Where SMBG can provide clinically useful information, it should be made available to people with type 2 diabetes - primarily (but not exclusively) to those treated with insulin, sulphonylureas and incretin mimetics\*. It is important to note:

- SMBG is not a stand-alone exercise but rather an integral part of the individual's self-management plan.
- People with type 2 diabetes and healthcare professionals must be clear as to what they hope to achieve from SMBG and how the results are to be interpreted and acted upon.
- The frequency, timing and duration of testing should be agreed on an individual basis, reviewed regularly and recorded in the medical record.
- People treated with insulin should monitor blood glucose on a daily basis. HbA<sub>1c</sub>, as an integrated measure of fasting and post-meal glucose excursions, should be measured regularly. However, post-meal hyperglycaemia and inter-prandial or nocturnal hypoglycaemia can occur even when HbA<sub>1c</sub> values are normal. Therefore HbA<sub>1c</sub> values, particularly for people using insulin, need to be interpreted alongside SMBG results.
- Suggested approaches to the frequency of monitoring are given in Table 1.

\* Incretin Mimetics – primarily during initiation and then depending on concomitant therapy.

The National Institute for Health and Clinical Excellence (NICE) recommends that, in a person newly diagnosed with type 2 diabetes, SMBG should only be offered as an integral part of his or her self-management education.<sup>7</sup> For such newly diagnosed individuals who wish to monitor, SMBG provides an opportunity to learn about the impact of food and physical activity on glycaemic control. It also provides feedback on changes in lifestyle and therapy. Such information helps people to understand and maintain those interventions that have had the desired effect on their pre-prandial and post-prandial blood glucose and review those elements that work less well.<sup>8</sup>

## AVAILABILITY of SMBG

SMBG should be available:

- To those on insulin treatment or those for whom insulin may be considered.
- To those on OHAs which have the potential to cause hypoglycaemia (N.B. sulphonylureas).
- When intensifying or changing treatment regimes to improve blood glucose control where there is the potential to cause hypoglycaemia.
- To newly diagnosed individuals who wish to monitor to gain information and understanding about how food / activity interact and the effect on diabetes management – as part of their self-management education.
- To monitor changes during intercurrent illness or if glucocorticoids are co-prescribed (e.g. for an exacerbation of COPD or asthma).
- During fasting for religious or other reasons (e.g. during Ramadan).
- To reduce the risk of hypoglycaemia during activities, such as driving and regular or intensive physical activity (e.g. swimming) if using an oral agent with the potential to cause hypoglycaemia.
- To optimise blood glucose control prior to conception and during pregnancy, including gestational diabetes.
- If regular HbA<sub>1c</sub> is not possible or convenient.

In people who are not treated with insulin or sulphonylureas, NICE and the NHS Diabetes Working Group advocate the *routine provision of SMBG only where there is an agreed purpose or goal to testing.*

## EDUCATION on SMBG

### Blood glucose meter

**People with diabetes should be instructed by a competent healthcare professional about:**

- Normal blood glucose range.
- Individual blood glucose targets.
- Frequency, timing and recording of blood glucose tests.
- How to use a blood glucose meter appropriate to the individual (e.g. coding / no coding, brightness of display, audio prompts, etc).
- How to clean the meter, register it with the company and complete the guarantee.
- How and when to recode the meter, if required.
- How to use the lancing device, including inserting / changing lancets, setting / changing depth of penetration and site rotation.
- The safe disposal of used lancets in sharps containers and how these are obtained and returned.
- The safe disposal of used strips.
- Reasons for, and frequency and method of, quality control tests.
- How to obtain supplies of strips, lancets, replacement batteries, quality control solutions.
- Who to contact if problems arise with use of the meter, including customer care number for the manufacturer.
- Appropriate action to take on obtaining results outside target range.

### Steps in performing a capillary blood glucose test

- Wash and dry hands.
- Prepare equipment in accordance with manufacturer's guidance.
- Insert a new lancet into the finger pricking device.
- Strips must be stored in the original container, kept dry and at correct temperature.

- The expiry date should be checked and the strips should be in date.
- Milk the blood to the end of finger to be used.
- Prick the side of the fingertip (not the thumb or index fingers).
- Allow sufficient blood to accumulate at the puncture site before touching to the end of the test strip, ensuring that the test pad strip is completely covered.
- Use tissue / cotton wool to stem blood loss.
- Dispose of used lancet in sharps container.
- Dispose of used strip carefully.
- Record blood glucose value in agreed format.
- Act on results outside target range.
- Observe trends in blood glucose values and discuss with the healthcare professional if readings are consistently above agreed targets.  
(Note: exceptional reporting (below) if reason ascertained for variation in blood glucose – e.g. process incorrect, dietary factors, illness, stress, etc).

## TARGETS

Each individual should agree a target HbA<sub>1c</sub> during discussion with their healthcare professional.

The frequency, timing and duration of SMBG, together with review dates should be agreed with the individual and recorded as part of the self-management plan.

## REVIEW of SMBG

If results are not being utilized satisfactorily, SMBG may have a negative impact on lifestyle and quality of life, and places a large cost burden on the NHS. Therefore, the value of SMBG, as an adjunct to therapy, should be reviewed regularly. At least annually, an assessment should be made of:<sup>7</sup>

- Self monitoring skills.
- Quality and appropriate frequency of testing.
- Use made of the results obtained.
- Impact on quality of life.
- Continued benefit.
- Equipment.

## DRIVING

All individuals on insulin should monitor their blood glucose levels immediately prior to driving and be aware of how to manage a hypoglycaemic episode. For long journeys people with diabetes should be advised of the need to check blood glucose every 2 hours. In addition, to ensure safety whilst driving, SMBG may be of benefit to those receiving drugs with the potential to cause hypoglycaemia. This should be agreed on an individual basis. Up-to-date DVLA guidance may be accessed through <http://www.dft.gov.uk/dvla/medical/ataqlance.aspx>.<sup>9</sup>

## PREGNANCY (type 1, type 2 and Gestational Diabetes Mellitus)

Good glucose control before and during pregnancy can reduce the risk of stillbirth and congenital abnormalities. SMBG should be done at least four times daily, and often more frequently in those on insulin. This will be guided by the specialist in a dedicated joint metabolic antenatal clinic.

## SELECTION of BLOOD GLUCOSE METER

Currently people with diabetes obtain meters from a variety of sources, including community pharmacies. There is a need to:

- Quality assure the technology chosen since it will be used by individuals with diabetes to make important clinical choices about self-management.
- Match the device chosen to the individual's particular needs.
- Ensure knowledge and competency both to discuss how SMBG fits within the individual's overall care plan and to support the patient to ensure that monitoring is meaningful and effective.

It has been proposed that the feasibility of adopting a regional procurement of such technology should be investigated.

## PROVISION of MONITORING by HEALTHCARE PROFESSIONALS

This guideline is recommended for use by healthcare professionals in primary and secondary care when supporting people

with type 2 diabetes in their SELF monitoring of blood glucose. Healthcare professionals undertaking capillary glucose measurement for patient management purposes in other settings (such as in care homes, GP surgeries, HSC Trusts, community pharmacies) should only do so within an appropriate quality assured framework as described in the documents below:

- Medicines and Healthcare products Regulatory Agency (MHRA): Point of Care Testing: Blood Glucose Meters: Advice for healthcare professionals (2011). [www.mhra.gov.uk](http://www.mhra.gov.uk)
- Guideline and Audit Implementation Network (GAIN): Guidelines and Clinical Standards of Care for People with Diabetes in Care Homes (February 2010) [www.gain-ni.org](http://www.gain-ni.org)
- Health Protection Agency (HPA): Infection Prevention and Control Guidelines for Blood Glucose Monitoring in Care Homes (October 2009) [www.hpa.gov.uk](http://www.hpa.gov.uk)
- Northern Ireland Regional Point of Care Testing Policy (2010) as adapted by individual HSC Trusts
- Pharmaceutical Society of Northern Ireland (PSNI): Code of Ethics [www.psni.org.uk](http://www.psni.org.uk)
- Royal Pharmaceutical Society of Great Britain (RPSGB): Diagnostic Testing and Screening Services: Practice Guidance (March 2009) [www.rpharms.com](http://www.rpharms.com)
- Royal Pharmaceutical Society of Great Britain (RPSGB): Diagnostic Testing and Screening Services: Quick Reference Guide (May 2010) [www.rpharms.com](http://www.rpharms.com)



**Table 1: SUGGESTED APPROACHES FOR SMBG**

**Targets, frequency, timing and duration of monitoring are agreed with the individual during discussion with a healthcare professional.**

Monitoring Mode Treatment Type		Intensive	Conventional
		No medication	Lifestyle only (ie diet +/- exercise)
	<i>Could test once a week before breakfast and once a week 2 hours after an evening meal</i>		
Oral drugs/non-insulin Injections	Sulphonylureas*, Meglitinides (alone or in combination with other non-insulin anti-diabetic agents)	eg when need to change dose to cover situations such as intercurrent illness, steroid therapy, or if very symptomatic <i>Before meals and 2 hours after evening meal as guide to dose reductions or persisting hyperglycaemia</i> + Specific guidance for problem solving tests	Once weekly before breakfast and once weekly 2 hours after an evening meal
	Other oral agents (eg metformin, pioglitazone, gliptins) (alone or in combination with each other)	<i>Not necessary - as for "lifestyle only" above</i>	<i>Not necessary - as for "lifestyle only" above</i>
	Incretin Mimetics (eg exenatide, liraglutide)	eg when initiating treatment / before stabilisation – NB concomitant sulphonylurea <i>As for Sulphonylureas above</i>	<i>Dependent on concomitant anti-diabetic agents</i>
Insulin	Once daily basal insulin (eg NPH, Glargine, Detemir) ± OHAs	<i>Before breakfast tests are essential to implement the agreed titration scheme to achieve target fasting blood glucose. Test 2 hours after food if fasting blood glucose is on target but HbA<sub>1c</sub> is not</i> + Specific guidance for problem solving tests	<i>Fasting blood glucose daily</i>
	Insulin regimens (twice daily fixed, mixtures)	<i>Before meals and 2 hours after evening meal to establish the best match of dose to requirements throughout the day</i> + Specific guidance for problem solving tests	<i>Test daily pre each injection</i>
	Basal bolus insulin regimen	<i>Before meals and before bed tests will establish the best match of dose to requirements throughout the day. To optimise the dose of the rapid acting analogue some post-prandial tests may be needed</i> + Specific guidance for problem solving tests	<i>Test daily pre meals and bedtime</i>

\* The necessity for close monitoring of blood glucose is well recognized in those individuals using insulin. NICE and NHS Diabetes Working Group also specifically mention the important role of SMBG in detecting hypoglycaemia in those treated with *sulphonylureas*.

Most individuals will move between **intensive** and **conventional** testing modes according to their individual needs and circumstances. Some will always monitor in the intensive mode e.g. those with an active lifestyle who may wish to exploit fully the flexibility of the analogue multiple insulin regime (particularly those counting carbohydrate and adjusting their insulin dose with each meal). It is recommended that those on insulin monitor in the intensive mode for one week prior to attending their clinic appointment.

## EXPLANATORY NOTES

### Problem solving tests

These are used in specific circumstances, and include such questions as:

- “My HbA<sub>1c</sub> is above target – at what times of the day is my sugar too high?”
- “I feel funny. Is my blood sugar OK?”
- “I’m about to drive my car. Am I safe to do so?”
- “Is my blood sugar too low in the night?”
- “Am I experiencing nocturnal hypo’s?”
- “I have to eat more to prevent hypo’s.”
- “My weight is increasing despite efforts to lose /maintain weight.”
- Shift patterns / change in normal routine / exercise.
- Intensive monitoring one week pre clinic.
- Illness.

### Post-prandial monitoring

- **For conventional short-acting insulin:** not necessary – the dose of short-acting insulin is likely to be limited by the blood glucose trough before the next due meal.
- **For short-acting analogue insulin:** peak action of insulin is 30 mins - 3 hours after injection. During optimisation of treatment, monitoring 2 hours after meals will enable individuals to adjust treatment to improve post-prandial blood glucose control with minimum risk of hypoglycaemia.

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The Executive Summary has been closely based on NHS Diabetes Fact Sheet 32 “Glucose Self Monitoring in Diabetes” (December 2010). This in turn was based on “Self monitoring of blood glucose in non-insulin-treated type 2 diabetes: A report prepared by an NHS Diabetes Working Group” (March 2010). Both publications may be accessed at [www.diabetes.nhs.uk](http://www.diabetes.nhs.uk)

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