# SELF MONITORING OF BLOOD GLUCOSE (SMBG) GUIDELINE

## Aim and objective

It is important to ensure that people with Diabetes are given the opportunity to self monitor their blood glucose appropriately as an integral part of their individual self-management, to inform them about the day-to-day control of their diabetes and make adjustments in their treatment of lifestyle to optimise that control. This guideline aims to inform and advise members of the user group (as outlined below) regarding the effective use of SMBG.

## Authors

Dr Susan Arnott, NHS Lanarkshire Diabetes MCN Lead Clinician  
June Currie, Diabetes Service Manager

## Guideline

### Introduction

Self monitoring of blood glucose involves the measurement of blood glucose concentration by people with diabetes or their carers in their own daily environment. This usually entails pricking a finger with a lancet device to obtain a small blood sample at certain times of the day. A drop of blood is applied to a reagent strip which is then inserted into a meter for automated determination of the glucose concentration in the blood sample at the time of the test. It is not equivalent to HbA1c measurement.

For people with diabetes, maintaining good glycaemic control is vital in order to minimise the risk of the development of diabetes related complications. Regular monitoring of glucose control is fundamental to that approach and, for people with Type 1 Diabetes and insulin requiring Type 2 Diabetes, self monitoring is essential to optimise insulin doses and avoid hypoglycaemia.

SMBG should be viewed as part of the self-management of diabetes, not a stand alone intervention. It is used to inform the person of their blood glucose to allow decision making regarding treatment and to inform the person on the impact of changes in lifestyle, diet and physical activity which could influence the longer term control of their diabetes. The Diabetes MCN in Lanarkshire recommends that SMBG should be used only as an integral part of self-management education, including a discussion on how results should be interpreted and acted upon.

SMBG is recommended as an integral part of the management of Type 1 Diabetes to allow active dose titration and adjustment of insulin and for Type 2 diabetes where insulin forms a part of the individual’s management plan. It is also recommended that SMBG should be carried out by people with Type 2 Diabetes who have complications or significant co-morbidity including intercurrent illness (e.g. infection) to promote early recognition of deteriorating control, allowing for prompt intervention to avoid diabetes related emergencies and admission to hospital.

For these individuals training in SMBG technique and interpretation should form part of their diabetes management plan.

With regards specifically to Type 2 diabetes, recent systematic reviews pooling results from randomised control trials suggest a modest reduction of approximately 0.2% in HbA1c in non-insulin controlled patients undertaking SMBG, compared to those who do not. Interpretation of the results is difficult due to the diversity in the studies undertaken to date and more recently published high quality trials demonstrate the lack of significant benefit of SMBG in certain Type 2 patient groups. Recent reports have suggested that some
patients with Type 2 diabetes who do not require treatment with insulin, may not gain any benefit from SMBG, hence it adds little to the management or treatment of their diabetes and therefore may not be necessary. Stopping unnecessary monitoring in Type 2 diabetes should be considered on an individual basis, be motivated by the person’s interests and should be undertaken in consultation with the individual when discussing their self-management regime.

It should be highlighted that the cessation of unnecessary SMBG has the potential to generate cost savings for NHS Lanarkshire.

**Epidemiology**

Diabetes is a progressive disorder of glucose metabolism. The 2009 Scottish Diabetes Survey recorded 26 350 people in Lanarkshire (4.7%) have diabetes, just above the Scottish average of 4.4%. Type 1 diabetes accounts for 13.1% of this population (3454), Type 2 Diabetes 86.5% of this population (22 794). The lifetime risk of developing diabetes is 10%. Diabetes is associated with a significant healthcare burden, both for surveillance of the condition and the management of complications (premature death, cardiovascular disease, leg and foot ulcers, amputation, visual impairment, renal failure).

Observational studies have suggested that each 1% reduction in HbA1c is associated with a 21% reduction in diabetes related death, 12-14% reduction in myocardial infarction and stroke and a 37% reduction in microvascular complications.

**SMBG and Type 1 and Gestational Diabetes**

- SMBG is an integral part of self management
- People with diabetes and, if possible, their carers should be trained on self dose adjustment of insulin based on home monitoring results
- If HbA1c is to target, and there are no symptoms to suggest hyper- or hypoglycaemia, recommend 1 test daily, varying the timing of the test throughout the week OR 4 tests per day on 2 days of the week
- If HbA1c is out-with target, control is erratic, during intercurrent illness, hypoglycaemia unawareness, following the occurrence of a diabetes emergency (DKA, hypoglycaemia requiring third party intervention), frequent hypoglycaemia, driving a long distance, pregnancy and breastfeeding, children, pre and post surgical procedures, on intensive treatment with insulin pump therapy or multiple daily injections or following DAFNE principles, more frequent SMBG is recommended, up to 4-6 times daily
- Urine or blood ketone measurement is recommended in addition to SMBG, 1-4 times daily during intercurrent illness or if hyperglycaemia (defined as random blood glucose >15) persists for more than 24-48 hours.

**SMBG and Type 2 Diabetes treated with Insulin**

- SMBG is an integral part of self management
- People with diabetes and, if possible, their carers should be trained on self dose adjustment of insulin based on home monitoring results
- Once daily insulin regimes – daily pre breakfast (fasting) blood glucose during dose titration or if HbA1c not to target; also consider 2 hour post-prandial tests, x 2 weekly if HbA1c not to target
- HbA1c to target and otherwise well (no symptoms to suggest hyper- or hypoglycaemia) – 2-3 tests per week – pre-breakfast tests, with occasional 2 hours post-prandial test
- Increase frequency of testing during intercurrent illness and intervention according to ‘sick day rules’
- More complex insulin regimes requiring 2 or 4 injections of insulin daily should self monitor as for Type 1 diabetes

**SMBG and Type 2 Diabetes not treated with Insulin**

- HbA1c is the primary outcome measure
- If HbA1c is within that individual’s target and they are otherwise well with no symptoms to suggest hyper- or hypoglycaemia, routine SMBG is not required
- If the patient is on treatment with a Sulphonylurea, has significant co-morbidity or intercurrent illness, requires treatment which may destabilise diabetes control (e.g. steroids) or gives a history of hypoglycaemic symptoms, short-term monitoring is recommended to inform decision making to alter management to improve diabetes control. ‘Routine’ SMBG is not required.
- If SMBG is currently being undertaken the impact of this should be assessed at the person’s annual diabetes review and consideration given to modifying or stopping this activity if no benefit is
perceived, recognising that the philosophy of self-management means encouraging individual responsibility and choice

- Note – if compliance with the management plan is the primary problem, it should be recognised that additional testing may not help the person to improve the control of their diabetes

**Safety considerations**

- Needlestick injuries and transmission of infection from lancets
- Misinterpretation of readings due to differing meter displays or differing units used by different devices i.e. mg/l (European and American measurement) as opposed to mmol/l (UK measurement)
- Incompatibility between test strips prescribed and meters used
- Interference in results by other treatments e.g. certain solutions (icodextrin) used in peritoneal dialysis; certain drugs/products containing maltose – pharmaceutical companies provide precise information regarding test interferences in their patient information
- Manufacturing defects related to meter calibration or test strip accuracy (finite shelf life)
- Has been shown to increase levels of anxiety or depression in some individuals
- People with diabetes should be given written information explaining when they should be testing and how they should action results

**Blood Glucose Meters**

- NHSL reviewed 5 meters in 2005; an updated direct comparison of the range of meter currently available is included as appendix 1.
- If a patient buys a meter, or is currently using a meter not on the comparison list, consumables can still be prescribed and there is no need to encourage them to use a different meter.
- Suppliers operate meter support and people with diabetes should be encouraged to contact the company representative if they are experiencing problems with their meter.
- Blood glucose meters should be selected based on the most suitable for the individual’s needs, capability and preference to encourage appropriate use.
- Those involved in advising people with diabetes on self monitoring by blood glucose testing should be aware of the different characteristics of the available meters to assist people in making an informed choice about the device used.
- The meter recommended for professional use will be based on the outcome of the ongoing National Procurement exercise
Self Monitoring Blood Glucose (SMBG) Guideline Summary

**Type 2 Diabetes**
- Treatment includes Sulphonylurea
- Not recommended routinely
- Short term monitoring:
  - 1-4 times daily during intercurrent illness, reports of hypoglycaemia, concomitant treatment likely to destabilise diabetes
- If well but average SMBG out-with individual target (but less than 15) over 4-6 weeks, consider reviewing current treatment taking into consideration HbA1c

**Type 2 Diabetes**
- Treatment includes insulin*
- Test 2-3 times weekly (mixture of fasting and 2 hour post-prandial testing)
  - *insulin injected once
- Increase to 4-6 times daily if unwell, treatment changes, control erratic, symptoms suggestive of hypoglycaemia or loss of hypoglycaemia warning

**Type 1 Diabetes & Gestational Diabetes**
- Test once daily OR do 4 tests per day on 2 days of the week
  - *insulin injected 2-4 times daily
- Self adjust insulin dose as per sick day rules or individual management plan and/or instruct person to contact GP Practice or Diabetes Team for further advice
### Training

Detail the need for training or support in relation to this guideline and who will provide this. List contact details if possible.

All those instructing people with diabetes on the appropriate use of self monitoring equipment should be familiar with blood glucose meters and lancet devices, including the disposal of sharps and the intervention required in the event of a result out-with the person’s individual target. Technical and practical advice can be provided by the companies who manufacture the devices or via the Diabetes Specialist Nursing Team. Contact June Currie, Diabetes Service Manager (email june.currie@lanarkshire.scot.nhs.uk or telephone 07766763240), for further information.

### Review Date

June 2012

### References

- SIGN 116 Management of Diabetes March 2010
- NHS QIS evidence note Number 26 Clinical and cost-effectiveness of self-monitoring of blood glucose (SMBG) for non-insulin treated type 2 diabetes (January 2009)
- NHS Lanarkshire Prescribing Action Plan version 6 (June 2009)
- NHS Lanarkshire Prescribing Action Plan version 7 (June 2010)
- NHS Lanarkshire home blood glucose monitoring guidelines 2005
- PRISMS Blood Glucose testing strips quarter 2009/10 (July-Sept 2009)

### Further Reading

- Appendix 1 – table 1 Blood glucose meters for people with diabetes - NHS Lanarkshire 2010
- Appendix 2 – patient education literature
- Appendix 3 – table 2 – Blood Glucose Meters for professional use - NHS Lanarkshire 2010 (in development)
# Appendix 1 - Table 1 Blood Glucose Meters for people with diabetes (personal use) – NHS Lanarkshire 2010

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<th>FreeStyle Lite</th>
<th>FreeStyle Freedom Lite</th>
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<td>FreeStyle (200) Abbott Thin Lancets (200)</td>
<td>FreeStyle (200) Abbott Thin Lancets (200)</td>
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<td>Ascensia Microlet (100)</td>
<td>One Touch Fine Point (100)</td>
<td>One Touch Ultra soft (100)</td>
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* consumable costs variable – prices quoted as at July 2010
Self Monitoring Blood Glucose

Type 2 Diabetes
(if short-term monitoring is recommended)

What is your target?

________________

How often should you test your blood glucose?

- daily
- Vary the time of the test
- Before breakfast, before evening meal or before bed
- Record the result in your self monitoring diary
- Bring the diary and your meter with you to your diabetes check ups

When should you test?

- If you feel unwell – cold, flu, infection, vomiting, diarrhoea
- If you feel your sugar is low – hungry, sweaty, shaky, light-headed, dizzy, irritable
- If you are exercising or are more active than usual
- Regularly during a long drive

What if it is below target (hypoglycaemia – less than 4mmol/l)

- Drink a glass of Lucozade, non-diet drink or fruit juice OR
- Take 3 or more Glucose tablets OR
- Five sweets e.g. barley sugar

THEN:

- Eat a sandwich OR
- Fruit OR
- Bowl of cereal OR
- Biscuits and milk
- Inform your GP or Practice Nurse

IF YOU NEED HELP FROM SOMEONE ELSE THAT PERSON SHOULD:

- Insert Glucogel (available on prescription), treacle, jam or honey on the inside of the cheek and gently massage the outside of the cheek

THEN YOU SHOULD:

- Eat a sandwich OR
- Fruit OR
- Bowl of cereal OR
- Biscuits and milk
- Inform your GP or Practice Nurse

**What if it is above target?**
- Repeat the test if you forgot to wash your hands before the procedure
- Are you following a low sugar/low fat diet and taking regular exercise?
- Are you taking any medication prescribed regularly?
- Do you feel unwell?

**If the answer to the above questions is ‘Yes’ arrange to see your Practice Nurse or GP to have your treatment reviewed.**

If your blood glucose is over your target but less than 15 and you do not feel unwell, monitor for 4-6 weeks to get an average reading, consider making changes to you diet and physical activity if required, follow advice on taking your medication appropriately then contact your Practice Nurse or GP for advice.

**Contact details:**

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<tr>
<th>Who</th>
<th>Name</th>
<th>Telephone</th>
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<td>Practice Nurse</td>
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<tr>
<td>Diabetes Specialist Nurse</td>
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<td>Out of Hours</td>
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</table>
Self Monitoring Blood Glucose

Type 2 Diabetes
(when treatment includes insulin)

What is your target?

________________

How often should you test your blood glucose?

- If your dose of insulin is adjusted test your blood sugar daily before each injection
- If your dose of insulin is stable and your blood glucose is within your target test twice weekly.
- Vary the time of the test
- Before breakfast, before evening meal or before bed
- Record the result in your self monitoring diary
- Bring the diary with you to your diabetes check ups

When should you test more often?

- If your treatment is changed
- If you feel unwell – cold, flu, infection, vomiting, diarrhoea
- If you feel your sugar is low – hungry, sweaty, shaky, light-headed, dizzy, irritable
- If you do not get any warning that your sugar is low (no symptoms)
- If you are exercising or are more active than usual
- Regularly during a long drive

What if it is below target (hypoglycaemia – less than 4mmol/l)

- Drink a glass of Lucozade, non-diet drink or fruit juice OR
- Take 3 or more Glucose tablets OR
- Five sweets e.g. barley sugar

THEN:

- Eat a sandwich OR
- Fruit OR
- Bowl of cereal OR
- Biscuits and milk
- Inform your GP or Practice Nurse

IF YOU NEED HELP FROM SOMEONE ELSE THAT PERSON SHOULD:

- Insert Glucogel (available on prescription), treacle, jam or honey on the inside of the cheek and gently massage the outside of the cheek
- Inject Glucagon (available on prescription)
THEN YOU SHOULD:
- Eat a sandwich OR
- Fruit OR
- Bowl of cereal OR
- Biscuits and milk
- Inform your GP or Practice Nurse

What if it is above target?
- Repeat the test if you forgot to wash your hands before the procedure
- Are you following a low sugar/low fat diet and taking regular exercise?
- Are you taking any medication prescribed regularly?
- Are you rotating your injection sites and are they smooth and soft?
- Do you feel unwell?

If the answer to the above questions is ‘Yes’, adjust your insulin dose if you have been instructed how to do this and/or contact your Practice Nurse, GP or Diabetes Specialist Nurse for advice.

If your blood glucose is over your target and you do not feel unwell, test more often for 2 weeks to get an average reading, consider making changes to your diet and physical activity if required, follow advice on taking your medication appropriately then contact your Practice Nurse or GP for advice.

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<td>Out of Hours</td>
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Self Monitoring Blood Glucose

**Type 1 Diabetes**

**How often should you test your blood glucose?**
- If your treatment regimen or dose of insulin is adjusted, test your blood sugar daily before each injection.
- If your dose of insulin is stable and your blood glucose is within your target daily or 4 times per day for 2 days per week.
- Vary the time of the test.
- Before breakfast, lunch, and evening meal, and before bed.
- Record the result in your self-monitoring diary.
- Bring the diary with you to your diabetes check-ups.

**When should you test more often?**
- If your treatment is changed.
- If you feel unwell – cold, flu, infection, vomiting, diarrhoea.
- If you feel your sugar is low – hungry, sweaty, shaky, light-headed, dizzy, irritable.
- If you do not get any warning that your sugar is low (no symptoms).
- If you are exercising or are more active than usual.
- Regularly during a long drive.

**What if it is below target (hypoglycaemia – less than 4mmol/l)**
- Drink a glass of Lucozade, non-diet drink, or fruit juice OR
- Take 3 or more Glucose tablets OR
- Five sweets e.g. barley sugar

THEN:
- Eat a sandwich OR
- Fruit OR
- Bowl of cereal OR
- Biscuits and milk
- Inform your GP or Practice Nurse

**IF YOU NEED HELP FROM SOMEONE ELSE THAT PERSON SHOULD:**
- Insert Glucogel (available on prescription), treacle, jam, or honey on the inside of the cheek and gently massage the outside of the cheek.
- Inject Glucagon (available on prescription).

THEN YOU SHOULD:
- Eat a sandwich OR
- Fruit OR
- Bowl of cereal OR
What if it is above target?
- Repeat the test if you forgot to wash your hands before the procedure
- Are you following a low sugar/low fat diet and taking regular exercise?
- Are you taking any medication prescribed regularly?
- Are you rotating your injection sites and are they smooth and soft?
- Do you feel unwell?
- If your blood glucose is over 15mmol/l, do you have ketones in your urine or blood? (your diabetes team will advise on how to test for this)

If the answer to the above questions is ‘Yes’, adjust your insulin dose if you have been instructed how to do this and/or contact your Practice Nurse, GP or Diabetes Specialist Nurse for advice.

If your blood glucose is over your target, you do not feel unwell, and have no ketones in your urine or blood, test 4 times daily, before meals and bed, for 2 weeks to get an average profile, consider making changes to you diet and physical activity if required, follow advice on taking your medication appropriately then contact your Practice Nurse or GP for advice.

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