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TRAINING, RESEARCH AND EDUCATION FOR NURSES IN DIABETES

Blood Glucose Monitoring Guidelines

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RATIONALE AND REMIT:

This guidance has been developed to update the blood glucose monitoring consensus guidelines published in 2004 *(Owens et al, 2004)*. The prevalence of diabetes and the treatment choices for people with the condition has increased significantly in the last decade, resulting in escalating costs. The pressure on the NHS to keep up with demand and meet expectations has led to increasing consideration in ensuring resources are good value for money. Initiatives to save money have included reducing access to blood glucose monitoring for some people depending upon their glycaemic therapy. There has been a variation in the way this advice has been interpreted and implemented locally, resulting in inequalities and confusion.

This document is intended to serve as a helpful resource for healthcare professionals working with people with diabetes, those who prescribe self-monitoring equipment, and for commissioners and designers of services.

This guidance was written by Training, Research and Education for Nurses in Diabetes *(TREND UK)*. Other organisations representing people with diabetes and those who support them have been involved in the development of the guidance via a process of review.

When implementing this guidance, full account should be taken of the local context and any action taken should be in line with statutory obligations required of the organisation and individual. No part of this guidance should be interpreted in a way that would knowingly put anybody at risk.

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- Association of British Clinical Diabetologists (ABCD)
- National Diabetes Nurse Consultant Group
- Diabetes In-patient Specialist Nurses Group (DISN)
- Diabetes UK
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INTRODUCTION:

The importance of blood glucose control in reducing the risk of complications in people with type 1 and type 2 diabetes is well established *(DCCT 1993, UKPDS 1998, Stratton et al, 2000)*. The use of self-monitoring of blood glucose (SMBG) to facilitate the achievement of evidence-based blood glucose targets has increasingly been incorporated into routine management for many people with diabetes. Indeed, SMBG has been described as possibly the most important advance in controlling diabetes since the discovery of insulin *(Tonyushkina and Nichols, 2009)*.

The first visual blood glucose monitoring strip was Dextrostix, developed in 1963, and the first blood glucose meter became available in 1970, weighing 3 lbs and costing $650 *(Tonyushkina and Nichols, 2009)*. Today in the UK, there are approximately 40 different prescribable blood glucose (BG) testing strips for use with a wide range of meters which are small, light in weight, take only a few seconds to deliver a BG result with a small drop of capillary blood, and may have a variety of additional features including test results memory, insulin dose calculators, and the facility to alert the user to results which fall below or above pre-set targets. The BG meters are relatively low cost but may also be provided at no cost to the individual by their diabetes or primary care team. However, the cost to the NHS of prescribing the BG strips is significant: £152.6 million in 2010/2011 in England alone *(NHS Information Centre, 2012)*.

The rapidly increasing prevalence of diabetes in the UK *(Diabetes UK, 2012)* is consuming a significant proportion of NHS resources. For example, the diabetes prescribing costs alone for primary care in England increased from £458.6 million in 2004/5 to £649.2 million in 2009/10 *(NHS Information Centre, 2010)*. Despite the financial constraints the NHS faces, there is a requirement to maintain quality, afford new expensive treatments, meet public expectations and increase capacity to deliver healthcare services to all who need them, which has led to a consideration of how and where precious healthcare resources are used. Reviewing the routine prescribing of BG testing strips for people with type 2 diabetes who do not use insulin was recommended by Quality, Innovation, Productivity and Prevention (QIPP) as an area where considerable financial savings could be made to the NHS *(NPC, 2011)*.

The interpretation of this recommendation has resulted in blanket bans in some areas on SMBG for all people who have type 2 diabetes and who do not use insulin *(Diabetes UK, 2012)*. This has resulted in considerable debate between those who see SMBG as an empowerment tool for people to self-manage their diabetes even if managed by lifestyle alone, others who have concerns about people who are at risk of hypoglycaemia from particular oral hypoglycaemic agents, and those who draw on the lack of robust evidence that SMBG can facilitate a reduction in HbA1c that is clinically significant. This had led to confusion about who should test blood glucose, with restrictions on SMBG making it difficult even for some people with type 1 diabetes to obtain sufficient strips in some areas *(DiabetesUK, 2012)*.

A decade ago, consensus guidelines for SMBG for people with type 1 and type 2 diabetes were published, at a time when £90 million was being spent annually on blood glucose testing strips, 40% more than was spent on oral hypoglycaemic agents *(Owens et al, 2004)*. The concerns regarding inappropriate use of NHS resources remain but much has changed in the NHS and in diabetes management since 2004. A significant number of new but costly diabetes therapies are now available with lower risk of hypoglycaemia, there have been changes in driving regulations, there is an increasing awareness of the risk of hypoglycaemia in an ageing population and those with renal impairment, and there is varied availability of structured education to improve self-management skills. These are some of the drivers that may increase demand for SMBG, in an environment of much tighter financial constraint and significant organisational change.

THE AIM OF THIS DOCUMENT IS TO:

- Summarise the evidence available on where SMBG can be effective
- Briefly review the existing UK and key international guidelines
- Clarify what QIPP advises for SMBG in people with type 2 diabetes
- Provide a simple guide on who could benefit from access to SMBG
- Describe how to maximise the effectiveness of SMBG in those who use it
- List some areas to consider when developing a limited formulary of meters
- Recognise the responsibilities of the people with diabetes who SMBG, the healthcare professionals who support them, and the organisations which control the commissioning and funding of diabetes services

WHY SHOULD PEOPLE USE SMBG?

The landmark trials for type 1 and type 2 diabetes *(DCCT, 1993;UKPDS, 1998)* related the level of HbA1c achieved to the risk of developing complications, providing evidence that better glycaemic control reduced risk. HbA1c reflects the exposure to prevailing blood glucose levels during the lifespan of red blood cells (approximately 120 days, but 50% of the value reflects the last 30 days) *(Pickup, 2003)*. However, HbA1c does not reflect the variations in blood glucose levels during that period of time and, depending on the type of treatment, activity levels, state of general health and diet consumed, SMBG can provide additional valuable information for a variety of situations:

1. **Safety:**
   - To identify and confirm hypoglycaemia in people using insulin, sulphonylureas or glinides to facilitate appropriate treatment
   - To confirm safety to drive, and before commencing other activities such as climbing or swimming if using insulin or oral hypoglycaemic agents (OHA) with a risk of hypoglycaemia
   - To inform management to optimise glycaemic control in women planning or during pregnancy (foetus safety)
   - To inform management of inter-current illness and stress in order to reduce risk of acute metabolic de-compensation (diabetic keto-acidosis and hyperosmolar hyperglycaemic state) and avoid unplanned admission to hospital
   - To reduce risk of hypoglycaemia in those using insulin or OHAs with a risk of hypoglycaemia during fasting (e.g. Ramadan)

     Although awareness of the risk of hypoglycaemia in those using insulin is well recognised, awareness of the risk with the use of sulphonylureas may not be. People treated with sulphonylureas had similar levels of hypoglycaemia as those with type 2 diabetes in the first 2 years of insulin treatment *(UK Hypoglycaemia Study Group, 2007)*. All people using insulin or OHAs with an increased risk of hypoglycaemia should be advised about the symptoms and treatment of hypoglycaemia. However, symptoms may not always be a reliable indicator of biochemical hypoglycaemia *(Pramming et al, 1990)* and episodes may be missed.
2. **Empowering Lifestyle Changes:**

   Can give objective feedback to the person with diabetes about the success or otherwise of lifestyle changes as well as effectiveness of their medication dose.
3. **Supporting Decision-Making:**

   Can provide data to support healthcare professionals (HCPs) in providing tailored advice for individuals with diabetes about lifestyle and blood-glucose lowering medications.
4. **Reducing Complications:**

   Reduction of costly acute and long-term complications may be achieved if SMBG is used to make behavioural changes, facilitate medication concordance and make effective use of medication.
5. **Special Circumstances:**

   Can inform medication management to facilitate appropriate adjustments of insulin or OHA dose with steroid use, or when commencing an antipsychotic medication.

EVIDENCE FOR AND AGAINST SMBG IN TYPE 2 DIABETES:

The usefulness of SMBG, coupled with structured education in self-management, for people using insulin is generally accepted and the QIPP recommendations for reviewing blood glucose testing strip usage does not include insulin users. The concern with providing this facility for people with type 2 diabetes who are not using insulin is that the evidence that it gives clinical benefit or is cost-effective is either not available or is conflicting. Indeed, the focus on glycaemic control alone may be inappropriate in people with type 2 diabetes, and a more holistic approach including blood pressure and lipid management to reduce cardiovascular risk is more beneficial *(Yudkin et al, 2010)*. Encouraging very tight glycaemic control (e.g. HbA1c less than 53 mmol/mol) may be harmful, especially in those with long-standing diabetes or in the elderly *(Currie et al, 2010)*.

A brief summary of some of the evidence for SMBG in type 2 diabetes is given below:

> "The German-Austrian trial incorporated meal-related SMBG to empower patients to make medication and lifestyle adjustments. This resulted in lower HbA1c with an increase in general well-being and less depression (Schwedes et al, 2002). However, a qualitative study by (Peel et al, 2004) found that although SMBG could increase awareness of diabetes, empower, reassure and motivate people, it could also increase anxiety and depression, and lead to self-blame.
>
> DiGEM compared three groups of people with type 2 diabetes using OHAs only: those who did not SMBG, those using SMBG three times a day on 2 days a week and instructed to contact a healthcare professional for interpretation and advice on action, and those who used SMBG at the same frequency but who were trained to interpret and initiate their own response. After 4 years, the trial concluded there was no significant difference between the 3 groups (Farmer et al, 2007).
>
> In the ESMON trial, people with newly diagnosed type 2 diabetes who SMBG were compared with those who did not monitor. The HbA1c fell in both groups with no statistical difference between them. However, depression scores were higher in the group who monitored their blood glucose. No difference was found in hypoglycaemia, body mass index or use of OHAs (O'Kane et al, 2008).
>
> DINAMIC-1 assessed the contribution of SMBG as part of evaluating safety, efficacy and tolerability of modified-release gliclazide (Barnett et al, 2008). The SMBG group achieved a 0.24% greater reduction in HbA1c than the control group who did not SMBG. However, as SMBG results guided changes in gliclazide dose, this may have influenced HbA1c. More episodes of hypoglycaemia were reported in the SMBG group (8.7% vs 7%) but asymptomatic episodes were identified in this group, confirming evidence that relying on symptoms for hypoglycaemia is not infallible (Pramming et al, 1990).
>
> A 12 month trial by Polonsky et al (2011) followed 483 people with poorly controlled type 2 diabetes (HbA1c >7.5%) and not using insulin, and encouraged them to use structured profiles of SMBG to make lifestyle changes. The healthcare professionals supporting them were trained to interpret the blood glucose results to adjust medication. The SMBG group had a 1.2% reduction in HbA1c compared to a 0.9% reduction in the control group. No loss of general well-being was noted in the SMBG group.
>
> Reviews summarising the numerous trials and observational studies are useful. An early review of 6 RCTs in 2005 found that SMBG groups had a 0.39% greater reduction in HbA1c than non-SMBG groups. The authors compared this to a 14% reduced risk of developing micro-vascular complications achieved by the same reduction of HbA1c in the UKPDS but suggested the reduction achieved in the SMBG groups should be considered with caution as there were so many other variables within the 6 trials that made it difficult to consider the effect of SMBG alone (Welschen et al, 2005)."

A more recent health technology assessment (HTA) report on SMBG in type 2 diabetes considered whether SMBG is worth its cost and effort by looking at glycaemic control, incidence of hypoglycaemia, quality of life, and cost per quality-adjusted life-year (QALY). 30 randomised-controlled trials were reviewed but very few were noted to be of high quality. A reduction in HbA1c of 0.21% was found in those who tested BG but had no education or support in how to use the results compared to those who did not test (but this was not thought to be clinically significant). A reduction of 0.52% in HbA1c was achieved in the enhanced group where patients and HCPs received education or feedback.

There was no consistent effect on hypoglycaemia episodes or medication changes. The reviewers concluded that SMBG has limited clinical effectiveness in people with type 2 diabetes using OHAs or diet alone and is unlikely to be cost-effective. However, the HTA does suggest SMBG may improve glycaemic control if used in conjunction with education for both patients and HCPs to enable them to use the results to make changes to medication and lifestyle. A common complaint from patients' however, is that HCPs do not show any interest in their results *(Diabetes UK, 2013)*.

More research is needed to identify what type of education is effective, which patients may benefit, what are the ideal testing times and frequencies, and when SMBG may cause depression or anxiety *(Clar et al, 2010)*. More recent reviews and meta-analyses of the evidence confirm these findings *(Farmer et al, 2012; Malanda et al, 2012)*.

WHAT DOES NICE SAY?

NICE guidelines for blood glucose monitoring in type 1 diabetes:

- Self-monitoring of blood glucose levels should be used as part of an integrated package that includes appropriate insulin regimens and education to help choice and achievement of optimal diabetes outcomes
- Self-monitoring should be performed using meters and strips chosen by adults with type 1 diabetes to suit their needs and usually with low blood requirements, fast analysis time, and integrated memories
- Optimal frequency of self-monitoring will depend on the characteristics of their blood glucose control, insulin treatment regimen and personal preference in using the results to achieve the desired lifestyle
- Structured assessment of self-monitoring skills, the quality and use made of the results obtained, and the equipment used should be made annually. Self-monitoring skills should be reviewed as part of the annual review, or more frequently, according to need and re-enforced where appropriate

(NICE, 2004)

NICE guidelines for blood glucose monitoring in type 2 diabetes:

Offer self-monitoring of plasma glucose to a person newly diagnosed with type 2 diabetes only as an integral part of his or her self-management education. Discuss its purpose and agree how it should be interpreted and acted upon.

Self-monitoring of plasma glucose should be available:

- To those on insulin treatment
- To those on oral glucose lowering medications to provide information on hypoglycaemia
- To assess change in glucose control resulting from medication or lifestyle changes
- To monitor changes during inter-current illness
- To ensure safety during activities including driving

Assess annually in a structured way:

- Self-monitoring skills
- The quality and appropriate frequency of testing
- The use made of the results obtained
- The impact on quality of life
- The continued benefit
- The equipment used

(NICE, 2008)

Scottish Intercollegiate Guidelines Network:

- SMBG is recommended for patients with type 1 or type 2 diabetes who are using insulin where patients have been educated in appropriate alterations in insulin dose
- Routine self-monitoring of blood glucose in people with type 2 diabetes who are using oral glucose lowering drugs (with the exception of sulphonylureas) is not recommended
- Motivated patients with type 2 diabetes using sulphonylureas may benefit from routine use of SMBG to reduce risk of hypoglycaemia
- SMBG may be considered in the following groups of patients who are not using insulin: those at increased risk of hypoglycaemia, those experiencing acute illness, those undergoing significant changes in pharmacotherapy, those fasting (e.g. during Ramadan), those with unstable or poor glycaemic control (e.g. HbA1c >64 mmol/mol), and women during or planning pregnancy

(SIGN, 2010)

WHAT DOES THE DVLA SAY?

The DVLA gives specific instructions regarding SMBG for people who drive and use insulin:

Group 1 drivers
"There must be appropriate blood glucose monitoring. This has been defined by the Secretary of State's Honorary Medical Advisory Panel on Driving and Diabetes as no more than 2 hours before the start of the first journey and every 2 hours while driving."
Group 2 (lorries and buses)
"Regularly monitors blood glucose at least twice daily and at times relevant to driving (no more than 2 hours before the start of the first journey and every 2 hours while driving) using a glucose meter with a memory function to measure and record blood glucose levels. At the annual examination by an independent Consultant Diabetologist, 3 months' of blood glucose readings must be available."
However, the instructions are not very specific for group 1 drivers managed by tablets which carry a risk of inducing hypoglycaemia (this includes sulphonylureas and glinides): "It may be appropriate to monitor blood glucose regularly and at times relevant to driving to enable the detection of hypoglycaemia." Group 2 drivers on these agents are instructed to regularly monitor blood glucose at least twice daily and at times relevant to driving *(DVLA, 2013)*.

If all group 1 drivers using sulphonylureas were to test as regularly as insulin users, this would result in a considerable increase in cost to the NHS. However, all drivers who are at risk of hypoglycaemia should have access to blood testing strips, especially those who drive for a living.

The **Association of British Clinical Diabetologists** recommend targeted testing for these patients: in patients who are starting treatment with sulphonylureas (the greatest risk of hypoglycaemia is in the first 3 months of therapy), those who are experiencing hypoglycaemia, and those with reduced hypoglycaemia awareness. The highest risk for people with type 2 diabetes prior to insulin occurs during late afternoon *(Gallen et al, 2012)*.

WHAT DO OTHER BODIES SAY?

The **International Diabetes Federation (IDF)** Task Force on Clinical Guidelines and the Self-Monitoring Blood Glucose international working group *(IDF, 2008)* make the following recommendations:

- SMBG should only be used when the patient has the knowledge and willingness to incorporate SMBG and therapy adjustment into their diabetes care plan in order to attain agreed treatment goals
- It can be used by newly diagnosed patients to enhance their understanding of diabetes as part of their education programme, and to facilitate timely treatment initiation and dose optimization
- The frequency of SMBG monitoring should be individualised depending on education, behavioural and clinical requirements (i.e. to identify/prevent/manage hyperglycaemia and hypoglycaemia)
- It can also be used where it will provide healthcare professionals with the data to inform therapeutic decisions

Diabetes UK updated their position statement on SMBG monitoring in April 2013, endorsed by the Association of British Clinical Diabetologists. They emphasise that SMBG is not a stand-alone intervention and should be incorporated into the diabetes care plan, accompanied by education to interpret the results and adjust treatment. It should be available to all insulin users but also for those taking sulphonylurea and prandial glucose regulators (glinides) because of the risk of hypoglycaemia. They call for the removal of blanket policies that deny access to BG monitoring equipment to people not using these agents or insulin, and recommend SMBG availability should be based on individual assessment. Diabetes UK identifies the responsibilities of all involved in SMBG monitoring: the person with diabetes, the healthcare professional, the pharmacist, the strip manufacturer, and the commissioners of services *(Diabetes UK, 2013)*.

The **American Association of Diabetes Educators (AADE)** advises SMBG is a key component of the treatment regimen, giving immediate critical feedback about the effectiveness of behaviour change and changes to medication, as well as identifying and treating potential acute complications. It must be integrated into a self-management plan with education *(AADE, 2010).* The American Diabetes Association guidelines concur with these.

WHAT DOES QIPP SAY?

The Quality, Improvement, Productivity and Prevention initiative included reducing the prescribing of SMBG strips in a list of options for local implementation (along with choice of oral hypoglycaemic agents and long-acting analogue insulins) to save money for the NHS. The guidance states:

" Review, and where appropriate, revise local use of self-monitoring blood glucose (SMBG) in type 2 diabetes mellitus to ensure that it is in line with NICE guidance."

There is no mention of restricting blood glucose meter choice or assuming a blanket approach of stopping testing for all people with type 2 diabetes who are not using insulin. QIPP acknowledges that blood glucose control is important but is part of the holistic treatment approach to managing type 2 diabetes which also includes improving blood pressure, lipids and lifestyle issues *(NPC, 2011)*.

WHO SHOULD TEST?

The following table draws from national and international guidelines to suggest who may benefit from SMBG. Rather than a blanket approach determined by therapy alone, it attempts to identify individual circumstances which may make SMBG useful, albeit for a short period of time. Concerns about risks of hypoglycaemia in vulnerable groups (e.g. the elderly, those with renal impairment) may be better addressed by a review of medication choice rather than increased SMBG.

Table 1:

Who should have access to SMBG strips?		
Treatment	**Recommendation**	**Source of guidance**
Type 1	Yes, with self-monitoring education	• NICE CG15 • SIGN 116 • Diabetes UK position statement (2012)
Type 2 diabetes and any of the following as monotherapy or in combination: Diet and lifestyle Metformin Pioglitazone DPP4 inhibitors SGLT2 inhibitors GLP-1 receptor agonists	**Should not be routinely offered. However, an agreed period of SMBG may be useful:** • During periods of acute illness • When changing therapy to assess effectiveness • To provide feedback on lifestyle changes when newly diagnosed and following structured education • Preconception and duration of pregnancy	• NICE CG66 • SIGN 116 • Diabetes UK position statement (2013) • NICE pregnancy CG63, SIGN 116
Type 2 diabetes using: Sulphonylureas or glinides as monotherapy or in combination with any of the above	As above • To identify hypoglycaemia especially in the first 3 months of starting sulphonylureas, in those who experience episodes of hypoglycaemia and are drivers, and those who have reduced awareness of hypoglycaemia • Those who fast, especially if drivers • Group 2 drivers must test at least twice daily and at times relevant to driving	• Gallen et al • NICE CG66 • SIGN 116 • DVLA
Type 2 diabetes using insulin as mono-therapy or in combination with any of the above	• Based on individual assessment, depending on number of insulin injections and degree of hypoglycaemia awareness • Increased frequency of testing will be needed during periods of acute illness, change of routine and activity levels, when dose adjustment is required • Before driving and every 2 hours on long journeys	• NICE CG66 • SIGN 116 • Diabetes UK position statement (2013) • DVLA

When auditing BG strip usage in a given population (usually the diabetes population in an individual GP practice) there may be more useful areas to investigate rather than total BG strips being prescribed per se. Identifying people using insulin but who are not requesting BG strips, especially if they are drivers; people who are requesting a significant number of strips but who have poor glycaemic control; those who use a large number of BG strips and have very tight glycaemic control, should all trigger concern. Investigation may identify safety issues, fear of hypoglycaemia, and poor use of resources.

GETTING THE MOST OUT OF TESTING:

People with diabetes (and HCPs and carers using BG meters) should know their BG targets and understand what action is required if the result is out of target range (i.e. the detection and correction of hypo- and hyperglycaemia).

Other issues to consider include:

- Correct user technique is critical
- Hands should be washed and dried before commencing the procedure
- BG testing strips should be in date
- Strips should be stored at the correct temperature and in manufacturer's packaging
- A sufficient blood sample should be obtained (using an appropriate finger pricking device and technique)
- The BG meter should show results in **mmol/L** *not mg/dL*
- The user should be aware of the degree of error especially in the low BG range
- The user should know to re-check if symptoms do not tally with BG reading
- Quality assurance (both internal and external) is mandatory for HCPs *(MHRA, 2011)*
- Patients should not have abnormalities with haematocrit or interferences that would give inaccurate readings
- Only specific meters are suitable for patients on peritoneal dialysis, so HCP need to check with manufacturers' guidance.

QUALITY STANDARDS FOR BLOOD GLUCOSE METERS:

ISO (International Organization for Standardization) 15197:2013 (E) describes the requirements for blood glucose monitoring systems using capillary blood *(ISO, 2013)*.

Originally developed in 2003, the standards have been revised, made more stringent, and published in 2013. All capillary blood glucose monitoring strips must meet the ISO standards by 2016. The standards cover the following areas:

- Ease of operation, maintenance, cleaning. Ensuring the visual display is clear and there is no likelihood of misinterpretation of the result
- Safety and reliability (e.g. no risk of electric shocks to the user, resistance to shock, vibration and heat)
- Precision, accuracy and influence by abnormalities in haematocrit and other interferences
- User performance evaluation, including ease of understanding instructions

Haematocrit affects the fluid content of blood, where the glucose is carried. Therefore abnormalities of haematocrit can result in erroneous blood glucose results. High haematocrit (common in chronic respiratory conditions, high triglycerides, shock, dehydration) can give falsely low BG reading (less fluid in the blood sample volume), whereas conditions with low haematocrit (e.g. pregnancy) give falsely high BG results *(Tonyushkina and Nichols, 2009)*.

Although the ISO standards are important, the skill of the user, not the meter, is the most significant source of blood glucose error accounting for 91-97% of overall inaccuracies.

TOP TIPS FOR DEVELOPING A TEST STRIP FORMULARY:

Although QIPP does not recommend reducing patient choice of BG meter, many health organisations have made the decision to develop a restricted formulary for preferred BG strips that can be prescribed in their area. Diabetes UK is concerned about the effect this has on patient choice. However, restricting choice to a small number of strips from the 40 or so prescribable BG strips available in the UK is attractive: it may enable HCPs to get to know a few meters very well.

It is essential to involve all stakeholders in this decision, including user representation. Quality performance (including meeting the new ISO requirements), meter features (for example, blood ketone testing and insulin calculators are features to consider if the restricted formulary will apply to people with type 1 diabetes as well), quality assurance, user support services, shelf-life after opening (for infrequent testers), patient feedback, and not just the cost, will need to be considered.

BLOOD GLUCOSE MONITORING: EVERYBODY'S RESPONSIBILITY

Diabetes UK's position statement on SMBG *(Diabetes UK, 2013)* identifies the responsibilities of the providers and users of blood glucose strips for people with type 2 diabetes. The key points are summarised below:

The person with diabetes:

- Should ensure correct technique is followed, know what to do with the results, use the resource wisely and consider whether testing frequency and timing is optimal
- They should understand that the results reflect the success, or otherwise, of their day-to-day management of their diabetes so SMBG without adherence to a healthy eating plan and concordance with medication has limited value

The healthcare professional:

Should work in partnership with the person with diabetes to agree whether SMBG is appropriate, recognising the need for cost-effective use of NHS resources. If so, agree the frequency, timing, BG targets and the period of time testing should be done.

- SMBG is a tool for providing feedback on diabetes management so it should always be incorporated into an individual's education programme
- HCPs should review the results of testing and discuss the implications with the person with diabetes
- HCPs should be trained in correct SMBG technique, self-management education, and interpretation of BG result

Manufacturers of BG testing strips:

Should review the cost of BG testing strips and work with the Department of Health to agree the most affordable price for the NHS

Community Pharmacists:

Should advise customers considering purchasing a BG meter to discuss with their diabetes HCP whether SMBG is appropriate for them

Commissioners:

Should ensure education in self-management of diabetes is available for all people with diabetes. SMBG should be available to all who would benefit, using a meter suitable for their needs.

SHARPS DISPOSAL:

Every person who is asked to perform blood glucose monitoring should be provided with the correct means of safe disposal of their sharps, i.e. lancets

- The 'Sharpsguard' is a collection receptacle for used sharps that can be sealed once appropriately filled
- It is available on prescription from the General Practitioner
- Each local council may have a different collection service; this should be clearly communicated to each person with diabetes who is asked to monitor their blood glucose levels
- The EU Directive 2010/32, which became UK Law in May 2013, focuses on the need to provide greater protection to all healthcare workers, downstream workers and others who are at risk of sharps injury
- The directive sets out to protect patients and workers at risk by ensuring the safest possible working environment. People with diabetes who are monitoring their own blood glucose levels, at home or whilst they are out and about, should be aware of the dangers of disposing of their sharps inappropriately and be encouraged to use the correct equipment provided

CONCLUSION:

Self-monitoring of blood glucose is essential for people with diabetes who use insulin therapy. The evidence for its value in those who do not use insulin is less clear.

For some people with type 2 diabetes who treat the condition with lifestyle measures and oral blood glucose lowering medication, SMBG may not be a good use of NHS resources (cost of strips, HCP time for training the user) especially given the financial constraints on healthcare services.

Potentially, savings made on reducing unnecessary SMBG can finance the use of newer glucose-lowering therapies and structured education programmes.

However, for some people with type 2 diabetes who do not use insulin, the cost is justified in certain situations for safety, managing inter-current illness, facilitating appropriate medication adjustment, and motivating lifestyle improvements.

However, SMBG is not a stand-alone intervention: it should be used in combination with structured education to empower the individual to use the results effectively.

Regular review of the quality, benefits and frequency of testing should be incorporated into the annual diabetes review.

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