

Blood Glucose Monitoring

Guideline for the choice of blood glucose meters, test strips
and lancets in diabetes

Addendum:

Guidance on self-monitoring of glucose and ketones

Developed in collaboration with:



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GUIDELINES FOR CHOICE OF BLOOD GLUCOSE METERS, TEST STRIPS AND LANCETS FOR SELF-MONITORING OF BLOOD GLUCOSE

Scope

These guidelines are intended to help healthcare professionals working in both primary care and specialist centres choose blood glucose monitoring products for people with diabetes who need to self-monitor their blood glucose (SMBG).

How the guideline was developed

A multidisciplinary sub-group of the DMMAG (Diabetes Medicines Management Advisory Group) consisting of diabetes specialist nurses, GP leads for diabetes and diabetes pharmacists was convened. This had representatives from the CCGs, GP practices, community teams and secondary care trusts across the Birmingham, Solihull and Sandwell (BSSE) health economy.

The subgroup defined a comprehensive set of evaluation criteria for the manufacturers to assess all their meters/strips/lancets against. These criteria looked at:

- Compliance with the latest ISO standards for accuracy (available for meters and needles)
- Cost to the NHS of the test strips and lancets
- Clinical features such as glucose & ketone testing, carbohydrate counting
- Usability e.g. meter size, expiry, coding, suitability for people with disabilities
- Utilisation of the latest technology e.g. supported by apps., downloadable results
- Support for patient self-management
- Support for healthcare professionals
- Availability in both primary and secondary care
- Compatibility with DVLA requirements e.g. memory storage
- Plans to discontinue the product or any UK safety alerts

Once the criteria had been approved by BSSE Area Prescribing Committee (APC), the subgroup allocated scores to each criterion, weighted according to each one's relevance to clinical care and patient outcomes. All of the scoring was approved by DMMAG.

The manufacturers of all the blood glucose monitoring products currently on the market were then invited to submit their products for inclusion in the review process. The resulting submissions were scored according to the pre-approved system. Those products which scored highest were shortlisted, and samples were taken to a patient event convened in collaboration with Diabetes UK for patient evaluation. The report received from Diabetes UK after the patient event helped inform the final decision about which products to take forward. These were agreed at DMMAG and signed off by the BSSE APC for inclusion on the formulary.

Note: not all of the products currently available on the market were submitted by the manufacturers for inclusion in the evaluation process. These products were therefore not assessed by the review.

Supply of meters

Any newly diagnosed diabetic patient should be assessed by a healthcare professional, and if deemed appropriate, a suitable formulary meter should be supplied to the patient. Training on the correct use, storage and recording of the readings should be provided by the issuing clinician. Note:

- Meters can be obtained free of charge from manufacturers by all GP surgeries or specialist diabetes clinics, to issue *free* to patients. There is no need for any diabetic to purchase a meter.
- Patients should be dissuaded from buying their own meter without consulting their diabetes specialist first.
- Prescribing of test strips and lancets for off-formulary meters purchased by a patient will not be supported.
- Clinics and practices are advised not to accept stock of non-formulary meters from manufacturers for distribution within the local health economy.

Types of meters

This guideline has divided blood glucose meters into 3 categories. Healthcare professionals are advised to select a meter that takes into account patient preferences and clinical needs.

Categories of blood glucose meters	
Category 1 meters	For patients with type 1 diabetes who need to monitor their blood ketone and blood glucose levels
	The majority of patients with type 1 diabetes (especially those at risk of DKA) need to have a meter with ketone testing functionality. These can be initiated by the specialist diabetes clinic or by a primary care health care professional. A small number of these meters can be stocked in primary care. The issuing clinician should ensure patients clearly understand when to test for blood ketones and how to interpret results. The ongoing supply of the glucose and ketone strips and lancets will be made by the patients GP practice. If a patient requires an additional meter from a different category for a specific reason e.g. for carbohydrate counting functionality, for compatibility with an insulin pump, or if blood ketone testing is not routinely required, the appropriate formulary approved meter will be advised and made available.
Category 2 meters	For patients with type 2 diabetes or with gestational diabetes
	These are for the majority of patients with type 2 diabetes (including those using insulin), for those with diabetes in pregnancy (gestational diabetes), and occasionally for patients with type 1 diabetes that need to self-monitor their blood glucose. GP practices are advised to keep a suitable stock of these meters.
Category 3 meters	For patients using insulin pumps or those who have been taught carbohydrate counting
	These are specialist meters with more advanced functionality which should only be stocked and initiated by specialist care teams. The ongoing supply of test strips and lancets should be made in primary care. Note that these meters do not have ketone testing functionality so alternative ketone testing facilities should be made available where needed.

Please note - all concerns about meter/strip malfunctions or errors should be reported to the MHRA & NRLS to ensure that any emerging patterns can be identified. They should also be reported via any Local Reporting Systems.

Issuing new blood glucose meters

All new patients starting to self-monitor their blood glucose must be initiated and trained to use a formulary meter. A formulary meter should also be used whenever offering a replacement meter.

Existing patients on non-formulary blood glucose meters

If a patient has had their existing meter for more than 18 months, it may be warranted to consider a review and switch to a formulary approved meter, with patient consent.

If there are clinical concerns or supply issues with a patient's current meter, it is recommended that the patient is reviewed and offered a formulary-approved meter.

Any patient using a non-formulary meter with standard glucose strips which costs > £10 per 50 strips, may be considered for a formulary meter **where clinically appropriate and with patients consent**. DMMAG and BSSE APC have advised that the "bulk switching" of glucose meters without patient involvement/consent is avoided.

If a patient is going to have their meter switched it should have the same functionality as the old meter with regards to blood glucose and ketone testing.




The formulary meters are expected to be suitable for the majority of patients (around 80-90%) but it is recognised that some patients may have individual needs and will require an alternative choice.

Please note: If a patient is using an insulin pump or is carbohydrate counting, their meter should not be switched in primary care. Please refer to the specialist clinics if any review is required.


Category 1 meters: for use in type 1 diabetes to monitor blood glucose & blood ketones

	Preferred first choice	Alternative meter	Restricted for use on advice of specialist centres only
Name of meter	GlucoMen Aro 2K 	CareSens Dual 	Freestyle Optium Neo 
Glucose test strips (expiry once open)	GlucoMen Aro Sensor , supply x10 with meter (12 months)	CareSens PRO , supply x10 with meter (12 months)	FreeStyle Optium blood glucose , x10 with meter (18-24 months)
Lancets supplied with meter and quantity	GlucoJect Lancets Plus x10	CareSens Lancets x10	Freestyle Lancets x10
Will other lancet brands fit the lancing device?	Yes	Yes	Yes
Ketone testing function and quantity supplied with meter (expiry once open)	Yes - GlucoMen Aro Ketone Sensor, purple strips, x2 with meter (24 month)	Yes – KetoSens, purple strips, x2 with meter (12 months)	Yes - FreeStyle Optium beta-ketone strips, purple/white strip, none with meter (18-24 months)
Memory	730 glucose and 100 beta-ketone results (locked)	1000 results (locked)	1000 results (locked)
Price of strips (DT February 2018)	Glucose sensor £9.95 x50 Ketone sensor £9.95 x10	Glucose strip £9.95 x50 Ketone strip £9.95 x10	Glucose strip £16 x50 Ketone strip £21.53 x10
Ability to download results	Yes - NFC (contactless), Bluetooth, Cloud and USB connectivity	Yes – USB and SmartLog software and Balansio software	Yes – USB and FreeStyle Auto-Assist Neo Software
Supported by smart phone application ('app')	Yes (free) – Diasend Personal (Android), Social Diabetes (iPhone and Android), GlucoLog (iPhone & Android), GDM-health (gestational app)	Yes (free) – SmartLog software (Bluetooth app for iPhone & Android)	No.
Suitability for use in:			
Pregnancy	Yes	Yes	Yes
Paediatrics	Not stated	Yes	Yes
Visual impairments	"White on black" screen display	Backlit white	"Black on white" screen display
Dexterity problems	Yes, as per manufacturer	Yes, as per manufacturer	Yes, as per manufacturer
Additional considerations	Social Diabetes app provides insulin dose recommendations and a carbohydrate calculator	Smartlog/Balansio software allows insulin dose setting, exercise and carb. counting	Has an optional insulin dose logging feature to avoid insulin mis-dosing
Contra-indications	None stated by manufacturer	None stated by manufacturer	Do not use during xylose absorption testing
Local contact	David Place 07833 681969	David Englefield 07880 195470	Sarah Page 07899 065979
Patient /clinician helpline, or to order supplies	8:30-5:50 (Mon-Fri) 0800 243667	24/7 and all year 0800 881 5423	8:00–20:00 (Mon-Fri) 0800 170 1177
Website	www.glucomen.co.uk	www.spirit-healthcare.co.uk	www.freestylediabetes.co.uk

Category 2 meters: for use in type 2 diabetes or with gestational diabetes

	Preferred first choice	Alternative choice	RESTRICTED USE (see below)
Name of meter	Tee2+ 	Wavesense Jazz Wireless 	Accu-Chek Mobile 
Glucose test strips (expiry once open)	Tee2 blood glucose strips (24 months)	Wavesense Jazz or JazzDuo Testing strips (6 months)	Mobile cassette (3 months)
Lancets supplied with meter	CareSens x10	AgaMatrix Ultra-Thin x30	Fastclix Lancets x2 drums (6 lancets per drum)
Will other lancet brands fit the lancing device?	Yes	Yes	No
Ketone testing	No	No	No
Memory	1000 tests (locked)	300 results in meter, unlimited in app (locked)	2000 tests (locked)
Price/ 50 strips (DT February 2018)	£7.75	Jazz (1x50 pack) £8.74, Jazz Duo (2x25 pack) £8.74	£9.99
Ability to download results	Yes (free) – SmartLog software (Bluetooth app for iPhone & Android)	Yes – Bluetooth to iPhone and Android	Yes
Supported by smart phone app.	Yes – SmartLog and Balansio	Yes – AgaMatrix Diabetes Manager for iOS and Android and GDM-health (gestational app)	No
Suitability for use in:			
Pregnancy	Yes	Yes	Yes
Paediatrics	Yes	Yes	Yes
Visual impairments	Yes	Yes	Yes – in acoustic mode, audible beeps guide the user through the test. Backlit.
Dexterity problems	Yes	Small meter that connects directly with smartphones via Bluetooth	Yes – all-in-one device (no individual strips or lancing device)
Additional considerations	Meter shelf-life in use is 5 years, but it has a lifetime warranty. Balansio/Smartlog apps/software has advanced features to assist with insulin dosing if required.	App. allows insulin doses/ratios and exercise to be input if required. For smartphones users only	Restricted for use in people with needle phobia, paediatrics, visual impairment or physical impairments requiring single-handed use. Ensure patients are trained how to correctly apply blood to the glucose strip.
Contra-indications	None stated by manufacturer	None stated by manufacturer	Ceftriaxone treatment, or blood galactose levels ≥ 1.1 mmol/l (false results)
Local contact	David Englefield 07880 195470	Andrew Riddell 07342 880 082	Sanjay Parmar 07841 363929
Patient /clinician helpline & to order	24/7 and 365 days 0800 881 5423	8:00 – 18:30 (Mon – Fri) 0800 0931812	8:00 – 18:00 (Mon - Fri) 0800 701 000
Website	www.spirit-healthcare.co.uk	www.agamatrix.co.uk	www.accu-chek.co.uk

Category 3 meters: for patients undertaking carbohydrate counting or using insulin pumps

	Preferred meter for carbohydrate counting
Meter name	Accu-Chek Aviva Expert 
Glucose test strips (expiry once opened)	Aviva testing strips (18 months)
Lancets supplied with meter	Yes. Fastclix Lancets – meter box contains 4 drums with additional 2 drums in meter pouch (6 lancets per drum).
Will other lancet brands fit the lancing device?	No. Fastclix lancets are only compatible with the Fastclix lancing device
Memory	1000 tests - Locked memory function
Ketones	No (but if glucose levels are high the system gives a ketone warning)
Price/ 50 strips	£16.09 (DT February 2018)
Ability to download results	Yes
Supported by smart phone application (app.)	No
Suitability for use in:	
Pregnancy	Yes
Paediatrics	Yes
Visual impairments	No, but full colour display
Dexterity problems	No
Additional considerations	Bolus advisor - calculates the units of insulin to administer based on test result, exercise, carb intake and previous insulin doses. Compatible with Accu-Chek insulin pumps.
Contra-indications	Triglycerides > 20.3 mmol/l, galactose > 0.83 mmol/l, ascorbic acid >0.17 mmol/l will give false results. Glucose values in neonates suspect for galactosemia should be confirmed by an alternate glucose methodology.
Local contact	Sanjay Parmar 07841 363929
Patient / clinician helpline or to order supplies	0800 701 000 (8am – 6pm, Mon-Fri, excl. bank holidays).
Website	www.accu-chek.co.uk

Meters for use with insulin pumps used within the BSSE area

Insulin pumps and compatible meters will always be provided by specialist centres, but the test strips can be prescribed in primary care. Note these meters do not do quantitative ketone testing.

Insulin Pump	Meter	Test strips
Cellnovo	Cellnovo Handset	Aviva
Accu-Chek Combo	Accuchek Combo Handset	Accu-Chek Aviva
Accu-Chek Insight	Insight Handset	Accu-Chek Aviva
Omnipod	Omnipod PDM	Freestyle Lite
Medtronic 640 G	Ascensia Contour Next 2.4 USB	Contour Next test strips
Medtronic Paridigm Veo	Ascensia Contour Next USB link	Contour Next test strips

Lancets





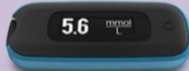


- There are a range of universal-fit different sized lancets available on prescription at a cost of <£3 per 100 lancets, that fit most of the standard lancing devices
- Most lancing devices will take a universal-fit lancet, but if the brand of lancets supplied with the meter is cost-effective it can continue to be prescribed
- The higher the gauge (G) of lancet, the smaller the diameter of the lancet needle. The guideline development group did not feel there was any clinically relevant difference between the gauges or length of the lancets, choice should be guided by clinician and patient preference
- Lancets are for single use only, patients should be provided with adequate sharps-disposal bins. Disposal arrangements for the filled sharps bins are different across the BSSE area – CCGs can provide advice as needed
- Multi-device lancets and their lancing device e.g. FastClix drum should be restricted to those with specific need e.g. those with dexterity problems, needle phobia, or visual impairments. They may be preferred for use by paediatrics

References

1. NHS BSA Drug Tariff (October 2017 – February 2018)
2. Information provided by various manufacturers (October 2017 – March 2018)
3. Best Practice Guidance: Development of a formulary for blood glucose testing devices. All-Party Parliamentary Group on Diabetes (July 2014)
4. BSSE APC Blood Glucose Meters Policy, April 2015 (previous guidance)

With thanks to all of the colleagues who have supported this process and Diabetes UK for their assistance with the patient evaluation event.

SUMMARY OF FORMULARY BLOOD GLUCOSE METERS, TEST STRIPS AND LANCETS

Meter name	Compatible test strips and price (DT Feb 18)		Lancets
Category 1 meters	For patients with type 1 diabetes who need to monitor their blood glucose and blood ketone levels		
PREFERRED FIRST LINE: GlucoMen Areo 2K		Glucomen Areo Sensor glucose sensor (£9.95 x 50) Glucomen Areo Ketone sensor (£9.95 x 10)	GlucoJect Lancets Plus
CareSens Dual		CareSens PRO blood glucose test strips (£9.95 x 50) KetoSens blood ketone test strips (£9.95 x 10)	CareSens Lancets
Restricted use: Freestyle Optium Neo (££)		Freestyle Optium blood glucose test strips (£16 x 50) Freestyle Optium blood beta-ketone test strips (£21.35 x 10) <i>Meter restricted for use on the advice of specialist care only</i>	Freestyle Lancets
Category 2 meters	For patients with type 2 diabetes or with gestational diabetes		
PREFERRED FIRST LINE: Tee2+		Tee2 Blood glucose strips (£7.75 x 50)	CareSens Lancets
FOR SMARTPHONE USERS: Wavesense Jazz Wireless meter		Wavesense Jazz testing strips (1 x 50 pack £8.74) Wavesense Jazz Duo testing strips (2 x 25 pack for less frequent users £8.74)	AgaMatrix Ultra-Thin Lancets
Restricted use: Accu-Chek Mobile		Mobile Cassette (£9.99 x 50) <i>Meter restricted for use in patients with needle phobia, paediatrics, visual impairments, and physical impairments requiring single-handed use.</i>	Fastclix lancets
Category 3 meters	For patients using insulin pumps or those who have been taught carbohydrate counting		
Accu-Chek Aviva Expert (££)		Aviva (£16.09 x 50) <i>Meter for initiation by specialist centres only</i>	Fastclix lancets
Meters compatible with pumps	<i>See full guideline or liaise with a diabetes specialist or prescribing support pharmacist for advice</i>		

Points to consider prior to initiating self-monitoring of blood glucose

- Clinicians should ensure that they promote equality for all patients when following this guidance
- Advice on choice of blood glucose meters is available on the BSSE APC Formulary
- Patients who self-monitor must be given adequate training around the purpose, the interpretation and what actions they need to take with the readings
- Self-monitoring of blood glucose should always be an integral part of a wider agreed management plan and take into account guidance from the [Driver and Vehicle Licensing Agency \(DVLA\)](#)
- Ensure the patient fits the relevant NICE criteria for self-monitoring of blood glucose
- **Do not routinely offer** self-monitoring of blood glucose levels for adults with type 2 diabetes unless ([NICE NG28](#)):
 - The person is on insulin or
 - There is evidence of hypoglycaemic episodes or
 - The person is on oral medication that may increase their risk of hypoglycaemia while driving or operating machinery or
 - The person is pregnant, or is planning to become pregnant. For more information, see the NICE guideline on [diabetes in pregnancy](#).
- Short-term self-monitoring in patients who do not otherwise test their glucose may be useful to help understand blood glucose variations over a period of time, when escalation of treatment is being considered. It can also be useful as part of patient education.
- Frequency of testing may need to increase on a short-term basis e.g. during periods of illness, or whilst fasting for religious reasons (such as the month of Ramadan). Prescribing of glucose test strips should be adjusted to support any increased short-term clinical need
- In line with NICE guidance, if patients with diabetes are self-monitoring their blood glucose levels, carry out a structured assessment at least annually. The assessment should include:
 - the person's self-monitoring skills
 - the quality and frequency of testing (frequency can go up as well as down – address any excess usage)
 - checking that the person knows how to interpret the blood glucose results and what action to take
 - the impact on the person's quality of life
 - the continued benefit to the person
 - the equipment used e.g. not to use strips past their 'use-by' date

Blood Glucose: self-monitoring guidance for diabetes

Diabetes Type	Treatment Group	Medication	Testing Frequency	Rationale	Prescriptions requirements per month (or as specified)
Type 1 diabetes (see NICE NG17 and NG18)	All people with Type 1 diabetes	Insulin	Adults should test at least 4 times a day, incl. before each meal and before bed Children and young people should test at least 5 times a day	<ul style="list-style-type: none"> SMBG is an integral part of treatment to avoid hypoglycaemia and manage hyperglycaemia Patients should be educated to monitor blood glucose and skills reviewed annually Increase frequency during periods of illness; before, during and after sport; if frequency of hypoglycaemia increases; before/during pregnancy/breastfeeding Follow legal requirements for testing e.g. DVLA 	3-4 boxes (150 -200 strips)
Continuous subcutaneous insulin infusion therapy (CSII or 'insulin pump') NICE TA151	Type 1 diabetics requiring a pump (in line with NICE)	Insulin via a pump	At least 4– 6 times per day.	<ul style="list-style-type: none"> More frequent monitoring during establishment of therapy and during times of illness. 	3-4 boxes (150 -200 strips)
Intensive management or loss of hypoglycaemia awareness	Frequent testing essential in: newly diagnosed; children under 5 yrs; insulin pump therapy; those unwell; carbohydrate counting; due to a person's lifestyle (for example, driving for a long period of time, undertaking high-risk activity or occupation, travel)		More than 10 tests daily	<ul style="list-style-type: none"> A management plan should be developed and agreed with the individual 	5 boxes (250 strips)
Gestational Diabetes (see NICE NG3)	All women with diabetes planning a pregnancy, pregnant women with diabetes, gestational diabetes	Metformin, SU, insulin or diet	At least 4 times a day on metformin or diet. If on insulin test 7-8 times a day	<ul style="list-style-type: none"> All should SMBG at least 4 times a day to include both fasting and post-prandial blood glucose measurements 	3 - 5 boxes (150 -250 strips)
Type 2 diabetes (see NICE NG28)	Diet & exercise alone with/without: Metformin, glitazone, DPP4 inhibitor, GLP-1 mimetic, SGLT-2 inhibitor (or any combination of the above)		SMBG not routinely recommended as part of routine care.	<ul style="list-style-type: none"> No hypo risk, monitor glycaemia via HbA1c Motivated patients may wish to monitor effects of changes in diet/exercise (up to once a day, 2-4 times a week is sufficient) or if on steroids/unwell 	<i>Issued only as clinically required with patient education</i>
	Sulphonylureas or glinides, alone or in conjunction with other therapies		2-4 times per day, when starting/changing dose. Once stable, 2-4 times per week	<ul style="list-style-type: none"> Monitoring can help titrate treatment and reveal or refute hypoglycaemia Testing frequency can increase e.g. whilst fasting Follow legal requirements for testing e.g. DVLA 	1 box (50 strips) every 2 months or as per agreed management plan
	Insulin therapy with/without oral hypoglycaemic agents	Once daily insulin	1-4 times a day, once stable 2-3 times a week	<ul style="list-style-type: none"> Readings should be taken as per specialist advice Test more often when starting or changing treatment, when unwell or diabetes is unstable. Assess patient understanding and use of results to adjust lifestyle and treatment Follow legal requirements for testing e.g. DVLA 	Once – twice daily testing
Twice daily insulin		2-4 times a day, once stable 2-3 times a week	> Twice daily testing		3-4 boxes (150 strips) every month
More than twice daily insulin		At least 4 times a day			

Ketones: self-monitoring guidance for diabetes

- Ketone monitoring should be taught as part of 'sick-day rules' to facilitate self-management of an episode of hyperglycaemia.
- Advise patients with type 1 diabetes to check their ketones if they are feeling unwell or present with symptoms of hyperglycaemia (see NICE guidance)
 - Adults can measure ketones in either blood or urine. Current best practice is to measure blood ketones
 - Children, young people, and pregnant women should measure blood ketones (offer appropriate meter)
- It is important to remind patients not to use strips after their 'use-by' date
- Teaching patients to interpret **blood ketone** results as follows:

	< 0.6	Normal levels
	0.6 – 1.5	Slightly increased risk of Diabetic Ketoacidosis (DKA), extra insulin is needed. Follow advise from diabetes healthcare team, and test ketones again in 1-2 hours
	1.6 – 2.9	Increased risk of DKA - contact your diabetes team or GP as soon as possible
** WARNING: Blood ketones ≥ 3.0 (or urine ketone of 2+ or greater) should be treated as a medical emergency due to the very high risk of DKA - get medical help immediately **		

Ref: NHS Choices - Diabetic Ketoacidosis www.nhs.uk/conditions/diabetic-ketoacidosis

Supplying ketone test strips:

Diabetes Type	Treatment Group	Medication	Testing Frequency	Rationale	Prescriptions requirements (as advised by specialists)
Type 1 diabetes	Adults Children and young people Pregnancy	Insulin	During periods of illness or hyperglycaemia	<ul style="list-style-type: none"> • Ketone testing is required to facilitate self-management. • Adults can monitor blood or urine ketones. Children/young people and pregnant women should only measure blood ketones, using the appropriate meter. 	Minimum of 1 box of 10 strips, as needed (Note reduced shelf life once box opened)
Type 2 diabetes	People at high risk of <u>recurrent</u> diabetic ketoacidosis (DKA) as identified by the diabetes specialist service		During periods of illness or hyperglycaemia following specialist recommendations only	<ul style="list-style-type: none"> • Recurrent DKA may warrant home ketone monitoring. • Do not issue ketone strips solely for use by patients prescribed an SGLT-2 inhibitor, but if a patient on one of these agents presents unwell, their blood ketone levels should be checked even if blood glucose levels are in the normal range. 	Not required routinely