

Guideline for blood glucose & ketone monitoring for adults with diabetes

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Document control

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Document management

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Contents

Type 2 diabetes: Blood glucose meter recommendations.....	4
Type 1 diabetes: Blood glucose meter recommendations.....	5
Frequency of blood glucose testing (Type 1 and Type 2 diabetes).....	6
1. Target audience.....	7
2. Purpose.....	7
3. Self-monitoring of blood glucose	7
3.1. Who should be self-monitoring blood glucose levels?.....	8
3.2. Who should not need to self-monitor blood glucose levels?.....	8
3.3. DVLA guidance for driving and BG monitoring.....	8
3.4. Sick day testing	8
3.5. Process for initiating blood glucose monitoring.....	8
3.6. Process for reviewing blood glucose monitoring	9
3.7. Troubleshooting: things to consider for patients reporting erratic SMBG results.....	9
4. Self-monitoring of ketones.....	9
4.1. Type 1 diabetes: blood ketone monitoring	9
4.2. Type 2 diabetes: ketones monitoring.....	9
5. Sharps disposal	10
6. Associated documents.....	11
Appendix 1: Exceptions to NCL Blood glucose & ketone monitoring for adults with diabetes	12
Appendix 2: Diabetes and driving.....	13





Type 2 diabetes: Blood glucose meter recommendations

	myLife Pura X	Omnitest 3	GlucoRX Nexus	WaveSense Jazz	OneTouch Select Plus	Accu-Chek Mobile (regular testers only)
						
Compatible strips	Pura	Omnitest 3	GlucoRx Nexus	WaveSense JAZZ	OneTouch Select Plus	Mobile
Cost per 50 strips (£)	£9.50 per 2x25	£9.89 per 2x25	£9.98 per 1x50	£8.74 per 1x50	£9.99 per 1x50	£9.99 per 1x50
Compatible lancets	mylife lancets (30G)	Omnican lance soft (30G)	GlucoRx Lancets (30G)	Agamatrix Ultra-Thin (28G)	OneTouch Delica (30G)	Accu-Chek FastClix (30G)
Cost of lancets (£)	£5.50 per 200	£5.45 per 200	£5.50 per 200	£5.43 per 200	£5.85 per 200	£5.90 per 204
Kit contents	7 lancets 10 test strips	10 lancets 5 test strips	10 lancets 10 test strips	30 lancets 25 test strips	10 lancets 10 test strips	2 drums (12 lancets) 1 cassette (50 tests)
Replacement batteries	Available free of charge from the company or patients may choose to buy their own (CR2032)	Available free of charge from the company or patients may choose to buy their own (CR2032)	Available free of charge from the company or patients may choose to buy their own (AAA)	Available free of charge via GP surgery (surgeries to obtain via company rep; service may not be offered by all surgeries) or patients may buy their own (CR2032)	Patients to buy their own batteries (CR2032)	Available free of charge from the company or patients may choose to buy their own (AAA)
Company & contact	info@ypsomed.co.uk 0344 8567820	info.bbmun@bbbraun.co.uk 0800 8400498	info@glucorx.co.uk 01483 755133	customercare@agamatrix.co.uk 0800 0931812	customercare@lifescan.co.uk 0800 121200	mannheim.icc@roche.com 0800 701000

[†] All meters comply with DVLA requirements (no delete function) and comply with the latest ISO standards standard for accuracy ('15197:2013').

**Do not use Accu-Check Aviva range, Contour Next range or FreeStyle range for adults with type 2 diabetes (please note this list is not exhaustive).
These devices have very high test strip costs which cannot be justified.**

Type 1 diabetes: Blood glucose meter recommendations

	Not carbohydrate counting		Carbohydrate counting	
	Glucomen Areo 2K	Glucorx HCT & Ketone	Accu-Chek Aviva Expert	FreeStyle InsulinX
				
Compatible strips - glucose Cost per 50 strips (£)	Glucomen Areo Sensor £9.95 for 1x50	Glucorx HCT £9.95 for 1x50	Aviva £15.95 for 1x50	FreeStyle Lite £15.97 for 1x50
Compatible strips - ketone Cost per 50 strips (£)	GlucoMen areo Ketone Sensors £9.95 for 10	Glucorx HCT Ketone Test Strips £9.95 for 10	N/A	N/A
Compatible lancets Cost of lancets (£)	Glucoject Lancets PLUS (33G) £5.50 per 200	Glucorx Lancet (30G) £5.50 x 200	Accu-Chek FastClix (30G) £5.90 per 204	USE: Glucoject Lancets PLUS (33G), or Glucorx Lancet (30G), or any lancet ≤ £5.50 for 200 NOT: FreeStyle Lancets due to high cost
Kit contents	10 lancets 10 glucose + 2 ketone test strips	10 lancets 10 glucose + 1 ketone test strips	1 drum (6 lancets) 10 glucose test strips	10 lancets 10 glucose test strips
Replacement batteries	Available free of charge from the company or patients may choose to buy their own (CR2032)	Available free of charge from the company or patients may choose to buy their own (AAA)	Available free of charge from the company or patients may choose to buy their own (AAA)	Patients to buy their own batteries (CR2032)
Other info	Glucose & ketone meter	Glucose & ketone meter	Bolus advisor system	Bolus advisor system
Company & contact	myglucomen@menarinidiag.co.uk 0800 243667	info@glucorx.co.uk 01483 755133	mannheim.icc@roche.com 0800 701000	ADChelpuk@abbott.com 0800 1701177

[†] All meters comply with DVLA requirements (no delete function) and comply with the latest ISO standards standard for accuracy ('15197:2013').

Free-style Libre has not been assessed as being cost-effective therefore the associated sensors or strips should not be prescribed on the NHS.
Patients who decide to self-fund Free-style Libre should either self-fund the compatible strips or have access to one of the above meters.

Frequency of blood glucose testing (Type 1 and Type 2 diabetes)

	Type 1 diabetes	Type 2 diabetes			
		Diet and exercise, metformin, gliptins (DPP-4i), flozins (SGLT-2i), pioglitazone, liraglutide & dulaglutide (GLP-1RA) only	Sulfonylurea, meglitinides	Basal insulin	Other insulins regimens
Routine	Essential for ALL patients with type 1 diabetes. Most will need to monitor at least 4 times a day. Monitoring up to 10 times a day may be required in some circumstances, see 'Additional' below.	Patients do not need to monitor blood glucose levels on a daily basis. Ensure HbA1c is checked no more than once every 3 months.	Patients who experience hypoglycaemic episodes may need to test 2-3 times per week at different times of day. Also see DVLA advice for drivers	HbA1c to target: test 2 – 3 times a week at different times of the day HbA1c not to target: Fasting glucose should be tested once a day before breakfast to titrate basal insulin. Once fasting glucose is at target, test at different times each day to identify periods of hyper- and hypoglycaemia. Also see DVLA advice for drivers	Biphasic Test twice a day at various times to include pre and post prandial and pre bed time blood glucose. Basal-bolus As for Type 1 diabetes Also see DVLA advice for drivers
Strips	Prescribed on repeat prescription - quantities depend on testing frequency	Acute prescriptions only if/when consultation deems necessary (see 'Additional' information below) – not on repeat (request as necessary). If not clinically indicated, patients may choose to self-fund (patient choice).	Acute prescriptions only – not on repeat (request as necessary).	Prescribed on repeat prescription - quantities depend on testing frequency	Prescribed on repeat prescription - quantities depend on testing frequency
Additional	Adults should test between 4 and 10 times a day in these circumstances: <ul style="list-style-type: none"> HbA1c target is not achieved Impaired hypo awareness / frequent hypos Driving (see DVLA advice for drivers) During periods of illness Before, during and after sport Lifestyle changes / disruptions to routine Pre-conception 	Monitoring should be considered (additional if already being done) in these circumstances: <ul style="list-style-type: none"> Intercurrent illness When therapy is changed or intensified If steroids are co-prescribed (midday, before evening meal and 2 hours after) Patients with post-prandial hyperglycaemia Pre-conception Lifestyle changes / disruptions to routine On Percutaneous endoscopic gastrostomy (PEG) feed 			

1. Target audience

GPs, practice nurses and diabetes specialist nurses working in primary and secondary care.

2. Purpose

This guideline applies to adults with type 1 and type 2 diabetes. Guidance is provided for:

- Preferred self-monitoring of blood glucose (SMBG) meters with compatible test strips and lancets
- Which patients could benefit from access to SMBG
- How often patients should test
- Initiating and reviewing patients with SMBG
- Sharps disposal
- Which patients could benefit from access to ketone monitoring (blood or urine)

This guideline does NOT apply to the following patient groups:

- Paediatrics and adolescents
- Adults who are pregnant
- Insulin pump therapy

For patients who fall outside the scope of this guideline, please follow the treatment plan set out by the patient's specialist team. The treatment plan should specify any reasons for exceptionality (an example 'exceptionality letter' is provided in Appendix 1).

3. Self-monitoring of blood glucose

Self-monitoring of blood glucose (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.

Whilst HbA1c is the mainstay of monitoring the effectiveness of diabetes treatment, SMBG can provide additional valuable information for a variety of situations:

- Safety
 - To identify and confirm hypoglycaemia
 - To confirm safety to drive, and before commencing other activities such as climbing if using insulin or oral hyperglycaemic agents with a risk of hypoglycaemia
 - To inform management of intercurrent illness and stress in order to reduce risk of acute metabolic decompensation (diabetic ketoacidosis and hyperosmolar hyperglycaemic state) and avoid unplanned admission to hospital
- Special circumstances
 - Can inform medication management to facilitate appropriate adjustments diabetes medications when starting/stopping oral corticosteroids or antipsychotic medications.
 - Empowering lifestyle changes
 - Supporting decision making
 - Reducing complications

When considering suitability for blood glucose monitoring the following points should be considered:

- Visual acuity
- Manual dexterity
- Ability to use blood glucose meter
- Willingness of patient to perform tests

3.1. Who should be self-monitoring blood glucose levels?

SMBG is **essential** for patients with T1DM.

SMBG is **essential** for patients with T2DM who:

- Are prescribed insulin
- Are a Group 2 driver licence holder (large lorries [category C] or buses [category D]; see [DVLA guidance](#)) and are prescribed sulphonylureas or glinides

SMBG **may be considered** for non-insulin managed patients with T2DM who:

- Are a Group 1 driver licence holder (vans, cars and motorcycles) **or** operate machinery **and** prescribed sulphonylureas or glinides. For those who drive or operate machinery for a living, testing is strongly recommended.
- Are reporting symptomatic hypoglycaemic episodes

3.2. Who should not need to self-monitor blood glucose levels?

SMBG should not be required for patients with T2DM who:

- Control their diabetes by diet and exercise alone
- Control their diabetes using metformin alone or in combination with a gliptin (DPP-4i), flozin (SGLT-2i), GLP-1 receptor agonist or pioglitazone.

3.3. DVLA guidance for driving and BG monitoring

Appendix 2 provides the following tables:

- Table 1: To notify or not to notify the DVLA
- Table 2: Additional requirements for license issue by DVLA
- Table 3: Monitoring requirements for drivers
- Table 4: Motor insurance

See full [DVLA guidance](#) for further details.

3.4. Sick day testing

Patients should be provided with the TREND-UK [Diabetes: What to do when you are ill](#) leaflet.

3.5. Process for initiating blood glucose monitoring

- Offer a standardised meter suitable for the patient's needs ([T2DM](#), [T1DM without carbohydrate counting](#), [T1DM with carbohydrate counting](#)).
 - *Supply meter from practice/service stock (practice/service to order meters)*
- Demonstrate meter and finger pricking device, identifying procedure for patient to follow
- Demonstrate how to wash hands before use
- Give information on the safe disposal of sharps
- Issue blood glucose monitoring diary indicating agreed individual target range and frequency of testing (see [Frequency of testing](#))
- Agree the patient's blood glucose target and give verbal and written information regarding what to do with results
- Ensure patient has a contact number for access to HCP advice
- Arrange to review self-testing results at a suitable interval
- Clinicians are asked to convey to patients the importance of regularly Quality Checking the accuracy of their meters by using control solutions (control solution should be used in line with the manufacturers' recommendations; typically with each new pot of strips, in the event of an unusual reading or if the meter has been dropped, damaged or exposed to liquids).

- Encourage patients to register their meter with the company (to obtain free batteries and control solution, and to allow the company to contact the patient in the event of an alert/recall)

3.6. Process for reviewing blood glucose monitoring

Assess at least 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

3.7. Troubleshooting: things to consider for patients reporting erratic SMBG results

If results are outside what is expected then:

- 1) Ensure hands are always washed prior to testing
- 2) Check expiry date of strips
- 3) Carry out quality control test on the meter using the control solution
- 4) Ensure strips have been stored within the appropriate temperature range and appropriate place

Clinicians are asked to convey to patients the importance of regularly checking the accuracy of their meters by using quality control solutions.

4. Self-monitoring of ketones

4.1. Type 1 diabetes: blood ketone monitoring

Consider blood ketone monitoring as part of 'sick-day rules' for adults with type 1 diabetes, to facilitate self-management of an episode of hyperglycaemia.

Ketone testing is recommended for all patients with Type 1 diabetes. **Ketone test strip use must be carefully monitored as usage is not expected to exceed more than 10 strips per year, with the exception of insulin pump patients, children and patients with frequent DKA admissions** (outside the scope of this guideline). Use a meter that can measure both blood glucose and blood ketone meters, see table below:

Meter	Ketone test strip	Test strip price
GlucoMen Areo 2K	GlucoMen areo Ketone Sensors	£9.95 x10
Glucorx HCT & Ketone	Glucorx HCT Ketone	£9.95 x10

4.2. Type 2 diabetes: ketones monitoring

Testing of ketones is not routinely required for patients with Type 2 diabetes. Urine dipsticks may be considered to exclude DKA in patients taking SGLT-2i (empagliflozin, dapagliflozin or canagliflozin) or small groups of patients with Type 2 Diabetes that are ketone prone; see [table](#) for detailed advice.

Patient group	Ketone monitoring?	Counselling
Patients taking SGLT2i with concurrent OADs (no prior history of ketosis)	<p>Nil for most.</p> <p>If a patient is deemed able and reliable to perform urine tests <i>when unwell</i>, they can be <i>offered</i> urine test strips (if available in clinic).</p>	<p>Advise patients there is a risk they may produce ketones if unwell. Stop taking SGLT2i if any vomiting occurs and seek medical help if feeling any symptoms of DKA suggested in the 'Type 2 diabetes and Diabetic Ketoacidosis' leaflet on the TREND-UK website www.trend-uk.org</p> <p>Patients who have chosen to self-perform urine ketone testing when feeling unwell should seek medical help in the event of a positive reading. Testing ceases to become necessary when the patient feels well again (eating and drinking normally).</p>
Patients taking SGLT2i with concurrent insulin (no prior history of ketosis)	As for OADs	As for OADs
Patients taking SGLT2i with history of being ketosis-prone	Specialist initiation only. Offer blood ketone testing especially if insulin is being altered/weaned. ~5 strips per month.	Extensive counselling from specialist required for the patient to understand when to test blood ketones and how to respond to high levels.

5. Sharps disposal

Sharps disposal boxes are available on prescription.

- Sharpsguard 1 litre (landscape)
- Sharpsafe 1 litre (portrait)

The boxes should be disposed according to the patient's local council procedures.

CCG	Disposal instructions
Barnet	https://www.barnet.gov.uk/citizen-home/rubbish-waste-and-recycling/household-recycling-and-waste/clinical-waste.html
Camden	Contact Camden Council Clinical waste Collection on 0207 7974 444 http://camden.gov.uk/ccm/content/contacts/council-contacts/environment/contact-environment-service/
Enfield	Contact Enfield Customer Service on 020 8379 1000 or book a collection on the Enfield Council website: https://new.enfield.gov.uk/services/rubbish-and-recycling/special-collections/household-clinical-waste-collection/
Haringey	Patients must be referred by their GP to escs.support@haringey.gov.uk . Once registered the patient should call 020 8885 7700 or email escs.support@haringey.gov.uk to have the sharps bin collected.

CCG	Disposal instructions
Islington	Patients should ask their GP to register them with Islington Clinical Waste collection service. Call 020 7527 2000 for further information. https://www.islington.gov.uk/recycling-and-rubbish/clinical-waste

6. Associated documents

NCL [Antihyperglycaemic agents for Type 2 diabetes](#)

NCL [Guideline for Insulin in Type 2 diabetes](#)

TREND-UK: [Diabetes: What to do when you are ill](#) leaflet, www.trend-uk.org

TREND-UK: [Safe Driving and DVLA](#) leaflet, www.trend-uk.org

TREND-UK: [Type 2 diabetes and diabetic ketoacidosis](#) leaflet, www.trend-uk.org

Responsible Diabetes Prescribing Bulletin: [Diabetes and Driving](#), January 2018. NHS London Procurement Partnership

Diabetes UK: [Diabetes and Driving FAQ](#), January 2018

Appendix 1: Exceptions to NCL Blood glucose & ketone monitoring for adults with diabetes

Date:

Patient Demographics:

Blood glucose & Ketone monitoring for adults with diabetes

Dear GP,

We are aware of the NCL guidance regarding blood glucose and ketone testing for adults with diabetes.

We feel the patient above requires a testing arrangement outside of this guidance for the following reasons:

Please can you therefore prescribe:

Meter:

Strips:

Lancet Device:

Frequency of Testing:

This specific choice has been made because....

Enclosed is a copy of the most recent clinic assessment/letter relating to this patients care

If you require any further information regarding this request please do not hesitate to contact me.

Kind regards,

Appendix 2: Diabetes and driving

Table 1: To notify or not to notify the DVLA

Drivers have a legal responsibility to tell the DVLA about any conditions or treatments that may affect their ability to drive; clinicians should enable patients to do this by ensuring they are aware of what they do and do not need to report to the DVLA. Very occasionally, patients may choose to not do so, and continue to drive even if they are not fit to. Clinicians must then make a decision about whether to disclose relevant information without consent to the DVLA in the public interest. GMC has published guidance on this, which can be found on the [GMC website](#).

Recent changes to DVLA guidance

From 1st January 2018, statutory changes came into place for group 1 drivers, defining notifiable episodes of severe hypoglycaemia as those whilst awake, and reducing the suspension to 3 months (subject to medical enquiries with the DVLA). If more than one episode occurs within the preceding 12 months, the driver needs to notify the DVLA so that they can undertake medical enquiries into their fitness to drive.

	Group 1 – Cars and motorbikes	Group 2 – Taxis/private hire, Buses, coaches, lorries
Diabetes managed by diet	No – do not need to notify the DVLA*	No – do not need to notify the DVLA*
Diabetes managed by non-insulin injections and oral tablets	<p>No – do not need to notify the DVLA (regarding diabetes) unless:</p> <ul style="list-style-type: none"> • Had more than 1 episode of severe hypoglycaemia while awake in preceding 12 months • Medical team feel at high risk of developing hypoglycaemia • Develop impaired awareness of hypoglycaemia (defined as “inability to detect the onset of hypoglycaemia because of total absence of warning symptoms”) • Suffer severe hypoglycaemia while driving • Problems with vision in both eyes, or in remaining eye if sight in one eye only • Need laser treatment in both eyes, or in remaining eye if patient has sight in one eye only • Develop any problems with circulation or sensation in the legs or feet which mean need a certain type of vehicle to drive(e.g. automatic, vehicles with a hand operated accelerator or brake) • If monitoring has been deemed as appropriate, this is carried out as per agreement between driver and their specialist team <p>NB Individual should be under regular medical review</p>	Yes – notify the DVLA
Diabetes managed by insulin	Yes – notify the DVLA	Yes – notify the DVLA

* If relevant disqualifying conditions develop or insulin treatment is required then MUST NOT drive and need to notify the DVLA

Table 2: Additional requirements for license issue by DVLA

The following groups of drivers need to meet certain criteria to be issued a license by the DVLA:

- Group 1 drivers on insulin
- Group 2 drivers on insulin, non-insulin injections and/or oral tablets

Please note that licenses may be refused or revoked if disqualifying complications of diabetes develop, such as diabetic retinopathy or other visual field defects. Short term licenses may be issued in some cases.

	Group 1 – Cars and motorbikes	Group 2 – Taxis/private hire, Buses, coaches, lorries
Diabetes managed by non-insulin injections and oral tablets	N/A	License issued for indeterminate period of time if individual under regular medical review and does not have any of the following: <ul style="list-style-type: none"> • More than 1 episode of severe hypoglycaemia in last 12 months • Medical team feel at high risk of developing hypoglycaemia • Development of impaired awareness of hypoglycaemia (defined as “inability to detect the onset of hypoglycaemia because of total absence of warning symptoms”) • Severe hypoglycaemia while driving • Problems with vision in both eyes, or in remaining eye if sight in one eye only - Need for laser treatment in both eyes, or in remaining eye if patient has sight in one eye only • Development of any problems with circulation or sensation in the legs or feet which mean need a certain type of vehicle to drive (e.g. automatic, vehicles with a hand operated accelerator or brake)
Diabetes managed by oral tablets, including sulphonylureas and glinides	N/A	License may be issued for 1, 2 or 3 years if: <ul style="list-style-type: none"> • No episode of severe hypoglycaemia in the last 12 months • Full awareness of hypoglycaemia • Regular self-monitoring of blood glucose (see below) • Demonstrates an understanding of the risks of hypoglycaemia • No disqualifying complications of diabetes
Diabetes managed by insulin	License may be issued for 1, 2 or 3 years if: <ul style="list-style-type: none"> • Adequate awareness of hypoglycaemia • No more than 1 episode of severe hypoglycaemia while awake in the preceding 12 months OR the most recent episode occurred more than 3 months ago • Practices appropriate blood glucose monitoring as defined below • Not regarded as a likely risk to the public when driving • Meets the visual standards for acuity <p>Group 1 drivers must notify the DVLA on starting insulin and are advised to follow their clinician’s advice regarding their fitness to drive.</p>	License may be issued for 1 year (with annual review as detailed in full document) if: <ul style="list-style-type: none"> • Full awareness of hypoglycaemia • No episode of severe hypoglycaemia in the preceding 12 months • Practices blood glucose monitoring as defined below • Uses a glucose meter with sufficient memory to store 3 months of necessary readings • Demonstrates an understanding of the risks of hypoglycaemia • No disqualifying complications of diabetes <p>The license application process for insulin-treated group 2 drivers cannot start until an applicant’s condition has been stable for at least 1 month.</p>

Applicants will be asked to sign an undertaking to comply with the directions of the healthcare professionals treating their diabetes and to report any significant change in their condition to the DVLA immediately. Group 2 drivers require an additional assessment as detailed in the main DVLA document.

Table 3: Monitoring requirements for drivers

	Group 1 – Cars and motorbikes	Group 2 – Taxis/private hire, Buses, coaches, lorries
Diabetes managed by diet	No documented requirement	No documented requirement
Diabetes managed by non-insulin injections and oral tablets	No documented requirement – decision made based on individual risk of hypoglycaemia	No documented requirement – decision made based on individual risk of hypoglycaemia
Diabetes managed by oral tablets carrying a hypoglycaemia risk	May offer self-monitoring of blood glucose at times relevant to driving to enable detection of hypoglycaemia, if deemed necessary	Monitor blood glucose: <ul style="list-style-type: none"> • at least twice daily (including on days not driving) AND • no more than 2 hours before start of first journey AND • every 2 hours while driving
Diabetes managed by insulin	Monitor blood glucose: <ul style="list-style-type: none"> • no more than 2 hours before start of first journey AND • every 2 hours while driving 	Monitor blood glucose: <ul style="list-style-type: none"> • at least twice daily (including on days not driving) AND • no more than 2 hours before start of first journey AND • every 2 hours while driving <p>Meter(s) should have sufficient memory to store 3 months of readings</p>

Drivers on insulin should always carry their glucose meter and testing strips with them. The first test must be undertaken no more than two hours before the start of a journey and further tests should then be carried out every two hours following this, for however long the individual is driving. More frequent self-monitoring than this may be indicated with any greater risk of hypoglycaemia, e.g. increased physical activity, altered meal routine.

Table 4: Motor insurance

All drivers should notify their motor insurance provider if they have diabetes.

- The driver should promptly inform their insurance provider of:
- Any changes to the driver's condition
- Any changes to the driver's treatment
- Any new notifications that are made to DVLA
- Any changes in the terms of the driver's license

In conjunction with this, the insurance is only fully valid if the DVLA are also notified of any relevant changes.