Lincolnshire Community Health Services NHS Trust

BLOOD GLUCOSE AND BLOOD KETONE MONITORING POLICY

Reference No:	P_CS_58
Version	1
Ratified by:	LCHS Trust Board
Date ratified:	14 July 2020
Name of originator / author:	LCHS Diabetes Specialist nurse team
Name of responsible committee / Individual	Effective Practice Assurance Group
Date issued:	June 2020
Review date:	June 2022
Target audience:	Clinical Staff
Distributed via	Website

Chair: Elaine Baylis QPM
Chief Executive: Maz Fosh

Blood Glucose and Blood Ketone Monitoring Policy

Version Control Sheet

Version	Section / Para / Appendix	Version / Description of Amendments	Date	Author / Amended by
1	New Policy to replace P_CS_48	To separate into 3 separate Policies replacing the previous policy. To also incorporate the Nursing Associate role.	16.04.2020	Estelle Walden
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Blood Glucose and Blood Ketone Monitoring Policy

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Blood Glucose and Blood Ketone Monitoring Policy

Procedural Document Statement

Background
The purpose of this guidance is to implement a co-ordinated and uniform approach to the clinical management of blood glucose and blood ketone monitoring.

Statement
Lincolnshire Community Health Service will develop policies to fulfil all statutory and organisational requirements. These will be comprehensive, formally approved and ratified, disseminated through approved channels and implemented.

Responsibilities
Compliance with the policy will be the responsibility of all Lincolnshire Community Health Service staff involved in delivering direct patient care or responsible for supporting those to deliver patient care.

Training
Practitioners undertaking blood glucose and blood ketone monitoring should have completed the appropriate training and competencies as identified in this document.

Dissemination
Websites
Training
Team Brief / Newsletter

Resource Implication
Provision of training rooms
Availability of Diabetes specialist nurses to provide training
Availability of staff from clinical areas to attend training
Blood glucose meters and testing strips for demonstration.

Consultation

Blood Glucose and Blood Ketone Monitoring Policy

1. Scope and Purpose

1.1 Objectives

The objective of this guideline is to ensure practitioners, working in the community in Lincolnshire, undertake blood glucose and blood ketone monitoring safely in accordance with Trust Policy.

In order to:

- Standardize procedures
- Improve quality assurance and Quality Control
- Set out training mechanisms
- Minimize unnecessary testing and costs
- Minimize risks to staff and patients and improve quality of care

1.2 Patients Covered

Adult patients, 18 and above, with diabetes who require blood glucose and blood ketone monitoring.

1.3 Target Users

Registered health care professionals, Associate nursing staff, Senior Health Care Support workers and Health Care Support Workers who undertake blood glucose and blood ketone monitoring within Lincolnshire Community Health Services.

1.4 Implementation of Guideline

Guideline and procedure document to be followed by all staff undertaking Blood glucose and blood ketone monitoring.

2. Indications for blood glucose and ketone monitoring

2.1 Blood glucose monitoring

Blood glucose monitoring allows patients with diabetes and health care professionals to evaluate response to therapy and assess whether glycaemic targets are being safely achieved. Integrating blood glucose monitoring into diabetes management can be useful for guiding dietary choices, response to physical activity, preventing hypoglycaemia and adjusting medication.

2.2 Patients with type 1 diabetes

Routine self-monitoring of blood glucose is advised for all adults with type 1 diabetes with the recommendation to test at least 4 times per day including before each meal and bed time (NICE 2015).

2.3 Patients with type 2 diabetes

For adults with type 2 diabetes self-monitoring of blood glucose is recommended for those that:

- Are on insulin
- Take oral medication that may cause hypoglycaemia
- Are pregnant or planning pregnancy
- Experience hypoglycaemia
- For short term use whilst taking steroid medication
- To confirm suspected hypoglycaemia

NICE (2015b)

2.4 Frequency of blood glucose monitoring

Patients with both type 1 and type 2 diabetes must have blood glucose monitored prior to administration of insulin by Healthcare professionals employed by LCHS.

Patients with Type 1 diabetes:

Adults with type 1 diabetes should be supported to test blood glucose at least 4 times per day and up to 10 times per day if any of the following apply:

- the desired target for blood glucose control, measured by HbA1c level is not achieved
- the frequency of hypoglycaemic episodes increases
- there is a legal requirement to do so (such as before driving, in line with the Driver and Vehicle Licensing Agency [DVLA] At a glance guide to the current medical standards of fitness to drive)
- during periods of illness
- before, during and after sport
- when planning pregnancy, during pregnancy and while breastfeeding (see the NICE Guideline on diabetes in pregnancy)
- If there is a need to know blood glucose levels more than 4 times a day for other reasons (for example, impaired awareness of hypoglycaemia, high-risk activities). NICE (2015).

Patients with type 2 diabetes:

During periods of illness those who have access to blood glucose meters and those using insulin should monitor blood glucose levels at least 4 times per day including before each meal and bed time.

A blood glucose monitoring regimen for patients with type 2 diabetes using oral therapy which increases the risk of hypoglycaemia or insulin may include testing:

- 1-2 times per day, varying times of testing
- 4 times per day (pre meal and bed time)
- In relation to driving in line with the Driver and Vehicle Licensing Agency (DVLA])At a glance guide to the current medical standards of fitness to drive.

2.5 Blood Ketone testing

Patients with Type 1 diabetes:

Should test for ketones while unwell and blood glucose is above 11.0mmol/L

Patients with type 1 diabetes who are unwell and have ketone levels of 1.5mmol/L or greater should test blood glucose and ketones every 2 hours including during the night until illness resolves.

Patients with type 2 diabetes:
Patients with type 2 diabetes are not routinely prescribed ketone testing equipment as the risk of developing Diabetic ketoacidosis (DKA) in lower in this type of diabetes. However:
Healthcare professionals should test for ketones in anyone with Type 1 or Type 2 diabetes who is acutely unwell, especially if vomiting.
See Appendix 1. for ketone testing algorithm

2.6 Blood glucose targets
Glycaemic targets should be individualised, factors such as life expectancy, disease duration, important co-morbidities, risks potentially associated with hypoglycaemia, resources and support systems should be taken into account when setting treatment targets.
Patients with Type 1 diabetes:
Advise patients to aim for:

- a fasting plasma glucose level of 5–7 mmol/L on waking
- a plasma glucose level of 4–7 mmol/L before meals at other times of the day
- a plasma glucose level of 5-9mmol/L after meals.
-

Patients with Type 2 diabetes:

Advise patients to aim for:

- a fasting plasma glucose level of 5.5–7 mmol/L
- a pre bed time plasma glucose level of 6-8mmol/L

Blood glucose targets in special circumstances:

In hospital setting:

- Critically ill patients should have glucose levels maintained between 7.8-10mmol/L
- Non- critically ill patients should have glucose levels maintained between 6.0-10mmol/L

Patients using steroid therapy:

- Aim for glucose levels of 6-15mmol/L

Patients entering last days of life:

- Aim for glucose levels 6-15mmol/L
- Keep testing to a minimum, check blood glucose either fasting or at teatime. It is difficult to identify symptoms of hypoglycaemia of hyperglycaemia in a dying patient. If symptoms are observed it could be due to abnormal glucose levels.

Frailty:

- Aim for acceptable glucose levels 6-12mmol/L (less stringent targets required to avoid hypoglycaemia)

2.7 Blood ketone levels

- Less than 0.6mmol/L is normal
- 0.6 to 1.5mmol/L indicates individual is at risk of DKA (test again after 2 hours)
- 1.6 to 2.9mmol/L indicates individual is at risk of DKA (contact Diabetes service/GP/111)
- 3mmol/L or higher indicates individual is at very high risk of DKA call 999
- If individual is only able to perform a urine ketone test a result of 2+ indicates individual is likely to develop DKA

3. Materials for blood glucose and blood ketone testing

3.1 Materials for blood glucose monitoring within LCHS premises Community hospitals –wards and outpatient departments, treatment centres, GP centres and community nurse team meters.

Equipment / Product Required	LCHS Approved Product	Where to obtain supply
Blood Glucose and Ketone Test Meters for Professional Use	Freestyle Optium Neo H Meter (Inpatient/community nurse use) Freestyle Optium H blood glucose strips	Further supplies can be obtained from the Abbott Diabetes Care Representative. All Optium H meters must be placed on the medical device Register and registered at Goole Pathlinks for the external quality assurance samples.
Blood Glucose Test Strips for Professional Use	Freestyle Optium Neo H (for use with the freestyle optium Neo H only) **NB Blue Foil Packaging**	Abbott Diabetes Care RDC

Ketone Testing Strips	Freestyle Optium Beta ketone (compatible with either freestyle optium H or freestyle optium Neo H or Libre meter) **NB. Purple Foil packaging** In Hospital areas these must be kept in a clearly labelled workstation that is separate to that of the blood glucose testing equipment.	Pharmacy/GP dispensary In hospital - supplies via pharmacy. Community Patients e.g. unstable Type 1 diabetes, obtain on prescription.
Batteries		RDC
Lancet Device	Single Use Lancet e.g Unistik 3	RDC
Quality Control Solution Internal	Supplied by Abbott Diabetes Care	Abbott Diabetes Care representative Abbott diabetes care website Some supplies kept locally eg Louth Hospital Urgent Care.
External Quality Control Solution (Horse blood sample)	Circulated monthly by PathLinks at Scunthorpe	PathLinks Scunthorpe.
NB: It is essential that blood ketone strips are not mistaken for blood ketone strips. Serious errors in treatment decisions could occur. Be aware of contra-indications with some strips and meters if not using LCHS recommended meter and strips. Some systems are not suitable in renal failure, etc. –refer to manufacturers instruction manual.		

3.2 Quality Control for Blood Glucose Meters within LCHS premises

Type of QC	Frequency and Recording of Results	Supplier of Solution	Troubleshooting / Issues
Internal	Daily – when in use Weekly – in low use areas If the meter is not used frequently then it should be QC.d prior to use. *Check test strips expiry date QC solutions should be checked for expiry date and changed every 3 months All tests to be recorded in QC Log Book QC Log books must be kept locally for 7 years and should not be archived Follow manufacturers guidance when using patient's own meters and QC solutions	Abbot Diabetes Care Contact Details to be kept in meter workstation box Local supplies of IQC solution may be held locally in community hospitals	If a problem is identified, the meter must not be used for patient testing until the issue has been identified and resolved. Problems may relate to either test strips or meter. CONTACT ABBOTT DIABETES CARE FOR ADVICE 0800 170 1177
External	4 Weekly Horse blood sample sent to each meter holder (with written instructions on how to use and how to log results onto the Path Links website SAME DAY TESTING IS HIGHLY RECOMMENDED TO AVOID NEED FOR REFRIGERATION (Responsibility of nurse in charge on the day to ensure this is completed) If this cannot be avoided then the sample must be stored in a specimen fridge and used within 5 days	Path Links Scunthorpe Hospital Contacts: Nlg-tr.PointofCare@nhs.net 01724 282282 ext. 2513. Goole Path Lab 01405 720720 ext. 4024.	**Poor performance:** If two returns fall outside the analytical limits, meter user will be contacted to discuss this. If, on the next return, there is no improvement the meter should be replaced. **Failure to return EQA:** If there is failure to return EQA on two occasions the meter user will be contacted to discuss and the meter may be removed until further training has been given.

EQA Instructions	EQA provides confidence in the accuracy of the test results and their application to patient management via monthly analysis of samples circulated by Path Links at Scunthorpe Hospital. These samples contain a known glucose concentration which is varied from month-to-month. Each meter user returns results to the laboratory by submitting data to http://nww.nlg.nhs.uk. Once logged onto homepage, select the point of care icon in quick links on the right side of the screen. Select the link to the glucose meter EQA scheme from the Point of Care tool bar (top screen) and enter your meter ID number in the field provided. The page displayed now is for your specific meter and location. Check the details are correct before filling in the blank fields. All entry fields must be completed before you submit the result. Upon submission the page will display a successfully submitted graphic. A performance report is produced for each meter.

3.3 Cleaning Instructions for Blood Glucose Meter and Workstation

Cleaning schedule Clinimed wipes should be used for cleaning equipment Blood glucose meter – clean after each use Workstation outside – clean after every use Workstation inside- clean weekly If blood is spilt in the inside of the station or it is contaminated in any way clean immediately As the weekly cleaning programme is completed the details must be documented in the meter's log book to demonstrate an audit trail
Audit Diabetes Resource files to be maintained by Link nurse to include records of training and QC exercises and weekly cleaning. Annual audits will be undertaken by the Community Diabetes Teams to monitor meter usage and QC records.
FURTHER INFORMATION AVAILABLE FROM THE MANUFACTURER'S OPERATORS GUIDE, AVAILABLE IN EACH WARD / DEPT / COMMUNITY TEAM.

3.4 Materials for blood glucose and ketone monitoring within patients own home

Housebound Patients with both type 1 and type 2 diabetes who receive support from LCHS community nurse teams to administer insulin will have access to various blood glucose meters dependent upon their GP practice preferred blood glucose meter.

Blood glucose monitoring requires the use of appropriate equipment. Blood glucose/ blood ketone test strips greatly range in price, promoting the use of cost effective strips as first line will enable savings to be made without affecting patient care.

OPTUM in association with Lincolnshire Clinical Commissioning Groups, Lincolnshire Community Health Services, United Lincolnshire Hospitals Trust and Lincolnshire Partnership Foundation Trust have compiled a list of blood glucose meters and testing strips which should be used as first and second line by patients with both type 1 and type 2

diabetes. All meters on the list comply with required ISO 15197:2015 accuracy standards Medicines management & Optimisation service optum commissioning support unit (2019)

PACEF recommended blood glucose and ketone meters for patient use.

First Line-meets the needs of majority of patients with type 2 diabetes:

First choice meter	Company	Test Strips	Customer Care number
Finetest Lite	Neon Diagnostics	Finetest Lite	0800 131 3378

Second Line- for patients with type 2 diabetes who have difficulties using first line meter:

Second choice meter	Company	Test Strips	Customer Care Number
TEE 2	Spirit Healthcare	TEE 2	0116 2865000
Wavesense Jazz	Agamatrix	Wavesense Jazz	0800 093 1812
Glucomen Aero	Menarini	GlucoMen Aero	0800243667
Contour	Ascensia Diabetes Care	Contour	03456006030
GlucoRx Nexus/mini Nexus	GlucoRX	GlucoRx Nexus	01483755133
Accu-Chek Performa	Roche	Performa	08000407221
Accu-Chek mobile	Roche	Accu-Chek Mobile cassette	08000407221

Preferred Meters for specific patient groups:

Patient Group	Meter	Company	Test Strips	Customer Care number
Visually impaired where sound is required	GlucoRx Nexus Voice	GlucoRX	GlucoRx Nexus	01483755133
Impaired manual dexterity	1. MyLife Pura 2. Accu-Chek Mobile	Ypsomed Roche	MyLife Pura Accu-chek Mobile Cassette	03448567820 08000407221
Ketone testing	1. Glucomen Aero 2K 2. Freestyle Optium	Menarini Abbott	Glucomen aero ketone Freestyle Optium b ketone	0800243667 08001701177
Carbohydrate counting required	1. Contour Next One 2. Accu-Chek Aiva Expert	Ascensia Roche	Contour Next Aviva	03456006030 08000407221

Type 1 patients	Freestyle Libre	Abbott	Libre Sensor	08001701177

Equipment for use in patients home.

Equipment/product required	**Where to obtain supply**
Blood glucose meter	Patients GP practice
Blood glucose testing strips compatible with blood glucose meter	Patient prescription from GP practice
Single use lancets (unistik)	Patient prescription from GP practice
Sharps disposal unit	Patient prescription from GP practice
Quality control solution	Customer service centre of meter manufacturer
Blood ketone meter	Local Diabetes specialist nurse team

3.5 Quality control testing of patients own meters

Community nursing staff within LCHS who use patients own blood glucose meters for blood glucose monitoring should perform a quality control test on a weekly basis. If staff do not feel that the patients' blood glucose meter is functioning correctly or the blood glucose result does not match how the patient is feeling a quality control test should be performed to confirm the accuracy of the blood glucose meter.

If a quality control result is not within expected range:

- Check expiry date of solution and when opened.
- Check expiry date of test strips.
- Check the meter matches the code for the test strip if applicable.

Repeat the test and if still out of range do not continue to use the blood glucose meter and obtain a new blood glucose meter from the patients GP practice.

Quality control solutions can be obtained by contacting the manufacturer's customer care line.

Quality control solution should be stored as per manufacturer's instructions. Follow manufacturer's instructions regarding when the solution should be discarded from date of opening.

Patients own blood glucose meters are not required to have external quality assurance tests performed.

Results of the quality control test should be documented in the patient's record.

4. Cautions/Contraindications to blood glucose monitoring

Blood glucose monitoring must not be used to:

- Diagnose diabetes mellitus
- Treat any blood readings not related to the clinical picture.

In certain circumstances capillary blood glucose monitoring may be unreliable therefore laboratory analysis of venous blood should be performed to support blood glucose monitoring.

Common situations this is likely include:

- Peripheral Circulatory Failure
- Severe Dehydration
- Diabetic Ketoacidosis
- Hyperosmolar hyperglycaemic state
- Sustained uncontrolled diabetes
- Severe hypotension
- Shock
- Extremes of Haematocrit including COPD, Anaemias, Leukaemias, Polycythaemia, Severe Gastro-Intestinal or post-operative bleeds
- High bilirubin values
- Diarrhoea and vomiting
- Prescribed treatment such as intravenous infusion of high dose ascorbic acid or during xylose absorption testing

Read manufactures guidelines regarding cautions and contraindications.

5. Procedure for performing blood glucose monitoring

All users of extra-laboratory blood glucose meters must be aware of:-

- The Manufacturer's instructions for use of equipment and blood glucose and ketone testing. The manufacturer's instruction manual is provided with each meter. All Registered and non-registered practitioners undertaking blood glucose monitoring must familiarise themselves with its contents and follow the instructions for use and testing at all times.
- Quality Control, Cleaning and Audit Procedures must be adhered to, including when using patient's own meter.
- Cautions and Contra-indications of blood glucose and blood ketone testing must be considered and documented.
- Optimum temperature and humidity for performing blood glucose monitoring (refer to manufacturer's instructions).
- Correct storage conditions for blood glucose meter and testing strips.

Action	Rationale
Workstation/patients own blood glucose meter and testing strips, single use lancets, sharps disposal unit and non-sterile gloves are required for the procedure.	To prevent cross infection and sharps injury. To comply with infection control policy

Explain procedure to the patient and ask for document informed consent.	To obtain consent and comply with NMC code (2018)
Ensure the meter has quality control performed as per policy	To ensure accuracy of results.
Ask the patient to wash their hands with soap and warm water, or staff to wash patient's hands if they are unable to do so independently. Dry hands with clean towel. (use of alcohol gel and wet wipes is not recommended)	To ensure that glucose residue from food and drink is removed from hands. To ensure accurate results.
Staff to decontaminate their hands and apply non-sterile gloves	To prevent cross infection
Check the expiry date of the test strips	To ensure strips are in date
Remove strip from foil or container and insert into the meter The meter will prompt to apply blood (For Accu-chek Mobile meters open the tip cover)	To start the meter
Where the meter requires coding, ensure that the code number on the test strip packaging matches the code number on the meter display. **(Freestyle Optium H meters have a calibration bar which must be inserted into the meter prior to using a new batch of testing strips)**	To ensure the meter is correctly calibrated
Use single use lancet to obtain well-formed blood sample	To prevent cross infection and needle stick injury
Use sides of fingers (avoid thumb and index finger and finger pad). Gently milk the finger if necessary to help with blood circulation to the finger tip Avoid using on skin or fingernail with infection present	To reduce discomfort.
Discard single use lancet into sharps container	To prevent needle stick injury
Take the meter with the strip in it and ensure the meter is above the drop of blood. Touch the strip tip into the drop of blood.	Blood will be drawn up by capillary action
Beep tone will sound indicating the test in progress. Wait until meter displays blood glucose/ketone reading	
Wipe away blood from patients finger with tissue	To avoid bleeding and contamination
Remove and safely dispose of the test strip from the meter, remove gloves and wash hands (Accu-chek Mobile meter, close tip cover)	To prevent cross infection
Document result in patients notes.	Maintain clear and accurate records in accordance with NMC (2018)
If glucose result is outside individualized target range for patient take appropriate action, or ask for help from a suitably qualified practitioner to carry out any action	To ensure safety of patient and comply with NMC Code 2018

which is beyond the limits of a person's competence	

6. Training Requirements

Blood Glucose and Ketone Testing Training Requirements

The initial training programme was co-ordinated by the Community Diabetes Service and Abbott Diabetes Care throughout the county and is now delivered by Community Diabetes Service and Diabetes Link Nurses who have received additional training.
Only healthcare professionals / care workers who have undertaken an LCHS recognised training programme and have achieved criteria of competence may undertake blood glucose and blood ketone monitoring, and demonstration of competence should be updated annually.

Health care support workers and senior health care support workers:

- Must attend LCHS basic diabetes awareness and blood glucose monitoring training
- Competency to be reassessed on yearly basis

Associate nurses:
Must complete blood glucose training on commencement of employment with LCHS
Competency to be reassessed on yearly basis

Registered nurses:
Must complete blood glucose training on commencement of employment with LCHS
Competency to be reassessed on yearly basis

The update programme will either be delivered by the Community Diabetes Nurse specialists or delegated to the Diabetes Link Nurse for that work area/ team. A link nurse should be nominated for each team, who will have protected time in which to attend Diabetes Update sessions and to update training for their own teams.

To ensure compliance with medical device policy, records of the following information must be maintained:

- Names of staff who have attended the training (Electronic Staff Record)
- Serial Numbers of meters issued; so that evidence can be provided regarding the management of medical devices (LCHS Asset Register and Scunthorpe Pathlinks).

7. Recognising and Managing Hypoglycaemia

Hypoglycaemia is a blood glucose level less than 4.0mmol/L. Hypoglycaemia may occur when people with diabetes are treated with medication such as sulphonylureas, prandial glucose regulators (repaglinide) or insulin.

Any blood glucose level less than 4mmol/L in a patient treated with insulin/sulphonylurea or prandial glucose regulators should always be treated for hypoglycaemia.

If patients using Libre Flash glucose monitoring experience episodes of hypoglycaemia always confirm reading with blood glucose test before initiating treatment.

7.1 Signs and symptoms of hypoglycaemia

Adrenergic (Early)	Neuroglycopenic (Late)
Sweating Palpitations Shaking Hunger Anxiety Paraesthesia General Malaise: Headache and nausea	Confusion Drowsiness Unusual behaviour Speech difficulties Lack of co-ordination Coma

7.2 Risk factors for hypoglycaemia

Medical issues:

- Strict glycaemic control
- Previous history of severe hypoglycaemia
- Long duration of Type 1 diabetes
- Duration of insulin therapy in Type 2 diabetes
- Lipohypertrophy at injection sites
- Inappropriate insulin injection needle size
- Severe liver impairment
- Impaired renal function (including those requiring renal replacement therapy
- Sepsis
- Inadequate treatment of previous hypoglycaemia
- Terminal illness
- Cognitive dysfunction/dementia
- Steroid reduction in people taking insulin or sulphonylureas
- Inappropriate use of Stat or PRN rapid or short acting insulin
- Inappropriate timed insulin or oral glycaemic therapy relation to meal or enteral feed
- Incorrect type of insulin or oral hypoglycaemic therapy prescribed and administered
- Enteral feeding tube is blocked or positioned incorrectly
- Enteral feed is stopped
- Carbohydrate content of enteral feed is reduced but the insulin dose or type is not adjusted
- Recovery from acute illness or stress

Insulin prescription errors:

- Misreading poorly written prescriptions- when “u” is used for units
- Confusing the insulin name with the dose (eg Humalog mix 25 becoming Humalog 25 units)
- Confusing insulin strength with the dose (eg 100 unit dose prescribed)
- Transcription errors
- Inappropriately withdrawing insulin using a standard insulin syringe from a prefilled insulin pen containing higher concentration insulins

Lifestyle issues:

- Increased physical activity
- Irregular lifestyle
- Alcohol
- Increasing age

- Early pregnancy
- Breastfeeding
- No or inadequate blood glucose monitoring

Reduced carbohydrate intake/absorption:

- Food malabsorption e.g. gastroenteritis, pancreatic disease
- Bariatric surgery involving bowel resection
- Fasting e.g. during Ramadan

7.3 Patients for whom hypoglycaemia has potentially severe consequences

Older adults:

Older adults with diabetes and a history of hypoglycaemia have a high risk of falls and falls-related fractures.

HbA1C targets are more relaxed in the older and frail person with diabetes, and acceptable range is 59-69mmmmol.

Driving:

Those with diabetes who use insulin or take medication that increases the risk of hypoglycaemia such as sulphonylureas and prandial glucose regulators and drive must:

- Have adequate awareness of hypoglycaemia signs
- Practice appropriate blood glucose monitoring
- Not have had more than one episode of severe hypoglycaemia while awake in the preceding 12 months, or the most recent episode occurred more than 3 months ago

Further guidance regarding drivers who take glucose lowering therapy can be found at the DVLA: www.gov.uk/diabetes-driving

7.4 Treatment of hypoglycaemia

For patients who are conscious and able to swallow 15 to 20g of quick acting carbohydrate are required to treat hypoglycaemia such as:

- 60mls of Glucojuice
- 200ml (small carton) of smooth orange juice
- 5 or 6 dextrose tablets
- 4-5 large jelly babies

See Appendix 2 for hypoglycaemia algorithm

7.5 Following an episode of hypoglycaemia

Do not omit insulin injection if due following a hypoglycaemic episode. A hypoglycaemic episode close to insulin injection time should always be treated and once the blood glucose level is above 4mmol/L the usual insulin dose and food should be taken.

Always review medication following an episode of hypoglycaemia, if hypoglycaemia occurs more than once within the same time frame with an unknown cause consider

reducing insulin and /or sulphonylurea doses (Contact the Diabetes specialist nurses or patients GP for review of medication).

If the episode of hypoglycaemia was due to sulfonylurea or long acting insulin therapy the risk of hypoglycaemia may persist for up to 24-36 hours following the last dose, especially if there is concurrent renal impairment.

Document hypoglycaemic event in the patients notes. Ensure regular blood glucose monitoring is continued for at least 24-48 hours.

7.6 Prevention of hypoglycaemia

- Be aware of situations that increase risk of hypoglycaemia (missed meal, poor timing of insulin in relation to meals, increased physical activity)
- Encourage regular meals, which should include a small portion of starchy carbohydrate
- Ensure patients and staff know the early warning symptoms of hypoglycaemia and how to treat it promptly.
- Ensure that treatment for hypoglycaemia is readily available and within reach
- Check injection sites for signs of lipohypertrophy
- Ensure that the correct type and dose of insulin is given
- Be aware that environmental changes such as hot weather or hot bath/shower can lead to hypoglycaemia
- Look for low HbA1C in older people, the frail and those in end of life care treated with insulin or sulphonylureas, avoid sulphonylureas in these individuals
- Avoid treating isolated episodes of hyperglycaemia with “stat” doses of rapid acting insulin.

8.0 Recognising and managing hyperglycaemia

8.1 Symptoms of hyperglycaemia:

- Increased thirst
- Dry mouth
- Passing more urine than usual
- Tiredness or lethargy
- High glucose levels in blood or urine

8.2: Causes of hyperglycaemia

- Diet- excess carbohydrate/ intake of sugary foods and drinks
- Stress
- Medication- Steroids

Illnesses causing hyperglycaemia:

- The common cold
- Influenza
- Stomach upset
- Urinary tract infection
- Chest infection
- Abscesses
- Injury, such as broken bones
- Wound infections

Intercurrent illness in people with diabetes should be taken seriously because it may cause hyperglycaemia and lead to dehydration and DKA or HHS.

If blood glucose is consistently above 15mmol/L contact the Diabetes nurse specialist or GP/ out of hours service for advice.

9.0 Diabetic ketoacidosis

Diabetic ketoacidosis (DKA) is a condition which requires urgent hospital treatment. It occurs when there is insufficient insulin available to allow glucose to enter the cells to be used for energy. The body begins to break down fat stores to use as an energy source, which results in the production of acidic ketones.

Diabetic ketoacidosis is most likely to occur during periods of intercurrent illness. It occurs in people with Type 1 diabetes/ LADA , but can also develop in people with Type 2 diabetes during severe illness.

9.1 Signs and Symptoms of DKA

- Excessive thirst
- Passing frequent large volumes of urine
- Dehydration
- Shortness of breath and labored breathing
- Abdominal pain
- Nausea and vomiting
- Mental confusion and drowsiness
- Ketones (pear drop smell on breath)

If left untreated DKA can lead to coma and even death

9.2 Diagnosis of DKA:

- Blood ketones 3.0mmol/L or greater (more than 2+ of urine ketones)
- Blood glucose greater than 11.0mmol/L or known diabetes
- Bicarbonate less then 15mmol/L and /or venous pH less then 7.3

DKA is a medical emergency. The individual requires hospital admission for rehydration, restoration of electrolyte balance and insulin therapy.

10.0 Hyperosmolar hyperglycaemic state

Hyperosmolar hyperglycaemic state (HHS) has a slow onset and develops over days or weeks resulting in more severe dehydration. Extremely high blood glucose levels and high serum osmolality are features but there is a lack of significant amount of blood ketones (less than 3.0mmol/L).

10.1 Signs and symptoms of hyperosmolar hyperglycaemic state

- Marked hyperglycaemia (blood glucose 30mmol/L or more)
- Disorientation or confusion
- Passing frequent large volumes of urine
- Thirst and dry mouth
- Nausea
- Hypovolaemia
- Later stages of HHS person becomes drowsy and gradually loses consciousness

HHS is a medical emergency. The individual requires hospital admission for rehydration, anti-coagulation therapy and restoration of electrolyte balance.

11.0 Management of diabetes during intercurrent illness

The aim of management during illness is to avoid hypoglycaemia and hyperglycaemia and prevent severe dehydration and progression to DKA or HHS.

11.1 General principles:

- Encourage individual to rest
- Increase fluid intake to avoid dehydration. Sugar free fluids at least 100ml per hour aiming for 2.5-3.5 Litres over 24 hours (Caution in those with conditions such as heart failure who may have fluid restriction in place)
- Meal replacements- aim to eat normal meals. If the individual is unable to eat use easily digested carbohydrate foods and drinks.
- Monitor blood glucose levels –increase testing to every 4-6 hours. (in those using Libre flash glucose monitoring if the glucose level is fluctuating rapidly the readings may not be reliable, confirm results with finger prick blood test)
- Monitor ketone levels.

Interpreting ketone levels:

Less than 0.6mmol/L	Normal

0.6 to 1.5mmol/L	Risk of developing DKA retest in 2 hours
1.6 to 2.9mmol/L	High risk of developing DKA Increase in insulin required
3mmol/L or higher	Very high risk of DKA. Requires admission to hospital Accident and Emergency department

11.2 Adjustment of glucose lowering treatment during illness:

If blood glucose levels are above target insulin doses will need to be increased. If blood glucose levels are lower than agreed targets insulin will need to be reduced.

Please contact the Diabetes specialist nurse help line 01522 308838 or the patients GP/ 111

See Appendix 3 for Medicines sick day guidance

11.3 When to seek urgent medical help:

Individuals with diabetes should seek urgent medical help in the following situations:

- If persistent vomiting and unable to keep fluids down
- If blood ketones are 1.6mmol/L or higher and appropriate action is unable to be taken
- If unable to keep glucose levels above 3.5mmol/L
- If not improving or getting worse, despite increasing insulin/ additional insulin doses
- In someone who is pregnant
- In someone taking SGLT2 inhibitors who has the signs and symptoms of DKA even if their blood glucose is normal or only slightly raised.

12.0 References and associated documentation

Diabetes UK (2018) End of life diabetes care clinical care recommendations 3rd ed. Available from http://trend-uk.org/wp-content/uploads/2018/04/EoL_Guidance_2018_Final.pdf [accessed 20 December 2019].

Diabetes UK (2017) *Position statement: self-monitoring of blood glucose (SMBG) for adults with type 2 diabetes.* Available from https://diabetes-resources-production.s3-eu-west-1.amazonaws.com/diabetes-storage/migration/pdf/SMBGType2%2520Final%2520April%25202017.pdf [accessed 20 December 2019].

International Diabetes Federation (2013) *Managing older people with type 2 diabetes global guideline.* Brussels: Available from https://www.idf.org/e-library/guidelines/78-global-guideline-for-managing-older-people-with-type-2-diabetes.html [accessed 7 December 2019].

Joint British Diabetes Societies Inpatient Care Group (2019) *A good inpatient diabetes service.* Available from https://abcd.care/sites/abcd.care/files/resources/A_good_Inpatient%20Service_FINAL_Aug_19.pdf [accessed 20 December 2019].

Joint British Diabetes Societies Inpatient Care Group (2019) *Inpatient care of the frail older adult with diabetes.* Available from

https://abcd.care/sites/abcd.care/files/resources/Inpatient_Care_of_the_Frail_Older_Adult.pdf [accessed 7 December 2019].

Joint British Diabetes Societies Inpatient Care Group (2014) *Management of hyperglycaemia and steroid (Glucocorticoid) therapy.* Available from https://abcd.care/sites/abcd.care/files/resources/JBDS_IP_Steroids.pdf [accessed 7 December 2019].

Joint British Diabetes Societies Inpatient Care Group (2020) *The hospital management of hypoglycaemia in adults with diabetes mellitus,* 4th Ed. Available from https://abcd.care/sites/abcd.care/files/site_uploads/JBDS_HypoGuideline_4th_edition_FINAL.pdf [accessed 20 December].

LCHS (2019) Infection prevention policy
LCHS (2019) Medical devices policy
LCHS (2019) NHS Lincolnshire Mental capacity act including deprivation of liberty safeguards policy and procedure for LCHS

LCHS (2019) Policy for consent to examination or treatment
NICE Guideline (2015) *Type 2 diabetes in adults: management*. Available from:

http://www.nice.org.uk/guidance/ng28 [Accessed: 02 October 2018].

NICE Guideline (2015) *Type 1 diabetes in adults: diagnosis and management*. Available from https://www.nice.org.uk/guidance/ng17 [accessed 20 December 2019].

Nursing and Midwifery Council (2018) *Standards of proficiency for nursing associates*. Available from https://www.nmc.org.uk/globalassets/sitedocuments/education-standards/nursing-associates-proficiency-standards.pdf [accessed 04 January 2020].
Nursing and Midwifery Council (2018) *The Code: professional standards of practice and behaviour for nurses and midwives.* Available from https://www.nmc.org.uk/globalassets/sitedocuments/nmc-publications/nmc-code.pdf [accessed 04 January 2020].
TREND (2016) *Blood glucose monitoring guidelines consensus document version 2.* Available from http://trend-uk.org/wp-content/uploads/2017/02/170106-TREND_BG_FINAL.pdf [accessed 20 December 2019].
TREND (2018) *Hypoglycaemia in adults in the community: recognition, management and prevention.* Available from https://trend-uk.org/wp-content/uploads/2018/09/HCP_Hypo_TREND_FINAL.pdf [accessed 04 December 2019]
TREND (2019) *For Healthcare professionals and carers working in primary care and the community: Managing diabetes during intercurrent illness.* Available from https://trend-uk.org/wp-content/uploads/2019/10/HCP_Illness_TREND_FINAL.pdf [accessed 01 January 2020].

Appendix 1 Ketone testing algorithm

Management of Hyperglycaemia in adults with diabetes

Consider the cause- intercurrent illness, sepsis, missed/incorrect dose of insulin/oral hypoglycaemic agents, steroids, enteral nutrition, excess intake of carbohydrates/sugary food and drink

Check for ketones in the following circumstances
(Capillary or urine ketones)

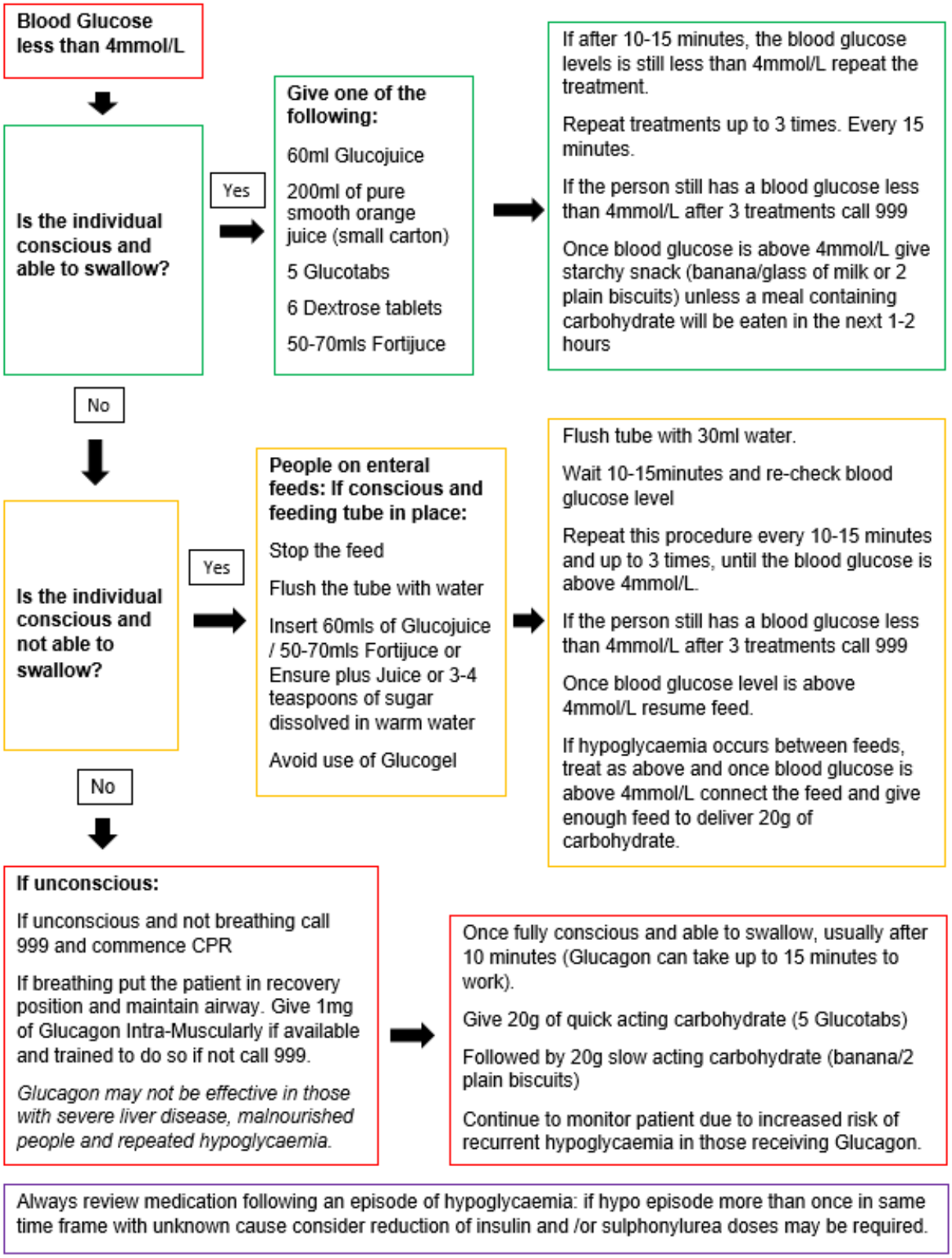
Type 1 Diabetes: Clinically unwell, sepsis, vomiting, not eating and drinking or if blood glucose is >14mmol/L
Type 2 Diabetes: Acutely unwell, vomiting or taking SGLT-2 inhibitors (Dapagliflozin, empagliflozin or canagliflozin)

Interpretation of Ketone results

Blood ketone less than 0.6mmol/L (negative urine ketones) **Is Normal**	Blood ketone 0.6 to 1.5mmol/L (trace of urine ketones) **May be at risk of DKA**	Blood ketone 1.6 to 2.9mmol/L (+ to ++ of urine ketones) **At risk of DKA**	Blood ketone 3.0mmol/L or higher (+++ to ++++ of urine ketones) **Very High risk of DKA**
Assess pre meal and bed time blood glucose readings Treat cause of hyperglycaemia, consider need for treatment review	Test blood glucose and ketone levels every 4-6 hours including during the night Contact Diabetes help line 01522 308834 or GP/111 Individual will require increase in insulin	Give additional insulin if prescribed or contact Diabetes help line 01522 308834 or GP/111 Test blood glucose and ketones every 2 hours including during the night If ketones present treat individual according to ketone level	Call 999 Individual requires hospitalisation Consider diagnosis of HHS in a clinically unwell individual With Blood glucose levels >30mmol/L, hypovolaemia with blood ketone <1.5mmol/L or + to negative urine ketones Seek medical advice

If an individual is vomiting, unable to keep fluids down, or is unable to control blood glucose or ketone levels seek urgent medical advice.

Appendix 2: Management of Hypoglycaemia



Adapted from Diabetes UK (2018) End of Life Diabetes Care: Clinical Care Recommendations

Appendix 3: Medicines sick day guidance

Medicines sick day guidance

Omit taking the medications listed below when you are unwell with any of the following:

- Persistent vomiting or diarrhoea
- Fever with significant sweating and shaking

These medications are all very important, but when you are seriously ill or become dehydrated, they may cause side effects.

These medications can be restarted once you start eating and drinking normally after 24 -48 hours. If your sickness lasts longer than that, you would be best advised to seek medical attention.

If you have diabetes and you usually monitor your blood glucose at home, increase the number of times that you check your blood glucose levels. If your levels run too high or too low, contact your diabetes team.

If you are taking insulin, seek medical advice regarding dose adjustment if you are uncertain, but never stop taking the insulin.

If you are in any doubt, contact your pharmacist, GP or diabetes specialist nurse.

Medications to omit temporarily

- **Metformin**
- **SGLT-2 inhibitors:** medicine names ending in “flozin” eg Canagliflozin, Dapagliflozin and Empagliflozin
- **GLP-1 receptor agonist:** medicine names ending in “tide” eg Exenatide, Liraglutide, Dulaglutide, Lixisenatide and Semaglutide

Seek advice from your GP or pharmacist before omitting any of the medications below.

- **ACE inhibitors:** medicine names ending in “pril” eg Lisinopril, Perindopril and Ramipril
- **ARBS:** medicine names ending in “artan” eg Losartan, Candesartan and Valsartan
- **NSAIDS:** anti-inflammatory painkillers eg Ibuprofen, Diclofenac and Naproxen
- **Diuretics:** sometimes called “water pills” eg Furosemide, Indapamide, Bendroflumethiazide, Bumetanide and Spironolactone

(ACE= angiotensin converting enzyme; ARBs= angiotensin receptor blockers; NSAIDS- non-steroidal anti-inflammatory drugs; SGLT-2 =sodium-glucose cotransporter; GLP-1 Glucagon-like-peptide-1)

Association of British Clinical Diabetologists (2018)

Appendix 4 - Equality Analysis

Name of Policy/Procedure/Function*

Equality Analysis Carried out by: Estelle Walden

Date: 16.04.2020

Equality & Human rights Lead: Racheal Higgins

Date:

Director\General Manager:

Date:

***In this template the term policy\service is used as shorthand for what needs to be analysed. Policy\Service needs to be understood broadly to embrace the full range of policies, practices, activities and decisions: essentially everything we do, whether it is formally written down or whether it is informal custom and practice. This includes existing policies and any new policies under development.**

Section 1 – to be completed for all policies

A.	Briefly give an outline of the key objectives of the policy; what it's intended outcome is and who the intended beneficiaries are expected to be	Key Objective: To outline good practice for all aspects of management of injectable medicines in clinical areas. Intended Outcome: To avoid harm to patients and ensure compliance with relevant legislation and best practice. Beneficiaries: Patients receiving subcutaneous injections in an LCHS setting. LCHS staff		
B.	Does the policy have an impact on patients, carers or staff or the wider community that we have links with? **Please give details**	:Non known		
C.	Is there is any evidence that the policy\service relates to an area with known inequalities? **Please give details**	No		
D.	Will/Does the implementation of the policy\service result in different impacts for protected?	No		
		Yes	No	
	Disability		**x**	
	Sexual Orientation		**x**	
	Sex		**x**	
	Gender Reassignment		**x**	

	Race		**x**	
	Marriage/Civil Partnership		**x**	
	Maternity/Pregnancy		**X**	
	Age		**x**	
	Religion or Belief		**x**	
	Carers		**x**	
	If you have answered 'Yes' to any of the questions then you are required to carry out a full Equality Analysis which should be approved by the Equality and Human Rights Lead – please go to section 2			
The above named policy has been considered and does not require a full equality analysis				
Equality Analysis Carried out by:		Estelle Walden		
Date:		16.04.2020		