MWL – Whiston & St Helens Adult Diabetes Guidelines 2023-2028 v4.0b

Title	Adult Diabetes Guidelines 2023-2028
Authors	Professor Kevin Hardy, Gemma Lewis and Dr Sam Westall on behalf of Adult Diabetes Specialist Team
Purpose	Diabetes management guidance for non-specialists
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Contact	Email kevin.hardy@sthk.nhs.uk or call 01744646497
Format	Electronic
Evidence-base	See Introduction and Topics & full NICE guidance.
Approval by:	MWL Clinical Effectiveness Council.
Target population	Staff & students involved in the management of adults with diabetes in and around St Helens & Knowsley (this may later include West Lancs (Southport & Ormskirk) after consultation).
Training needs	All of those using the document are offered specific (specialist) training relating to use of the document – please contact Prof Hardy's secretary on 01744-646497
Superseded Guidelines	St Helens & Knowsley Teaching Hospitals adult inpatient & outpatient guidelines all versions up to and including V36.
Note	The format of this document was approved by exception by Clinical Effectiveness Council because it is harmonised with Community and Northwest Coast versions of these guidelines in the same format and has appeared in this format for over 25 years.

Introduction

Our aim is to provide brief guidance for non-experts.

Tension exists between ease of reference and discussion of the evidence base. Consider these recommendations in conjunction with best practice guidance notably joint American Diabetes Association (ADA)/European Association for Study of Diabetes (EASD) and NICE Type 2 Diabetes Guideline, February 2022.

Other 'guidelines' produced by Diabetes UK, ABCD and JBDS arguably lean more heavily on expert opinion (Cochrane Level D) and have therefore received less weight.

As far as is practicable, diabetes care should be personalised and underpinned by NICE-compliant structured education and appropriate lifestyle advice.

Pragmatically, some management of Type 1 & Type 2 is harmonised, but where appropriate T1DM and T2DM are considered separately.

This document is for guidance only. Clinicians should always use their knowledge, experience and expertise to best manage patients' individual needs & preferences.

Use the web-version – printed or downloaded versions may be outdated & unsafe.

Drugs should be prescribed and monitored per data sheet recommendations and best practice, unless experience and the patient's best interests dictate otherwise. Insulin must always be administered using an insulin specific syringe or device. Insulin should NEVER be prescribed using 'u' or 'iu' instead of units.

If you are not confident that you have the relevant knowledge, skills and experience to manage care to an appropriate standard, consider seeking specialist advice. Education and training opportunities are available locally and elsewhere.

You must be familiar with the drugs contained within this guideline to use them. NICE underscores the importance of assessing and discussing with patients the metabolic effectiveness, safety, individual suitability, licensing requirements & cost effectiveness of treatment options. Doctors must also be conscious of GMC prescribing guidance when prescribing treatments for people with diabetes.

Management of adults with diabetes undergoing surgery and elective procedures is subject of separate national guidance see for example:

Diabetes, surgery and medical illness | Treatment summaries | BNF | NICE

Fluid therapy for adult surgical patients is described in British Consensus Guidelines (GIFTASUP). mM = mmol/l.

List of Topics

Topic 1: Diagnosis of Diabetes

Type 1 Diabetes

Diagnosed clinically. Patient typically has hyperglycaemia, thirst, dry mouth & polyuria and one or more: rapid weight loss (e.g. 1-2st in 4-8 wk), ketonaemia, BMI < 25, onset age < 50 yr (median age is 12 years in UK). Do not discount just because age > 50 or BMI > 25.

ACTION - refer to a specialist urgently (same day) – the MWL-St Helens referral form includes the number to ring. Please include the patient's BMI and how much weight they have lost and over what period in the information you provide.

Type 2 Diabetes

(mM = mmol/litre)

NORMAL = Fasting plasma glucose (laboratory) (FPG)	< 6.0 mM or
NORMAL = Random plasma glucose (laboratory) (RPG)	< 7.8 mM or
NORMAL = 120-minute OGTT glucose (laboratory)	< 7.8 mM
NORMAL = HbA1c (A1c)	< 42 mmol/mol

DIABETES – glycaemic criteria

*DIABETES = HbA1c(A1c)	≥ 48mmol/mol (x 2) or
DIABETES = RPG	≥ 11.1 mM (x 2) or
DIABETES = FPG	≥ 7.0 mM (x 2) or
DIABETES = RPG	≥ 11.1 mM and FPG ≥ 7.0

*Preferred. Don't mix test-types. Use BG tests in situations where HbA1c unreliable.

What is left?

IMPAIRED GLUCOSE REGULATION ('IGR' or 'pre-diabetes')

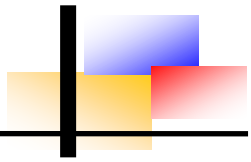
= FPG 6.0–6.9 mM (incl.) or 2 hr OGTT BG 7.8–11.0 mM (with a FPG < 7.0) or

HbA1c 42-47mmol/mol.

Important Notes

- Blood glucose strips / meters are **not** adequate for the diagnosis of diabetes.
- HbA1c may be unreliable in certain circumstances e.g. haemolysis.
- Second HbA1c test can be done immediately – you need not delay - it's looking for assay variance NOT patient factors. If one HbA1c is ≥ 48 and the other is <48, then they do NOT have diabetes. There is no maximum interval between repeat tests.
- Diagnosis of GESTATIONAL diabetes is different – see **Topic 11**.

Topic 2: Impaired Glucose Regulation (IGR) & Diabetes Prevention



Definition

See Topic 1

Impaired fasting glucose (IFG) = FPG 6.0 – 6.9 mM (inclusive) and Impaired glucose tolerance (IGT) = RPG 7.8 – 11.0 mM (inclusive) (with FPG < 7.0 mM.) or HbA1c 42-47mmol/mol are known as **IMPAIRED GLUCOSE REGULATION** (IGR) or **'Pre-Diabetes'**.

Aims of Management

1. Prevent diabetes & (preferably) restore normal glucose tolerance.
2. Reduce increased cardiovascular risk.
3. Detect future diabetes (should it occur) early.

Management of IGR (IFG & IGT)

- Diabetes Prevention Programmes are available – consider referral to the most appropriate local programme.

- Regular exercise prevents or delays diabetes-onset in high-risk patients. Aim for 20-30 or more minutes of daily exercise sufficient to cause breathlessness & sweating (Ideally 150 min per week - can be taken in 10 min blocks). A mix of aerobic and resistive exercise may be optimal for health.

- Modest weight loss prevents or delays the onset of diabetes in high-risk patients. Aim for sustained 5-15% weight loss. Consider enrolment in trials of low-calorie diet programmes if available.

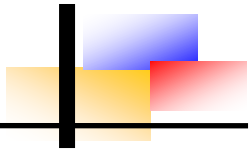
- Metformin prevents or delays the onset of diabetes in high-risk patients, but it may not as effective as lifestyle measures and is not recommended.

- Cardiovascular risk factor modification is important. Consider: smoking cessation, measures to achieve BP control & Atorvastatin therapy if known vascular disease or if 10-yr CVD risk > 10% using QRISK3.

- Consider screening in high-risk patients: BMI > 30 (or waist circumference > target), strong family history of diabetes, high risk ethnic groups, those who have delivered a baby of > 9 lb (4.1kg), hypertensive patients, PCOS patients, those with atherosclerotic cardiovascular disease (ASCVD), and if signs of insulin resistance (e.g. acanthosis nigricans) are present.

- The National Screening Committee (NSC) recommends targeted screening for diabetes in the UK.

Topic 3: Monitoring Blood Glucose & Ketones



Self-Monitored Blood Glucose (SMBG) & CGM

- NICE recommends frequent SMBG in Type 1; & routine SMBG in Type 2 only if patient is on insulin, has symptomatic hypo, takes medication that may increase hypo-risk (e.g. on driving) or with some drugs e.g. steroids…etc.

- Continuous glucose monitoring CGM (e.g. Freestyle Libre2 or Dexcom) is used in Type 1 & some Type 2 patients (NICE/Mersey APC (2022)). Type 2 must be on multiple daily insulin injections and have recurrent or severe hypo or impaired hypo awareness, or have a condition/disability preventing SMBG, or need to do SMBG >8 x/day or need health professional SMBG. Libre2 is real-time from July 2023.

- Target SMBG levels are related to personalised target HbA1c:

HbA1c goal	Pre-b'fast	Pre-lunch	Pre-tea	Pre-bed
48	6 – 7	6 - 7	6 -7	7 - 8
53	7 – 8	7 – 8	7 – 8	8 – 9
58	8 – 9	8 – 9	8 – 9	9 – 10
64	9 – 10	8 – 9	8 – 9	9 – 10
69	9 – 10	9 – 10	9 – 10	10 – 13

Self-Monitored Blood Ketones

- Type 1 should have and be able to use & action blood ketone test strips and should check blood ketones if SMBG >15mM **and** they feel unwell. Routine testing is not necessary.

- Type 2 on SGLT2 inhibitor treatment should be supplied with and trained in use of urine ketone test strips to be used if they feel unwell, when ketonuria ≥ ++ should prompt seeking urgent medical advice.

Glycated Haemoglobin (HbA1c)

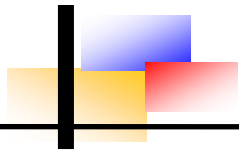
- HbA1c remains the gold standard for glucose balance over 2-3 months. Perform 3-6 monthly. HbA1c underestimates glycaemia in reduced red cell survival e.g. pregnancy or haemolysis (see (NICE 2022).

- Use personalised HbA1c targets agreed with patients as per NICE. 'Target' = threshold above which treatment intensification considered:

T1 Diabetes	HbA1c < 53 mmol/mol
T2 Diabetes (single OHA & no hypo risk)	HbA1c < 48 mmol/mol
T2 Diabetes (max dose single OHA or more)	HbA1c < 53 mmol/mol
T2 Diabetes (special considerations)	HbA1c ≤ 58-69 mmol/mol

(N.B. we underscore the need to relax targets in frail or elderly)

Topic 4: Diabetes Annual Review



What to do

The following should typically be undertaken annually in primary care:

- General Diabetes review & formal assessment of need for (further) structured education (DHSC). Appropriate vaccination e.g. pneumococcal, Flu, COVID vaccines etc for those for whom it is appropriate.

- Surveillance for complications:
    - Accredited community digital retinopathy screening
    - Accredited community foot screening
    - Blood pressure assessment (see Topic 6 for targets)
    - Cardiovascular risk assessment, including QRISK3.

- Blood & urine tests:
    - HbA1c (see Topic 3)
    - Serum eGFR (review medications etc if <60)
    - Non-fasting lipids (see Topic 7)
    - Urine for Albumin:creatinine ratio (ACR) (Topic 12)
    - Tests related to therapy (e.g. LFTs)
    - Annual TSH measurement in T1DM
    - Occasional B12 estimation if on Metformin

Actions

Weight Management discuss weight management if BMI >25 and consider referral to local Weight Management Programmes if BMI > 28 (lower thresholds if non-Caucasian). See NICE Obesity guidance.

HbA1c: targets should be individualised. (NICE 2022) offers a helpful aid to target setting. Review lifestyle & medications. Refer to hospital specialist teams if recurrent, problematic or severe hypoglycaemia or for insulin initiation.

Awareness & Management of Hypoglycaemia should be assessed at each annual review. Consider the Gold Score of delayed hypoglycaemia awareness of hypo onset:

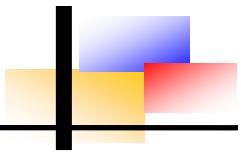
Fully aware 1 2 3 4 5 6 7 Fully unaware

eGFR: if reduced, review medications. Consider specialist referral if eGFR < 45 (CKD G3b) or if deteriorating at > 2 ml/min/year or if ACR raised (see below).

Urine ACR: consider referral for specialist assessment if ACR > 3.0 (x2) unless you're confident to manage it. Refer all patients with ACR ≥ 30 (x2) (overt nephropathy).

Non-fasting lipids: see Topic 7.
Hypertension: see Topic 6..
Microalbuminuria or Nephropathy: see Topic 12
Retinopathy or visual problems: consider referral to ophthalmologist if recommended by accredited screening programme if not referred directly to ophthalmologist by scheme).

Topic 5: Diabetes and Driving



****N.B. People with diabetes must inform their motor insurance company**

DVLA guidance about diabetes and driving is reviewed regularly. We therefore strongly recommend that you consult the website for the latest advice.

https://www.gov.uk/diabetes-driving

Essentially:

Insulin-treated patients must inform the DVLA, must monitor blood glucose and take appropriate action, must recognise warning symptoms of hypoglycaemia and must meet required visual standards. In addition, they must not have any other conditions (e.g. neuropathy leading to loss of joint position sense) that would compromise safe driving – see website.

Temporary Insulin Treatment

E.g. gestational diabetes & post-myocardial infarction. Patients may retain licence but should stop driving if experiencing disabling hypoglycaemia. Notify DVLA again if treatment continues for more than 3 months – see website.

Diet & Tablets

Patients will be able to retain "Till 70 licence" unless develop relevant disabilities e.g. diabetic eye problems affecting visual acuity or visual field or if insulin required. In the absence of complications, diet and tablet-treated patients need not routinely inform the DVLA – see website.

GLP-1 Analogs & oral drugs combined with Sulfonylurea

– see website**.**

Group 2 Entitlement (LGV & PCV) & other special licences

– see website**.**

Diabetic Complications, (including Hypoglycaemia)

– see website**.**

Topic 6: Diagnosis and Management of Hypertension in Diabetes

NICE BP Guidance was updated in 2019 and again in 2023 - it's complicated so you will need to study the detailed guidance.

Diagnosis

- Measure BP per NICE - it's very detailed. "BP"= clinic BP.
- If BP 140/90 to 180/120, offer ambulatory monitoring (ABPM) or home monitoring (HBPM). If HBPM: do min 7 days' morning & evening – ignore Day 1, then average the rest. Seek target organ damage and do CV risk assessment.
- Hypertension = "BP" ≥ 140/90 **plus** ABPM daytime average or HBPM average ≥ 135/85.
- If initial BP > 180/120 & no relevant symptoms or signs, investigate for target organ damage ASAP (and if target organ damage – TREAT). If initial BP > 180/120 plus retinal haemorrhage or papilloedema or new confusion, chest pain, heart failure or acute kidney injury refer urgently (same day) to A&E.

Treatment

Offer lifestyle (see NICE) interventions to all patients.

Stage 1 = BP 140/90 to 159/99 **plus** ABPM/HBPM 135/85 to 149/94
Stage 2 = BP 160/100 to 179/119 **plus** ABPM/HBPM ≥ 150/95
Stage 3 = BP ≥ 180/120

Target organ damage = LVH, CKD, BP↑ retinopathy or ↑ ACR
White coat effect = > 20/10 difference between (clinic) BP and ABPM or HBPM

Typical targets (use judgement, especially in frail)

	Age < 80	**Age ≥ 80**	**Nephropathy**
BP	< 140/90	< 150/90	< 130/80
ABPM / HBPM	< 135/85	< 145/85	< 125/75

	Step 1	**Step 2**	**Step3**	**Step 4**
People with Diabetes	ARB or long-acting ACE (use ARB rather than ACE if Black African or African Caribbean)	Add CCB or Thiazide-like diuretic	Add CCB or thiazide-like diuretic (whichever not used in Step 2	Consider specialist advice unless expertise in BP management

Topic 7: Diagnosis and Management of Dyslipidaemia in Diabetes (see NICE)

Primary Prevention

- Do QRISK3 score and consider treatment if 10 yr CV risk is ≥ 10%
- Consider treatment at lower threshold if BMI>40, HIV, Trigs 4.5-9.9, severe mental health disease, antipsychotics, steroids, immunosuppressants or deprivation
- Consider treatment without QRISK3 score if age ≥ 85; TIDM & Age ≥40 yr or T1DM & Duration ≥10 yr or T1DM & ↑CV risk factors; or eGFR < 60; or ACR ↑

1. Check full lipids & ALT. Prescribe ATORVASTATIN 20 mg nocte if ALT < 3x ULN
2. STOP statin if ALT > 3 x ULN at any stage. If intolerant, try alternative statin.
3. If still statin-intolerant, prescribe EZETIMIBE 10 mg od
4. Repeat full lipid profile & ALT after 3 months Rx.
5. Target LDL-C < 2.0 or target non-HDL-C < 2.6. If achieved, continue Rx.

- If non-HDL cholesterol ≥ 2.6 on statin (or LDL-C ≥2.0), titrate statin dose until <2.6 / <2.0 respectively. If not and on max ATORVA, add Ezetimibe 10 mg od
- Refer Specialist Lipid Clinic if non-HDL cholesterol ≥2.6 or LDL-C ≥2.0, on ATORVA 80 + EZETIMIBE 10
- If non-HDL ≥2.6 or LDL-C ≥2.0 and statin-intolerant & on Ezetimibe, add Bempadoic acid.
- Refer Specialist Lipid Clinic if non-HDL-C ≥2.6 on EZETIMIBE + BEMPADOIC acid

Secondary Prevention

- In the absence of contraindications, treat CAD, CVD or symptomatic PAD ASAP.

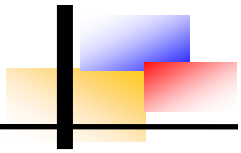
1. Check full lipid profile & ALT
2. Consider prescribing ATORVASTATIN 80 mg nocte if ALT <3x ULN
3. Repeat full lipid profile and ALT after 3 months Rx.
4. STOP statin if ALT > 3 x ULN at any stage
5. If non-HDL cholesterol fall < 40% (or non-HDL-C > 2.5 if no baseline) on ATORVA 80, add EZETIMIBE 10 mg od.
6. Repeat full lipid profile and ALT after 3 months combination Rx.
7. If non-HDL cholesterol fall < 40% (or non-HDL-C > 2.5 if no baseline) on ATORVA 80 + EZETIMIBE 10 mg od. Refer to Special Lipid Clinic.

Triglycerides

- If non-fasting Trigs > 20 and not diabetes or alcohol, refer urgently to lipid clinic.
- If non-fasting 10-20, repeat fasting in 1-2 weeks. If not 2° to some obvious cause, refer to Lipid Clinic.
- If Trigs 4.5-9.9, repeat fasting. Manage 2° causes (e.g. ↑ HbA1c). Manage CV risk. Refer to Lipid Clinic if non-HDL-Chol > 7.5.

1. If ASCVD & taking a statin and LDL-C between 1.04 - 2.6 and Trigs > 1.7, consider Icosapent Ethyl.

Topic 8: Aspirin & Antiplatelet Therapy in Diabetes



Secondary Prevention of Atherosclerotic Vascular Disease (ASCVD)

Use of antiplatelet therapy in known pre-existing vascular disease (ASCVD) is associated with improved outcomes (whether or not the person has diabetes). In the absence of contraindications, after 'acute' therapy, patients should receive antiplatelet therapy as dictated by their specific condition and circumstances. This is typically guided by a cardiologist, a stroke physician or a vascular surgeon.

Primary Prevention of Vascular Disease

Do **NOT** routinely prescribe ASPIRIN (or other antiplatelet agents) for the primary prevention of vascular disease in diabetes (NICE 2015 & 2022).

Topic 9: Insulins and Oral hypoglycaemic Agents in Type 1 Diabetes

In Type 1 diabetes, we typically use basal-bolus treatment. Twice daily mixtures are NOT routinely recommended (NICE 2022) (but some patients prefer two rather than four injections).

Continuous Subcutaneous Insulin Infusion ("PUMPs") may be suitable for some Type 1 patients and is offered at local hospitals. St Helens has a large pump service offering a range of pump options, including so-called hybrid closed loop systems.

Insulin initiation is typically undertaken by a hospital team – structured education and intensive post-insulin-start support for patients is a critical element of insulin initiation. If this cannot be assured in primary care, refer to the hospital team.

N.B. Safer insulin guidance recommends prescribing insulin by brand (i.e. non-generic) names and for prescriptions delivery device should be specified. Do NOT use abbreviations 'u' or 'iu'.

Basal Bolus Regimen

Use a short-acting analog (e.g. Trurapi) 15 minutes before breakfast, lunch & evening meal, together with a longer-acting insulin (e.g. Toujeo). Use acquisition cost to guide choice (but note there may not be complete dose-equivalence). NICE says biosimilars are an acceptable alternative if acquisition cost is lower. Exceptionally, human insulin, e.g. Humulin S or Actrapid may be useful.

Insulin + Oral Hypoglycaemic Agents

In the absence of contraindications, consider addition of METFORMIN to insulin in T1DM if body mass index (BMI) > 25 (23 in Asians).

Insulin in Pregnancy & Preconception

See Topic 11.

Insulin Dose Adjustment in Adults

Patients are taught to self-adjust. Increments and decrements must be individualised. Guidance is available on some hospital websites e.g. St Helens & Knowsley Teaching Hospitals (search 'diabetes').

Topic 10: Oral hypoglycaemic Agents (OHAs), GLP-1 agonists & insulins in Type 2 Diabetes

NICE Type 2 guidance (2022) and Joint American (ADA) and European guidance (EASD) guidance (2022) are more concordant than previously, though they still differ in some important respects.

ASCVD=coronary artery disease, acute coronary syndromes, previous MI, stable angina, coronary or other revascularisation, ischaemic stroke or TIA, or peripheral arterial disease.

High CV risk QRISK 3 score ≥ 10% if age > 40 or an elevated lifetime risk defined as 1 or more CV risk factors developed before age < 40, where CV risk factors=BP↑, dyslipidaemia, smoking, obesity, FH *premature* CVD in first degree relative.

CHF=chronic heart failure.

CKD= eGFR<60 and ACR > 3.0.

First line treatment

1. If symptomatic of BG↑, consider insulin or sulfonylurea (*rescue treatment*), then review when BG controlled.

2. In all cases, in the absence of contraindications, offer Metformin plain (MR if GI disturbance) and establish tolerability. Monitor B12 periodically (MHRA).

3. Assess for ASCVD, high CV risk, CHF and CKD (see above definitions).

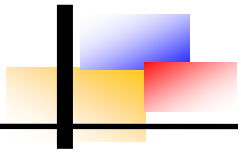
4. If Metformin tolerated and ASCVD or CHF or CKD with ACR >30, in the absence of contraindications, offer addition of appropriate SGLT2 inhibitor (e.g. Dapagliflozin 10 mg daily) to Metformin.

5. If Metformin tolerated and no ASCVD, CHF or CKD with ACR >30, but high CV risk or CKD with ACR 3-30, consider adding appropriate SGLT2 inhibitor (e.g. Dapagliflozin 10mg daily) to Metformin.

6. If Metformin intolerant and ASCVD or CHF or CKD with ACR >30, in the absence of contraindications, offer appropriate SGLT2 inhibitor as monotherapy (e.g. Dapagliflozin 10mg daily).

7. If Metformin intolerant and high CV risk or CKD with ACR 3-30, consider adding using appropriate SGLT2 inhibitor ((e.g. Dapagliflozin 10mg daily) as monotherapy.
8. If no ASCVD, not high CV risk, no CHF and no CKD, continue Metformin monotherapy, unless HbA1c > target or other reason to change.

Topic 10: Oral hypoglycaemic Agents (OHAs), GLP-1 agonists and insulins in Type 2 Diabetes



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Further treatment

9. If subsequently symptomatic of BG↑ (at any stage), consider insulin or sulfonylurea (*rescue treatment*), then review when BG controlled.

10. If at any point, patient develops ASCVD or CHF or high CV risk or CKD - see (4), (5), (6) and (7) above.

11. If on Metformin or Metformin plus appropriate SGLT2 inhibitor as above and HbA1c above personalised target, consider further lifestyle intensification (including potentially bariatric surgery), a DPP-4 inhibitor (e.g. Linagliptin 5mg daily), Pioglitazone, an SGLT2 inhibitor (if not on one), a Sulfonylurea (e.g. Gliclazide), a GLP-1 agonist (if available) or when approved by NICE a (superior) so-called dual GLP/GIP-agonist (e.g. Tirzepatide), or Insulin.

    You must engage the patient in a detailed conversation informed by their diabetes, their personal health, their considerations and preferences and a suitably detailed discussion of each of the above alternatives therapies to facilitate fully informed patient choice about treatment intensification.

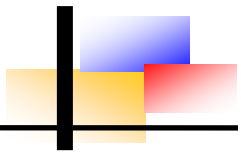
    Treatment for Type 2 diabetes has become increasingly complex and personalised in recent years.

    If in doubt, seek specialist review.

Important Note

There is a current global shortage of all GLP-1 RAs which is forecast to last at least until mid-2024. National guidance is NOT to initiate patients on these drugs and for pre-existing patients, not to switch between GLP-1 RAs. This means that at least until mid-2024, we will not be able to offer GLP-1 RAs as a treatment option for Type 2 diabetes and existing patients who cannot get a supply of their drug may need to choose between using them intermittently (with associated potential swings in glycaemia and associated complications) or move to an alternative treatment, which for many is likely to be insulin. NICE guidance on a new licensed dual GLP/GIP agonist (Tirzepatide) which is superior to GLP agonists in terms of HbA1c and weight loss has been published and should be considered as an appropriate alternative to GLP-1 agonist treatment for some patients.

Topic 11: Contraception, Conception and Pregnancy



Contraception

Most modern forms of contraception are typically acceptable in diabetes; some gestagens carry increased venous thromboembolic risk – combined oral contraceptive pills using lowest practicable dose of oestrogen and lower risk gestagens are preferable.

Conception

Diabetes is associated with substantially increased risks to mother and baby, including greatly increased risk of congenital malformations. Near-normal glycaemic control at or near conception is likely to reduce these increased risks.

Women with diabetes contemplating pregnancy should be referred without delay to the specialist team for pre-conception management.

Pregnancy & Labour

People with pre-existing diabetes and gestational diabetes should usually be seen by the specialist team, as early in pregnancy as possible. Typically, pregnancy and labour are jointly managed by diabetes specialists and obstetricians. Many women need insulin, but it should be noted that Metformin may be used in some patients (specialist use only).

Gestational Diabetes

Numerous different criteria made this confusing in the past. NICE NG3 recommends the WHO guidelines for diagnosis of diabetes in pregnancy:

Fasting	≥ 5.6 mM
Post-prandial (e.g. 2 hr OGTT)	≥ 7.8 mM

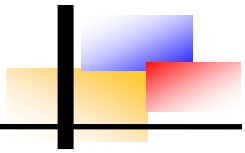
Targets for Glycaemic Control during Pregnancy

Target HbA1c for pre-conception and pregnancy is ≤ 48 mmol/mol. Targets for SBGM set by patient and diabetes specialist. Typically, pre-meal BMs 3.5-5.3 mM and 1-hr post-prandial BMs <7.8 mM or 2-hr post-prandial BMs < 6.4mM. Keep BM > 4.0 if insulin treatment.

Prescribe Aspirin 150mg daily in T1DM and T2DM from 12 to 36 weeks gestation.

Current national guidelines recommend FOLIC ACID 5mg daily for women with diabetes from 3 months pre-conception to 12 weeks gestation.

Topic 12: Diabetic Microalbuminuria and Nephropathy



Untreated, diabetic proteinuria (nephropathy) is associated with high risk of progression to renal failure and high risk of cardiovascular morbidity and premature mortality.

Albumin to creatinine ratio (ACR) on 'first pass' early morning MSSU sample sent to the hospital laboratory is the method of choice for detecting and quantifying proteinuria. If 1 ACR is raised, repeat twice more within 3-4 months.

Consider alternative diagnosis if no retinopathy, blood pressure particularly high, sudden-onset proteinuria, significant haematuria or systemic ill health.

Definitions

NORMAL = ACR < 3.0 mg/mmol in men & women

MICROALBUMINURIA = (**2** x) ACR 3.0 – 30 men & women

NEPHROPATHY = (**2** x) ACR > 30 men & women

Management

See NICE (RAAS RAAS = renin-angiotensin-aldosterone system blockade e.g. ACE- or ARB)

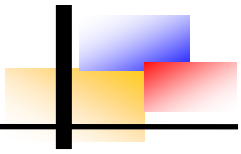
In the absence of contraindications, there are 8 key (individualised) interventions:

1. BP < 130/80 (125/75 for ABPM or HBPM. N.B. consider < 140/90 target if Age > 80yr; or if T1DM & ACR<70 (NICE but other authorities disagree); or if frail) (Topic 6)
2. RAAS blockade: Use max tolerated ARB or generic long-acting ACE-inhibitor.
3. SGLT2 inhibitor treatment providing there are no reasons not to use
4. Non-steroidal mineralocorticoid receptor antagonist (fineronone) if eligible
5. Statin therapy (see Topic 7).
6. Aspirin 75 mg o.d therapy (**only if known vascular disease**).
7. Good glycaemic control, typically HbA1c < 53 mmol/mol (see Topics 9 & 10) but should be individualised – use higher target where appropriate.
8. Smoking cessation

N.B. Use RAAS blockade even if the BP is 'normal'. Statins should be used even if the cholesterol is 'normal' (see Topic 7). Patients with reduced eGFR often need additional measures. Patients with Type 2 on maximum tolerated RAAS blockade, should be considered for SGLT2 inhibitor treatment for reno-protection, particularly if ACR > 30.
Consider early specialist referral.

Note: a**ll medications should be reviewed and monitored very carefully in CKD and AKI, particularly when the eGFR falls below certain thresholds: 60, 45 and 30.**

Topic 13: Diabetes & Endoscopy or Radiology



Diabetic patients needing endoscopic or radiological investigations may have to fast, modify their diet or receive intravenous contrast media.

For information see also JBDS 2016 guidance.

Summary of Common Situations and Actions for diabetes medications

	MF alone	**MF+ any other glucose lowering agent(s)**	**SU or Pioglit or gliptin or SGLT2 or combination**	**Insulin[4] or GLP or both**
SMBG	No	Pt. should monitor BMs closely & seek help if problems if taking SU or Insulin or SGLT2 or GLP		
IV Contrast?	Stop MF	Stop MF Review SGLT2 Continue others	Review SGLT2 Continue others	Continue
Bowel Prep.?	Continue meds	Continue meds Use liquid substitute for CHO as required.	Continue meds Use liquid substitute for CHO as required.	Continue meds Use liquid substitute for CHO as required.
Overnight fast?	No problem	Hypo risk Use "Lucozade" or other substitute for CHO as required.	Hypo risk Use "Lucozade" or other substitute for CHO as required.	Hypo risk Use "Lucozade" or other substitute for CHO as required.

Notes

1. MF=Metformin, SU=sulfonylurea, Pioglit=Pioglitazone, SGLT2=sodium glucose co-transporter 2 inhibitor, GLP=glucagon-like peptide 1 mimetic; BM=self-monitored capillary blood glucose (SMBG), Hypo=hypoglycaemic episode, CHO=carbohydrate.
2. Metformin should be stopped 48hr before intravenous contrast and not restarted until post-procedure serum creatinine confirmed 'normal'.
3. SGLT2 inhibitors may cause volume depletion.
4. Emergency endoscopies etc should be performed with patient on GKI (see Topic 20c) regardless of T1DM or T2DM.
5. May need dose adjustment – if in doubt phone DNS for advice.

Topic 14: Diabetic Neuropathies & Foot Care

Diabetes foot care is the subject of specific NWCSCN guidance – see NWCSN

There are many forms of neuropathy in diabetes, only the most common are discussed here.

Chronic Sensorimotor Neuropathy

Common: usually symmetrical numbness, skin changes and variable motor weakness in feet; predisposes to foot ulceration. No specific treatment. Aim for good glycaemic control & education re footcare (Community Foot Screening Programme – increased risk) together with appropriate footwear to try to prevent foot ulceration.

Diabetic Peripheral Painful Neuropathy (DPN)

After diagnosis of neuropathic pain & together with management of underlying condition (see NICE guideline on neuropathic pain in adults):

- Offer a choice of Amitriptyline, Duloxetine, Gabapentin or Pregabalin as initial treatment for neuropathic pain. Use good prescribing principles as with all drugs. Review early and adjust dosage. Some local guidelines specify an order in which the drugs should ideally be used. Adverse effects are common.

- If initial treatment is ineffective at maximum tolerated dose, offer one of the remaining 3 drugs or consider additive treatment (combination treatment is more effective than monotherapy). Seek side effects.

- Consider Tramadol only if acute rescue therapy is needed.

- Consider Capsaicin cream (0.075% Axsain) for people with localised neuropathic pain who wish to avoid or who cannot tolerate oral treatments.

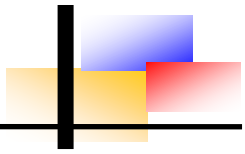
Consider referring the patient to a Specialist Pain Service or condition-specific service (e.g. Vascular Surgery) at any stage, including initial presentation and at the regular clinical reviews, if:

- They have severe pain, or
- Pain significantly limits their daily activities and participation, or
- Their underlying health condition has deteriorated

Autonomic Diabetic Neuropathy

Postural hypotension, recurrent vomiting (gastroparesis), recurrent severe diarrhoea, nocturnal diarrhoea, urinary retention, unexplained bladder-emptying and gustatory sweating may result from diabetic autonomic neuropathy, typically in longstanding diabetes. Always ask & if suspected, referral to the Hospital Specialist Diabetes Team for assessment and management is recommended.

Topic 15: Out of Hospital Hypoglycaemia



Hypoglycaemia typically manifests as hunger, sweating, tremor, headache (and/or a host of other symptoms), with or without confusion and reduced conscious level in association with a blood sugar, typically < 4.0 mM. Some patients suffer seizures during hypoglycaemia and some develop (reversible) hemiparesis.

Hypoglycaemia awareness and management should be assessed as part of annual review in T1DM (NICE). We recommend the Gold Score (see Topic 4).

Oral Treatment

In cases of mild hypoglycaemia, Glucose (e.g. 5 dextrosol, 5 jelly babies or a standard mug (200ml) of a sugary drink e.g. full sugar Coke is the best treatment for hypo, but 200 ml of fresh orange juice, or sugary (3-5 sugars) tea are ok.

A rapidly absorbable sugary solution is available (DEXTROGEL). This may be used in semiconscious patients (who can still protect airway) if parenteral treatment and emergency help is not available (not in unconscious patients).

If short-acting carbohydrate (as above) is used then it should be followed up by more complex carbohydrate (such as a sandwich) to prevent further hypoglycaemia.

Strive for a BM ≥ 4.0 mM before discharging the patient from close monitoring and clinical supervision.

If Patient can't take Carbohydrate by mouth

If the patient is unable to take oral carbohydrate then:

1 mg of glucagon may be given IM or IV while awaiting an ambulance (999). Glucagon may cause headache & vomiting (especially in young – consider 0.5 mg in teenagers).

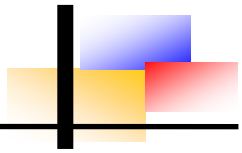
Sulfonylurea-induced hypoglycaemia may require prolonged treatment and supervision – refer urgently for hospital admission.

Subsequent Management

Severe hypoglycaemia is often recurrent – after one episode people are particularly susceptible to further hypo over the next few days or more. After an episode of severe hypoglycaemia, patients should be advised to run their sugars higher (say 8-15 mM) for a week or two and should avoid driving or other situations where hypo would put them or others at risk

→ referral to the Hospital Specialist Diabetes Team is recommended.

Topic 16: Consider referral to Consultant-led Adult Specialist Diabetes Services



NOTE: Precise criteria may vary slightly from area to area.

Diabetes & pregnancy (T1DM or T2DM)
Diabetes in pregnancy (GDM)
Diabetes & planning pregnancy
Young people (18-25 yr) with diabetes (refer to Young Adults Clinic – Dr Balafshan)
Newly diagnosed T1DM
Patients with severe, unexplained or recurrent hypo
Patients with hypo unawareness or delayed awareness (Gold score ≥4)
Patients wishing to be considered for Insulin Pump Therapy
Patients where differentiation between T1DM & T2DM is in doubt
Maturity onset diabetes of the Young (MODY)
Problematic painful neuropathy
Autonomic neuropathy
Neuropathic or neuroischaemic foot ulceration (refer direct to Foot Clinic)
Diabetes + ACR > 30 (unless specific expertise in Diabetic Nephropathy Mx)
Diabetes + eGFR < 45 (CKD Stage 3B) where ACR is raised (see above). If ACR normal, refer to Nephrologist for investigation.
Persistent poorly controlled diabetes despite appropriate guideline-led primary care treatment (Please follow steps in guidance first).
New or suspected Charcot
Diabetes & sight-threatening retinopathy (in addition to Eye Clinic for risk factor Mx)
Patients for consideration for Insulin treatment

Topic 17: End of Life Care & Diabetes

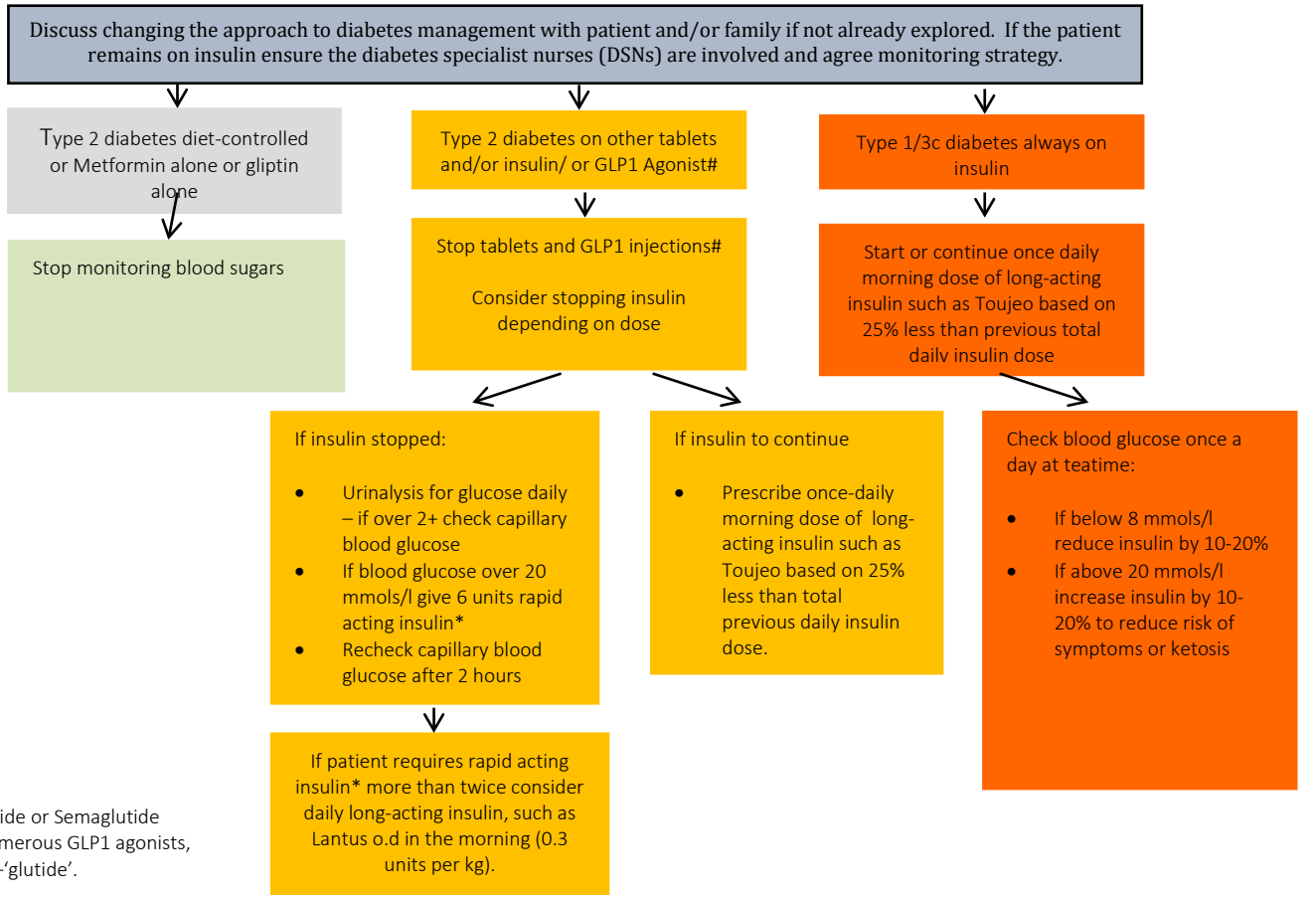
Detailed guidance on End-of-Life Diabetes Care, including for example managing diabetes with steroid treatment and managing hypoglycaemia is beyond the scope of this guideline, but is available from Diabetes UK.

Glucose targets: Symptomatic control is the priority, typically 6-15.

Preventative treatments: Review need for: Aspirin, Clopidogrel, Antihypertensives & Reno-protective drugs, Ferrous compounds, Vit D analogs and Statins...

Glucose Treatment:

(treat hypo as per usual hypo treatment – see Topic 15)



Key

e.g. Liraglutide or Semaglutide (there are numerous GLP1 agonists, all ending in –'glutide'.

*e.g. Apidra

^e.g. Humulin I

Long-acting insulins include: Lantus, Humulin I, Toujeo, Tresiba

- Keep tests to a minimum. It may be necessary to perform some tests to ensure unpleasant symptoms do not occur due to low or high blood glucose.
- It is difficult to identify symptoms due to "hypo" or hyperglycaemia in a dying patient.
- If symptoms are observed it could be due to abnormal blood glucose levels.
- Test urine or blood for glucose if the patient is symptomatic of high sugars. Test blood if suspect hypo.
- Observe for symptoms in previously insulin treated patient where insulin has been discontinued.

Topic 18a: Inpatient care of people with Diabetes

- Check blood glucose (BG) in all Pts with diabetes within 30 min of hospital arrival.
- Check blood ketone within 30 minutes (finger prick or lab sample) of arrival in all emergency attendances if BG >11.0 or pH < 7.3 or HCO3- < 18 mmol/l or on SGLT2 inhibitor (gliflozin) treatment. Seek urgent assessment if blood ketones ≥ 3.0 mM.
- Stop SGLT2 inhibitors if unwell or ketones raised. Don't restart 'till ketones normal.
- All diabetes admissions should have a documented foot examination as part of initial assessment and must have one within 24 hours of decision to admit.
- Don't use PRN insulin & don't use 'u' or 'iu' - state 'units'. Insulin must only be delivered by specific insulin syringe or insulin pen and NEVER by ordinary syringe.
- If a person wants to self-manage, knows how to and is currently able to do so – please support them to self-manage – they usually know their diabetes.
- Use Inpatient Diabetes Chart. If BMs mostly 6-12, do QDS (pre-breakfast, pre-lunch, pre-tea, pre-bed (wake patient if sleeping at test time)) twice weekly. If unstable or unsure, do QDS daily. Take timely ACTION if results out of range.
- If it is DKA (Topic 26) or HHS (Topic 27) please manage as per these guidelines.
- If patient's BGs are largely above 6-12, **ACTION** is needed. If high sugars persist for ≥ 3 days despite treatment change, refer to diabetes inpatient specialist nurses (IP DSN). If recurrent or severe hypo or DKA, refer within 24hr to IP DSN.

We recommend:

- TDS soluble insulin **for glucose lowering** in people who are hyperglycaemic but stable and able to eat (Topic 20b) and e.g. in IP hyperglycaemia during steroid use.
- VRII (variable rate intravenous insulin = an 'IV insulin pump') **for glucose lowering** (without simultaneous IV glucose) in people who are hyperglycaemic and unstable and/or unable to eat. There must be appropriate expertise and monitoring to use this regimen safely (Topic 20c). If not, refer to a more intensive area.
- 16-unit GKI **for glucose maintenance** on general wards (incl. pre- and post-surgery) in people who cannot or must not eat. Having insulin and glucose in the same bag is as effective and safer than VRII combined with separate IV glucose (Topic 20d).

Topic 18b: Inpatient diabetes monitoring charts

Monitoring capillary blood glucose & blood ketones

Attach patient addressograph label here

Name:
Hospital Number:
Date of Birth:

Date: .../.../..... Ward: .....

St Helens and Knowsley Teaching Hospitals NHS Trust

Inpatient Blood Glucose Monitoring Chart

Inpatient blood glucose target: 6.0 -12.0 mmol/L, for monitoring frequency and management of blood glucose readings outside this range refer to Diabetes Inpatient Guidance (up to date policy on intranet)

- If blood glucose <4mmol/L: manage as per hypoglycaemia policy (HYPO BOX), record on hypoglycaemia event table
- If blood glucose >15mmol/L: Check urine/serum ketones, if present and/or patient systemically unwell, seek medical advice. Consider referral to in-patient diabetes team using CareFlow Connect

Blood glucose readings (plus ketones as per inpatient guidance)

Date	.../.../...		.../.../...		.../.../...		.../.../...		.../.../...		.../.../...		.../.../...	
	BG	Ket.	BG	Ket.	BG	Ket.	BG	Ket.	BG	Ket.	BG	Ket.	BG	Ket.
Pre-breakfast														
Pre-Lunch														
Pre-Evening Meal														
Pre-Bed														

All insulin must be administered by an approved insulin pen device or by an insulin syringe. DO NOT draw out of insulin cartridges or insulin pen devices.

If requiring IV insulin infusions or more frequent monitoring for another reason, please use hourly blood monitoring chart. In the event of DKA, use the Adult DKA Clinical Management Pathway Booklet.

Hypoglycaemic Event 1

Date: .../.../...	BG	Treatment given/ Escalation
Time: ...:...		
15 min. repeat		
30 min. repeat		
45 min. repeat		
Additional		

Hypoglycaemic Event 2

Date: .../.../...	BG	Treatment given/ Escalation
Time: ...:...		
15 min. repeat		
30 min. repeat		
45 min. repeat		
Additional		

Hypoglycaemic Event 3

Date: .../.../...	BG	Treatment given/ Escalation
Time: ...:...		
15 min. repeat		
30 min. repeat		
45 min. repeat		
Additional		

BG Monitoring Chart, Version 2, H Sullivan, S Michaels, P Narayanan: Review Date 01.01.2025

Management of Blood Ketones

St Helens and Knowsley Teaching Hospitals NHS

Blood Ketone levels should be checked on a finger prick sample using a blood ketone meter.
Check blood ketones if the patient is unwell and BM>15 mmol/L or unwell and on an SGLT2 Inhibitor (Gliflozin medication)

	< 0.6 mmol	0.6 – 1.5 mmol	1.6 – 3.0 mmol	≥ 3.0 mmol
	Readings below 0.6mmol/l are in the normal range	This may indicate a problem developing		Seek URGENT Medical Advice
Action	**Normal** Usual diabetes management for that Patient	**Slightly raised** Give sugary oral fluids 100 ml/hr or food & TDS Humulin S (see Topic 20b)	**High risk of imminent DKA** Do VBG, U&E, Lab BG & seek urgent Specialist Registrar advice (see Topic 26)	**High likelihood of DKA** Do VBG, U&E, Lab BG & seek urgent Specialist Registrar advice (see Topic 26)

Why?

Raised blood ketones are an indication that insulin levels are low and counterregulatory hormones (principally glucagon) are high resulting in fat breakdown. In the presence of adequate insulin, giving carbohydrate switches off fat breakdown and ketone production. Fluids enhance ketone clearance.

When blood ketones are markedly raised they cause harmful acidosis (DKA). IV insulin switches off ketone production and IV fluids promote renal ketone clearance

What next?

The aim of blood (glucose and) ketone monitoring is to detect any deterioration early to allow timely treatment to prevent DKA and other harm. A normal blood ketone level in someone who is unwell and has a raised sugar provides reassurance that they are not developing DKA. A raised blood ketone level is an alert that timely intervention to prevent deterioration and ongoing monitoring are essential. Don't delay – follow this guidance and act. There is detailed guidance on the Trust website – search 'Diabetes' and 'STHK Adult Diabetes Guidelines 2023-2028'. If you're unsure what to do, seek help immediately.

Topic 19: If you don't know patient's usual insulin(s) or dose(s)

Sometimes, patients who use insulin are admitted to hospital, but are unable state their insulin brand or doses….and you don't know if any documented doses are current or historical.

Only use uncorroborated records if the dates of these records are recent.

If insulin details cannot be established, refer to the Inpatient Diabetes Specialist Nurses as soon as possible.

Please include patient details, location, reason for referral and name of referrer.

If IP DSN review is not available before next insulin dose is due:

- If usual insulin brand is not known- use TDS Humulin S insulin as per inpatient guidelines (Topic 20b). *Patients must not be discharged on TDS Humulin S. If further support is needed, refer to Inpatient Diabetes Specialist Nurses.*

- If insulin brand is known, but doses are not known- use weight-based formula:

- If on multiple doses of insulin (Type 1 or Type 2 diabetes), use 0.5 units per Kg total dose:

    1. If on BD mixed insulin - split 2/3 AM and 1/3 PM
       e.g. Weight 60kg, then 0.5 units per Kg = 30 units total daily dose;
       Give Pre breakfast 20 units (2/3) and Pre tea 10 units (1/3)

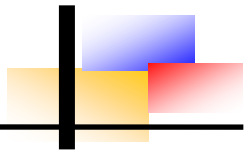
    2. If on Basal-Bolus regimen – give 50% as basal and 50% split equally between the 3 pre-meal doses. e.g. Weight 60 kg, then 0.5 units per Kg = 30 units total daily dose:
       Basal insulin (e.g. Toujeo) 15 units (50%) and Short/rapid acting insulin (e.g. Humalog) 5 units before each meal (5+5+5 = 15 (50%).

- If on once-daily long-acting insulin injection (type 2 diabetes), use 0.3 units per kg

    e.g. Weight 100kg, then 0.3 units per Kg = 30 units total daily dose:
    Basal insulin 30 units at 'bedtime'.

Please record in the patient's notes that the doses have been calculated from patient's weight as a temporary measure until current usual doses can be identified.

Topic 20a: TDS soluble vs VRII vs GKI vs FRII



There is no robust evidence or NICE guidance on choice of temporary subcutaneous insulin regimens or intravenous insulin in inpatients with diabetes - and practice varies.

Our priority ladder (in order) is SAFETY · EFFICACY · SIMPLICITY · COST

TDS Soluble (three times daily subcutaneous soluble insulin)

TDS soluble insulin is easy to start and easy to adjust and avoids intravenous cannulation which is associated with inherently increased risk of local and systemic infection (e.g. MRSA bacteraemia) …and it's easier for patients. Use of subcutaneous TDS soluble insulin in stable patients with high sugars who are eating - see Topic 20b.

VRII (variable rate insulin infusion)

Variable rate insulin infusion is an effective method for delivering intravenous insulin to lower blood glucose in people who are unstable and not eating. Its major advantage over TDS soluble insulin is that IV insulin delivery is quicker, more reliable and easier to adjust than subcutaneous administration – see Topic 20c.

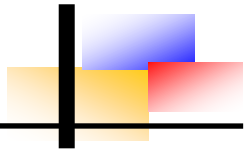
VRII is different to GKI which is used as a glucose-maintaining regimen. VRII can also be used to maintain blood glucose (when the VRII is combined with a separate intravenous infusion of glucose), but except in intensively monitored areas, we recommend GKI for glucose maintenance because nursing staff are more familiar with GKI and combining the insulin and glucose in the same bag prevents inadvertent unopposed administration of either glucose or insulin which can lead to DKA/HHS or hypoglycaemia respectively.

In intensively monitored areas, where clinicians have expertise choosing an appropriate intravenous glucose concentration and infusion rate, risks from VRII are small.

GKI (glucose potassium insulin infusion)

GKI is an IV insulin infusion where insulin and glucose are in the same bag (with potassium as required). Developed in the UK in the 1980s for use in surgery, it typically kept BG in target range throughout the entire peri-operative period. Its success in surgery led to more widespread use in inpatients with diabetes to maintain blood glucose. To use it to lower blood glucose is illogical - it involves giving IV glucose to someone who is hyperglycaemic. GKI is less flexible than VRII because the whole bag must be changed if the insulin infusion rate is changed, but GKI is safer because insulin and glucose are in the same bag so it is impossible to give unopposed glucose or unopposed insulin – this is much safer, particularly in less intensively monitored areas, such as general wards – see Topic 20d.

Topic 20a: TDS soluble vs VRII vs GKI vs FRII



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FRII (fixed rate insulin infusion)

Until the 1970s, DKA was treated with large doses of intravenous insulin and the incidence of hypoglycaemia and hypokalaemia was very high and harm was common. Subsequently in DKA, it was shown that low-dose intravenous insulin (starting dose 0.1 units/kg/hr) was as effective but caused dramatically less hypoglycaemia and hypokalaemia. Typically, the insulin infusion rate was halved (0.05 units/kg/hr) in the recovery phase (BG 10-14).

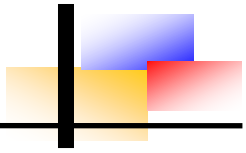
Some years ago, the JBDS recommended 'fixing' the insulin dose at 0.1 units/kg/hr throughout DKA treatment (initial and recovery phases) - so-called *fixed rate insulin infusion* or 'FRII'. At STHK, as in the USA and elsewhere, we continued to reduce the insulin infusion rate in the recovery phase because higher doses are not necessary to completely suppress glucose production and ketogenesis (maximum suppression at 0.015 units/kg/hr) and hypoglycaemia and hypokalaemia are reduced.

In 2022, JBDS acknowledged an increased risk of hypoglycaemia and hypokalaemia with FRII and now recommends considering reducing the infusion rate (as per USA and MWL-STHK), but confusingly, JBDS continues to call this variable insulin infusion, FRII. Newly published (July 2024) joint American/European/British guidelines do not advocate 'fixing' the IV insulin infusion in DKA and FRII is confusing and out of date.

In summary, we recommend:

- TDS soluble insulin **for glucose lowering** in people who are hyperglycaemic but stable and able to eat (Topic 20b).
- VRII (variable rate intravenous insulin = an 'IV insulin pump') **for glucose lowering** (without simultaneous IV glucose) in people who are hyperglycaemic and unstable and/or unable to eat (Topic 20c).
- 16-unit GKI **for glucose maintenance** on general wards (incl. pre- and post-surgery) in people who cannot or must not eat. (Topic 20d).
- If in doubt, transfer the patient to an appropriately intensively monitored area.

Topic 20b: TDS Soluble Insulin



TDS Soluble Insulin

Whether T1DM or T2DM, & usually diet, tablet or insulin-treated, if sugars are unstable or high & patient is eating and well, TDS soluble insulin (e.g. Humulin S) is useful to establish blood glucose control short-term.

Aggressive dose titration is essential to achieve control.

TDS Soluble Insulin TYPICAL STARTING DOSE

Use a weight-based calculation to determine starting dose.

- Total daily dose = 0.5 units/kg
- Divide total daily dose by 3 to determine TDS dose

For example, for a 60 kg patient:

Total daily dose = 0.5 units/kg = 30 units

Give 10 units TDS before meals.

Give each insulin dose 30 min. before meals and monitor BMs. Adjust often and aggressively until BMs largely 6-12 mM.

If no progress after 72 hr ask IP Diabetes Specialist Team to review.

Topic 20c: (VRII) Intravenous Insulin Infusion

VRII (variable rate Intravenous Insulin Infusion)

- IV insulin is the quickest, most effective way to control blood sugar.
- GKI is safer in less intensively monitored areas for maintaining stable sugars (see Topic 20a).
- Only use VRII if you have sufficient knowledge and experience and if you are confident that monitoring is sufficiently intensive to prevent potential hazards (see Topic 20a).

For VRII, use pre-filled insulin syringes if possible. They are stock on: A&E (Resus & Ambulance Assessment Area Ward), 1B, 1C, 1E, 3C, 4E and in the emergency cupboard. If pre-filled syringes are unavailable make up a 50 ml syringe with 50 units of soluble insulin (e.g. HUMULIN S) in 49.5 ml of 0.9% saline. This makes a concentration of 1 unit per ml.

Hourly blood glucose measurements MUST be done to reduce the very real risk of hypoglycaemia. If blood glucose is not measured hourly, then this protocol is not safe.

As per national consensus, continue long- and intermediate- acting insulins, such as Lantus, Levemir, Toujeo, Tresiba, Insulatard & Humulin I.

Check U&E (potassium) frequently and regularly until you are assured that it is stable and satisfactory. We would recommend 4-hourly U&E initially.

Insulin Starting Point

Start IV insulin in VRII at 0.1 units/kg/hr.

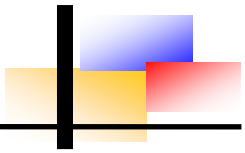
Insulin Infusion Adjustment

Bedside Capillary Blood Glucose (mmol/l)	VRII Insulin Infusion Adjustment (units per hour)
< 4.0	Stop insulin & give 100ml 20% dextrose IV stat. Resume after 30 min at half previous rate if IV insulin infusion still required (if not switch to TDS soluble insulin (Topic 20b)
6.0 – 12.0	Continue VRII at current infusion rate.
> 12.0	If higher than the last test, increase by 2 units / hour If same as the last test, increase by 1 unit / hour If lower than the last test, keep at the same rate

Converting to Subcutaneous Insulin

PLEASE NOTE: You MUST continue IV insulin pump for 1-2 hours AFTER first injection of subcutaneous soluble insulin (alone or in a mixture). See Topic 29a for patients treated by CSII (subcutaneous insulin pump therapy).

Topic 20d: GKI (Glucose-Potassium-Insulin Infusion)



GKI is an extremely efficient method for MAINTAINING blood glucose.

Standard GKI

Add 16 units soluble insulin (e.g. Humulin S) to 500 ml 10% dextrose with 10 mmol potassium chloride (KCL) & infuse at 80 ml/hr. New bags every 6 hr - dictated by glucose and U&E taken 5 hr after a bag was started (i.e. 1 hr before new bag needed):

Plasma Glucose	Soluble Insulin added to new bag	Plasma K	KCL in new bag (pre-mixed bags)
6-12	Same as last bag	3.5-5.0	10 mmol
<6	4 units less	< 3.5	20 mmol
> 12	4 units more	> 5.0	0 mmol

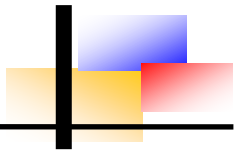
1-2 hourly BMs alert staff to unusual insulin sensitivity or resistance. They are unnecessary once the patient is clearly stable on a particular regimen. Continue long- and intermediate-acting insulins, e.g. Lantus, Levemir, Toujeo, Tresiba, Insuman basal & Humulin I. Note: in insulin-sensitive patients (requiring only small doses of s.c. insulin) lower insulin doses may be required; in insulin-resistant states higher insulin doses may be required (and here we typically start with a 24-unit GKI).

If patient goes hypo (BG < 4.0) on GKI, suspend GKI, treat hypo as per Topic 28 and then start a fresh GKI with 4 units less insulin, once blood glucose has risen to ≥ 8.0 mmol/l.

Converting to Subcutaneous Insulin

PLEASE NOTE: You MUST continue IV insulin pump for 1-2 hours AFTER first injection of subcutaneous soluble insulin (alone or in a mixture). See Topic 29a for patients treated by CSII (subcutaneous insulin pump therapy).

Topic 21: Diabetes & Surgery



Management of adults with diabetes undergoing surgery and elective procedures has been addressed by UK national guideline.

JBDS Surgical Guidance January 2023: https://abcd.care/resource/jbds-03-management-adults-diabetes-undergoing-surgery-and-elective-procedures-improving

After publication of this guidance, we had removed our 2022 guidance, but the IP diabetes nurses have been asked repeatedly by surgical and anaesthetic teams to continue to include the older 2022 guidance. Use your judgement about how you use old and new guidance.

Please note that you should suspend SGLT2 inhibitor treatment at least 4 days before elective surgery (FDA recommendation) and routinely monitor blood ketones in SGLT2 inhibitor-treated patients. Only restart SGLT2i when well and blood ketones normal.

Note we continue to recommend GKI (Topic 20d) except in intensively monitored settings because we believe that it is safter than Variable Rate Insulin Infusion (VRII) (Topic 20c) on general wards.

Emergency surgery

Stop usual diabetes treatments and use GKI (Topic 20d) in Type 1 & Type 2 DM, **BUT NOTE** if the patient usually takes a long- or intermediate- acting insulins, such as Lantus, Levemir, Toujeo, Tresiba, or Humulin I, this should be continued alongside GKI. If at all possible, every effort should be made to stabilise diabetes before surgery. Aim to maintain blood glucose 6-12 mmol/l.

Elective surgery

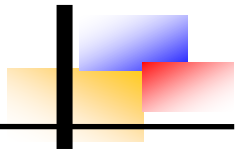
Key points:

- Routine overnight admission for preoperative management should not be required.
- Management of elective patients should be with modification to their usual diabetes treatment if fasting is minimised (no more than one missed meal) as the routine use of IV insulin is not recommended.
- Poor pre-operative glycaemic control is associated with adverse outcomes post-surgery. Where possible optimise before surgery (HbA1c < 69 if at all possible).

Pre-operative assessment

All patients with diabetes in whom elective surgery (necessitating a period of starvation) is planned should attend for pre-op assessment ASAP and before being listed for surgery.

Topic 21: Diabetes & Surgery



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If glycaemic control is sub-optimal, the risks of proceeding should be balanced against the urgency of the procedure.

Referral to GP if HbA1c ≥ 69 mmol/mol (8.5%), or to Diabetes Specialist Team if urgent cancer surgery or if the patient has hypo unawareness or autonomic neuropathy.

Minimise starvation time by prioritising patients on the operating list (patients expected to miss more than one meal should have a GKI (Topic 20d)) – use pre-op bloods if healthy, no new medications and eGFR > 60 and K+ 3.5-5.0 mmol/L.

*If contrast medium is to be used, metformin should be omitted on the day of surgery and for the following 48 hours. Restart metformin after 48 hours if eGFR is stable (if in doubt, ASK).

Peri-operative monitoring of Diabetes - short starvation (one missed meal)

Monitor capillary blood glucose on admission and hourly during the day of surgery, including at least one capillary blood glucose < 60 min pre-operatively, one intra-operatively, and one in post-op recovery (before the patient returns to the ward) for any patient whose operation is anticipated to last more than one hour. Aim for blood glucose 6-12 mmol/L. Suspend SGLT inhibitor treatment and routinely monitor blood ketones in SGLT2 inhibitor treated patients. Only restart SGLT2i when blood ketones normal.

Peri-operative DKA

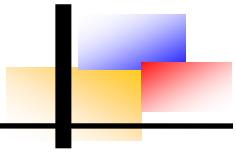
If blood glucose > 15 mmol/L pre- or post- surgery check for ketones. If capillary blood ketones > 3 mmol/l, cancel surgery and follow DKA guidelines (Topic 26) and contact medical on call team immediately.

***Pre-operative hyperglycaemia*: BM > 12.0 & blood ketones < 3.0 mmol/l**

Type 1 diabetes: give subcutaneous rapid-acting analogue insulin (e.g. Humalog or Apidra). Assume that 1 unit of insulin will reduce blood glucose by 3 mmol/l BUT wherever possible take advice from the patient about the amount of insulin usually required to correct a high glucose. Recheck blood glucose after 1 hour. If surgery cannot be delayed use VRII (Topic 20c), switching to GKI (Topic 20d) when blood glucose < 12 mmol/L.

Type 2 Diabetes: give 0.1 units/kg of subcutaneous rapid acting analogue insulin and recheck blood glucose after 1 hour to ensure it is falling. If surgery cannot be delayed use VRII (Topic 20c), switching to GKI (Topic 20d) when blood glucose < 12 mmol/L.

Topic 21: Diabetes & Surgery



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Peri-operative tablet & GLP-1 injections - short starvation (one missed meal).

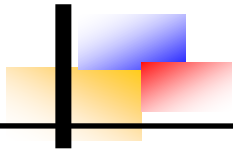
Insulins	**Day prior to admission**	**Day of surgery** **Patient for AM surgery**	**Patient for PM surgery**
Metformin (*procedure not requiring use of contrast media)	Take as normal	Take as normal	Take as normal
Sulfonylurea (e.g. Gliclazide, Glipizide, Glimepiride)	Take as normal	Once daily AM: omit Twice daily: omit AM	Once daily AM: omit Twice daily: omit AM and PM
Pioglitazone	Take as normal	Take as normal	Take as normal
DPP-IV inhibitor (e.g. Sitagliptin, Linagliptin)	Take as normal	Omit on day of surgery	Omit on day of surgery
SGLT-2 inhibitor (e.g. Empagliflozin, Canagliflozin, Dapagliflozin)	Suspend 4 days prior to surgery	Omit 4 days prior to surgery and routinely monitor blood ketones. Don't restart until blood ketones normal.	Omit 4 days prior to surgery and routinely monitor blood ketones. Don't restart until blood ketones normal.
GLP-1 analogue injections (e.g. Semaglutide, Liraglutide, Tirzepatide)	Take as normal	Omit if due on the day of surgery	Omit if due on the day of surgery
Meglitinide (Repaglinide or Nateglinide)	Take as normal	Omit morning dose if NBM	Give morning dose if eating
Acarbose	Take as normal	Omit morning dose if NBM	Give morning dose if eating

*If contrast medium is to be used, metformin should be omitted on the day of surgery and for the following 48 hours. Restart metformin after 48 hours if eGFR is stable (if in doubt, ASK).

For longer starvation periods – MORE THAN ONE missed meal, stop oral meds, usual insulins (except intermediate and long-acting insulins) and GLP agonists and USE GKI **(**Topic 20d**).**

For advice, contact the diabetes team.

Topic 21: Diabetes & Surgery



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Peri-operative insulin adjustment - short starvation (one missed meal).

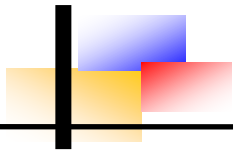
Insulins	Day prior to admission	Day of surgery	
		Patient for AM surgery	**Patient for PM surgery**
Once daily (evening) (e.g. Toujeo, Lantus, Levemir, Tresiba, Humulin I)	No dose change	Check blood glucose on admission	Check blood glucose on admission
Once daily (morning) (e.g. Toujeo, Lantus, Levemir, Tresiba, Humulin I)	No dose change	No dose change Check blood glucose on admission	No dose change Check blood glucose on admission
Twice daily (e.g. Novomix 30, Humalog Mix 25, Humulin M3)	No dose change	Halve the usual morning dose. Check blood glucose on admission. Leave the evening meal dose unchanged	Halve the usual morning dose. Check blood glucose on admission. Leave the evening meal dose unchanged
3, 4, or 5 injections daily	No dose change	Basal bolus regimens: omit the morning and lunchtime short-acting insulins. Keep the basal unchanged. Premixed AM insulin: Halve the morning dose and omit lunchtime dose. Check blood glucose on admission	Take usual morning insulin doses(s). Omit lunchtime dose. Check blood glucose on admission
Continuous Subcutaneous Insulin Infusion (CSII or insulin 'pump' therapy)	No dose change	Use GKI (continue until the patient is able to resume self-management of CSII – stop GKI 1-2 hr after CSII is recommenced and a mealtime bolus has been given)	Use GKI (continue until the patient is able to resume self-management of CSII – stop GKI 1-2 hr after CSII is recommenced and a mealtime bolus has been given)

*If contrast medium is to be used, metformin should be omitted on the day of surgery and for the following 48 hours. Restart metformin after 48 hours if eGFR is stable (if in doubt, ASK).

For longer starvation periods – MORE THAN ONE missed meal, stop oral meds, usual insulins (except intermediate and long-acting insulins) and GLP agonists and USE GKI **(**Topic 20d**).**

For advice, contact the diabetes team.

Topic 21: Diabetes & Surgery



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***Post-operative hyperglycaemia*: BM** > 12.0 & blood ketones < 3.0 mmol/l

Type 1 diabetes: give subcutaneous rapid acting analogue insulin (i.e. Novorapid, Humalog or Apidra). Assume that 1 unit of insulin will reduce blood glucose by 3 mmol/l BUT wherever possible take advice from the patient about the amount of insulin usually required to correct a high glucose. Recheck blood glucose after 1 hour to ensure it is falling. Consider giving further subcutaneous insulin after 2 hours if BM remains > 12.0.

Type 2 Diabetes: give 0.1 units/kg of subcutaneous rapid acting analogue insulin and recheck blood glucose after 1 hour to ensure it is falling. Consider giving further subcutaneous insulin after 2 hours if BM remains > 12.0.

Peri-operative (pre-, peri-, or immediately post-op) hypoglycaemia (see topic 25)

If hypoglycaemic pre-surgery give 100ml 20% dextrose by IV infusion over 10-15 mins and repeat BM after 15 minutes and every 15 mins for next hour and longer if felt necessary.

Topic 22: Management of Blood Glucose in Diabetes in Acute Coronary Syndromes (ACS) & Stroke

Blood Glucose in AMI and ACS

Robust evidence to guide optimal management of hyperglycaemia in patients admitted to hospital for an acute coronary syndrome (ACS) is lacking. Whilst avoiding sustained hyperglycaemia appears to be of benefit, the optimal regimen to achieve this is not clear. Additionally, hypoglycaemia may be particularly detrimental, as may be the fluid load associated with GKI.

Suspend SGLT2 inhibitor treatment and routinely monitor blood ketones in SGLT2 inhibitor treated patients. Only restart SGLT2i when blood ketones normal.

Until new evidence resolves this issue, we recommend the following:

Aim to keep blood glucose levels 6-12 mmol/litre

- Treat sustained hyperglycaemia while avoiding hypoglycaemia.
- If eating use TDS soluble insulin (e.g. Humulin S) (Topic 20b), preceded if necessary by IV insulin infusion (VRII) (Topic 20c) if severely hyperglycaemic (> 15 mmol/l).
- If not eating, consider a dose-adjusted insulin infusion (VRII) to achieve and maintain blood glucose 6-12 mmol/L with regular monitoring of blood glucose levels (see Topic 20a & 20b: VRII Intravenous Insulin Infusion Pump).

Tests for Diabetes

Identifying patients with hyperglycaemia after ACS who are at high risk of developing diabetes. Offer all patients with ACS-associated hyperglycaemia and without known diabetes:

- Outpatient HbA1c. If HbA1c $\geq$ 48 mmol/mol (6.5%) x 2 (can be done on same sample), then notify GP that patient has newly diagnosed T2DM. Does not require diabetes specialist team referral.

Do not routinely offer oral glucose tolerance tests to patients with hyperglycaemia after ACS.

Acute Stroke

There is no specific national guidance on managing hyperglycaemia in acute stroke, but the principles outlined above for AMI and ACS might reasonably be applied to acute stroke.

Topic 23: Diabetes & Enteral Feeding (For TPN, ask IPDSN)

Patients on enteral feeding often experience high sugars and high sodium - most require temporary insulin to stabilise blood glucose and to prevent HHS. Use VRII (Topic 20a) if other measures are unsuccessful – IV insulin caries additional risks c.f. sc insulin e.g. MRSAb. Consider 2024 JBDS guidance and local guidance (below) in formulating your plan.
You MUST monitor blood glucose 4-6 hourly on and off the feed and you MUST check blood sodium daily. You MUST take steps to control blood glucose and you MUST prevent hypernatraemia with appropriate hydration. This is vital to prevent HHS and the very high risk of premature death associated with severe hypernatraemia.

Usual Medications Suspend all oral hypoglycaemics except plain Metformin. Prescribe this in liquid form and give via NG, NJ or PEG at usual dose/times.
Existing insulin should continue but the regimen may need changing.

Temporary Insulin Consider starting temporary insulin if capillary BGs >12mmol/l. Refer to Inpatient Diabetes Specialist Nurses (DSNs) without delay.

Insulin Calculation Total daily insulin dose = 0.5units/kg: give 50% as once daily basal insulin (Toujeo) at bedtime, & give 50% as fast-acting insulin (Apidra), divided equally into bolus injections dictated by feed duration:

For continuous feeds, in addition to once daily Toujeo (0.25 units/kg):

- 10 hr feed: give Apidra bolus at time 0 and 5 hrs after start (each bolus = 0.125 units/kg).
- 12 hr feed: give Apidra bolus at time 0, 4 and 8 hrs after start (each bolus = 0.08 units/kg).
- 15 hr feed: give Apidra bolus at time 0, 5 and 10 hrs after start (each bolus = 0.08 units/kg).

e.g. Patient of 60 kg on 10 hr continuous feed:

Prescribe Insulin Toujeo, 0.25 units per kg once daily (0.25 x 60) = 15 units at once daily at bedtime; and prescribe Insulin Apidra, 0.125 units per kg at times 0 & 5 hr (0.125 x 60 for each dose) = 8 units at time 0 and 8 units at time 5 hours.

If bolus feed chosen, you must discuss required insulin dose with inpatient DSN before initiating feeds. Hypernatraemia & HHS appear to be more common with bolus feeding.

Monitoring Monitor capillary BG every 4-6 hours, on & off enteral feed. Target = 6-12mmol/l. If capillary BG persistently >12mmol/l, contact IP DSN. If BG >15mmol/l & unwell, check blood ketone and escalate.

Insulin titration Adjust insulin doses every 24-72 hr, until BG mostly 6-12mmol/l.

Feed suspended Do not omit Toujeo Insulin. Only give Apidra Insulin if patient is to get the enteral feed. If enteral feed stopped early – monitor for hypo and treat as per Hypo Box algorithm. Escalate if persistent or recurrent

Review/Discontinue If plan is to stop enteral feed, contact Inpatient Diabetes Specialist Nurses for advice about ongoing management.

Topic 24: Management of Blood Glucose & Diabetes in inpatient COVID19 infection

What is known?

- After adjustment for age, race and other risk factors, compared with non-diabetics, people with diabetes appear to be 3-4 x more likely to be hospitalised and 3-4x more likely to suffer severe COVID illness.
- Hyperglycaemia on admission (and subsequently) is associated with a poorer outcome.
- Some authorities report increased COVID-associated DKA and HHS.
- Dexamethasone treatment can increase blood sugars in those with and without diabetes.

What is not known

- Whether measures to improve blood sugar control during admissions with COVID improve COVID outcomes.

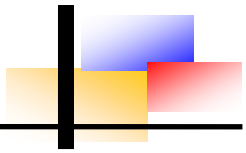
Glycaemic management in inpatients with COVID-19

Despite a paucity of high-quality evidence, it is reasonable to take reasonable steps to prevent excessive hyper- and hypo- glycaemia in inpatients with COVID-19, to avoid drugs that might make things worse and to monitor for and manage dexamethasone-induced dysglycaemia. Management of blood glucose in people with diabetes and COVID within the Trust has not raised any significant concerns and we would encourage people to continue to use existing trust guidance on the management of dysglycaemia. If these measures are ineffective in an individual, then you may wish to consider the so-called "National Diabetes Inpatient COVID-19 Response Team" advice (click on link):

1. 'Front door' guidance.
2. Guidance on dexamethasone treatment and management of blood glucose.

Manage DKA/HHS and other aspects of diabetes as before (see this guideline).

Topic 25: Management of IP Diabetic Foot Ulceration



1. All patients with diabetes in whom a decision to admit to hospital is made should have a documented foot examination as part of their initial assessment & must have one within 24 hr of admission.

2. All patients with diabetic foot ulceration should have detailed description (with measurements and ideally photographs) of ulcers within 4 hours of detection. All ulcers must routinely be swabbed for MRSA (see Infection Control Policy).

3. All patients with foot ulceration that is not healing or appears infected to have antibiotics within 6 hr of admission (check previous MRSA status if possible).

4. All inpatients with diabetic foot ulceration to be referred to specialist diabetes team within 24 hr of admission.

5. All inpatients with diabetic foot ulceration to be seen by specialist diabetes foot team within 72 hr of admission.

Referrals

- Predominantly neuropathic ulceration below the malleoli - refer to **Diabetes Foot Ulcer Clinic (Dr Niall Furlong – see Topic 30).**

- Predominantly ischaemic ulceration, critical ischaemia, intermittent claudication or ischaemic rest pain – refer urgently to **Vascular Team**.

- Traumatic ulceration & in-growing toenails - refer to General Surgery.

- Ulceration on or above the malleoli - refer to **Dermatology Clinic**.

- Use the MWL Whiston Adult Inpatient Diabetes Foot Pathway (diabetes intranet homepage) to guide initial assessment, management and referral / triage.

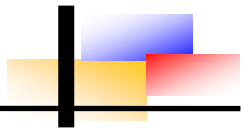
Antibiotics

Not all foot ulceration requires antibiotics but if in doubt start antibiotics guided by microbiology advice and seek expert review.

Level B – use antibiotics. First line antibiotics for diabetic foot ulceration is guided by current edition of hospital antibiotic policy – please consult this policy for guidance.

See Hospital Antibiotic Policy for details.

Topic 26: Management of Adult Diabetic Ketoacidosis (DKA)



Important Note – September 2024

Collective MDT review of a new version of our adult DKA guideline harmonised with the new joint American/European Consensus statement on the management of DKA provoked considerable concerns from medical and nursing members of the specialist diabetes team that elements of the new consensus approach were impractical for safe and effective delivery of DKA care at Whiston Hospital at the present time. This version and the accompanying revised DKA Management Booklet therefore represent a pragmatic compromise between alignment with international consensus and safe and effective local DKA care.

Diagnosis	Typically polyuria, polydipsia, thirst, weight loss, vomiting, dehydration, abdominal pain, and hyperventilation. Usually alert. PLUS:
AND	**pH < 7.3 or HCO_3 < 18 mM and ketonaemia ≥ 3 mM and BG > 11 mmol/l (any BG qualifies in pre-existing diabetes or SGLT2i (gliflozin) treatment).**
Clinical	Confirm diagnosis, seek cause (esp. infection/ischaemia), assess CVS/RS/CNS. Consider alternatives: alcohol/starvation/pregnancy/hyperemesis ketoacidosis.
Laboratory	Check lab BG, U&E & venous pH. Do ECG. Consider individually relevant tests for infection guided by the patient and the clinical presentation.
General	Add Enoxaparin 40 mg o.d. (if not contraindicated). Monitor GCS + NEWS2. STOP SGLT2i & GLP-RA permanently. IV bicarbonate Rx is not recommended.
Management	NEW from July 2024: DKA is classified: Mild, Moderate or Severe. Use DKA BOOKLET (available A&E & AMU) to guide and record management.
MILD	**Diabetes or BG > 11.0 + ketones 3-6 + pH 7.26-7.29 + HCO3 15-18**
MODERATE	**Diabetes or BG > 11.0 + ketones 3-6 + pH 7.00-7.25 + HCO3 10-14.9**
SEVERE	**Diabetes or BG > 11.0 + ketones >6 or pH <7.0 or HCO3 <10**

There is a recommendation to consider subcutaneous insulin to manage uncomplicated mild or moderate DKA in ED or in a nurse-led 'step-down area' it was the view of our inpatient specialist doctors and nurses that this was impractical at Whiston at present, not only because of a drive to try to move patients out of ED to prevent congestion, but also because there were concerns about the practicalities of safe use of subcutaneous insulin and monitoring in this context.

Transfer of mild and moderate DKA patients to enhanced monitoring on an assessment unit is appropriate, but as stated in the new international

Topic 26 Adult DKA Management. Continued from page 40.

guidance and in existing UK guidance, ALL patients with severe DKA and DKA in pregnancy should be referred to ICU immediately (not necessarily for organ support but for intensive monitoring and sometimes complex metabolic intervention such as in the management of serum potassium). No patient with DKA should be managed on a corridor.

Treatment

Start fluids immediately. Start insulin if gas machine K^+ >3.5mmol/l. If K^+ < 3.5 mmol/l, hold insulin & discuss at once with Senior who should consider giving KCL by IV infusion at a rate of 10-20 mmol per hour until K+ > 3.5mmol/l. We would strongly recommend that specific interventions for hyperkalaemia and hypokalaemia in DKA are managed on ICU.

Fluids

Fluid replacement is dictated by hydration & health status. Ideally Ringer's solution may lead to faster resolution, shorter length of stay and less hyperchloraemic acidosis, but pragmatically use of 0.9% saline is satisfactory.

Typically, give 1.0 litre over first 2 hr and then correct remaining fluid deficit over 24-48 hr (informed by HR, BP, fluid balance charts and serum Na). Typically, you might expect total fluid deficit to be of the order of 3-5 L, but each patient should have fluid replacement tailored to their hydration status and co-morbidities (and the rationale for your choice should be documented in the health record).

For conditions where fluid replacement is more critical and there is a greater risk of fluid overload, for example, pregnancy, frailty, heart failure or CKD 3B or worse, consider regular 250 ml boluses guided by frequent assessment rather than a continuous infusion with less frequent assessment. We would strongly recommend that complex fluid replacement in DKA is managed on ICU.

If in doubt, seek senior advice without delay.

Potassium

Await K+ result before using KCL. Only use 0.9% saline pre-constituted bags. If K+ > 5.0 mmol/l, use fluid without KCL; if K+ 3.5-5.0 mmol/l, use bag with 10-20 mmol KCL per litre; if K+ <3.5 mmol/l (5-10% DKA patients), hold insulin and discuss at once with Senior who should suspend IV insulin and consider giving KCL by IV infusion at a rate of 10-20 mmol per hour until K+ >3.5 mmol/l. Severe hypokalaemia K+ ≤ 2.5 mmol/l is an emergency associated with 5-fold increased mortality risk – contact ICU immediately. We would strongly recommend that specific interventions for hyperkalaemia and hypokalaemia in DKA are managed on ICU.

If in doubt, seek senior advice without delay.

Insulin

Once DKA confirmed, give 1 x (STAT) dose of 0.3 units/kg insulin Toujeo subcutaneously AND start Humulin S at a rate of 0.1 units/kg/hr by IV infusion pump. Once BG < 14 mmol/l (or if initial BG < 14 mmol/l), halve IV insulin infusion to 0.05 units/kg/hr and add 10% dextrose IV initially at 80 ml/hr –

Topic 26 Adult DKA Management. Continued from page 40 and 41.

adjust dextrose infusion to maintain target BG 6 - 12 mmol/l (see examples in 'ongoing management' in DKA booklet) until DKA resolved (see Return to S/C below); continue any IV saline (with or without KCL guided by U&Es).

You must use pumps that alarm if either infusion fails – use a bifurcated or trifurcated extension set ("octopus").

If in doubt, seek senior advice without delay.

Monitoring

Check hourly capillary BG. Check first U&E at 2 hr, and check U&E, PO_4^{3-}, creatinine (eGFR), ketone and venous pH every 4 hours. Check serum K+ every 2 hr if <3.5 or >5.0 mmol/l.

If untoward results or doubt, seek senior advice without delay.

Phosphate

Treatment of low PO_4^{3-} is controversial and should only be considered by senior intensivists on ICU – there is a significant risk of precipitating hypocalcaemia and little evidence of clinically relevant benefit.

Return to S/C

Resume subcutaneous long-acting insulin at the patient's usual time and dose on day after admission; resume other insulins when well and pH ≥7.3 or HCO3 ≥ 18 & blood ketones falling (ideally < 0.6).

Commence subcutaneous insulin 1-2 hr before stopping IV insulin infusion (and IV Dextrose) and patients usually treated by S/C insulin (CSII pump) must have had a mealtime bolus before stopping IV insulin (and IV dextrose)(see also inpatient insulin pump guidance due imminently).

For newly diagnosed Type 1 diabetes, calculate total daily insulin dose as 0.5 units/kg, then give half (0.25 units/kg) as long-acting insulin Toujeo at bedtime and give the other half, in three equal divided doses 15 minutes before meals.

For example, for a 72 kg person,

Total daily dose = 0.5 units/kg = 36 units.

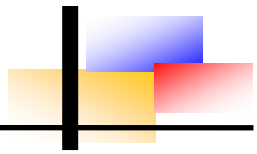
Give half (0.25 units/kg) as bedtime long-acting insulin Toujeo = 18 units

And half as rapid-acting insulin (e.g. Insulin Trurapi) (0.25 units/kg) divided equally between the 3 meals = 18/3 = 6 + 6 + 6. If in doubt ask the IP Diabetes Specialist Nurse.

Aftercare

Assess for complications. Refer all DKA patients to Diabetes Specialist Team without delay (Topic 30) and before discharge to try to prevent recurrence, which is common and associated with increased mortality.

Topic 27: Management of Hyperosmolar Hyperglycaemic State (HHS)



Important Note – September 2024

Collective MDT review of a new version of our adult HHS guideline harmonised with the new joint American/European Consensus statement on the management of HHS provoked considerable concerns from medical and nursing members of the specialist diabetes team that elements of the new consensus approach were impractical for safe and effective delivery of HHS care at Whiston Hospital at the present time. This version therefore represent a pragmatic compromise between alignment with international consensus and safe and effective local HHS care.

Diagnosis	Typically polyuria, polydipsia, thirst, weight loss, vomiting, dehydration, and drowsiness or altered cognition often with other acute illness. PLUS:
AND	**(1) BG ≥ 33.3 mM + (2) pH ≥ 7.3 + HCO3 ≥ 15 mM + (3) ketonaemia < 3 mM + (4) calculated effective serum osmolality > 300 (E-Osm = [2x[Na]+BG), OR Total serum osmolality > 320 (T-Osm = 2x[Na]+BG+Urea). All four (1-4) criteria must be present for diagnosis of HHS.** Up to 33% of patients have diagnostic overlap between HHS and DKA. If there is overlap with DKA, treat as DKA (see Topic 26).
Clinical	Confirm diagnosis, seek cause, esp. infection and/or ischaemia; assess CVS/RS/CNS/Feet.
Laboratory	BG, U&E, Gases, Blood Ketones, T-Osm (see above), Lactate, Urinalysis, MSSU, ECG, CXR & blood cultures (if suspect Sepsis, do full sepsis screen).
General	Add Enoxaparin 40 mg o.d. (if not contraindicated). Monitor GCS + NEWS2. Timing of insulin initiation is controversial. Most patients will require ICU. No patient with HHS should be managed on a corridor.
Treatment	Start fluids. Start insulin if gas machine K^+ >3.5mmol/l. If K^+ < 3.5 mmol/l, hold insulin & discuss at once with Senior who should consider giving KCL by IV infusion at a rate of 10-20 mmol per hour until K+ > 3.5mmol/l. We would strongly recommend that specific interventions for hyperkalaemia and hypokalaemia in HHS are managed on ICU. If in doubt, seek senior advice without delay.
Fluids	Typically, give 0.5 – 1.0 L/hr over first 2-4 hr (note this is less fluid than in previous guidelines) and then correct remaining fluid deficit over 24-48 hr (informed by HR, BP, fluid balance charts, Osm and serum Na). Typically, you might expect total fluid deficit to be circa 6-10 L, but each patient should have fluid replacement tailored to their hydration status and co-morbidities. For conditions where fluid replacement is more critical and there is a greater risk of fluid overload, for example, pregnancy, frailty, heart failure or CKD,

Topic 27, Management of HHS – continued from page 43.

consider regular 250 ml boluses guided by frequent assessment rather than a continuous infusion with less frequent assessment. We would strongly recommend that complex fluid replacement in HHS is managed on ICU.

Fall in osmolality must not exceed 3-8 mOsm/kg/hr to minimise risk of neurological complications, if osmolality fall > 8 mOsm/kg/hr, reduce intravenous fluids and monitor hourly. Serum sodium may rise initially (as a result of fall in BG) – this is not an indication for 0.45% saline. Consider 0.45% saline only if osmolality not falling despite adequate positive fluid balance and appropriate insulin administration.

If in doubt, seek senior advice without delay.

Potassium

Await K+ result before using KCL. Only use 0.9% saline pre-constituted bags. If K+ > 5.0 mmol/l, use bag with nil KCL; if K+ 3.5-5.0 mmol/l, use bag with 10-20 mmol KCL per litre; if K+ <3.5 mmol/l, hold insulin and discuss at once with Senior who should suspend IV insulin and consider giving KCL by IV infusion at a rate of 10-20 mmol per hour until K+ >3.5 mmol/l. Severe hypokalaemia K+ ≤ 2.5 mmol/l is an emergency associated with increased mortality risk – contact ICU immediately.

If in doubt, seek senior advice without delay.

Insulin

Once HHS confirmed, continue their usual basal long-acting insulin at their usual time of administration if the patient already takes it; AND start Humulin S at a rate of 0.05 units/kg/hr by IV infusion pump. Fall in blood glucose must not exceed 6.7 mmol/l/hr to prevent cerebral oedema. If rate of fall > 6.7 mmol/l/hr, halve IV insulin infusion and reassess.

Once BG < 14 mmol/l, continue intravenous insulin infusion at 0.05 units/kg/hr; and add 10% dextrose IV at 80 ml/hr to the saline infusion. Adjust the IV 10% dextrose to maintain blood sugar between 6-14 mmol/l (ideally 11-14) until HHS is resolved. You must use pumps that alarm if either infusion fails – use a bifurcated extension set ("octopus").

If in doubt, seek senior advice without delay.

Monitoring

Hourly capillary BG. Check first U&E and Osm at 2 hr, and check BG, U&E, Osm, creatinine (eGFR), every 4 hours. Check Serum K+ every 2 hr if <3.5 or >5.0 mM.

Resolution

Clinical improvement especially cognitive status + total osmolality < 320 mOsm/kg, BG < 14 mmol/l + urine output > 0.5 ml/kg/hr.

Return to SC

Continue subcut. long-acting insulin at usual time and dose throughout. Resume other insulins when HHS resolved. Must be 1-2 hr overlap between starting mealtime S/C insulin and stopping IV insulin infusion (and Dextrose). If patients usually treated by S/C insulin (CSII pump) (unlikely), they must have had a mealtime bolus before stopping IV insulin (and dextrose infusion).

Aftercare

Assess for complications. Refer all HHS patients to Diabetes Specialist Team without delay (Topic 30) and before discharge to try to prevent recurrence.

Topic 28: Management of In-Hospital HYPOglycaemia

Hypoglycaemia typically manifests as hunger, sweating, tremor, headache ± confusion & ↓ conscious level, with BG typically < 4.0 mM. Some patients suffer seizures or reversible hemiparesis.

1. Give all patients fast-acting carbohydrate ASAP & always within 15 mins of finding low BG.

2. Monitor BG every 15 mins for at least 45 mins and until blood glucose BG >4.0 mmol/L (whichever is longer). Use judgement about monitoring frequency (don't just stop - think).

3. If BG still < 4.0 mmol/L after 45 mins or hypo is recurrent (>2 distinct hypos in 24hr) or severe (causing confusion, seizures or coma), care MUST be escalated to a doctor or IP Diabetes Specialist Nurse without delay (out of hours, ask on call medical registrar).

4. Cause of low blood glucose, ongoing diabetes management plan and any follow-up should be discussed with patient before discharge.

Oral Treatment

In cases of mild hypo, give Glucose via ward hypo box, (5x Glucotabs or 60 ml Glucojuice) or 5 jelly babies or 200 ml full-sugar Coke, 200 ml fresh orange juice, or sugary (3-5 sugars) tea.

Use 2 tubes of GLUCOBOOST (= 20g glucose) (via the ward hypo box) in semiconscious patients who can still protect airway if parenteral treatment and emergency help not available. Do not use GLUCOBOOST in unconscious patients.

If short-acting carbohydrate (as above) used, it should be followed up by more complex carbohydrate (such as a sandwich) to prevent further hypoglycaemia.

If Patient can't take Carbohydrate by mouth, give either

IV glucose, ideally use 20g of 20% (100 ml) by IV infusion over 10-15 min (but 20g of 10% (200 ml) or 20g of 5% (400 ml) will suffice if higher concentration solution unavailable and if volume of IV fluid is judged safe for this patient. Repeat infusion if BG does not rise > 4.0 mmol/L. Monitor as per oral.

1 mg of glucagon may be given IM or IV where IV glucose is unavailable. Glucagon may cause headache and vomiting (especially in young – consider 0.5 mg in teenagers).

If NG tube or PEG, give 60 ml Glucojuice or 2 tubes of GLUCOBOOST or 5 spoons of sugar in warm water down the NG/PEG/PEJ tube.

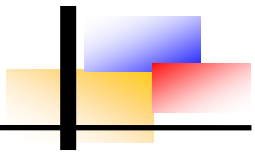
Sulfonylurea-induced hypoglycaemia may require prolonged treatment and supervision – refer to specialist diabetes care.

Subsequent Management

Severe hypoglycaemia is often recurrent over a few days or more, so advise patient to run sugars higher (8-15 mM) for 1-2 weeks and to avoid driving or situations where hypo would put them or others at risk. **Referral to the Hospital Specialist Diabetes Team is recommended**.

Hypo boxes are available in most clinical/ward areas and contents should be checked and topped up daily as required.

Topic 29a: Continuous Subcutaneous Insulin (Pumps)



Background Insulin pumps are small, pager-size, external devices in type 1 diabetes used to stabilise blood glucose control. Rapid-acting insulin (e.g. Novorapid) is delivered subcutaneously by an indwelling cannula (changed every 2-3 days) at pre-programmed rates set by the patient or specialist team. Typically there are one or more 'basal rates' augmented by mealtime boluses.

Important As insulin pumps only administer rapid-acting insulin, discontinuation without alternative provision of insulin, can rapidly result in DKA. Inform the Diabetes Team if a patient using as insulin pump is admitted.

Education Patients receive intensive education in pump use and inpatients should ideally be allowed to self-manage if stable and well enough to do so. Pump settings should only be adjusted by the patient or the Diabetes Team.

Unwell patients If the patient is not well enough to self-manage, or is unconscious / incapacitated, the pump should be removed (and safely stored) with insulin administered via a different route; typically GKI or VRII (Topic 20) or basal-bolus therapy. A pump should **NEVER** be discontinued without immediate substitution of insulin via another route and must only be restarted when the patient is well and able to self-mange (contact the IP Diabetes Team for advice).

DKA If an insulin pump user is admitted with DKA, the pump should be removed (and safely stored) & the patient treated with IV insulin / fluids etc. as per Topic 26. When the patient is well and able to self-manage, insulin pump therapy can be restarted with a new cannula, giving set and reservoir.

Restarting pump When changing from GKI or VRII to s.c. insulin e.g. pump therapy, IV insulin must CONTINUE until the pump has been running for 30-60 minutes *and* a mealtime bolus has been given **(2 hour overlap post DKA).**

Hypoglycaemia For patients able to self-manage, give 20g quick-acting carbohydrate orally (Topic 28). Follow-up with long-acting carbohydrate may not be needed, but infusion rates may need adjusting, particularly if hypoglycaemia is recurrent (contact the Diabetes Team for advice). For unconscious / incapacitated patients, use IV dextrose (ideally 100ml 20% dextrose over 15 mins). Remove the pump if hypoglycaemia is persistent AND only restart insulin pump therapy when blood glucose has returned to normal and the patient is well and able to self-manage (see Topic 28).

Radiological tests Insulin pumps must be suspended and removed prior to MRI, and not taken into the scanning room (removal for CT also advised). Pumps can be safely suspended / removed for up to 1 hour without alternative insulin but should be restarted **immediately** following the investigation. Check capillary BG before and after procedure.

Surgery **See Topic 21. Contact the diabetes team for advice.**

Topic 29b: Recognising Insulin Pumps & Continuous Glucose Monitors (CGM)

Background

Increasingly, patients with diabetes mellitus use advanced technology to (1) monitor glucose levels and (2) to deliver insulin. For patients with T1DM (and some T2DM), 'traditional' finger-prick testing is being replaced by continuous glucose monitoring (GCM).

Whilst most insulin-treated patients still use pen devices to inject insulin, Type 1 patients now often use insulin pumps.

Glucose Monitoring

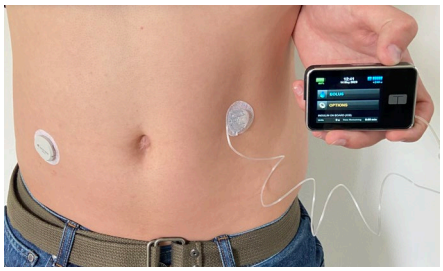
Continuous glucose monitoring (CGM) systems use a small sensor worn on the skin with a subcutaneous sensor that monitors interstitial glucose. Some systems require the sensor to be scanned with a reader device or mobile phone to give a glucose reading (intermittently scanned CGM or isCGM, e.g. Freestyle Libre2), whilst others automatically send glucose data to the reader or phone rtCGM (e.g. Dexcom CGM). Libre 2 with smartphone is rtCGM from 1st July 2023.

Freestyle Libre2

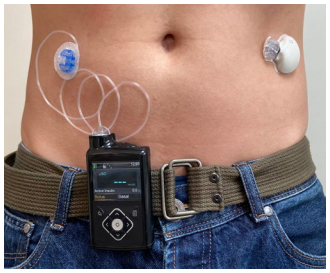
Insulin pumps

These devices can be 'tethered' (i.e. attached to the patient with tubing) or 'tubeless' (patch pumps). Insulin pumps deliver rapid-acting insulin (e.g. NovoRapid) subcutaneously at pre-programmed rates set by the patient or specialist team via an indwelling cannula, augmented by mealtime boluses. The delivery system is typically changed every 2-3 days. Some insulin pumps can integrate with CGM to automatically adjust insulin doses according to glucose levels. This is called Hybrid Close Loop (HCL).

Omnipod (patch pump) with handset

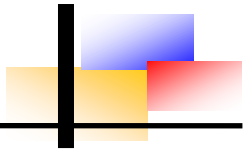


Tandem Slim insulin pump with Dexcom CGM sensor



Medtronic insulin pump with CGM sensor

Topic 30: Contacting Specialist Diabetes Services for Inpatients



The Diabetes Specialist Team provides management support (advice and consultations) to secondary care teams providing inpatient care to people with diabetes (e.g. surgical patients), including diabetes nurse specialist (DSN), registrar and consultant review.

For DSN inpatient referrals please use current referral process – this can be found on the Diabetes Inpatient Care page on the intranet.

For Consultant referrals please indicate whether IP or OP review is required (use Diabetes referral form for OP referrals), written consultant-consultant referrals should be emailed to InpatientReferrals.endo-diabetes@sthk.nhs.uk.

For emergency advice use the Diabetes Emergency Advice Line 01744 646200 option 5.

There is also ongoing diabetes specialist care for the small number of patients admitted to hospital with diabetes-related problems that require ongoing specialist input (e.g. medical management of severely infected diabetic foot ulcers).

Consultant Advice: Diabetes Consultants can be contacted through their secretaries, who typically know whether they are available to take a call and will connect you:

Dr Sumudu Bujawansa – Sarah.Henderson@sthk.nhs.uk or 01744 646497

Dr Prakash Narayanan – Thea.McCarten@sthk.nhs.uk or 01744 646502

Dr Sid McNulty – Michele.Wynn@sthk.nhs.uk or 01744-646500

Dr Niall Furlong – Michele.Wynn@sthk.nhs.uk or 01744-646500

Dr Tala Balafshan – Thea.McCarten@sthk.nhs.uk or 01744 646502

Dr Sam Westall – Chris.Miller@sthk.nhs.uk or 01744 646758

Dr Ei ThuzarAung – Chris.Miller@sthk.nhs.uk or 01744 646758

Mrs Jan Cardwell (Nurse Consultant) Sarah.Henderson@sthk.nhs.uk or 01744 646497

Dr Heather Sullivan - Michele.Wynn@sthk.nhs.uk or 01744-646500

Prof. Kevin Hardy (OP only) – Sarah.Henderson@sthk.nhs.uk or 01744-646497

Email: The diabetes consultants are accessible by email.

Letter: slower than telephone and email but available for those who prefer it.

MONITORING COMPLIANCE WITH THIS DOCUMENT

Key performance Indicators of the Policy

Describe Key Performance Indicators (KPIs) Must reflect	Frequency of Review	Lead
Compliance in the use of the Adult Diabetes Guidelines (Inpatient chapters) within MWL – Whiston & St Helens.	Monthly	Sue Michaels

Performance Management of the Policy

Aspect of compliance or effectiveness being monitored	Monitoring method	Individual responsible for the monitoring	Frequency of the monitoring activity	Group / committee which will receive the findings / monitoring report	Group / committee / individual responsible for ensuring that the actions are completed
Evidence of compliance of the use of Adult Diabetes Guidelines in relation to inpatient diabetes care.	Ongoing review of Datix at monthly diabetes safety MDT	Sue Michaels Senior Diabetes Specialist Nurse & Diabetes IP Nursing Team Leader	Monthly	Diabetes Safety MDT to review and feedback to full MDT and Care Group Governance meeting (and thus CEC or PEC) as appropriate.	Sue Michaels