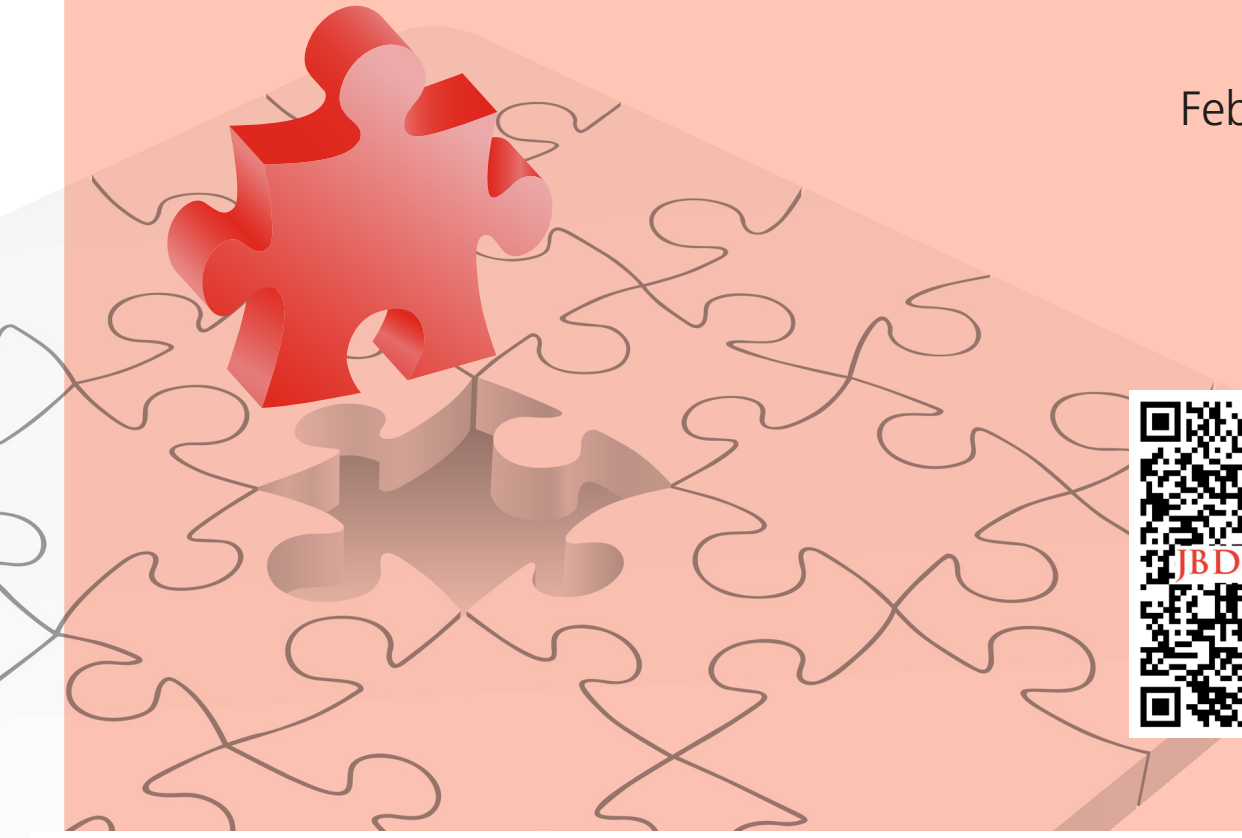
JBDS-IP Joint British Diabetes Societies for inpatient care

Managing diabetes and hyperglycaemia during labour and birth

February 2023



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Other JBDS documents:

The hospital management of hypoglycaemia in adults with diabetes mellitus	*JBDS 01*
The management of diabetic ketoacidosis in adults	*JBDS 02*
Management of adults with diabetes undergoing surgery and elective procedures: improving standards	*JBDS 03*
Self-management of diabetes in hospital	*JBDS 04*
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COncise adVice on Inpatient Diabetes (COVID:Diabetes)	*JBDS 18*

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These guidelines can also be accessed via the Diabetologists (ABCD) **app (need ABCD membership to access the app)**


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To enable the guideline to stay relevant, it is envisaged that all of the JBDS guidelines will be updated or reviewed each year. As such these are 'living' documents – designed to be updated based on recently published evidence or experience. Thus, feedback on any of the guidelines is welcomed. Please email christine.jones@nnuh.nhs.uk with any comments, suggestions or queries.

Conflict of interest statement

The authors declare no conflicts of interest

We are keen to know about your experiences using this guideline, particularly any data from audits of its use in situ. This will be used in the next update of the guideline. Please contact Dr Umesh Dashora u.dashora@nhs.net

Scope of the guideline

This guideline provides guidance on the management of women with pre-existing diabetes (type 1 or type 2), or gestational diabetes when admitted to maternity units in the following situations:

Induction of labour and delivery
Steroid administration for lung maturation if risk of premature labour
Specific issues in relation to diabetic ketoacidosis in pregnancy (Please also see JBDS DKA guidelines)

> This document is designed to support management of glucose control when pregnant women with diabetes are admitted to obstetric wards. It covers circumstances when the patients may be under the joint care of anaesthetists and obstetricians during labour and where less stringent targets may be used (please see Appendices 3 and 4)

Additional JBDS guidelines may be helpful in certain situations. We make the following recommendations for those circumstances.

Diabetic Ketoacidosis (DKA) The management of DKA in Adults [JBDS 02; March 2012, revised January 2023]
https://abcd.care/resource/jbds-02-management-diabetic-ketoacidosis-adults and Hyperosmolar hyperglycaemic State (HHS) The management of the hyperosmolar hyperglycaemic state [JBDS 06; February 2022] https://abcd.care/resource/jbds-06-management-hyperosmolar-hyperglycaemic-state-hhs-adults-diabetes

Who should read these guidelines?

All members of the hospital diabetes specialist team (DST), obstetric anaesthetists and obstetricians
All medical and nursing staff and allied healthcare professionals looking after pregnant women during delivery
Midwives involved with the care of pregnant women with diabetes
Trust Clinical Governance Leads and Risk Officers
Clinical and service managers covering obstetric and diabetes services

Terms and Abbreviations

American Diabetes Association	ADA
Artificial Rupture of Membranes	ARM
Blood Glucose	BG
Confidential Enquiry into Maternal and Child Health	CEMACH
Continuous Glucose Monitoring	CGM
Continuous Subcutaneous Insulin Infusion	CSII
Multiple Daily Injections	MDI
Diabetic Ketoacidosis	DKA
Gestational Diabetes	GDM
Glycaemic Index	GI
Hyperosmolar Hyperglycaemic State	HHS
Induction of Labour	IOL
International Association of Diabetes in Pregnancy Study Group	IADPSG
Maturity Onset Diabetes of the Young	MODY
Oral Glucose Tolerance Test	OGTT
Polycystic Ovary Syndrome	PCOS
Potassium Chloride	KCl
Pre-Eclamptic Toxaemia	PET
Respiratory Distress Syndrome	RDS
Sodium Chloride	NaCl
The National Institute for Health and Care Excellence	NICE
Total Daily Dose	TDD
Total Parenteral Nutrition	TPN
Urea and Electrolytes	U + Es
Variable Rate Intravenous Insulin Infusion	VRIII
World Health Organisation	WHO

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Endorsed by

Centre for Perioperative Care (CPOC)

UK Clinical Pharmacy Association (UKCPA Diabetes & Endocrinology Committee)

Training, Research and Education for Nurses in Diabetes (Trend Diabetes)

Primary Care Diabetes Society (PCDS)

Young Diabetologists & Endocrinologists' Forum (YDEF)

Royal College of Physicians (RCP)

Supported by

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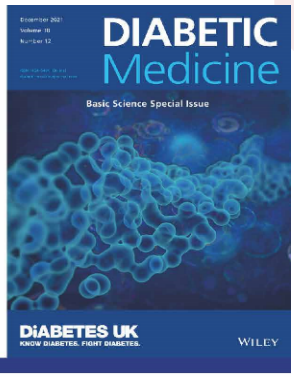
This guideline has also been reviewed by a patient panel organised by Diabetes UK

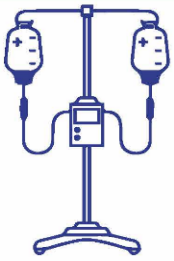
Managing hyperglycaemia during antenatal steroid administration, labour and birth in pregnant women with diabetes

JBDS-IP Joint British Diabetes Societies for inpatient care



The goals of diabetes management during the peripartum period include minimising the risks and consequences of maternal hyperglycaemia and neonatal hypoglycaemia, fluid overload, and maternal and neonatal hyponatraemia.

This guideline offers two approaches – the traditional approach with tight glycaemic targets (4.0-7.0 mmol.l^{-1}) and an updated pragmatic approach (5.0-8.0 mmol.l^{-1}) to reduce risk of maternal hypoglycaemia whilst maintaining safe glycaemia.



This updated pragmatic approach empowers women to self-manage their diabetes which may reduce use of variable rate intravenous insulin infusion, and reduces resource burden on delivery units.

Continuous glucose monitoring and continuous subcutaneous insulin infusion pumps are increasingly used before and during pregnancy and delivery. Placing insulin pumps clear of diathermy pads, and careful documentation of insulin doses, may empower more women to continue diabetes self-management before, during and postpartum.

Dashora U, Levy N, Dhatariya K et al. Managing hyperglycaemia during antenatal steroid administration, labour and birth in pregnant women with diabetes. *Diabetic Medicine* 2021 Epub 23 Nov

https://onlinelibrary.wiley.com/doi/full/10.1111/dme.14744

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Foreword

We recognise that there is considerable variation in the criteria used for diagnosing and managing diabetes in pregnancy and considerable variation in the protocols across NHS Trusts. While NICE advice on the target blood glucose range (4.0 - 7.8 mmol/L during pregnancy and 4.0 - 7.0 mmol/L during labour and delivery) is clear, there is no consensus on the urgency and/or the best route of insulin delivery (intravenous or subcutaneous) to achieve target glucose levels before and during delivery. An alternative approach using a more liberal approach (target blood glucose of 5.0 - 8.0 mmol/L) has been advocated by some authorities to reduce the risk of maternal hypoglycaemia. Increasing numbers of women now prefer to continue their own insulin pumps and self-manage their diabetes using intermittent and continuous glucose monitoring systems.

It is also acknowledged that different types of diabetes (type 1, type 2 or gestational) would require different approaches depending upon the risk factors, antenatal treatment (diet, metformin, insulin), risk of hypoglycaemia, risk of anaesthesia and the presence of obstetric complications. Individual targets may therefore be needed. Many of these issues are beyond the scope of this guideline.

There is broad consensus that striving for target glucose levels safely is desirable in all pregnant women with diabetes when admitted to maternity units. At such times, there are often multiple healthcare professionals involved in the care of the woman, many of whom do not have diabetes as their special interest. Furthermore, these healthcare professionals are often caring for women who are expert in self-managing their own diabetes; some can feel highly vulnerable leaving their diabetes therapy decisions 'in the hands' of less experienced staff. Involving women with diabetes in these decisions is therefore important.

To address some of these issues, (JBDS) has updated their previous guideline 'The Management of glycaemic control in pregnant women with diabetes on obstetric wards and delivery units'. It has been designed to be a practical guide to be used by any healthcare professional who manages obstetric inpatients with hyperglycaemia. Its main aim is to provide a consensus guide to optimum management of diabetes to minimise risk to mothers and babies.

The updated guideline is divided into sections, including the evidence base for recommendations to safely minimise antenatal hyperglycaemia and the practicalities of using therapies. Appendices 1 and 2 have been designed to be used as stand-alone prescriptions and documents which can be adapted and used on the wards. Appendices 3 and 4 give an alternative view on glucose management during steroid administration and intra-partum delivery period. It is hoped that its adoption will help harmonise management of diabetes in obstetric settings and enable local, regional and national audits to be carried out. This will allow continuous refinement of the guidance.




Introduction

Pre-existing diabetes (type 1 and type 2) is known to affect maternal wellbeing, obstetric outcomes and neonatal health. There is international consensus over the importance of aiming for tight glucose levels before conception and throughout pregnancy to optimise pregnancy outcomes.

This guideline will aim to provide consensus target glucose levels for managing diabetes in pregnant inpatients on maternity units.

The recommendations in this guideline are based on a combination of national audit, published research, guidelines from other JBDS groups where relevant, and consensus of experts who contributed to the development of this guideline.

The emphasis throughout this guideline is on the safe use of insulin to achieve the best possible pregnancy outcomes for both mother and baby.

It will not replace the need for referral to the local diabetes team as soon as possible after admission so that individual patient's needs may be assessed and appropriate action taken. This may not be possible in some Trusts depending on availability of expertise so local policies should be followed.

We recommend that healthcare professionals also complete the free e-learning module on insulin treatment at: INSULIN SAFETY e-LEARNING – Trend Diabetes

We recommend midwives looking after women with diabetes consider completing the e-learning module provided by the royal college of midwives at: Diabetes in pregnancy https://www.rcm.org.uk/news-views/rcm-opinion/2022/caring-for-pregnant-with-pre-existing-and-gestational-diabetes/

More information about using continuous glucose monitoring (CGM) and insulin pump therapy during delivery and postpartum is available from the ABCD Diabetes Technology Network Best Practice Guidelines available at https://abcd.care/dtn/CGM and https://abcd.care/sites/abcd.care/files/site_uploads/Resources/DTN/BP-Pregnancy-DTN-V2.0.pdf

Key recommendations

- All women with diabetes of any type should have hourly blood glucose (capillary, Flash or CGM) monitoring in established labour or from the morning of elective caesarean section. If general anaesthesia is used, monitoring should be every half an hour until the woman is fully conscious
- Aim to maintain glucose levels (capillary, Flash or CGM) during labour in either the target range advocated in the NICE guidelines (4.0 – 7.0 mmol/L) or in the more liberal range of 5.0 – 8.0 mmol/L due to lack of RCT evidence for either target
- Some women with type 1 diabetes, type 2 diabetes or GDM may require VRIII to achieve target glucose levels. An example pre-printed prescription chart and guidance is attached with this guideline (see Appendices 1 and 3)
- Women who are on insulin pump therapy or automated insulin delivery systems may choose to remain on insulin pump therapy or automated closed-loop systems (an insulin pump system which delivers basal insulin according to CGM glucose levels) after steroids and during the intrapartum and post-natal periods
- If VRIII is used, aim to achieve glucose levels in the pregnancy target range (either 4.0 - 7.8 or 5.0 - 8.0 mmol/L). Always use capillary blood glucose to adjust VRIII doses. Continue meal-time insulin when VRIII is started if the woman is eating and drinking
- If VRIII is used, the default fluid to run alongside should be 5% glucose in 0.9% saline with 0.15% KCl at a rate of 50 mL/h. Additional intravenous fluids may be required as per clinical need e.g. haemorrhage
- Reduce the rate of VRIII (if and when used) by 50% (or change to the lowest scale) once placenta is delivered
- Contact the diabetes team to review the on-going post-natal insulin doses in insulin treated patients with type 1 and type 2 diabetes. The insulin dose may be 25% less than the doses needed at the end of first trimester
- Women with type 1 diabetes are at increased risk of severe hypoglycaemia especially when breastfeeding and should have additional carbohydrate with meal or as a snack available during or before breastfeeds. Glucose levels over 6.0 mmol/L are advised before each breast feed and before bed
- Glucose lowering medications in women with gestational diabetes should be stopped after delivery of the placenta. Continue capillary glucose monitoring for up to 24 hours to exclude diabetes
- Women with pre-existing type 2 diabetes who are breastfeeding can take metformin after birth, but should avoid other oral glucose lowering treatments
- Capillary blood glucose (BG) levels (or Flash or continuous glucose monitoring [CGM] if applicable) should be monitored regularly when women are administered steroids in pregnancy
- The pregnancy glucose targets during steroid administration (4.0 – 7.8 or 5.0 to 8.0 mmol/L) can be achieved by starting s.c. insulin or increasing the total daily MDI or CSII dose (generally by 50%). If the BG levels are higher than target on two consecutive occasions, VRIII can be used to manage hyperglycaemia (Appendix 2 for NICE recommended targets and Appendix 4 for liberal targets)

Detailed recommendations

The NICE guidelines recommendations currently suggest (1):

Monitoring of plasma glucose hourly during labour and birth in all women with diabetes, ensuring it is maintained between 4.0 and 7.0 mmol/L. Intravenous dextrose and insulin infusion should be considered for women with type 1 diabetes from the onset of established labour. Use intravenous dextrose and insulin infusion during labour and birth for women with diabetes whose capillary plasma glucose is not maintained between 4.0 and 7.0 mmol/L.

The NICE guideline may be followed using the intra-partum glucose target of 4.0 - 7.0 mmol/L. In a service evaluation of these guidelines 30/60 (50%) women achieved the NICE recommended target glucose levels with very few women requiring VRIII [5/60 (8%)] and a low incidence [1/60 (1.7%)] of neonatal hypoglycaemia. None of the 5 women on VRIII experienced hypoglycaemia (2; 3). Overall 12/60 (20%) women experienced non-severe hypoglycaemia (corrected without external help).

However, JBDS recognises that the intra-partum glucose targets of 5.0 - 8.0 mmol/L may offer an acceptable margin of safety and be more appropriate for women vulnerable to hypoglycaemia, those on multiple infusion pumps for different medications during delivery and those undergoing regional analgesia or general anaesthesia (4-9). The advantages and disadvantages are summarised in Table 1. The risks of VRIII are outlined in Table 2. Appendix 3 provides scales and regimens to achieve this pragmatic target.

Table 1: Advantages and disadvantages of tight vs pragmatic glycaemic targets during labour and birth and when using steroids for suspected preterm birth

Approach	Advantages	Potential Disadvantages
Traditional intrapartum capillary glucose target range of 4.0 - 7.0 mmol/L	Widely used Supported by NICE	• Increased risk of use of VRIII which is intrusive for women and resource intensive for delivery units • Increased risk of maternal hypoglycaemia • Reduced autonomy for diabetes self-management • May be too late to reverse the consequences of sustained fetal hyperinsulinism and/ or to prevent neonatal hypoglycaemia
Pragmatic intrapartum capillary glucose target range of 5.0 – 8.0 mmol/L	• Reduced use of VRIII which allows women more autonomy and mobility during/after birth • Lower risk of maternal hypoglycaemia • Reduced resource burden for delivery unit staff	• Limited evidence-base • Fear of potential increased risk of neonatal hypoglycaemia

Table 2.
Potential complications associated with the use of the VRIII on maternity wards

Domain	Complication
VRIII initiation	• Delayed commencement leading to insufficient time to minimise neonatal hypoglycaemia and/or diabetic ketoacidosis (DKA) • Wrong connections • Lack of use of one-way anti-siphon valves • Incorrect programming
VRIII implementation	• Resource intensive and limits autonomy for diabetes self-management during birth • Insufficient blood glucose measurements resulting in either hypoglycaemia of hyperglycaemia • Titration scales that predispose to hypoglycaemia as there is no buffer zone between the lower capillary blood glucose target of 4.0 mmol/L and hypoglycaemia (<3.9 mmol/L) • Premature cessation of the substrate but with continuation of the intravenous insulin infusion leading to hypoglycaemia • Hyponatraemia due to inadequate sodium in the substrate fluid • Hypokalaemia due to inadequate potassium in the substrate fluid • Fluid overload • Erroneous blood glucose measurements caused by use of glucose in arterial flush lines
VRIII cessation	• Careful timing of pre-meal and basal subcutaneous insulin needed

JBDS recommends that the midwives should have at least two hours of training and yearly updates on managing VRIII. The unit should be supported by a daily ward round from the diabetes team.

This guidance recommends the use of 5% glucose in 0.9% saline with 0.15% KCl to be administered alongside the VRIII. Iatrogenic neonatal and maternal hyponatremia following the administration of hypotonic solutions to the parturient is well documented (5; 10-16). Neonatal hyponatremia occurs as sodium concentrations equilibrate across the placenta (5; 10-16). Moreover, postmenarchal women and children are particularly susceptible to harm from hyponatraemia due to the administration of hypotonic solutions (17). Salutatory administration of 5% glucose in 0.9% saline to the parturient is recommended in NICE guidance on intravenous fluid administration to children in order to prevent of iatrogenic hyponatraemia from fluid therapy (18). This is in contrast to the NICE guidance on peripartum management which recommends the use of hypotonic dextrose solutions (1). Potassium chloride is required to ensure hypokalaemia does not occur as a result of insulin activation of cellular Na/ K/ ATPase pumps (19).

1.1 Intrapartum recommendations for all women with diabetes

- All women with pre-existing diabetes or gestational diabetes should be seen in joint diabetic/obstetric clinics to monitor treatment and to discuss, agree and document a peripartum diabetes management plan. This plan should include the blood glucose target zone
- Women with GDM should be informed that all glucose lowering therapies will be stopped after the delivery of placenta
- Women using intermittent or real time continuous glucose monitoring (CGM) should be advised that additional capillary glucose tests may be required during labour and delivery. CGM measures interstitial glucose levels, and changes may lag 5 - 10 minutes behind capillary blood glucose measurements. CGM can be used to guide diabetes self-management but CGM should NOT BE USED to guide VRIII doses
- The peripartum diabetes management plan includes hourly glucose monitoring using CGM or capillary glucose measurement during established labour or after artificial rupture of membrane or on admission for caesarean section
- The intrapartum glycaemic target (either 4.0 – 7.0 mmol/L or 5.0 – 8.0 mmol/L) and the methods used to achieve this target should be clearly documented
- VRIII should be considered if two consecutive blood glucose levels are above the target range (7.0 or 8.0 mmol/L). The second blood glucose should be checked within an hour to prevent any delay in starting VRIII. For VRIII, a syringe pump is set up with 50 units human soluble insulin (e.g. Humulin® S or Actrapid®) in 49.5 mL of normal saline (See Appendices 1 and 3 of JBDS guidelines and Table 3 and 4)
- In some women with type 1 diabetes with erratic blood glucose control, it may be justified to start VRIII from the time of onset of labour irrespective of BG readings for more effective glucose control
- If general anaesthesia is used, capillary blood glucose should be monitored every half an hour until the woman is fully conscious
- The recommended substrate fluid to be administered alongside the VRIII is 0.9% NaCl with 5% glucose and 0.15% KCl (20 mmol/L) or 0.3% KCl (40 mmol/L) at 50 mL/hr. Additional intravenous fluids may be required as per clinical need e.g. haemorrhage. VRIII without substrate fluids may be required in some cases (e.g. fluid overload, hyponatraemia and pre-eclampsia). Pure dextrose containing fluids should be avoided due to risk of hyponatraemia
- During ongoing use of VRIII (>6 hours), serum electrolytes should be checked 4 – 6 hourly to maintain electrolyte balance. If ketoacidosis is suspected, blood ketones should be checked
- Particular care relating to the fluid management is needed in women with pre-eclampsia, as they may require fluid restriction alongside intravenous medications. The volume of all administered fluids should be carefully calculated. Provided there are not extra needs (e.g. haemorrhage), this should be kept to 80 mL/h (20)

Table 3.
Suggested VRIII for use during labour (NICE recommended targets):
(50 units Actrapid® or Humulin® S insulin in 49.5 mL 0.9% NaCl via syringe driver).
Flash or CGM glucose levels should not be used for insulin dosing during VRIII

	DOSING ALGORITHM *(Please see the guide below)*			
Algorithm →	1	2	3	4
Finger prick BG Levels (mmol/L)↓	For most women	For women not controlled on algorithm 1 or needing >80 units/ day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<4.0	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	

ALGORITHM GUIDE

- **ALL** women with diabetes should have Blood Glucose (BG) or intermittent or real time continuous glucose monitoring (CGM) testing hourly in established labour, after ARM or on admission for elective C-Section
- Start VRIII and Fluids if two consecutive BG/CGM > target (see below)

Algorithm 1 Most women will start here

Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)

Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 4.0 – 7.0 mmol/L

Check BG every hour whilst on VRIII and every half an hour if under anaesthesia

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

For hypoglycaemia management see JBDS guidelines (21):
https://abcd.care/resource/jbds-01-hospital-management-hypoglycaemia-adults-diabetes-mellitus

Table 4.
Suggested VRIII for use during labour (liberal targets):
(50 units Actrapid® or Humulin® S insulin in 49.5 mL 0.9% NaCl via syringe driver) with Flash or CGM glucose levels should not be used for insulin dosing during VRIII

	DOSING ALGORITHM *(Please see the guide below)*			
Algorithm →	1	2	3	4
Finger prick BG Levels (mmol/L)↓	For most women	For women not controlled on algorithm 1 or needing >80 units/ day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<5	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
5.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	

ALGORITHM GUIDE

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If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 5.0 – 8.0 mmol/L

Check BG every hour whilst on VRIII and every half an hour if under anaesthesia

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

For hypoglycaemia management see JBDS guidelines (21):
https://abcd.care/resource/jbds-01-hospital-management-hypoglycaemia-adults-diabetes-mellitus

1.1.1 Additional recommendations for women on metformin or Multiple Daily Injections (MDI)

- The day prior to induction, and during cervical ripening, glucose testing, insulin and oral glucose lowering drugs should continue as usual
- Prandial insulin (and metformin if taken) should be stopped if VRIII is started
- Basal insulin should be continued in women using insulin glargine (Lantus®, Toujeo®, Semglee®, Abasaglar®), Detemir (Levemir®), NPH insulin (Insulatard®), Insuman® Basal or Humulin® I or other basal insulins but prandial insulin should be discontinued if VRIII is started

1.1.2 Additional recommendations for women with type 1 diabetes on CSII

- Most women will self-manage their insulin pump doses, often with assistance from their birth partner. They will use correction boluses and/or basal rate changes to maintain target glucose levels following steroid administration and before and during birth
- The manufacturers of the CSII pumps state that the pumps should not be used near unipolar diathermy because of potential for electrical conduction. However, CGM and CSII are now increasingly used during caesarean section with both unipolar and bipolar diathermy. Women should be informed of the hypothetical risk and advised that a Teflon cannula can be used if the insulin pump and CGM sensor are situated away from the operative site and the diathermy pad(s). Steel infusion sets are not applicable for peri-operative use
- A discussion on the intrapartum diabetes management in the event of a planned or emergency Caesarean section should be considered. The options include continuation of CSII; transition to VRIII; or temporarily stop CSII (if glucose levels are within target) and recommence CSII, switching to postpartum basal rates immediately after surgery. CSII removal should not exceed 60 minutes. Table 5 highlights the potential advantages and disadvantages of the alternative strategies
- Further guidance on the safe perioperative use of the CSII is found in the patient-centric multidisciplinary guidance produced by the Centre for Perioperative Care (CPOC) (22)
- If the woman is unable to manage, or her glucose control is unstable or deteriorates, i.e. blood glucose >7.0 or 8.0 mmol/L on two consecutive occasions, or has urinary ketones ++ or more, or high ketones (>1.5 mmol/L), then VRIII (in hyperglycaemia) or FRIII (in ketoacidosis) should be immediately commenced. CSII should be switched off, removed, labelled and safely stored for postpartum use
- The insulin pump settings can be changed to postpartum doses by the woman or her partner immediately before or after surgery. It is important to confirm that each of the pump setting has been adjusted for postpartum glucose targets (typically 6.0 – 8.0 mmol/L), basal rate (at least 50% reduction), insulin to carbohydrate ratio (typically 12 – 15 g carbohydrate) and insulin sensitivity factor (typically 4.0 mmol/L)

Table 5. Options for the peripartum management of women with type 1 diabetes using insulin pumps before and during birth

Options	Benefits	Potential risks
Continuation of CSII during labour/birth	• Empowers diabetes self-management • Reduced resource burden on delivery unit staff • Safe and effective intrapartum glycaemia, with observational data suggesting superior efficacy compared to VRIII	Manufacturers liability concerns of pump failure near diathermy sites
Planned use of VRIII during labour/birth	Complies with CSII manufacturers' guidance	Intrusive for women and resource intensive for delivery unit staff Intrinsic complications including user errors with establishment and cessation leading to DKA, fluid and electrolyte imbalance and inadvertent hypoglycaemia
CSII to be used if vaginal delivery, and VRIII if operative delivery	Complies with CSII manufacturers' guidance	As a category 1 caesarean section can be called at any time, there is a risk that the VRIII will not be established
Continuation of CSII if vaginal, and cessation of CSII if urgent section called	Complies with CSII manufacturers' guidance	CSII can be safely stopped for up to 60 minutes but must be restarted immediately post-operatively to prevent DKA

1.2 Postpartum recommendations for women with diabetes

NICE recommends that babies of mothers with all types of diabetes should be monitored for neonatal hypoglycaemia for at least 24 hours post-delivery (1).

1.2.1 Additional recommendations for women with insulin-treated diabetes before pregnancy

Insulin requirements drop immediately after delivery of the placenta. Commonly used options include reverting to the pre-pregnancy dose, 25% reduction from the first trimester dose or 50% of the late pregnancy doses. Data from the use of closed-loop highlight substantial intra-individual variability but suggests that the average total daily insulin dose is approximately 50% of late pregnancy dose (6). Postpartum insulin doses should be reviewed in conjunction with diabetes team daily, with an emphasis on minimising risk of maternal hypoglycaemia, and before hospital discharge.

- The rate of VRIII (if and when used) should be reduced by 50% immediately after delivery. Hourly glucose monitoring should be continued until the first meal is eaten. Ensure woman is eating and drinking before restarting subcutaneous insulin

- VRIII should be stopped 30 - 60 minutes after the first subcutaneous pre-meal insulin injection. Women using CSIII may not necessarily require pre-meal insulin with the first light meal after delivery
- A post-partum glucose target range of 6.0 - 10.0 mmol/L is applicable for women with insulin-treated diabetes. This applies to hospitalised patients on glucose lowering medication (21)
- Postpartum insulin regimen should be resumed as per individual diabetes management plan. If there is no documented diabetes plan, the early pregnancy (about 12 weeks gestation) doses should be reduced by 25% or the late pregnancy (about 36 weeks gestation) doses by at least 50%
- Thereafter, healthy eating should be encouraged with increased carbohydrate as required to minimise the risk of hypoglycaemia, if breastfeeding / expressing. Women should be advised to snack (10 - 15 g carbohydrate) and drink each time they feed or express milk (including night feeds). Up to 450 extra calories per day may be needed when feeding is fully established. Healthy eating should be encouraged without additional calories or carbohydrates for women who are bottle feeding

1.2.2 Additional recommendations for women previously not on insulin

- Insulin infusion or injections should be stopped when the placenta is delivered
- In women on oral medications before pregnancy, glucose monitoring should be continued 4-hourly until the first meal. Thereafter pre-meals and pre-bedtime glucose levels should be monitored. Because metformin does not cause hypoglycaemia, a target glucose range of 4.0 - 10.0 mmol/L is acceptable. For those on other oral glucose lowering medications the target range is 6.0 - 10.0 mmol/L
- In women with gestational diabetes (GDM), all glucose lowering medications should be stopped after the placenta is delivered. Glucose levels should be monitored pre- and post-meals for 24 hours to detect new or pre-existing diabetes (fasting glucose >7.0 mmol/L and post-meal >11.1 mmol/L)
- Healthy diet choices should be encouraged with low GI diet along with weight management advice and referral for national diabetes prevention and/or weight management programmes as applicable

1.2.3 Additional recommendations for women on insulin pump

If she hasn't already done so, the woman must change the pump settings to her postnatal settings as described on her individual care plan provided by the diabetes team. If the woman's pump has been discontinued it should be re-connected for one hour prior to discontinuing the VRIII. Only discontinue VRIII when the woman can safely manage her own pump.

In the absence of a documented individual care plan, ensure the woman changes her pump following the advice below:

- Basal rates should be reduced to 0.5 units per hour
- Insulin to carbohydrate ratios should be changed to 1 unit of insulin per 15g of carbohydrate
- Insulin sensitivity should be increased to 4.0 mmol/L
- Blood glucose targets should be increased to 6.0 – 10.0 mmol/L

Please note that an insulin bolus is usually not required for the first light meal taken post-delivery. The emphasis is now on avoidance of maternal hypoglycaemia so glucose targets are relaxed.

- Refer to specialist diabetes pump team as soon as possible

1.3 Additional post-natal advice and review

This should include

- **Contraception/plans for future pregnancy.** Safe effective contraception is required to reduce risks of unplanned pregnancy. Support planning for future pregnancy with the diabetes team and encourage continuing contraception until 5 mg (must be prescribed) folic acid is taken, target glucose levels (HbA1c < 48 mmol/mol) and healthy pre-pregnancy bodyweight are achieved
- **Arrangements for on-going diabetes care.** For women with pre-existing or new onset diabetes, follow-up plan for diabetes management should be put in place
- **Fasting plasma glucose arrangements at 6-13 weeks post-natal.** For women with GDM, fasting plasma glucose should be done at 6-13 weeks after delivery to diagnose diabetes post-partum. HbA1c after 13 weeks is an alternative if the fasting plasma glucose is not done before 13 weeks post-partum (1). Annual HbA1c measurement is required during further follow up in women who have a negative post-natal test (1)
- **Lifestyle modifications.** Women with gestational diabetes have a ten times increased risk of developing type 2 diabetes within 5 years (23). Women with GDM are eligible for referral to the National Diabetes Prevention Programme (NDPP) regardless of baseline glycaemia (provided that type 2 diabetes has been excluded)
- **Breastfeeding support.** Women should be counselled about the maternal and child benefits of breastfeeding and be offered support to establish breastfeeding if this is how they choose to feed their baby
- **Review of medications.** Women who are breast feeding with pre-existing type 2 diabetes can take metformin after birth but should avoid other oral glucose lowering drugs. Women should continue to avoid medicines for their diabetes complications that were stopped for safety reason during pre-conception period or when pregnancy was identified.
- Women with type 1 diabetes should be screened for **post-partum thyroiditis** with a TSH at 3 and 6 months postpartum (24)

1.4 Practical guidance for management of glucose during steroid use

1.4.1 Women on diet control/ oral treatment and/or single or multiple dose insulin therapy

Administration of antenatal steroids for fetal lung maturity is recommended before 34^{+0} weeks and considered among women at risk for preterm birth between 34+0 and 35^{+6} weeks (25). Administration of steroids may result in a deterioration of glucose levels for 2 to 3 days. This should be anticipated and actively managed. JBDS recommends regular monitoring of BG levels in these women. Insulin (s.c.) may need to be started in women managed by diet or metformin and an increase in s.c. insulin dose typically by 50% is needed in those who are already on insulin. If BG levels remain higher than target on two consecutive occasions then VRIII may be used. If VRIII is used in this context, the following approach is suggested:

- Check U+Es prior to starting VRIII to monitor fluid balance and electrolyte abnormalities. Repeat 24 hourly
- Start variable rate intravenous insulin infusion (VRIII) (50 units human soluble insulin [Humulin® S or Actrapid®] made up to 50 mL with 0.9% NaCl) to achieve the target blood glucose of either 4.0 – 7.8 or 5.0 – 8.0 mmol/L. Use the scale in Tables 6 and 7 below. Continuous intravenous insulin may be needed until 12 hours after the administration of the second dose of steroids
- Basal insulin needs to be continued as usual. We recommend that meal time insulin is continued if the woman is eating and drinking to achieve adequate management of glycaemic excursions after meal. Appropriate documentation and education are needed to prevent insulin errors
- When on VRIII, check capillary blood glucose level hourly aiming for blood glucose (BG) 4.0 - 7.8 mmol/L
- We recommend 0.9% NaCl with 5% glucose and 0.15% KCl (20 mmol/L) or 0.3% KCl (40 mmol/L) as the substrate fluid with i.v. insulin to avoid maternal and neonatal hypoglycaemia, hyponatraemia and hypokalaemia (5; 10; 11; 16; 18). The rate of substrate infusion should take into account the volume status but generally 50 mL/h would be reasonable. Please see the prescription charts (Appendix 2 for NICE recommended targets and 4 for the more liberal targets) and Tables 6 and 7 for more details. Additional i.v. fluids may be needed if the patient is not eating or drinking reliably. Fluids, particularly dextrose containing fluids, may have to be restricted in patients who are at risk of or already have hyponatraemia. In some cases insulin without substrate fluids may have to be used (e.g. difficult i.v. access, fluid overload states like toxaemia, hyponatraemia or risk of hyponatraemia). Please consult senior medical/ obstetric and anaesthetic staff as needed.

Table 6.
VRIII for use during administration of antenatal steroids (NICE recommended targets): Administer 50 units Human soluble insulin (Humulin® S or Actrapid®) in 49.5 mL 0.9% NaCl via syringe driver). Flash or CGM glucose levels should not be used for insulin dosing during VRIII

Algorithm →	1	2	3	4
Finger prick BG Levels (mmol/L) ↓	For most women	For women not controlled on algorithm 1 or needing >80 units/ day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<4	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	

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- Start VRIII and Fluids if BG levels are > target on 2 consecutive readings and continue for up to 12 hours after the last dose
- **ALL** women with diabetes should have hourly blood glucose (BG) monitoring while on VRIII for the management of steroid hyperglycaemia during pregnancy

Algorithm 1 Most women will start here

Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)

Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 4.0 – 7.8 mmol/L

Check BG every hour whilst on VRIII

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

For hypoglycaemia management see JBDS guidelines (21): https://abcd.care/resource/jbds-01-hospital-management-hypoglycaemia-adults-diabetes-mellitus

Table 7.
VRIII for use during administration of antenatal steroids (liberal targets): Administer 50 units Human soluble insulin (Humulin® S or Actrapid®) in 49.5 mL 0.9% NaCl via syringe driver). Flash or CGM glucose levels should not be used for insulin dosing during VRIII

Algorithm →	1	2	3	4
Finger prick BG Levels (mmol/L)↓	For most women	For women not controlled on algorithm 1 or needing >80 units/ day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<5	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
5.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	

Flash or CGM glucose levels should not be used for insulin dosing during VRIII

ALGORITHM GUIDE

- Start VRIII and Fluids if BG levels are > target on 2 consecutive readings and continue for up to 12 hours after the last dose
- **ALL** women with diabetes should have hourly blood glucose (BG) monitoring while on VRIII for the management of steroid hyperglycaemia during pregnancy

Algorithm 1 Most women will start here

Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)

Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 5.0 – 8.0 mmol/L

Check BG every hour whilst on VRIII

Move to the higher algorithm if the BG is above target and is not dropping

Move to the lower algorithm if BG falls below 5.0 mmol/L or is dropping too fast

For hypoglycaemia management see JBDS guidelines (21): https://abcd.care/resource/jbds-01-hospital-management-hypoglycaemia-adults-diabetes-mellitus

1.4.2 Women on CSII receiving steroids

- The specialist diabetes team should be involved in the management of these patients
- Women on insulin pump therapy may be able to safely maintain glucose levels following steroid administration by use of correction boluses and temporary basal rate increases. In general approximately 50% increase in insulin doses may be needed
- If optimal glycaemia cannot be achieved (e.g. 2 consecutive blood glucose (BG) readings >7.8 mmol/L), a variable rate intravenous insulin infusion (VRIII) can be considered. The insulin pump should be disconnected, labelled and stored securely for future use

1.5 Diabetic Ketoacidosis (DKA)

Diabetic ketoacidosis is a medical emergency requiring prompt treatment, and is different to a ketosis of pregnancy. Women who are suspected of having DKA are admitted to the delivery suite or the high dependency unit where they can receive medical and obstetric care. Recent UK national data has suggested that the incidence rate of DKA in pregnancy is 6.3 per 100,000 (26). Risk factors were increased deprivation, mental health problems and poor long term glycaemic control. Whilst there were no maternal deaths, there was a significant (16%) fetal mortality. Ketones are toxic to the fetus, and there were 11 still births and 1 neonatal death. These data showed that the most common precipitants were infection, vomiting, steroid treatment or medication errors (26).

This protocol is based on national guidance (27) which uses a fixed rate of insulin infusion (FRIII) and a variable amount of intravenous glucose to prevent hypoglycaemia.

This guidance is only for use in DKA, a "traditional" intravenous insulin sliding scale (now called VRIII) should still be used for uncontrolled hyperglycaemia. For HHS an approach similar to DKA may be used but may require less insulin and more fluids (see JBDS guidelines https://abcd.care/resource/jbds-06-management-hyperosmolar-hyperglycaemic-state-hhs-adults-diabetes.

DKA may manifest as abdominal pain – always consider as a possible alternative to pre-term/term labour.

DKA can occur with only very modest elevation of glucose levels ('euglycaemic DKA') in women during pregnancy.

Symptoms include nausea and/or vomiting, abdominal pain, polyuria and polydipsia, and leg cramps. Later signs/symptoms include dehydration (manifesting as dry skin and mouth), blurred eyesight, tachypnoea, rapid pulse, a distinct smell on the breath (sometimes described as 'pear drops') and coma. Ketoacidosis should always be considered when a pregnant woman with diabetes feels unwell. These women must be assessed by a medical or diabetes team.

Due to the potential for poor maternal and obstetric outcomes, and because these women may present to areas outside of the obstetric unit, it is incumbent on management, medical and obstetric teams to ensure that the guidelines on the management of DKA in pregnant women is included in all guidelines used outside of the maternity setting.

Furthermore, institutions should consider skills and drills training on the management of DKA in pregnancy to ensure that obstetricians and midwives are aware of the symptoms and signs of diabetic ketoacidosis.

1.5.1 Diagnosis of DKA:

1. Presence of **D**iabetes mellitus (of any kind, DKA can occur in pregnancy in a woman with known diabetes with a normal blood glucose level) AND:
2. **K**etosis: urinary ketones >++ or blood ketones >3.0 mmol/L (high risk 1.5 mmol/L) **AND**
3. **A**cidosis: blood gas pH <7.3 and/or bicarbonate <15 mmol/L (N.B. bicarbonate is reduced in pregnancy). Use venous blood gases.

Encourage women to contact the obstetric team if not well or vomiting – may need hospital admission for intravenous insulin regime. Always ask when they last ate and when they had their last insulin: if they have omitted their insulin advise admission immediately.

Some women are testing blood ketones on a home meter. The normal range in pregnancy is not established, but outside pregnancy <1.0 mmol/L is normal.

1.5.2 Treatment of DKA:

If the woman is using an insulin pump discontinue the insulin pump and start intravenous insulin infusion at a fixed rate.

Use the JBDS guideline for management of DKA or the local trust guidelines (27).

Some of the salient specific points in DKA in pregnancy are:

- Involve the medical or diabetes team urgently
- DKA in pregnancy should be managed in critical care
- DKA during the delivery should be managed in accordance with principles laid out in the multidisciplinary document "Care of the critically ill woman in childbirth; enhanced maternal care" (28)
- Start i.v. fluids immediately whilst awaiting the diabetes/ medical team

1.5.2.1 Start i.v. insulin infusion and monitor blood glucose

- Set up an insulin infusion of **50 units of soluble insulin (Humulin® S or Actrapid®) in 49.5 mL 0.9% NaCl via syringe driver** and deliver insulin at a fixed rate of 0.1 unit/kg of actual body weight/hour
- A maximum dose limit of 14 units/h should be adhered to unless specifically over-ridden by medical SpR or consultant
- The fixed rate may have to be increased by 1 unit/h if there is inadequate response (less than 3 mmol/L drop in capillary glucose per hour or less than 0.5 mmol/L drop in blood ketone or less than 3 mmol/L rise in venous bicarbonate per hour). Check the pumps and the lines and involve the medical team
- Measure capillary glucose hourly
- Glucose level is not an accurate indicator of resolution of acidosis in euglycaemic ketoacidosis, so the acidosis resolution should be verified by venous gas analysis**
- Continue with the basal insulin i.e. Glargine (Lantus®, Abasaglar®, Toujeo®), Detemir (Levemir®) or Degludec (Tresiba®) but discontinue short acting insulin

** If ketones and glucose are not falling as expected always check the insulin infusion pump is working and connected and that the correct insulin residual volume is present (to check for pump malfunction)

1.5.2.2 Administer fluids and potassium

- The fluid requirement may be lower in pregnancy. Start with 1L 0.9% NaCl over 60 minutes and continue with the hydration fluids as per clinical need. Often patients with severe dehydration and typical DKA would need 1 litre of normal saline each in subsequent 2 hour, 2 hour, 4 hour, 4 hour, and 6 hours after the first bag
- Add 10% dextrose to run alongside 0.9% NaCl when capillary glucose < 14 mmol/L. Initially this should be administered at a rate of 50 mL/h but rate of infusion may need to be adjusted to prevent hypoglycaemia and avoid fluid overload or hyponatraemia. Currently there are not enough data to guide the speed of fluid replacement and individual discretion will be required
- Potassium may not be needed in the first bag. Aim for keeping K+ between 4.0 and 5.5 mmol/L. Add 40 mmol of KCL/L of normal saline from the 2nd litre of fluids onward. Use the pre-prepared 0.3% KCl with 0.9% NaCl
- Insulin may be infused in the same line as the intravenous replacement fluid provided that a Y connector with a one way, anti-siphon valve is used and a large-bore cannula has been placed

1.5.2.3 Monitor glucose, potassium, pH and fetus

- Monitor blood glucose (BG) and capillary ketones (if available) hourly, venous bicarbonate and potassium at 1 hour, 2 hours, 4 hours and then depending upon the need, serum electrolytes 4 hourly (27)
- Monitor fluid status as needed
- The fetus should be continually monitored but abnormalities of the fetal heart may improve with improvement of the maternal condition

1.6 Management of pre-eclampsia throughout in women with diabetes

Pre-eclampsia remains one of the leading causes of deaths in the puerperal period (29). The three pillars of treatment remain timely delivery of the fetus, blood pressure control (often with multiple intravenous infusions), and fluid restriction to 80 mL/h (including all drugs and intravenous fluids) (20). The incidence of pre-eclampsia in women with type 1 diabetes is 10-15%.(4)

As it is recognised that simultaneously managing glycaemic control using the VRIII to maintain the CBG 5.0 - 8.0 mmol/L, managing blood pressure control using intravenous magnesium and other intravenous agents delivered by multiple pumps, limiting total fluid input (including all infusions) to 80 mL/h and monitoring the fetus, the birth and the mother is complex; it is recommended that there is multi-disciplinary input into the management of these women using the principles laid out in the enhanced maternal care document (28).

1.7 Management of women who present with simultaneous DKA and pre-eclampsia

These are highly complex and vulnerable patients and need to be managed utilising principles laid out in the enhanced maternal care document (28).
The goals of treatment include:

1. Initial fluid resuscitation
2. Administration of FRIII to stop the ketogenesis
3. Administration of potassium
4. Prevention of hypoglycaemia from use of the FRIII
5. Control of BP
6. Prevention of fluid overload
7. Timely delivery
8. Monitoring to avoid the complications of PET

Background and Definitions

1.8 Background

The incidence of gestational diabetes and pregnancies complicated by type 1 or type 2 diabetes doubled during 1996-2010, with diabetes now affecting one in ten pregnant women by the age of thirty (30). There is overwhelming evidence that sustained maternal hyperglycaemia during pregnancy is associated with many obstetric and neonatal complications including preterm births, large for gestational age and neonatal hypoglycaemia. There is more uncertainty regarding the impact of acute hyperglycaemia exposure during and following corticosteroid administration or during labour and birth on risk of neonatal hypoglycaemia. This updated guideline from the JBDS is designed to offer practical, consistent, person-centred options to safely manage glucose levels in pregnant women with diabetes during hospital admissions for antenatal steroid administration, labour and birth.

The 2015 National Institute for Health and Care Excellence (NICE) guideline recommended aiming for capillary glucose levels within a tight range of 4.0 - 7.0 mmol/L during labour and birth to reduce the incidence of neonatal hypoglycaemia (1). Recent evidence questions the benefits of tight intrapartum glucose targets due to the increased risk of maternal hypoglycaemia and uncertain benefit on neonatal hypoglycaemia (5; 31; 32). Newer studies suggest that neonatal hypoglycaemia is strongly associated with sustained maternal hyperglycaemia during the second and third trimesters, as well as obstetric and neonatal factors including preterm birth and large for gestational age, which are unlikely to be impacted by acute intra-partum hyperglycaemia. Consequently, tight glycaemic control during labour may not reverse fetal hyperinsulinemia and its consequences. Therefore, some pregnant women with diabetes, anaesthetists, diabetes teams and obstetric units may consider that a pragmatic target range of 5.0 - 8.0 mmol/L is safer, as there is safety 'buffer zone' between the lowest acceptable glucose limit and hypoglycaemia (See Appendices 3 and 4 of the updated JBDS guidelines). The General Medical Council (GMC) advocates involving patients in shared decision making after "meaningful discussion" (33). This updated JBDS guideline therefore includes both options; tight glycaemic targets of 4.0 - 7.0 mmol/L as recommended previously by JBDS and NICE, or a pragmatic target range of 5.0 - 8.0 mmol/L to reduce risk of maternal hypoglycaemia and whilst maintaining safe glycaemia. Table 1 highlights the advantages and potential disadvantages of both approaches.

1.9 Types of Diabetes

The main types of diabetes likely to be encountered on the obstetric wards are as follows (34):

- Type 1 diabetes
- Type 2 diabetes
- Gestational diabetes (GDM) i.e. diabetes first detected in pregnancy. This may include women with pre-gestational (pre-existing) diabetes
- Specific types of diabetes due to other causes. This may include women with monogenic diabetes or maturity-onset diabetes of the young (MODY), cystic fibrosis, pancreatitis related diabetes and chemical or drug induced diabetes. The management of these conditions are beyond the scope this guideline, and if encountered, advice should be sought from the diabetes specialist team

1.10 Variable Rate Intravenous Insulin Infusion (VRIII) and Continuous Subcutaneous Insulin Infusion (CSII)

A variable rate intravenous insulin infusion (VRIII) that is adjusted according to hourly capillary blood glucose and a co-administered continuous intravenous infusion of glucose is widely used on medical and surgical wards. This can be adapted for use on obstetric wards and delivery units. VRIII is the established gold standard of care for managing hyperglycaemia among hospital inpatients who are nil by mouth for prolonged periods. However, the safety and efficacy of VRIII use following antenatal steroids administration and before or during birth in busy obstetric ward/delivery unit settings are uncertain (See Table 2). Following the December 2020 NICE guideline update pregnant women with type 1 diabetes are increasingly using Continuous Glucose Monitoring (CGM) alone or in conjunction with Continuous Subcutaneous Insulin Infusion (CSII) or hybrid closed-loop systems (4; 34-36). These are usually continued to support diabetes self-management during antenatal hospital admissions, including during and after antenatal steroids administration and before and during birth (See Table 3).

The choice of fluid accompanying VRIII also varies. NICE recommends the administration of intravenous dextrose. However, there is an association of peripartum hypotonic fluid administration with fluid overload, maternal hyponatraemia and neonatal hyponatraemia. Some maternity units administer a VRIII with no accompanying fluid ("dry sliding scale") to avoid hyperglycaemia, fluid overload and hyponatraemia (especially in pregnant women with renal disorders and pre-eclampsia), but this may increase the risk of maternal hypoglycaemia. Consequently, this updated JBDS guideline recommends administering 0.9% saline with 5% dextrose and 0.15% potassium chloride alongside a VRIII. This is in accordance with NICE guidance on prevention of inpatient hyponatraemia in hospitalised children and young people. To avoid fluid overload, the rate of this fluid should not exceed 50 mL/h.

Glucose levels during labour and delivery

1.11 Evidence in relation to tight glucose levels during labour and neonatal hypoglycaemia

Neonatal hypoglycaemia results from excessive fetal insulin production as a consequence of the sudden cessation of maternal-fetal glucose transfer after birth. The rates of neonatal hypoglycaemia vary between different patient populations, and different study definitions. Recent data suggest approximate prevalence of clinically relevant neonatal hypoglycaemia, defined as requiring treatment with intravenous dextrose, of ~5% in gestational diabetes, ~20% in type 2 diabetes and ~30% in type 1 diabetes pregnancy (31). During the CONCEPTT trial in type 1 diabetes pregnancy, rates of clinically relevant neonatal hypoglycaemia were 15% in women using CGM compared to 28% with women using capillary glucose monitoring (4). The numbers of mothers needed to treat with CGM to prevent one clinically relevant neonatal hypoglycaemia was eight; strongly suggesting that neonatal hypoglycaemia was associated with sustained maternal hyperglycaemia throughout the second and third trimesters. A subsequent secondary analysis found no difference in intrapartum glycaemia between mothers of neonates with and without hypoglycaemia (39).

Recent data contrast with previous studies suggesting that maternal hyperglycaemia during labour was associated with an increased risk of neonatal hypoglycaemia (37). Many of the studies on which NICE based their tight intra-partum glucose target range (4.0 - 7.0 mmol/L) were published during 1985-2000 and predated the use of insulin analogues and modern diabetes technologies including insulin pumps and CGM. Data were often not adjusted for important maternal and neonatal confounders like type of diabetes, maternal glycaemia during pregnancy, birthweight or gestational age at delivery.

Observational data in 161 pregnant women with type 1 diabetes using insulin pumps or VRIII demonstrated that women who continued to self-manage their diabetes using CSII achieved lower glucose levels during delivery than those who were switched to IV insulin (38). The authors noted high rates of maternal hypoglycaemia associated with tight intrapartum glucose targets. They recommended that it should be standard practice to allow women the option of choosing diabetes self-management CSII during labour and delivery (38). This is supported by a recent high quality meta-analysis which found no clear association between acute intrapartum maternal hyperglycaemia and neonatal hypoglycaemia (31). Taken together, the recent data and increased use of diabetes technology allowing women more autonomy for self-management of their diabetes during hospital admissions have generated widespread support for a pragmatic approach. The updated JBDS guideline offers the option of using either the NICE intrapartum glucose target of 4.0 - 7.0 mmol/L or the pragmatic target range of 5.0 - 8.0 mmol/L. The pragmatic target glucose level of 5.0 - 8.0 mmol/L during labour may be safer for women without increasing the risk of neonatal hypoglycaemia (Table 1).

1.12 Future directions

Closed-loop and automated insulin delivery systems are alternative options for managing glucose levels during labour, delivery and post-partum with preliminary research suggesting that these can be safely used (39). These women should have individualised care plans. Further research about alternative insulin delivery options is warranted.

Glucose levels during steroid administration for promotion of fetal lung maturity

The National Pregnancy in Diabetes audit (NPID) of 17,375 women with type 1 and type 2 diabetes showed that the prevalence of delivery before 37 weeks is approximately 45% in type 1 and 25% in type 2 diabetes. With this high risk of preterm delivery, the use of steroids for lung maturation is a common occurrence (40).

NICE guidelines (2015) *recommend steroids are used in all women at risk of preterm labour to aid fetal lung maturation. This will usually be associated with a rapid deterioration in maternal glycaemic control and even precipitation of diabetic ketoacidosis (DKA).* ***NICE*** *therefore recommends women with insulin-treated diabetes are given additional insulin according to an agreed protocol and are monitored closely (1).*

1.13 Evidence base for glucose management with steroid use

Mathiesen and colleagues describe their experience of use of an insulin algorithm (41). Betamethasone 12 mg was given and repeated 24 hours later. Eight women (control group) were managed with usual insulin dose adjustments based on blood glucose levels. In the other eight women (study group) the following percentage increase in insulin regime was used (compared to the pre-steroid doses).

Day 1 (the day on which the first betamethasone injection is given), the night insulin dose increased by 25%

Day 2, all insulin doses increased by 40%

Day 3, all insulin doses increased by 40%

Day 4, all insulin doses increased by 20%

Day 5, all insulin doses increased by 10–20% (all compared to pre-steroid doses)

Days 6 and 7, insulin doses reduced to pre-steroid doses

There was substantial individual variation and it was difficult to achieve and maintain tight glucose control (4.0 - 7.0 mmol/L) in both the study and control groups.
In the UK study by Kaushal and colleagues, 8 women (5 pre-existing diabetes, 3 GDM) requiring steroids were given additional insulin via VRIII (42). This was started immediately before the first injection of dexamethasone and continued for at least 12 hours after the second injection. They found high doses of supplementary insulin were required (median dose 74 units, range 32 – 88 units) to maintain median glucose levels between 5.8 - 8.9 mmol/L with 75% of glucose levels between 4.0–10.0 mmol/L.

Dashora and Taylor showed that when steroids were used to manage hyperemesis in pregnant women with diabetes, a 40% increase with the first dose of steroids maintained glycaemic control (43). Although this was not in the context of labour, it may help inform a clinician about the approximate increase in the insulin dose needed. It should be noted that these studies predated the widespread use of insulin analogues.

Rowe et al used have recently reported a retrospective cohort study on a pregnancy specific intravenous insulin infusion protocol compared to generic VRIII in 135 pregnant women with pre-existing diabetes to control steroid induced hyperglycaemia. Pregnancy specific protocol was safe and effective in women with type 1 diabetes (44).

Sweeting et al compared s.c. insulin (n = 13) vs i.v. insulin protocol (n = 6) in an randomised control trial with more women achieving target BG with s.c. protocol (statistically significant in the GDM women) with no difference in maternal or neonatal hypoglycaemia (45).

Recent studies using automated closed-loop insulin delivery show wide intra-individual variation in total daily insulin doses but on average a 50% increase in insulin dose in the 48 hours after the first dose of corticosteroids (36).

Controversial areas

There are some areas in the management of diabetes during labour and birth where practices vary from hospital to hospital. The National Institute for Health Research Health Technology Assessment (NIHR HTA) have commissioned research to evaluate the 'potential influence of more permissive maternal glucose monitoring on the assessment and management of neonatal glycaemic status'. JBDS has suggested a consensus approach in this document. Future work will audit the results of this approach to examine the risks and benefits of different glucose monitoring and insulin delivery approaches.

1.14 What should be the target glucose levels during labour and delivery?

There is no high quality research evidence to guide us about the optimal target glucose levels during labour, delivery and birth. Historically, some observational studies suggested keeping the glucose within a tight range of 4.0 - 7.0 mmol/L to reduce the risk of neonatal hypoglycaemia. The consequence of such a target is the increased support needed for monitoring these women closely, regular staff training updates and increased risk of maternal hypoglycaemia. Up to one in two women treated with intensive insulin infusions during labour experience clinically significant hypoglycaemia (38).

Other studies have questioned the relationship between tight intrapartum targets and risk of neonatal hypoglycaemia which is strongly associated with maternal glucose levels throughout the second and third trimester (4). A post hoc analysis from the CONCEPTT trial found no associations between maternal intrapartum glucose levels and neonatal hypoglycaemia (46). A retrospective Canadian cohort study also found no association between in-target intrapartum glucose control and neonatal hypoglycaemia after adjustment for confounding factors (32).

A high quality systematic review of intrapartum glucose levels in pregnancies complicated by diabetes found no association between maternal intrapartum glucose level and neonatal hypoglycaemia in half of the 23 studies which included 2,835 women with diabetes (31). These studies have therefore contributed to the argument that a slightly relaxed target of 5.0 - 8.0 mmol/L is not associated with subsequent neonatal hypoglycaemia, and can be advocated as a safer blood glucose target range during delivery.

Furthermore, it is increasingly recognised that striving for tight glycaemic control for hospitalised patients with glucose lowering medication (including insulin infusions) may inadvertently cause harm from hospital acquired hypoglycaemia. It for this reason that recent national and international guidelines suggest that the lowest BG whilst a hospitalised person is on glucose lowering medication should be 6.0 mmol/L (21; 22; 47). Having this slightly higher lowest acceptable blood glucose reduces the risk of hospital acquired hypoglycaemia, may also reduce the use of the VRIII and all of the intrinsic complications associated with its use.

The medical, obstetric and midwifery teams at each hospital will need to decide together with individual women whether to strive for the traditional intrapartum capillary glucose target of 4.0 - 7.0 mmol/L as advocated by NICE, or the more liberal intrapartum capillary glucose target of 5.0 - 8.0 mmol/L. Such an approach would be in keeping with the General Medical Council guidance on involving people in decision making (34).

Appendix 1 contains the strategies that need to be implemented to achieve the NICE target of 4.0 - 7.0 mmol/L, whilst Appendix 3 contains the strategies that need to be implemented to achieve the more liberal target of 5.0 - 8.0 mmol/L.

1.15 How to maintain glucose levels in the target range in women receiving steroids?

When women with diabetes are given corticosteroids for fetal lung maturation in the setting of anticipated preterm birth, NICE recommends that their glucose levels are closely monitored as most require additional insulin administration. The neonatal respiratory benefits of steroid administration are well established and applicable to all pregnant women before 34 weeks gestation. After 36 weeks gestation, the potential risks for increased neonatal hypoglycaemia and unphysiological activation of glucocorticoid receptors in the fetal brain may outweigh the potential respiratory morbidity benefits among women with diabetes. The balance of risks and benefits of steroid administration during 34-36 weeks gestation (approximate numbers needed to treat are 35 mothers to prevent 1 neonatal respiratory morbidity event) is uncertain and should be carefully evaluated on a case-by-case basis (48).

There are limited data to inform clinical practice on what are the most effective methods of insulin delivery (MDI, CSII, VRIII alone or in combination, or hybrid closed-loop systems) for achieving optimal glucose levels during and after steroids. During the CONCEPTT trial, approximately 25% of pregnant women with type 1 diabetes were admitted for antenatal corticosteroids and most continued diabetes self-management (4). A recent retrospective study described antenatal corticosteroid administration rates of 8.8% in a multi-ethnic New Zealand population (65% GDM, 21% type 2 diabetes, 13% type 1 diabetes). The average duration of hyperglycaemia was 3 days with almost all women (>90%) experiencing hyperglycaemia >7.0 mmol/L, and over 50% with hyperglycaemia >10.0 mmol/L. Rates of maternal hypoglycaemia before and after corticosteroid administration were high (49% and 58% of mothers with type 1 diabetes); further emphasising the importance of weighing up both the maternal and neonatal consequences (49). Therefore, this updated JBDS guideline also recommend using either the NICE target (4.0 – 7.8 mmol/L) or the more liberal target zone (5.0 – 8.0 mmol/L), for safely managing inpatient hyperglycaemia during and after steroid administration (50).

JBDS recommends adjusting insulin dose (MDI or CSII) by 50-80% to maintain glycaemic control with regular glucose monitoring. If the glucose levels are consistently higher than target levels then VRIII can be used (Appendix 2 or Appendix 4)

Promoting autonomy and safe delivery in women with diabetes and hyperglycaemia

Pregnant women with diabetes report feeling vulnerable when the ability to control their own blood glucose levels is taken away from them during acute hospital admissions, and is instead 'in the hands' of less experienced antenatal and delivery ward staff. It is hoped that this guideline will help improve the consistency of peripartum glucose management and also support those women who are able to self-manage using insulin pumps and advanced diabetes technology. Research led by investigators at the University of Nottingham is underway to determine current NHS practices in intrapartum glucose control and to evaluate the feasibility of future clinical trials of permissive versus intensive intrapartum glycaemia (https://fundingawards.nihr.ac.uk/award/NIHR130175). Until results are available, we hope that this JBDS guideline will encourage diabetes pregnancy teams to discuss both options with pregnant women and to audit their local clinical practice.

Audit Standards

Institutional standards:	
Indicator:	**Standard:**
Access to specialist support and data:	
Has the Trust adopted these national guidelines or their own alternative, evidence based and audited internal guidelines for the management of diabetes during delivery?	Yes
Does the Trust collect data about the outcomes for women (maternal and baby) delivering in the hospital?	Yes
Does the Trust have the services of a dedicated Diabetes Inpatient Specialist Nurse (DISN) at staffing levels most recently recommended by DISN (Number of beds occupied by people with diabetes x 50 minutes) / 60 = Hours spent per week Hours spent per week / 25 hours = WTE DISN required)	Yes
Does the Trust have mandatory diabetes training programme for midwives looking after pregnant women with diabetes?	Yes
Institutional accountability and integrity:	
Does the Trust have a clinical lead for the management of diabetes during delivery with responsibility of implementation of these guidelines?	Yes
NPSA standards:	
Indicator:	**Standard:**
All regular and single insulin bolus doses are measured and administered using an insulin syringe or commercial insulin pen device. Intravenous syringes must never be used for insulin administration	100%
The term 'units' is used for insulin measure in all contexts. Abbreviations such as 'U' or 'IU' are never used	100%
All clinical areas on obstetric wards have adequate supplies of insulin syringes and subcutaneous needs which they can obtain at all times	100%
An insulin pen is always used to measure and prepare insulin for an intravenous infusion	100%
A training programme is in place (JBDS recommends 2 hours initially and 1 hour per year refresher) for all midwives involved in the care of pregnant women with diabetes	100%
Policies and procedures are in place to ensure compliance with the above indicators	100%

Department of Health 'Never Event' standard:	
Indicator:	**Standard:**
Death or severe harm as a result of maladministration of insulin by a health professional	Never
Local standards:	
Indicator:	**Standard:**
Access:	
Percentage of obstetric staff involved in the care of pregnant women with diabetes who have received training in blood glucose measurement	100%
Percentage of deliveries where there is one to one ratio of midwife to patient during labour	100%
Percentage of obstetric staff involved in the care of pregnant women with diabetes who have received appropriate education (JBDS recommends 2 hours initially and 1 hour refresher every year) from the diabetes team	100%
Safety, quality and effectiveness during the patient stay in the hospital:	
Percentage of women admitted on obstetric ward for delivery with a clear plan including a prescription chart (either the one recommended by JBDS or a locally agreed and audited alternative) from the antenatal clinic. Unexpected or unbooked admissions will be exempted from this standard	100%. Where necessary, information should be shared with the antenatal clinic doctors and nurses to improve the standard
Percentage of women with diabetes in established labour whose CG/CGM is monitored hourly. Women delivering or having caesarean section within 2 hours of admission may be exempt from this criterion	100%
Percentage of eligible women on hourly CG/CGM monitoring whose CG levels are within the agreed target range (see guidelines)	80%
Percentage of women with CG/CGM levels higher than the target CG/CGM on two consecutive occasions receiving VRIII. (Women delivering or having caesarean with 2 hours of being in higher than target range can be exempted from the standard)	100%
Percentage of women who receive VRIII appropriately and BGs/CGM are to target (80% of the readings) but still deliver babies with neonatal hypoglycaemia	Not known
Percentage of women in whom VRIII is omitted inappropriately or was not effective in keeping BG/CGM to target and babies develop neonatal hypoglycaemia	Not known
Percentage of women who do not receive VRIII as the BG/CGM are in the target range but the babies still develop neonatal hypoglycaemia	Not known
Percentage of women with BG levels within the target BG receiving inappropriate VRIII	0%

Percentage of women with diabetes during pregnancy who required VRIII during delivery	Not defined
Percentage of women on VRIII with correct configuration of the one-way and anti-siphon valve	100%
Percentage of women with diabetes on VRIII whose BG/CGM is monitored hourly	100%
Percentage of women on VRIII who had at least one hypoglycaemic episode with BG < 4.0 mmol/L	JBDS recommends <10%
Percentage of women with diabetes who were on VRIII during delivery and whose hypoglycaemia was treated as per JBDS or an agreed trust guidelines	100%
Percentage of women with diabetes whose babies developed neonatal hypoglycaemia [< 2.2 mmol/L]44 or the locally agreed trust criterion]	0%
Percentage of babies who delivered to women with diabetes during pregnancy and developed neonatal hypoglycaemia that required NICU admission	Not defined
Percentage of babies delivered to women with diabetes during pregnancy and developed neonatal hypoglycaemia that required iv glucose	Not defined
Percentage of babies with neonatal hypoglycaemia who developed residual deficit	0%
Percentage of babies with neonatal hypoglycaemia in women with diabetes during pregnancy whose mothers received CG monitoring during labour appropriately	Not known
Percentage of babies with neonatal hypoglycaemia delivered by caesarean section, normal delivery or assisted delivery	Not known
Percentage of women with diabetes in pregnancy and who are admitted for an elective caesarean section and are able to have the section on priority (first third of the morning or afternoon list)	Not defined
Percentage of women with gestational diabetes whose treatment was stopped after the placenta was delivered	100%
Percentage of women with type 1 and type 2 diabetes on VRIII during delivery whose insulin dose was reduced by 50% after the delivery of placenta and changed to subcutaneous regimen appropriately	100%
Percentage of women with diabetes during pregnancy who developed hypoglycaemia after delivery	0%
Percentage of women in the row above whose treatment was not adjusted according to the guidelines	0%
Percentage of women with diabetes during pregnancy who are visited by the diabetes specialist teams during their admission for delivery	100%. The Trusts might like to collect these data for week days and weekends separately

Percentage of women with GDM delivering in the hospital who have received a plan for a diagnostic test after delivery (OGTT or Fasting Glucose)	100%
Percentage of pregnant women with diabetes who receive CG as per JBDS or an agreed and audited trust guideline after delivery	100%
Type of delivery (Caesarean, normal, assisted) in women with diabetes during pregnancy	Not defined. The Trusts might like to stratify all the audit criteria according to the type of delivery for more comprehensive understanding
Maternal outcomes (Pre-eclampsia, inadequately controlled glycaemia, post-delivery hypoglycaemia)	Not defined
Fetal outcomes (stillbirth, baby weight >4 kg, neonatal hypoglycaemia 2.2 mmol/L, admission to NICU, shoulder dystocia, neonatal jaundice, hypocalcaemia, hypomagnesaemia, Respiratory Distress Syndrome birth defects)	Not defined
Institutional accountability and integrity:	
Percentage of women with diabetes during pregnancy identified as such on the hospital patient administration system	100%
Percentage of women with diabetes during pregnancy coded correctly in the coding system	100%
Patient and staff satisfaction:	
Percentage of obstetric staff who feel they have appropriate, timely and adequate support from the diabetes team	100%
Percentage of patients who express satisfaction with their care using validated tools such as Diabetes Treatment Satisfaction Questionnaire (DTSQ) and the Diabetes Treatment Satisfaction Questionnaire for Inpatients (DTSQ-IP)	90%

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Appendix 1

JBDS-IP Joint British Diabetes Societies for inpatient care

Local Trust Logo

Intravenous Insulin Prescription and Fluid Protocol FOR PREGNANCY AND LABOUR ONLY (NICE recommended targets)

For use during pregnancy and labour for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII)
NEVER use an IV syringe to draw up insulin
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate* or basal insulin**
*Intermediate: Insulatard, Humulin I, Insuman basal
**Basal: Lantus and Toujeo (Glargine), Levemir (Detemir)
Doctor: All prescriptions for insulin and fluids must be signed
Nurse: All entries must be signed

Ward	Consultant	Admission Date:
		Discharge Date:
Surname		First Name
Hospital Number		Date of Birth / Age
NHS Number		
Address		

	DOSING ALGORITHM (Please see the guide below)			
Algorithm →	**1**	**2**	**3**	**4**
Finger prick BG Levels (mmol/L)↓	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<4	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	
Signed				
Print Name				
Date				

ALGORITHM GUIDE

- **ALL** women with diabetes should have Blood Glucose (BG) or intermittent or real time continuous glucose monitoring (CGM) testing hourly in established labour, after ARM or on admission for elective C-Section
- Start VRIII and Fluids if two consecutive BG/CGM > target (see below)

Algorithm 1 Most women will start here
Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)
Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 4 – 7 mmol/L
Check BG every hour whilst on VRIII and every half an hour if under anaesthesia
Move to the higher algorithm if the BG is > target and is not dropping
Move to the lower algorithm if BG falls below 4 mmol/L or is dropping too fast

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50mL with NaCl 0.9% (1 UNIT per mL)	IV			

SYRINGE PREPARATION			
Prepared and administered by	**Date**	**Time started**	**Time stopped**

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	Nurse's Signature
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L (0.15%) to run at 50 mL/h			
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L(0.15%) to run at 50 mL/h			

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	**100 mL**	**IV**	**15 min**				

BLOOD GLUCOSE MONITORING

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												

GESTATIONAL DIABETES:
STOP VRIII and IV Substrate Fluid regime once placenta is delivered

TYPE 1 DM and INSULIN TREATED TYPE 2 DM
Reduce the rate of VRIII by HALF once placenta is delivered.
Contact diabetes team to review on-going insulin requirements

Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team
Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

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DIABETES CARE PLANNING DOCUMENT

For use to communicate care plans for **ALL** patients with diabetes during and after pregnancy
Please complete **ALL** required information
To be completed by the Diabetes Team

Ward	Consultant	Admission Date:
		Discharge Date:

Surname	First Name
Hospital Number	Date of Birth / Age
NHS Number	
Address	

ANTENATAL INFORMATION

TYPE OF DIABETES

[ ] Type 1 DM	[ ] Type 2 DM	[ ] Gestational DM		
Age at diagnosis	Age at diagnosis	Diagnosed:	[ ] OGTT: Date:	[ ] OGTT: Date:
		_____ weeks	Fasting: mmol/L	Fasting: mmol/L
			2 hours: mmol/L	2 hours: mmol/L

PRE-PREGNANCY DIABETES MEDICATIONS

Medication	Dose	Time

HbA1c Record

Baseline	Date:	Value: mmol/mol
Additional HbA1c:	Date:	Value: mmol/mol
Notes:	Date:	Value: mmol/mol
	Date:	Value: mmol/mol
	Date:	Value: mmol/mol
	Date:	Value: mmol/mol

COMPLICATIONS DEVELOPED OR EXACERBATED BY PREGNANCY

DELIVERY DATES

Expected date of delivery	Date for IOL	Date for C-section

POST NATAL PLAN

PROPOSED POST-PREGNANCY DIABETES MEDICATIONS (FOR TYPE 1 OR TYPE 2 DM)

Medications	Dose	Time

DISCUSSED WITH PATIENT:

Issues:	Yes	No	Date discussed:
Contraception/plan for further pregnancy			
Arrangement for on-going diabetes care			
OGTT arrangement			
Lifestyle modifications			
Completed by:			
Name: Designation: Sign:			

POST NATAL BG MONITORING

Pre-existing diabetes: as per usual practice
GDM: pre-meal and 1 hour post-meal for up to 24 hours
High levels (>7 mmol/L pre-meal and <11.1 mmol/L post-meal) may need a diagnostic test for diabetes

Date:	Pre-breakfast	1 hr after breakfast	Pre-lunch	1 hr after lunch	Pre-evening meal	1 hr after evening meal	Pre-bed

MATERNAL OUTCOMES

Delivery	Tick ALL that applies	Complications	Tick ALL that applies
Normal		Pre-eclampsia	
Assisted/forceps		Inadequately controlled glycaemia	
C-section		Post-delivery hypoglycaemia	
Other:		Other:	

POST NATAL OUTCOMES (tick ALL that applies)

Stillbirth		Neonatal jaundice	
Baby weight >4 kg		Hypocalcaemia	
Neonatal hypoglycaemia		Hypomagnesaemia	
Admission to NICU		RDS	
Shoulder dystocia		Birth defects	
Other:		Other:	

Appendix 2

JBDS-IP Joint British Diabetes Societies for inpatient care

Local Trust Logo

Intravenous Insulin Prescription and Fluid Protocol FOR MANAGEMENT OF STEROID HYPERGLYCAEMIA DURING PREGNANCY (NICE recommended targets)

For use for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII) for the management of steroid hyperglycaemia during pregnancy
NEVER use an IV syringe to draw up insulin
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate* or basal insulin**
*Intermediate: Insulatard, Humulin I, Insuman basal
**Basal: Lantus, Toujeo (Glargine), Levemir (Detemir)
Doctor: All prescriptions for insulin and fluids must be signed
Nurse: All entries must be signed

Ward	Consultant	Admission Date:
		Discharge Date:

Surname	First Name
Hospital Number	Date of Birth / Age
NHS Number	
Address	

	DOSING ALGORITHM (Please see the guide below)			
Algorithm →	**1**	**2**	**3**	**4**
Finger prick BG Levels (mmol/L)↓	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<4	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
4.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	
Signed				
Print Name				
Date				

ALGORITHM GUIDE

- Start VRIII and Fluids if two consecutive BG/CGM > target and continue for up to 12 hours after the last dose of steroid
- **ALL** women on VRIII should have Blood Glucose (BG) testing hourly for the management of steroid hyperglycaemia during pregnancy

Algorithm 1 Most women will start here
Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)
Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 4.0 – 7.8 mmol/L
Check BG every hour whilst on VRIII
Move to the higher algorithm if the BG is > target and is not dropping
Move to the lower algorithm if BG falls below 4.0 mmol/L or is dropping too fast

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50mL with NaCl 0.9% (1 UNIT per mL)	IV			

SYRINGE PREPARATION			
Prepared and administered by	**Date**	**Time started**	**Time stopped**

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	Nurse's Signature
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L (0.15%) to run at 50 mL/h			
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L(0.15%) to run at 50 mL/h			

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	**100 mL**	**IV**	**15 min**				

Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team
Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

INTRAVENOUS INSULIN, BG AND KETONES MONITORING RECORD SHEET

Guide:
Only use for patients on intravenous insulin regimen. Use different chart for patients on subcutaneous insulin
Make sure the patient's hands are clean
Check BG hourly for further 24 hours after the last dose of steroid OR as per advice form the Diabetes Team

ADDRESSOGRAPH
LABEL

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												

Appendix 3

JBDS-IP Joint British Diabetes Societies for inpatient care

Local Trust Logo

Intravenous Insulin Prescription and Fluid Protocol FOR PREGNANCY AND LABOUR ONLY (liberal targets)

For use during pregnancy and labour for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII)
NEVER use an IV syringe to draw up insulin
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate* or basal insulin**
*Intermediate: Insulatard, Humulin I, Insuman basal
**Basal: Lantus and Toujeo (Glargine), Levemir (Detemir)
Doctor: All prescriptions for insulin and fluids must be signed
Nurse: All entries must be signed

Ward	Consultant	Admission Date:
		Discharge Date:
Surname		First Name
Hospital Number		Date of Birth / Age
NHS Number		
Address		

	DOSING ALGORITHM (Please see the guide below)			
Algorithm →	**1**	**2**	**3**	**4**
Finger prick BG Levels (mmol/L)↓	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<5	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
5.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	
Signed				
Print Name				
Date				

ALGORITHM GUIDE

- **ALL** women with diabetes should have Blood Glucose (BG) or intermittent or real time continuous glucose monitoring (CGM) testing hourly in established labour, after ARM or on admission for elective C-Section
- Start VRIII and Fluids if two consecutive BG/CGM > target (see below)

Algorithm 1 Most women will start here
Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)
Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 5.0 – 8.0 mmol/L

Check BG every hour whilst on VRIII and every half an hour if under anaesthesia

Move to the higher algorithm if the BG is > target and is not dropping

Move to the lower algorithm if BG falls below 5.0 mmol/L or is dropping too fast

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50 mL with NaCl 0.9% (1 UNIT per mL)	IV			

SYRINGE PREPARATION			
Prepared and administered by	**Date**	**Time started**	**Time stopped**

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	Nurse's Signature
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L (0.15%) to run at 50 mL/h			
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L(0.15%) to run at 50 mL/h			

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	**100 mL**	**IV**	**15 min**				

BLOOD GLUCOSE MONITORING

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												

GESTATIONAL DIABETES:
STOP VRIII and IV Substrate Fluid regime once placenta is delivered

TYPE 1 DM and INSULIN TREATED TYPE 2 DM
Reduce the rate of VRIII by HALF once placenta is delivered.
Contact diabetes team to review on-going insulin requirements

Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team

Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

JBDS-IP Joint British Diabetes Societies for inpatient care

DIABETES CARE PLANNING DOCUMENT

For use to communicate care plans for **ALL** patients with diabetes during and after pregnancy
Please complete **ALL** required information
To be completed by the Diabetes Team

Ward	Consultant	Admission Date:
		Discharge Date:

Surname	First Name
Hospital Number	Date of Birth / Age
NHS Number	
Address	

ANTENATAL INFORMATION

TYPE OF DIABETES

[ ] Type 1 DM	[ ] Type 2 DM	[ ] Gestational DM		
Age at diagnosis	Age at diagnosis	Diagnosed:	[ ] OGTT: Date:	[ ] OGTT: Date:
		_____ weeks	Fasting: mmol/L	Fasting: mmol/L
			2 hours: mmol/L	2 hours: mmol/L

PRE-PREGNANCY DIABETES MEDICATIONS

Medication	Dose	Time

HbA1c Record

Baseline	Date:	Value: mmol/mol
Additional HbA1c:	Date:	Value: mmol/mol
Notes:	Date:	Value: mmol/mol
	Date:	Value: mmol/mol
	Date:	Value: mmol/mol
	Date:	Value: mmol/mol

COMPLICATIONS DEVELOPED OR EXACERBATED BY PREGNANCY

DELIVERY DATES

Expected date of delivery	Date for IOL	Date for C-section

POST NATAL PLAN

PROPOSED POST-PREGNANCY DIABETES MEDICATIONS (FOR TYPE 1 OR TYPE 2 DM)

Medications	Dose	Time

DISCUSSED WITH PATIENT:

Issues:	Yes	No	Date discussed:
Contraception/plan for further pregnancy			
Arrangement for on-going diabetes care			
OGTT arrangement			
Lifestyle modifications			
Completed by:			
Name:	Designation:		Sign:

POST NATAL BG MONITORING

Pre-existing diabetes: as per usual practice
GDM: pre-meal and 1 hour post-meal for up to 24 hours
High levels (>7 mmol/L pre-meal and <11.1 mmol/L post-meal) may need a diagnostic test for diabetes

Date:	Pre-breakfast	1 hr after breakfast	Pre-lunch	1 hr after lunch	Pre-evening meal	1 hr after evening meal	Pre-bed

MATERNAL OUTCOMES

Delivery	Tick ALL that applies	Complications	Tick ALL that applies
Normal		Pre-eclampsia	
Assisted/forceps		Inadequately controlled glycaemia	
C-section		Post-delivery hypoglycaemia	
Other:		Other:	

POST NATAL OUTCOMES (tick ALL that applies)

Stillbirth		Neonatal jaundice	
Baby weight >4 kg		Hypocalcaemia	
Neonatal hypoglycaemia		Hypomagnesaemia	
Admission to NICU		RDS	
Shoulder dystocia		Birth defects	
Other:		Other:	

Appendix 4

JBDS-IP Joint British Diabetes Societies for inpatient care

Local Trust Logo

Intravenous Insulin Prescription and Fluid Protocol FOR MANAGEMENT OF STEROID HYPERGLYCAEMIA DURING PREGNANCY (liberal targets)

For use for ALL patients receiving Variable Rate Intravenous Insulin Infusion (VRIII) for the management of steroid hyperglycaemia during pregnancy
NEVER use an IV syringe to draw up insulin
ALWAYS draw up insulin using an insulin syringe
ALWAYS continue subcutaneous intermediate* or basal insulin**
*Intermediate: Insulatard, Humulin I, Insuman basal
**Basal: Lantus, Toujeo (Glargine), Levemir (Detemir)
Doctor: All prescriptions for insulin and fluids must be signed
Nurse: All entries must be signed

Ward	Consultant	Admission Date:
		Discharge Date:

Surname	First Name
Hospital Number	Date of Birth / Age
NHS Number	
Address	

	DOSING ALGORITHM (Please see the guide below)			
Algorithm →	**1**	**2**	**3**	**4**
Finger prick BG Levels (mmol/L)↓	For most women	For women not controlled on algorithm 1 or needing >80 units/day of insulin	For women not controlled on algorithm 2 (after specialist advice)	Customised Scale
	Infusion Rate (units/h = mL/h)			
<5	STOP INSULIN FOR 20 MINUTES Treat hypo as per guideline (re-check BG in 10 minutes)			
5.0 – 5.5	0.2	0.5	1.0	
5.6 – 7.0	0.5	1.0	2.0	
7.1 – 8.5	1.0	1.5	3.0	
8.6 – 11.0	1.5	2.0	4.0	
11.1 – 14.0	2.0	2.5	5.0	
14.1 – 17.0	2.5	3.0	6.0	
17.1 – 20.0	3.0	4.0	7.0	
>20.1	4.0	6.0	8.0	
Signed				
Print Name				
Date				

ALGORITHM GUIDE

- Start VRIII and Fluids if two consecutive BG/CGM > target and continue for up to 12 hours after the last dose of steroid
- **ALL** women on VRIII should have Blood Glucose (BG) testing hourly for the management of steroid hyperglycaemia during pregnancy

Algorithm 1 Most women will start here
Algorithm 2 Use this algorithm for women who are likely to require more insulin (on steroids; on >80 units of insulin during pregnancy; or those not achieving target on algorithm 1)
Algorithm 3 Use this for women who are not achieving target on algorithm 2 (No patient starts here without diabetes or medical review)

If the woman is not achieving targets with these algorithms, contact the diabetes team (out of hours: Medical SpR on call)

Target BG level = 5.0 – 8.0 mmol/L
Check BG every hour whilst on VRIII
Move to the higher algorithm if the BG is > target and is not dropping
Move to the lower algorithm if BG falls below 5.0 mmol/L or is dropping too fast

Drug (approved name) Please tick	Dose	Volume	Route	Prescriber's Signature	Prescriber Print name	Date
Human Actrapid ☐ Humulin S ☐	50 UNITS	Made up to 50mL with NaCl 0.9% (1 UNIT per mL)	IV			

SYRINGE PREPARATION			
Prepared and administered by	**Date**	**Time started**	**Time stopped**

INTRAVENOUS SUBSTRATE FLUID PRESCRIPTION

Date	Intravenous Fluid and Rate	Alternative Rate	Prescriber's Signature	Nurse' Signature
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L (0.15%) to run at 50 mL/h			
	500 mL 0.9% NaCl + 5% Dextrose with 20 mmol KCl/L(0.15%) to run at 50 mL/h			

PRESCRIPTION OF INTRAVENOUS MANAGEMENT OF HYPOGLYCAEMIA

Date	Time	Preparation	Volume	Route	Duration	Prescriber's Signature	Print Name	Given by:	Time given
		20% Dextrose	**100 mL**	**IV**	**15 min**				

Patients with type 1 DM on insulin pumps should be referred to the Diabetes Specialist Team
Maintain IV insulin infusion for 30 minutes after re-starting original insulin regime – IV insulin has a 5 minute half-life

INTRAVENOUS INSULIN, BG AND KETONES MONITORING RECORD SHEET

Guide:

Only use for patients on intravenous insulin regimen. Use different chart for patients on subcutaneous insulin

Make sure the patient's hands are clean

Check BG hourly for further 24 hours after the last dose of steroid OR as per advice form the Diabetes Team

ADDRESSOGRAPH LABEL

Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												
Date	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	24:00
BG												
Insulin rate												
Blood ketones												
Algorithm												
Initials												

Appendix 5

JBDS IP Group

Dr Ahmed Al-Sharefi, South Tyneside and Sunderland Hospital NHS Foundation Trust

Dr Parizad Avarai, Imperial College Healthcare NHS Trust

Elizabeth Camfield, Guy's and St Thomas' NHS Foundation Trust

Erwin Castro, (East Sussex) Chair, DISN UK Group

Dr Jason Cheung, Norfolk and Norwich University Hospitals NHS Foundation Trust

Dr Umesh Dashora, East Sussex Healthcare NHS Trust

Dr Parijat De, Sandwell and West Birmingham Hospitals NHS Trust

Professor Ketan Dhatariya, (Norwich), Chair, Joint British Diabetes Societies (JBDS) for Inpatient Care

Dr Daniel Flanagan, Plymouth Hospitals NHS Trust

Dr Stella George, East and North Hertfordshire NHS Trust

Klea Isufi, Diabetes UK

Dr Masud Haq, Maidstone and Tunbridge Wells NHS Trust

June James, University Hospitals of Leicester NHS Trust

Andrea Lake, Cambridge University Hospitals NHS Foundation Trust

Dr Anthony Lewis, Belfast Health and Social Care Trust, Northern Ireland

Dr Sue Manley, University Hospitals Birmingham NHS Foundation Trust

Dr Omar Mustafa, King's College Hospital NHS Foundation Trust, London

Philip Newland-Jones, University Hospital Southampton NHS Foundation Trust

Dr Dipesh Patel, Royal Free London, NHS Foundation Trust

Professor Gerry Rayman, The Ipswich Hospitals NHS Trust

Dr Stuart Ritchie, NHS Lothian

Dr Aled Roberts, Cardiff and Vale University Health Board

Professor Mike Sampson, Norfolk and Norwich University Hospitals NHS Foundation Trust

Dr Aaisha Saqib, Guy's and St Thomas' NHS Foundation Trust

Professor Alan Sinclair, Foundation for Diabetes Research in Older People (fDROP) and King's College, London

Esther Walden, Diabetes UK

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