Clinical Guideline for the management of paediatric patients with Diabetes Type 1 & 2 requiring Surgery or General Anaesthetic.

V4
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
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</thead>
<tbody>
<tr>
<td>PDSN</td>
<td>Paediatric Diabetes Specialist Nurse</td>
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<tr>
<td>DKA</td>
<td>Diabetic Ketoacidosis</td>
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<td>BG</td>
<td>Blood glucose</td>
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<tr>
<td>SC</td>
<td>Subcutaneous</td>
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<td>IV</td>
<td>Intravenous</td>
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<td>RCHT</td>
<td>Royal Cornwall Hospital NHS Trust</td>
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<td>HDU</td>
<td>Paediatric High Dependency Unit</td>
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<td>PEWS</td>
<td>Paediatric Early Warning Score</td>
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Summary.

Emergency surgery, or possible emergency surgery
  - with unpredictable, probably prolonged fasting time.

- Possible emergency surgery
  Surgeons liaise with:
  - Surgeons
  - Ensure consent considers implications of diabetes.
  - Liaise with:
    - Paediatric Registrar
    - Anaesthetist
    - PDSN
    - Ward nursing staff

- Definite emergency surgery
  Surgeons

ALL NEED TO READ
- Section 2.5: Responsibilities during admission.
- Section 2.6: Blood glucose monitoring and actions.
- Page 3: Emergency surgery flow chart
Management of children with diabetes having Emergency Surgery or Possible Emergency Surgery

_DKA may present as an acute abdomen, but acute illness may also precipitate DKA_

1. Paediatric registrar and surgical registrar involvement
2. Nil by mouth
3. IV access and bloods
   - Glucose (bedside and lab)
   - Ketones (bedside)
   - Electrolytes and venous blood gas
   - HbA1c (EDTA sample)
   - If sepsis suspected: FBC, CRP, blood culture
   - Annual review bloods (ask PDSN), if not done in previous 6 months
4. Prescribe long-acting eg Levemir/Lantus/Abasaglar/Tresiba or pump insulin to continue as usual.

FOR DKA

**NOT ACIDOTIC**
- pH ≥ 7.30
- HCO₃ ≥ 15

Possible surgery

**ACIDOTIC**
- pH < 7.30
- HCO₃ < 15

Definite surgery

1. Follow DKA protocol
2. Liaise with anaesthetist and surgeon
3. If possible delay surgery until circulating volume and electrolyte deficits are restored.

**Blood Glucose**
- < 15 mmol/l
- ≥ 15 mmol/l

**Blood ketones**
- < 1 mmol/l
- ≥ 1 mmol/l

Give normal correction dose of sc rapid-acting insulin (ask patient or see Section 2.11)

Give a subcutaneous correction dose of rapid-acting insulin (Novorapid or Humalog) as per ‘Sick Day Guidelines’

Monitor blood glucose and ketones 2 hourly

Informe anaesthetist

Well

Unwell

Either
Or

POST-OP:
- Manage as per Major Surgery in Section 2.8

If NBM for more than 6 hours
**Elective Surgery flowchart**

**Surgical decision to perform **ELECTIVE** surgery**
- Ensure performed at RCHT Treliske
- Morning list if possible, particularly for major surgery
- Book into Pre-op assessment clinic

**Pre-op assessment clinic**
- liaise with the following:
  - Anaesthetist
    - See Section 2.4
    - Prioritise position on list
  - PDSN
    - See Section 2.4 and Section 2.8
    - Agree Personalised Management Plan in liaison with Anaesthetist and Diabetes Consultant
  - Paediatric Diabetes Consultant
    - See Section 2.4 and Section 2.8

**Personalised Management Plan filed in notes**

**Minor Surgery**
- Outpatient

**Major Surgery**
- Day Case admission
- Inpatient admission HDU

**Ward Nursing Staff Inform:**
- Anaesthetist
- PDSN

**Ward Nursing Staff Inform:**
- Paediatric Registrar
- PDSN
## 1. Aim/Purpose of this Guideline

1.1. To provide clinical guidelines for all practitioners caring for paediatric patients with type 1 and 2 diabetes requiring a general anaesthetic or sedation for surgery or another procedure. Includes specific information and flow charts, observation and reference charts.

## 2. The Guidance

<table>
<thead>
<tr>
<th>Section</th>
<th>Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Contact Details</td>
<td>6</td>
</tr>
<tr>
<td>2.2</td>
<td>General Principles</td>
<td>6</td>
</tr>
<tr>
<td>2.3</td>
<td>Identify type of surgery/procedure:</td>
<td>7</td>
</tr>
<tr>
<td>2.3.1</td>
<td>Emergency surgery (or possible emergency surgery)</td>
<td>7 (flow chart page 2)</td>
</tr>
<tr>
<td>2.3.2</td>
<td>Elective surgery/procedure</td>
<td>7 (flow chart page 4)</td>
</tr>
<tr>
<td>2.4</td>
<td>Pre-admission planning for elective procedures</td>
<td>7-8</td>
</tr>
<tr>
<td>2.5</td>
<td>Responsibilities during admission</td>
<td>8-9</td>
</tr>
<tr>
<td>2.5.1</td>
<td>Ward Nursing Staff</td>
<td>9</td>
</tr>
<tr>
<td>2.5.2</td>
<td>Surgical Team</td>
<td>9</td>
</tr>
<tr>
<td>2.5.3</td>
<td>Named anaesthetist</td>
<td>9</td>
</tr>
<tr>
<td>2.5.4</td>
<td>Paediatric Registrar</td>
<td>9-10</td>
</tr>
<tr>
<td>2.6</td>
<td>Blood glucose (BG) monitoring and actions</td>
<td>10</td>
</tr>
<tr>
<td>2.6.1</td>
<td>Frequency</td>
<td>10</td>
</tr>
<tr>
<td>2.6.2</td>
<td>Target</td>
<td>10</td>
</tr>
<tr>
<td>2.6.3</td>
<td>If BG&lt;5mmol/L</td>
<td>10-11</td>
</tr>
<tr>
<td>2.6.4</td>
<td>If BG ≥15mmol/L</td>
<td>11</td>
</tr>
<tr>
<td>2.7</td>
<td>Emergency Surgery</td>
<td>11 (flow charts page 2&amp;3)</td>
</tr>
<tr>
<td>2.8</td>
<td>Management of diabetes-related medication</td>
<td>12</td>
</tr>
<tr>
<td>2.8.1</td>
<td>Subcutaneous Insulin</td>
<td>13</td>
</tr>
<tr>
<td>2.8.2</td>
<td>Insulin Pump</td>
<td>13</td>
</tr>
<tr>
<td>2.8.3</td>
<td>Oral anti-diabetic medications e.g. metformin</td>
<td>13</td>
</tr>
<tr>
<td>2.9</td>
<td>Variable Rate IV Insulin Infusion:</td>
<td>14</td>
</tr>
<tr>
<td>2.9.1</td>
<td>IV fluid</td>
<td>14</td>
</tr>
<tr>
<td>2.9.2</td>
<td>IV insulin</td>
<td>14</td>
</tr>
<tr>
<td>2.9.3</td>
<td>Patient variable rate IV insulin chart</td>
<td>15</td>
</tr>
<tr>
<td>2.10</td>
<td>Personalised management plan.</td>
<td>16-17</td>
</tr>
<tr>
<td>2.11</td>
<td>Insulin information</td>
<td>18-19</td>
</tr>
<tr>
<td></td>
<td>Including 2.9.4 Correction doses of rapid-acting insulin</td>
<td></td>
</tr>
</tbody>
</table>
2.1 Contact Information

PDSN: available on radio page via RCHT switchboard 8am – 8pm every day

Paediatric Registrar on call: available via switchboard

Pre-operative Assessment Office on Harlyn Ward: ext. 3910

2.2 General Principles

When children with diabetes need surgery or other procedures requiring sedation or anaesthesia, optimal management should maintain adequate hydration and near normal glycaemia, whilst minimising the risk of hypoglycaemia. The stress of surgery may cause hyperglycaemia and increase insulin requirements. However fasting may cause hypoglycaemia.

- Locally we have agreed less strict BG targets than quoted in References 1&2. This is to avoid excessive use of IV insulin which is not without risk. If there is felt to be a high risk of infection, the upper limit can be reduced to 10mmol/l.

Remember DKA may present as an acute abdomen, but acute illness may also precipitate DKA.

These procedures must take place on the Royal Cornwall Hospital Treliske site.

The child with diabetes should be first on, or near the beginning of the operating list, preferably in the morning.

If diabetes is poorly controlled with HbA1c > 75mmol/mol (9%) or recent high blood glucose readings: consider delaying the procedure if possible until control has improved. If it can’t be delayed then they may need to be admitted for a longer period prior to surgery for more detailed assessment and stabilisation.

Ideally, all children requiring elective procedures will have a Personalised Management Plan (Section 2.10) drawn up by the Paediatric Diabetes Specialist Nurses (PDSN) in consultation with the Diabetes Consultants and Named Anaesthetists.

Standard fasting rules apply (as per RCHT Policy ‘Fasting Patients Who Require Anaesthesia or Intravenous Sedation’):

- Solids and formula milk or cow’s milk: up to 6 hours pre-op
- Breast milk: up to 4 hours pre-op
- Clear, non-fizzy fluids: up to 2 hours pre-op

Long-acting insulins e.g. Lantus, Levemir, Tresiba (more information in Section 2.11) should be prescribed to continue, even if the patient requires IV insulin.
2.3 Identify the type of surgery/procedure

2.3.1 Emergency surgery, or possible emergency surgery
- with unpredictable, probably prolonged fasting time.

See flow chart page 2.

2.3.2 Elective surgery: see flowchart Page 4

a) Minor surgery/procedure
- only expected to miss one meal
- examples include: endoscopies, grommet insertion, adeno-tonsillectomy

► GO TO Sections 2.4, 2.5 & 2.6
► If no Personalised Management Plan has been made GO TO Section 2.8

b) Major surgery
- expected to miss more than one meal
- electively book into Paediatric HDU for postoperative management

► GO TO Sections 2.4, 2.5 & 2.6
► If no Personalised Management Plan has been made GO TO Section 2.8

2.4 Pre-admission planning for elective procedures

2.4.1 Inform (usually done via pre-operative assessment clinic)
- Paediatric Diabetes Specialist Nurses (PDSN) available 8am to 8pm via switch every day
- Surgical team
- Named anaesthetist

2.4.2 PDSN
- Try to optimise diabetes control, increasing contact with patient/parents if required.

- Liaise with the paediatric diabetes consultant to produce a Personalised Management Plan (Section 10) using the guidance in Section 2.8. This should be filed in the notes.

- liaise with the named anaesthetist to:
  a) Agree timing of admission:
     - Minor surgery/procedure (see definition in section 2.3.2)
       - Usually on the day of the operation/procedure.
     - Major surgery (see definition in section 2.3.2)
       - 2pm the afternoon before the operation/procedure.
- **Poorly controlled diabetes** (HbA1c > 75mmol/mol (9%) or recent high blood glucose readings)
  - need to ask whether surgeon whether procedure can be delayed until control has improved.
  - may need to be admitted for a longer period prior to surgery for more detailed assessment and stabilisation

b) **Agree the Personalised Management Plan.**
c) **If having major surgery, book electively into Paediatric HDU for postoperative management.**

- Establish whether annual review bloods are required and include this in the plan.
- Consider the need for Play Specialist input.
- Discuss plan with patient/parents, including the plan for the day prior to admission.

### 2.4.3 Named anaesthetist

- Liaise with the PDSN to agree timing of admission and agree Personalised Management Plan.
- Ensure the child with diabetes is first on, or near the beginning of the operating list, preferably in the morning.

### 2.4.4 Surgical team

- Book into pre-operative assessment clinic (if not going to use pre-operative assessment clinic, then inform PDSN directly).
- Ensure surgery/procedure will take place on the Royal Cornwall Hospital Treliske site.

### 2.5 Responsibilities during admission

#### 2.5.1 Ward nursing staff should:

a) **On admission**
- Weigh patient
- Apply ametop
- Check capillary blood glucose and ketones and refer to Section 2.6
- Between 8am and 8pm, contact the PDSN via switch
- **If BG still less than 5mmol/l after treatment for a low blood glucose level, or if BG > 15 mmol/l and it is less than 2 hours until the operation or ketones are more than 1 mmol/l, bleep a paediatric doctor to perform IV cannulation, manage as per Section 2.6 and contact the anaesthetist.**
- For elective surgery/procedure:
  - Follow the Personalised Management Plan, if there is one filed in the notes.
  - If the patient is having major surgery, inform paediatric registrar on call
- **For emergency surgery or possible emergency surgery:**
  - Remind the paediatric registrar to liaise with PDSN and anaesthetist.

b) **Throughout admission**
- Monitor and record blood glucose and ketones as per Section 2.6.
c) If on IV insulin: complete Paediatric variable rate IV insulin infusion chart CHA3228 available to print on Intranet, A-Z services > F: Forms > Forms to print, or A-Z services> Child Health> Paediatric Policies and Guidelines where this form is attached to this guideline.

d) Post-operatively
- when patient returns from theatre, contact the PDSN to decide what type and dose of insulin to give to cover food
- discuss with PDSN before discharge

2.5.2 Surgical team
a) Ensure consent considers implications of diabetes
b) Emergency surgery: liaise with paediatric registrar and anaesthetist on call.

2.5.3 Named Anaesthetist
a) If Variable Rate IV Insulin Infusion and IV fluids are required, follow guidance in Appendices 4 & 5 and complete the Paediatric variable rate IV insulin infusion chart CHA3228 available to print on Intranet, A-Z services > F: Forms > Forms to print, or A-Z services> Child Health> Paediatric Policies and Guidelines where this form is attached to this guideline.

b) Provide multi-modal analgesia (i.e. consider regional and local anaesthesia) with appropriate anti-emetics to enable an early return to a normal diet and usual diabetes regimen.

2.5.4 For emergency or major surgery, the paediatric registrar should nominate a member of the paediatric team to do the following:

a) Perform full history and examination
   - document current medication, insulin dosages and review recent blood glucose readings

b) For elective admissions follow the personalised Management Plan, which should be filed in the notes:
   If there is no Personalised Management Plan, then complete the Form to Print (see Section 10) using the guidance in Section 2.8 in liaison with the following people:
   - between 8am and 8pm, the PDSN
   - between 8pm and 8am, the paediatric registrar/consultant
   - the named anaesthetist

c) For emergency surgery – follow flow chart page 2

d) Insert IV cannula and do bloods:
   - for electrolytes, venous blood gas, plasma glucose and HbA1c
   - full blood count, CRP and blood cultures if sepsis suspected
   - annual review bloods (ask PDSN), unless done in the previous 6 months

e) Review blood results and follow guidance in section 2.6.

f) Prescribe intravenous 10% dextrose (2mls/kg), buccal Glucogel and intramuscular glucagon on the ‘As Required’ section of EPMA, for use if blood glucose <5mmol/l (normally we wouldn’t treat for hypoglycaemia unless BG was <4mmol/l, but the peri-procedure BG target levels are different – see Section 2.6).

g) Prescribe insulin as per Section 2.8.1, 2.8.2 and Section 2.11:
   - Subcutaneous insulin injections should be prescribed on the paper Paediatric Insulin Prescription Sheet with a note on EPMA:
     - Long-acting insulin e.g. Levmir/Lantus/Absaglar/Tresiba should continue as usual.
Intermediate or mixed insulins e.g. Novomix 30, will need to be omitted or reduced pre-procedure.

Rapid-acting insulin e.g. Novorapid/Apidra/Humalog:
- Carbohydrate boluses will need to be omitted pre- and post-procedure until ready to eat.
- Correction dose needs to be prescribed for BG≥15mmol/l.

Patients continuing on their insulin pump should have the appropriate rapid-acting insulin prescribed on the paper Paediatric Insulin Pump Prescription Sheet.

For major surgery, Variable Rate IV Insulin Infusion and IV fluids as per Section 2.9 should be prescribed to start 2 hours pre-procedure.

h) Patients on oral anti-diabetic medication e.g. Metformin: see Section 2.8.3

i) Post-procedure:
- Ensure long-acting insulin is prescribed at usual time.
- Ensure that if patient is receiving insulin via an insulin pump that it is prescribed as in Section g) above.
- Prescribe rapid-acting insulin injections as per advice from PDSN, advice in Section 2.8.1, or according to BG levels as per Section 2.6.
- If patient is normally on oral anti-diabetics, prescribe these as per Section 2.8.3.
- Perform usual post-procedure monitoring and management of fluids. If patient is on Variable Rate IV Insulin Infusion, use guidance in Section 2.9.
- Try to encourage oral intake as soon as possible by optimising analgesia and use of anti-emetics if appropriate.

2.6 Blood glucose monitoring and actions

2.6.1 Frequency (More frequently if BG’s unstable)
- If on IV insulin: check BG half an hour after any change to the insulin infusion rate or IV dextrose concentration as per Section 2.9.2.
- Pre-operatively:
  - Day before operation: pre-meals, pre-snacks and at bedtime
  - If poorly controlled diabetes: check 4 hourly overnight
  - Day of operation: hourly from 07.00am
- During procedure and in recovery: at least hourly
- Post-operatively:
  - Hourly for 4 hours post-op or until IV insulin discontinued
  - Then before meals and snacks and at bedtime

2.6.2 Target BG around the time of surgery or anaesthetic:
- Between 5 - 15 mmol/l for patients who are not on IV insulin
- Between 5 - 12 mmol/l for patients on IV insulin (see Section 2.9)

(Locally we have agreed less strict BG targets than are quoted in References 1&2. This is to avoid excessive use of IV insulin which is not without risk. If there is felt to be a high risk of infection with certain operations/procedures, the upper limit can be reduced to 10mmol/l).

2.6.3 If BG < 5 mmol/l:
- Treat as follows and remember to repeat BG every 10 mins until >5 mmol/l
- If the patient is on IV insulin:
  - see Variable Rate IV Insulin Infusion, Section 2.9
If the patient is not on IV insulin, but has an IV cannula:
- give 2mls/kg 10% dextrose.

If the patient does not have an IV cannula:
- If pre-op, or post-op and unable to tolerate oral fluids, give buccal Glucogel, or if they are unconscious give intramuscular glucagon, and then site an IV cannula.
- If post-op and able to tolerate oral fluids or food: Treat as per the guideline ‘Management of Hypoglycaemia in paediatric diabetic patients on insulin injections or pumps’ with 10-15g of carbohydrate as rapidly absorbed glucose.

2.6.4 If BG ≥ 15mmol/l:
- CHECK BLOOD KETONES every time BG ≥ 15mmol/l

If blood ketones ≥ 3mmol/l:
- Check blood gas and if pH < 7.3 & bicarbonate <15: follow DKA Care Pathway and inform paediatric registrar.
- If pre-procedure, inform the named anaesthetist as the procedure may need to be delayed.

If blood ketones 1 - 2.9 mmol/l, or ≥ 3mmol/l and not in DKA:
- If pre-procedure, inform the named anaesthetist as the procedure may need to be delayed.
- If on IV insulin, check that the cannula is patent and follow Variable Rate IV Insulin Infusion guidance in Section 2.9.2 and convert fluids to 0.9% saline until BG less than 15mmol/l.
- If not on IV insulin and pre-procedure: start Variable Rate IV Insulin Infusion and IV fluids as per Section 2.9
- If not on IV insulin and post-procedure: give a ‘Sick Day’ correction dose of rapid-acting insulin, such as Novorapid or Humalog as per ‘Sick Day Guideline’.

If blood ketones <1mmol/l:
- If on IV insulin follow Variable Rate IV Insulin Infusion in Section 2.9.2 and convert fluids to 0.9% saline until BG less than 15mmol/l.
- If not on IV insulin:
  - If more than 2 hours pre-procedure, or post-procedure:
    - give a correction dose of rapid-acting insulin, such as Novorapid, Apidra, or Humalog as per Section 2.11
    - The correction dose can be repeated 2 hourly if required.
  - If less than 2 hours before a minor procedure:
    - inform anaesthetist
    - insert a cannula and start a Variable Rate IV Insulin Infusion and IV fluids as per Section 2.9

2.7 Emergency Surgery

See flow charts page 2 and 3.
### 2.8 Management of diabetes-related medication

#### 2.8.1 Subcutaneous Insulin (*see Section 3.2 for further advice on children on insulin pumps and Section 7 for clarification of insulin names and actions*)

<table>
<thead>
<tr>
<th>Day before procedure</th>
<th><strong>MORNING SURGERY/PROCEDURE</strong></th>
<th><strong>AFTERNOON SURGERY/PROCEDURE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minor surgery</td>
<td>Major surgery</td>
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<tr>
<td><strong>Insulin</strong></td>
<td>Give usual subcutaneous insulin, including pump boluses and basal rates, but if morning blood glucose often less than 5mmol/l, consider reducing the dose of evening intermediate* - long-acting* insulin by about 20%, or for pump patients using a temporary basal rate reduction overnight. <strong>If poorly controlled diabetes</strong> (HbA1c &gt;9% or 75mmol/mol): admission 2pm the day before at the latest and monitor blood glucose levels pre-meals, bedtime and 4 hourly overnight.</td>
<td><strong>Food and drink</strong></td>
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<td>Solids and milk up to 6 hours pre-procedure. Clear, non-fizzy fluids up to 2 hours pre-procedure.</td>
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#### Post procedure

**Insulin and food**

If not on IV insulin: when ready to eat, give a trial of food and give insulin immediately afterwards:

- Before 10.30am, give the normal type of morning insulin (including pump carbohydrate bolus/ mixed insulins), but adjust the dose of rapid-acting* insulin according to the blood glucose level (correction dose - see Section 2.11) and how much they have eaten: ask family/ Expert meter/ PDSN for advice.
- After 10.30am, give subcutaneous rapid-acting* insulin/pump bolus to cover carbohydrate intake and to correct BG ≥15mmol/l (see Section 2.11) until next usual dose of insulin is due: ask family/ Expert meter/ PDSN for advice.

If on IV insulin and fluids:

- For those who usually have long-acting* insulin, continue this at the usual dose and time, whilst on IV insulin.
- Patients can eat small amounts whilst on IV insulin.
- When the patient is ready to eat a reasonable amount, plan to allow them to do this when their next usual, meal-related subcutaneous insulin dose is due (including patients converting back to an insulin pump). Allow them to eat first and give insulin immediately afterwards and adjust the rapid-acting* dose according to the blood glucose level (correction dose – see Section 2.11) and how much they’ve eaten: ask family/ Expert meter/ PDSN for advice.
- Patients going back on an insulin pump will need to re-start their basal rate (they may wish to use a temporary basal rate) as well as using boluses to cover carbohydrates or correct high blood glucose levels.
- Stop IV insulin 10 minutes after subcutaneous rapid-acting* insulin is given (includes restarting pump and Novomix 30 or Humalog Mix 25 or 50) Then if blood glucose is stable and the patient is eating normally recommence usual SC insulin/pump regime, adjusting doses according to blood glucose levels (correction dose – see Section 2.11) and the amount they are eating.
2.8.2 Management of children on insulin pumps

- Follow the advice relating to pumps in the table in Section 3.1.
- If they are due to be admitted electively for minor surgery/procedure, the PDSN and diabetes consultant will probably arrange a plan with the named anaesthetist for the child to stay on their insulin pump basal rate during the anaesthetic.
  o In this case, if the BG <5 mmol/l, then the pump can be suspended for 30 minutes in addition to giving 2 mls/kg of IV 10% dextrose.
  o If the pump is stopped for up to 1 hour, the child must be started on a Variable Rate IV Insulin Infusion and IV fluid as per Section 2.9 because they will have NO basal insulin in their body.
- However if it is not possible for them to stay on their insulin pump during the anaesthetic, they should be put on a Variable Rate IV Insulin Infusion as per Section 2.9.
- If the child is in DKA they should be put on IV insulin and fluids as per the DKA guideline.

2.8.3 Patients on oral anti-diabetic medications e.g. Type 2 Diabetes

2.8.3a Metformin

- Guidance also relevant to patients with Type 1 Diabetes who are on metformin in addition to insulin
- The following advice is related to the potential risk of lactic acidosis.
- Pre-procedure:
  - Elective surgery/procedure:
    o Minor surgery/procedure: stop on the day of the procedure i.e. omit the morning dose.
    o Major surgery: stop 24 hours before the procedure i.e. the day before the procedure, give the morning dose early and then omit subsequent doses until post-procedure.
  - Emergency surgery: omit as soon as there is a possibility of emergency surgery. If less than 24 hours since last dose, it is essential to maintain hydration and iv fluids during and post surgery.
- Post-procedure: restart when the patient is cardiovascularly stable and eating again, unless:
  - contrast medium has been used, they have renal impairment with eGFR <50 mls/min/1.73m2, or they have been cardiovascularly unstable at any stage, in which restart metformin no earlier than 48 hours post procedure if renal function has returned to normal.

2.8.3b Sulfonylureas, thiazolidinediones, DPP-4 inhibitors and GLP-1 analogues:

- Pre-procedure: omit on day of procedure.
- Post-procedure: restart when eating normal amounts.
2.9 Variable Rate IV Insulin Infusion

2.9.1 Intravenous fluid: should always run simultaneously with IV insulin

- **Rate:** usual maintenance volumes (see departmental IV fluid guideline).
  - If extra fluid is required for rehydration or to keep up with extra fluid losses, then 0.9% saline should be used.
  - If the maintenance fluid rate needs to be reduced, e.g. Syndrome of Inappropriate Anti Diuretic Hormone, be aware that this may cause a fall in BG level, in which case the IV Insulin Infusion rate or dextrose concentration would need to be adjusted as in the table below.

- **Type:**
  - Use dextrose and saline
  - **Saline strength:** 0.9% saline
  - **Dextrose strength:**
    - If blood glucose 5 - 14.9 mmol/l: start with 5% dextrose.
    - If blood glucose ≥15 mmol/l: use 0.9% saline until the blood glucose level returns to <15 mmol/l, then recommence 5% dextrose.
    - If blood glucose <5mmol/l: either reduce insulin rate or increase to 10% dextrose.

- **Potassium:**
  - If the initial blood potassium level is normal then 10 mmol of potassium chloride should be added per 500 ml.

- **U&E’s:**
  - Should be checked before IV fluids are commenced and then at least 12 hourly whilst on IV fluids and IV insulin.
  - IV fluid composition should be adjusted according to the results.

2.9.2 Intravenous insulin:

- **IV fluids should always run simultaneously with IV insulin**
  - Can run via the same cannula using a Y-connector

- **Drawing up**
  - Add 50 units of Actrapid insulin to 49.5 mls of 0.9% saline, making a solution of 1 unit of insulin per 1ml
  - Gently rotate the syringe to mix insulin and saline
  - Clearly label the syringe with details of total insulin (units) contained, the type and volume of diluent (normal saline); the date and time of preparation and then sign the label.

- Long-acting insulin e.g. Levemir, Lantus, Abasaglar, Tresiba (more information Section 2.11) should continue whilst on IV insulin.

- **Variable Rate IV Insulin Infusion:**

<table>
<thead>
<tr>
<th>Blood glucose (mmol/l)</th>
<th>STARTING insulin rate mls/kg/hr = units/kg/hr</th>
<th>SUBSEQUENT insulin rate change</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 (or hypo symptoms, which may occur at a higher level in some patients)</td>
<td>Treat with 2mls/kg IV 10% dextrose. Repeat BG after 15mins and start IV insulin when BG &gt; 5mmol/l as below.</td>
<td>Treat with 2mls/kg IV 10% dextrose and stop IV insulin, but repeat BG every 10 minutes and make sure IV insulin is restarted as soon as BG &gt; 4 mmol/l. Restart IV insulin at half the previous rate or increase dextrose concentration.</td>
</tr>
<tr>
<td>4 – 4.9</td>
<td>0.025 mls/kg/hr</td>
<td>Half insulin rate or increase dextrose concentration, then repeat BG after 30 minutes.</td>
</tr>
<tr>
<td>5 – 7.9</td>
<td>0.05 mls/kg/hr</td>
<td>Continue current rate, unless BG falling by &gt;3 mmol/l/hour, in which case decrease rate by 10%.</td>
</tr>
<tr>
<td>8 – 11.9</td>
<td>0.075 mls/kg/hr</td>
<td>If persistent over 1 hour (2 readings) and BG not falling by &gt;3 mmol/l/hour, then increase rate by 10%.</td>
</tr>
<tr>
<td>12 – 15</td>
<td>0.1 mls/kg/hr</td>
<td>If persistent over 1 hour (2 readings) and BG not falling by &gt;3 mmol/l/hour, then increase rate by 20%, stop IV dextrose and give 0.9% saline instead. Repeat BG after 30mins and when BG &lt; 15 mmol/l revert to 5% dextrose with appropriate % saline.</td>
</tr>
<tr>
<td>&gt;15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### PAEDIATRIC VARIABLE RATE IV INSULIN INFUSION CHART

Only to be used in conjunction with the 'guidelines for the management of paediatric patients with diabetes requiring a general anaesthetic or sedation for surgery or a procedure', Appendix 3.

#### Ward:

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Capillary blood glucose (mmol/l)</th>
<th>Blood ketones (mmol/l)</th>
<th>Rate of insulin infusion in mls/kg/hr</th>
<th>Rate of insulin infusion in ml/hour</th>
<th>Change to insulin (↑ or ↓)</th>
<th>New rate of insulin infusion in mls/kg/hr</th>
<th>New rate of insulin infusion in ml/hour</th>
<th>Volume of insulin left in syringe (mls)</th>
<th>Sign and print</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

CHA3228 V1 Printed 05/2013
Personalised management plan for paediatric patient with diabetes requiring general anaesthetic or sedation

<table>
<thead>
<tr>
<th>Procedure type</th>
<th>Procedure date</th>
<th>Procedure time</th>
<th>Paediatric registrar needs to be informed? (tick as appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Named anaesthetist</td>
<td></td>
<td></td>
<td>□ Yes  □ No</td>
</tr>
<tr>
<td>Agreed admission date</td>
<td></td>
<td></td>
<td>Agreed admission time</td>
</tr>
<tr>
<td>Annual review bloods (tick as appropriate)</td>
<td></td>
<td></td>
<td>□ Required □ Not required</td>
</tr>
</tbody>
</table>

**Day before procedure**

**Fluids and diet**

<table>
<thead>
<tr>
<th>Oral</th>
<th>Normal oral intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>IV fluids only if IV insulin is commenced. As per Appendix 3</td>
</tr>
</tbody>
</table>

**Insulin**

<table>
<thead>
<tr>
<th>SC</th>
<th>Time</th>
<th>Type</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**BG monitoring**

At least pre meals, snacks and at bedtime. If poorly controlled diabetes: 4 hourly overnight. If on IV insulin: at least hourly.

**Day of procedure**

**Pre-procedure**

<table>
<thead>
<tr>
<th>Fluids and diet</th>
<th>Oral</th>
<th>Clear fluids only from (insert time):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nil by mouth from (insert time):</td>
</tr>
<tr>
<td>IV</td>
<td></td>
<td>IV fluids only if IV insulin is commenced. As per Appendix 3</td>
</tr>
</tbody>
</table>

**Insulin**

<table>
<thead>
<tr>
<th>SC</th>
<th>Morning surgery</th>
<th>Give .................. units of Lantus/Levenir, but OMIT all other SC insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Afternoon surgery</td>
<td>At 7am with light breakfast give: ................................... units of ....................... insulin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>................................... units of ....................... insulin</td>
</tr>
</tbody>
</table>

**IV**

In all cases, if BG > 15 mmol/l and ketones > 1 mmol/l. As per Appendix 3.

Also in this case, routinely start IV insulin and fluids as per Appendix 3 at (insert time): (DELETE if not appropriate)

**BG monitoring**

At least hourly from 7am or if on IV insulin
### Day of procedure

<table>
<thead>
<tr>
<th>During Procedure</th>
<th>Insulin</th>
<th>If already on IV insulin and fluids, continue this as per Appendix 3. If not already on IV insulin and fluids, start these if BG &gt; 15 mmol/l and ketones &gt; 1 mmol/l as per Appendix 3.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG monitoring</td>
<td>At least hourly</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Post-procedure</strong></td>
<td><strong>Fluids and diet</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>IV</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Insulin</strong></td>
<td><strong>SC</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>IV</strong></td>
</tr>
<tr>
<td></td>
<td><strong>BG monitoring</strong></td>
<td>At least hourly for 4 hours post-op or until IV insulin is discontinued. Then before meals and snacks and before bedtime. More often if unstable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of person completing this plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation of person completing this plan</td>
</tr>
<tr>
<td>In discussion with the following people</td>
</tr>
<tr>
<td>Signature</td>
</tr>
<tr>
<td>Date plan completed</td>
</tr>
</tbody>
</table>
2.11 Insulin Information

2.11.1 The following table contains the actions of the most common insulins:

<table>
<thead>
<tr>
<th>Insulin Name</th>
<th>Onset of action (m = minutes h = hours)</th>
<th>Peak action (hours)</th>
<th>Duration of action (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid-acting analogues</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin lispro (Humalog)</td>
<td>15m</td>
<td>1.5</td>
<td>2 - 5</td>
</tr>
<tr>
<td>Insulin aspart (Novorapid)</td>
<td>10 - 20m</td>
<td>1 - 3</td>
<td>3 - 5</td>
</tr>
<tr>
<td>Insulin glulisine (Apidra)</td>
<td>10 min</td>
<td>1</td>
<td>2 - 4</td>
</tr>
<tr>
<td><strong>Short-acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soluble (Actrapid)</td>
<td>&lt;30m</td>
<td>1.5 - 3.5</td>
<td>7 - 8</td>
</tr>
<tr>
<td><strong>Intermediate-acting (Isophane insulins)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulatard</td>
<td>&lt;90m</td>
<td>4 - 12</td>
<td>24</td>
</tr>
<tr>
<td>Humulin I</td>
<td>30-60m</td>
<td>1 - 8</td>
<td>22</td>
</tr>
<tr>
<td><strong>Long-acting analogues</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insulin glargine (Lantus)</td>
<td>2.5h</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>Insulin detemir (Levemir)</td>
<td>2.5h</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>Insulin degludec (Tresiba)</td>
<td>4h</td>
<td></td>
<td>72</td>
</tr>
</tbody>
</table>

2.11.2 Pre-Mixed insulins contain a combination of a rapid-acting insulin and an intermediate-acting insulin eg:
- **Humalog Mix 25**: contains 25% as rapid-acting insulin Lispro (Humalog)
- **Novomix 30**: contains 30% as rapid-acting insulin Aspart (Novorapid)

2.11.3 For details of the action of insulins not mentioned here please go to the mims website and look under 'Tables', 'Diabetes', 'Insulin Preparations'.

2.11.4 Correction doses of rapid-acting insulin:

Patients should know their own correction dose and often it will be pre-programmed into an 'Expert' meter (if not, it can be calculated as shown below). In most cases this can be used, but around surgery/fasting there are the following exceptions:
- patients usually correct BG levels above 8 – 10 mmol/l, but around surgery/fasting a correction dose should not be used unless BG ≥15 mmol/l
- a correction dose should not be used within 2 hours of a previous dose of rapid-acting insulin
- Correction doses should be avoided within 2 hours prior to the procedure. If within this time BG levels are ≥ 15mmol/l then a Variable Rate IV Insulin Infusion should be commenced – see Section 2.6.4 and Section 2.9.
- If ketones are ≥ 1 mmol/l and a correction dose is required then a ‘Sick Day’ dose should be used as per the ‘Sick Day Rules’ Guideline

If patients do not know their usual correction dose, it can be calculated by dividing 100 by the Total Daily Dose (TDD) of insulin to estimate the number of mmol/l that the BG level will fall with 1 unit of insulin:
- e.g. patient usually on Novorapid 6 units with breakfast, 12 units with lunch, 12 units with tea, and Levemir 20 Units at bedtime = TDD of 50 Units:

\[
\frac{100}{50} = 2, \quad \text{therefore we would expect 1 unit of rapid-acting insulin to drop BG level by 2 mmol/l. At the time of surgery, aiming for a BG of about 10 mmol/l, this could be prescribed as follows:}
\]

- If BG 15 - 16.9 mmol/l give 3 units of rapid-acting insulin
- If BG 17 – 18.9 mmol/l give 4 units of rapid acting insulin
- If BG 19 – 20.9 mmol/l give 5 units of rapid-acting insulin
- If BG 21 mmol/l or above, give 6 units of rapid-acting insulin
### 3. Monitoring compliance and effectiveness

<table>
<thead>
<tr>
<th>Element to be monitored</th>
<th>Full guideline, which is included in the diabetic team's rolling programme of annual audits.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>Paediatric Diabetes team</td>
</tr>
<tr>
<td>Tool</td>
<td>Audit a sample of patient’s medical records who have had operations. Look for any complications like high or low blood glucose levels, and to ensure patients in DKA are not being mistakenly taken for surgery. Also to see if guidelines followed with prescribing.</td>
</tr>
<tr>
<td>Frequency</td>
<td>Every 3 years before new guideline due, or following a problem being identified. Because the PDSNs are involved in all cases, problems should be identified on each occasion and discussed with the named consultant. There is no national structure/ requirement to report back on this guideline. The guideline is used only a few times each year, hence the infrequent audit.</td>
</tr>
<tr>
<td>Reporting arrangements</td>
<td>Report to diabetes team meeting, and the Paediatric Audit and Guidelines meeting, which is minuted and thoroughly interrogated.</td>
</tr>
<tr>
<td>Acting on recommendations and Lead(s)</td>
<td>Paediatric diabetes team lead will ensure actioned within 3-6 months. Principally the outcome will need sharing with the anaesthetic department, and paediatric ward staff. Latter have mandatory annual diabetes training from PDSNs. However there have been no significant incidents in the last 3 years since the document implemented.</td>
</tr>
<tr>
<td>Change in practice and lessons to be shared</td>
<td>Paediatric diabetes team lead will ensure actioned within 3-6 months. Principally the outcome will need sharing with the anaesthetic department, and paediatric junior and senior doctors and ward nursing staff. Latter have mandatory annual diabetes training from PDSNs. Junior doctors have a rolling programme of training every 6 months. However there have been no significant incidents in the last 3 years since the document implemented.</td>
</tr>
</tbody>
</table>

### 4. Equality and Diversity

4.1. This document complies with the Royal Cornwall Hospitals NHS Trust service Equality and Diversity statement which can be found in the ‘Equality, Diversity & Human Rights Policy’ or the [Equality and Diversity website](http://www.royalcornwall.nhs.uk/equality/diversity).

4.2. **Equality Impact Assessment**

The Initial Equality Impact Assessment Screening Form is at Appendix 2.
### Appendix 1. Governance Information

<table>
<thead>
<tr>
<th>Document Title</th>
<th>Diabetes Type 1 &amp; 2 requiring General Anaesthetic- Clinical Guideline for the management of paediatric patients with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Issued/Approved:</td>
<td>21/9/17</td>
</tr>
<tr>
<td>Date Valid From:</td>
<td>21/9/2017</td>
</tr>
<tr>
<td>Date Valid To:</td>
<td>21/9/2020</td>
</tr>
<tr>
<td>Directorate / Department responsible (author/owner):</td>
<td>Dr Katie Mallam, Consultant Paediatrician</td>
</tr>
<tr>
<td>Contact details:</td>
<td>01872 252716</td>
</tr>
<tr>
<td>Brief summary of contents</td>
<td>Clinical guideline for practitioners caring for paediatric patients with type 1 and 2 Diabetes who are having a general anaesthetic or sedation. Includes specific information and flow charts, observation and reference charts.</td>
</tr>
</tbody>
</table>
| Suggested Keywords: | Diabetic  
Paediatric  
Child  
General anaesthetic  
Sedation  
Surgery |
| Target Audience | RCHT | PCH | CFT | KCCG |
| Executive Director responsible for Policy: | Medical Director |
| Date revised: | 18/6/17 |
| This document replaces (exact title of previous version): | Diabetes Type 1 & 2 requiring General Anaesthetic- Clinical Guideline for the management of paediatric patients with Also called CLINICAL GUIDELINE FOR THE MANAGEMENT OF PAEDIATRIC PATIENTS WITH DIABETES TYPE 1 AND 2 REQUIRING A GENERAL ANAESTHETIC OR SEDATION FOR SURGERY OR ANOTHER PROCEDURE And the forms to Print |
| Approval route (names of committees)/consultation: | Paediatric Diabetes Team (led by Dr Katie Mallam)  
Child Health Directorate Guidelines Meeting |
<p>| Divisional Manager confirming approval processes | Dr M Thorpe |</p>
<table>
<thead>
<tr>
<th>Name and Post Title of additional signatories</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name and Signature of Divisional/Directorate Governance Lead confirming approval by specialty and divisional management meetings</td>
<td>{Original Copy Signed}</td>
</tr>
<tr>
<td>Signature of Executive Director giving approval</td>
<td>{Original Copy Signed}</td>
</tr>
<tr>
<td>Publication Location (refer to Policy on Policies – Approvals and Ratification):</td>
<td>Internet &amp; Intranet ✓ Intranet Only</td>
</tr>
<tr>
<td>Document Library Folder/Sub Folder</td>
<td>/DocumentsLibrary/RoyalCornwallHospitalsTrust/Clinical/Paediatrics/DiabetesType1And2RequiringGeneralAnaestheticClinicalGuidelineForManagementOfPaediatricPatients.pdf Or via Child Health Intranet&gt; General Paediatrics</td>
</tr>
<tr>
<td>Training Need Identified?</td>
<td>No</td>
</tr>
</tbody>
</table>

### Version Control Table

<table>
<thead>
<tr>
<th>Date</th>
<th>Version No</th>
<th>Summary of Changes</th>
<th>Changes Made by (Name and Job Title)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 1998</td>
<td>1</td>
<td>Original document</td>
<td>Graham Taylor – paediatric consultant</td>
</tr>
<tr>
<td>December 2012</td>
<td>2</td>
<td>Reviewed and Updated</td>
<td>Rebecca Mawer, Consultant Anaesthetist Katie Mallam- paediatric diabetes consultant Simon Robertson- paediatric</td>
</tr>
<tr>
<td>July 2013</td>
<td>3</td>
<td>Re format</td>
<td>Tabitha Fergus- deputy ward manager, child health</td>
</tr>
</tbody>
</table>
June 2017 | 4 | Generally minor changes: added in names of new types of insulins, some changes to advice on insulin/oral anti-diabetic adjustments according to new ACDC guideline, and re-formatting (Appendices removed and Section numbers increased). | Dr Katie Mallam, paediatric diabetes consultant.

**All or part of this document can be released under the Freedom of Information Act 2000**

This document is to be retained for 10 years from the date of expiry.
This document is only valid on the day of printing.

**Controlled Document**

This document has been created following the Royal Cornwall Hospitals NHS Trust Policy on Document Production. It should not be altered in any way without the express permission of the author or their Line Manager.
Appendix 2. Initial Equality Impact Assessment Form

This assessment will need to be completed in stages to allow for adequate consultation with the relevant groups.

<table>
<thead>
<tr>
<th>Name of the strategy / policy / proposal / service function to be assessed</th>
<th>Directorate and service area: Child Health</th>
<th>Is this a new or existing Policy? Existing (updated)</th>
</tr>
</thead>
</table>

| Name of individual completing assessment: Dr Katie Mallam | Telephone: 01872 252716 |

1. **Policy Aim***

   **Who is the strategy / policy / proposal / service function aimed at?**

   Safe management of paediatric patients with Diabetes Type 1 and 2 requiring Surgery or General Anaesthetic. For use by paediatric ward staff, surgical teams and anaesthetists.

2. **Policy Objectives***

   As above

3. **Policy – intended Outcomes***

   No adverse events around surgery or general anaesthetic for paediatric patients with Diabetes Type 1 and 2.

4. *How will you measure the outcome?*

   All adverse events should be DATIXed. Audit 3 yearly.

5. **Who is intended to benefit from the policy?**

   All paediatric patients with Diabetes Type 1 and 2.

6a Who did you consult with

   - Workforce
   - Patients
   - Local groups
   - External organisations
   - Other

   - [ ]

   **b). Please identify the groups who have been consulted about this procedure.**

   Please record specific names of groups
   - Paediatric Diabetes Team
   - Child Health Guidelines Group (paediatric ward doctors and nursing staff)
   - Georgia Brooker, Consultant Anaesthetist
What was the outcome of the consultation? | Approved

7. The Impact
Please complete the following table. **If you are unsure/don’t know if there is a negative impact you need to repeat the consultation step.**

<table>
<thead>
<tr>
<th>Equality Strands:</th>
<th>Yes</th>
<th>No</th>
<th>Unsure</th>
<th>Rationale for Assessment / Existing Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (male, female, trans-gender / gender reassignment)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race / Ethnic communities /groups</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability - Learning disability, physical impairment, sensory impairment, mental health conditions and some long term health conditions.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Religion / other beliefs</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marriage and Civil partnership</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnancy and maternity</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual Orientation, Bisexual, Gay, heterosexual, Lesbian</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You will need to continue to a full Equality Impact Assessment if the following have been highlighted:
- You have ticked “Yes” in any column above and
- No consultation or evidence of there being consultation- this *excludes* any *policies* which have been identified as not requiring consultation. or
- Major this relates to service redesign or development
8. Please indicate if a full equality analysis is recommended. | Yes | No  | √  
---|---|---|---

9. If you are **not** recommending a Full Impact assessment please explain why.

---

<table>
<thead>
<tr>
<th>Signature of policy developer / lead manager / director</th>
<th>Date of completion and submission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Katie Mallam</td>
<td>21/9/17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Names and signatures of members carrying out the Screening Assessment</th>
<th>1. Dr Katie Mallam</th>
<th>2. Human Rights, Equality &amp; Inclusion Lead</th>
</tr>
</thead>
</table>

---

**Keep one copy and send a copy to the Human Rights, Equality and Inclusion Lead**
c/o Royal Cornwall Hospitals NHS Trust, Human Resources Department, Knowledge Spa, Truro, Cornwall, TR1 3HD

**This EIA will not be uploaded to the Trust website without the signature of the Human Rights, Equality & Inclusion Lead.**

A summary of the results will be published on the Trust’s web site.

Signed __ Dr Katie Mallam

Date ____21/09/2017