St Vincent's Hospital

Clinical Procedure

Blood Glucose and Blood Ketone Monitoring Procedure

Links to Policy	Inpatient Diabetes Management Policy
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1. Objectives:

a. To provide accurate blood glucose levels (BGL) and blood ketone levels (BKL), in all patients who require glucose or ketone monitoring, to inform and guide medical management decisions.

2. Principles of Action:

a. All patients ***with diabetes*** will have a BGM regimen prescribed and results made accessible to all members of the health care team[1] *(see table 1)*.

b. All patients ***without diabetes*** but ***at high risk of developing hyperglycaemia*** will have BGM performed according to *(table 2)*. Any patient with ***new hyperglycaemia,*** (BGL ≥ 7mmol/L fasting or pre-meal) will:

- Have an HbA1c performed[3]
- Require Endocrine advice and/or consultation regarding a management plan and discharge plan[3].

c. **Notify** treating team MO (or Endocrine Registrar if consulting) if reportable BGLs or BKLs are obtained (see section *5.10 Post Procedure Patient Care*).

d. Perform accurate BGM and BKM by ensuring:

- Correct blood glucose/ketone testing procedure, see *(5.5.1 Blood Glucose Test Procedure - Performa)* or *(5.6.1 Blood Glucose Test Procedure - Nova StatStrip)*
- All meters are Quality Control (QC) tested[4] daily according to *5.5.2 QC Test Procedure – Performa* or *5.6.2 QC Test Procedure - Nova StatStrip*. **Blood glucose or ketone meters are NOT used if QC test not in range**.
- All meters are Quality Assurance (QA) tested monthly *(see 5.7 Quality Assurance Test)*.
- ***CAUTION:*** Capillary BGLs may be inaccurate in those with **decreased peripheral blood flow** (e.g. severe hypotension or dehydration, shock, HHS) and venous or arterial blood samples are preferred[1].
- Blood glucose/ketone levels are monitored according to the following practice principles:
  - Patient consent
  - Clean technique
  - Standard precautions

e. Patients who wish to self- blood glucose monitor must meet the SBGM requirements outlined in this Procedure (see *section 5.3*).

f. Patients with DKA or HHS will have blood glucose and ketones monitored according to practice outlined in this Procedure and in the *Procedure for the Management of Diabetic Ketoacidosis (DKA) and Hyperosmolar Hyperglycaemic State (HHS)*

3. Definitions:

Blood glucose Level (BGL)	Measure of glucose in the blood in mmol/L.
Blood Glucose Monitoring (BGM)	Measurement and documentation of the Blood Glucose Level (BGL) using a capillary (finger-prick) blood sample and point of care (bedside) blood glucose meter.
Blood Ketone Level (BKL)	Measure of beta-hydroxybutyrate (ketone) in the blood in mmol/L.
Blood Ketone Monitoring (BKM)	Measurement and documentation of the Blood Ketone Levels using a capillary (finger-prick) blood sample and point of care (bedside) blood ketone meter.
Beta-hydroxybutyrate (β-OHB)	Predominant ketone in diabetic ketoacidosis (DKA). Measured using a blood sample (not urine).
Diabetic Ketoacidosis (DKA)	Medical emergency most common in type 1 diabetes, characterised by hyperglycaemia, ketosis and metabolic acidosis.
Hyperosmolar Hyperglycaemic State (HHS)	Severe hyperglycaemia (usually >33mmol/L) (without elevated ketones) resulting in a raised blood osmolality and dehydration, sufficient to impair consciousness.
Hyperglycaemia	BGL persistently >10mmol/L for more than twenty-four (24) hours.
Hypoglycaemia	Blood glucose level (<4 mmol/L) with or without symptoms.
HbA1c	The main fraction of haemoglobin to which glucose is bound. Used to assess glycaemic control over the previous 2 to 3 month period.
IFCC HbA1c	International Federation of Clinical Chemistry measurement of HbA1c expressed in mmol/mol
Quality Control (QC) Test	Daily monitoring of test results through the use of specimens with a known range of values called 'control solutions'.
External Quality Assurance (QA) Test	A monthly assay simulating patient blood samples, with an unknown range of values, provided by RCPA-QAP.
RCPA-QAP	Royal College of Pathologists Australasia – Quality Assurance Program.
Self-blood glucose monitoring (SBGM)	Measurement of blood glucose by the patient using a hospital blood glucose meter, or meter brought in from home.

4. Roles and Responsibilities:

4.1 Medical Officers (MO) are responsible for:

- Prescribing a BGM regimen on admission as per *Section 5.1 When to Test Blood Glucose* and documenting this on the *Adult Subcutaneous Insulin*

Prescribing Chart SMR130035. Reasons for alteration to the frequency of BGM is documented in the health care record.

- Reviewing patient BGLs on a daily basis and altering treatment as required.
- Ensuring blood ketone (β-OHB) tests are performed as per *Section 5.2 When to Test Blood Ketones*.
- **Notify** treating team MO (or Endocrine Registrar if consulting) if reportable BGLs or BKLs are obtained (see *5.10 Post Procedure Patient Care*).
- Contacting the Endocrine Team (Registrar page 6810 or Endocrinologist on-call out of hours, via switch ext 59) for advice and/or consultation when:
  - BGL > 10mmol/L for 24hrs or more
  - BGL ≥ 7mmol/L (fasting or pre-meals) in a person ***without*** known diabetes[3]
  - BKL (β-OHB) > 0.6mmol/L
  - Recurrent hypoglycaemia (<4mmol/L)
- Investigating the cause of any hypoglycaemia and adjusting treatments to prevent future episodes

- Referring patients to the Inpatient Diabetes CNC (page 6157), if SBGM education is required.

4.2 Registered Nurses (RNs) and Enrolled Nurses (ENs) are responsible for:

- Performing BGM according to *Section 5.1 When to Test Blood Glucose* or as otherwise directed by MO.
- Ensuring familiarity with BGM equipment in relation to safe and accurate practice.
- Completing a ***once only*** *'Blood Glucose Meter Competency Assessment'* with the Clinical Nurse Educator (CNE) in each clinical unit. See *Appendix 4: BGM Competency Assessment (Performa) ENs* **or** *Appendix 5: BGM Competency Assessment (Performa) RNs* **or** *Appendix 6: BGM Competency Assessment (Nova StatStrip Xpress) RNs*
- Recording all blood glucose results on the appropriate chart (see *5.11 Documentation)*.
- **Notifying** the treating team MO (or Endocrine Registrar if consulting) if reportable BGLs or BKLs are obtained (see *5.10 Post Procedure Patient Care*).
- Promptly treating hypoglycaemia (BGL <4 mmol/L) according to the *SVH Hypoglycaemia Management Procedure.*
- Referring patients who wish to SBGM to the Inpatient Diabetes CNC (via web DeLacy or page 6157).
- Supervising patients who SBGM and recording all BGL results on the appropriate chart.

4.3 In addition, Enrolled Nurses (ENs) are responsible for:

- **Notifying** the RN immediately if reportable BGLs or BKLs are obtained (see *5.10 Post Procedure Patient Care*).

4.4 In addition, Registered Nurses in (8N/ED/ICU) are responsible for:

- Performing capillary blood ketone monitoring according to section *5.2 When to Test Blood Ketones (β-OHB)*.
- Ensuring familiarity with blood ketone monitoring equipment, in relation to safe and accurate practice.
- Recording all blood ketone results on the *DKA/HHS Intravenous Insulin Infusion Management Chart, P186* (if on a DKA/HHS insulin infusion) or, the *Adult Subcutaneous Insulin Prescribing Chart SMR130035*.

4.5 Nurse Unit Managers are responsible for ensuring:

- Blood glucose and ketone meters are Quality Control (QC) and Quality Assurance (QA) tested:
  - **Daily:** Internal (QC) tests are performed daily (weekly if meter used less than once per week) see *Section 5.5.2 (Quality Control Test Procedure - Performa)* and *Section 5.6.2 (Quality Control Test Procedure – Nova Stat Strip Xpress)*.
  - **Monthly:** External (QA) tests are performed monthly, see *Section 5.7 (Quality Assurance Tests)*
- Completed QC Charts and QA result envelopes are returned to SVH Diabetes Centre (Garvan Building) by the **7th of each month**, in order to:
  - log results in the RCPA-QAP data entry applet prior to lockout
  - meet mandatory record keeping requirements
- All Nursing staff have completed the once only *BGM Competency Assessment for the relevant blood glucose or blood ketone meter* (see Appendices 4, 5 & 6) in their ward area.
- Essential equipment is easily accessible for all clinicians to monitor blood glucose (and in ED, ICU & 8N blood ketone levels).

4.6 Diabetes Educators are responsible for:

- Assessing when SBGM is appropriate for the patient by ensuring:
  - The patient's meter is compatible with any treatments the patient may be receiving e.g. peritoneal dialysis, icodextran.
  - A QC test is performed on the patient's blood glucose meter to ensure it is working accurately.
  - The patient has their own supplies to be able to SBGM e.g. blood glucose test strips and lancets.
  - The patient is able to demonstrate correct blood glucose monitoring technique.

- Teaching the patient to correctly dispose of used test strips and lancets according to the Waste Management Protocol.

5. Process:

5.1 When to Test Blood Glucose

5.1.1 Patients with diabetes

All patients with diabetes will have BGM performed according to the following:

Table 1: Blood Glucose Monitoring for Patients with Diabetes

Who	When
All patients	On admission[3].
All diabetes types on **insulin** All patients with diabetes receiving high dose oral or IV **corticosteroids**: e.g. all methylprednisolone, all dexamethasone[1] and all prednisolone > 5mg daily All patients with diabetes receiving **Total Parenteral Nutrition** or **Enteral Nutrition**	Pre-meals and bed (QID) [1,2].
All diabetes types on **insulin** & **NBM**	From 6am: • 2-hrly if BGL **more than** 6mmol/L, • 1-hrly if BGL **less than** 6mmol/L (commence IV glucose).
All diabetes types on **non-insulin medications** or **diet controlled**	Pre-meals and bed (QID) for first 48 hours, then as directed by MO[1].
All patients on an intravenous insulin infusion	Hourly[1] (2-hrly if BGL stable and not treated for DKA/HHS).

5.1.2 Patients <u>without diabetes</u> at risk of developing hyperglycaemia

All patients at high risk of developing hyperglycaemia during their admission (not previously diagnosed with diabetes) will have BGM performed according to Table 2.

Table 2: Blood Glucose Monitoring for patients at high risk of hyperglycaemia

Hyperglycaemia Risk Factor	When
• All patients receiving high dose oral or IV **corticosteroids**[1,2] (all methylprednisolone, dexamethasone[6] and prednisolone > 5mg daily)	Pre-meals and bed (QID) for first 48 hours [1,2], continue if fasting or pre-meal BGL > 7mmol/L **and**

• All patients receiving **Total Parenteral Nutrition** or **Enteral Nutrition.** • Any other patient identified as being at high risk of developing hyperglycaemia e.g. patient taking Octreotide. • Any patient **not previously diagnosed** with diabetes with a fasting or pre-meal BGL ≥ 7mmol/L or a random BGL >11mmol/L.	**Nurses refer patient to:** • the treating team and • the diabetes CNC (page 6157) **Treating team:** • perform an HbA1c[3] • If HbA1c > 6.5%, or hyperglycaemia likely to persist, contact Endocrine regarding a management plan/ discharge plan.

5.2 When to Test Blood Ketones (β-OHB)

Only 8N, ED and ICU have capillary blood ketone testing meters. All other clinical areas must order a formal blood ketone (β-OHB) measurement from pathology when ketone testing is required.

Table 3: Blood Ketone (β-OHB) Testing

Who	When
All patients who present to the **Emergency Department** with a **BGL > 14mmol/L.**	On presentation.
All patients diagnosed with Diabetic Ketoacidosis (**DKA**).	At minimum 4-hourly or as per treating MO - see *Procedure for Management of Diabetic Ketoacidosis (DKA) and Hyperosmolar Hyperglycaemic State (HHS)*.
All patients with **type 1 diabetes**.	• When BGL > 20mmol/L • When BGL >14mmol/L for 12-hrs or more
All **other diabetes types**	When BGL >30mmol/L

5.3 Patient self-blood glucose monitoring (SBGM)

Refer patients who want to SBGM to the Inpatient Diabetes CNC (page 6157) ***before*** patients commence SBGM. Staff must never use results from a patient's meter until an assessment by a diabetes educator has occurred.

5.4 Patients in isolation rooms, who require contact precautions or other transmission based precautions

- Remove the glucose/ketone meter, lancet, cotton swab and one test strip from the meter case and place in kidney dish.
- Leave glucose/ketone meter case with contents outside of the isolation room.

- Cleanse hands (moment 1) and put on apron and gloves (mask if the patient is on droplet or airborne precautions).
- Take only the contents of the kidney dish into the room. Perform test. On completion and after exiting room remove gloves and apron and cleanse hands (moment 3).
- Wipe down glucose/ketone meter with V-wipe before returning to case.

5.5 Performing a blood glucose test with an Accu-Chek™ Performa blood glucose meter

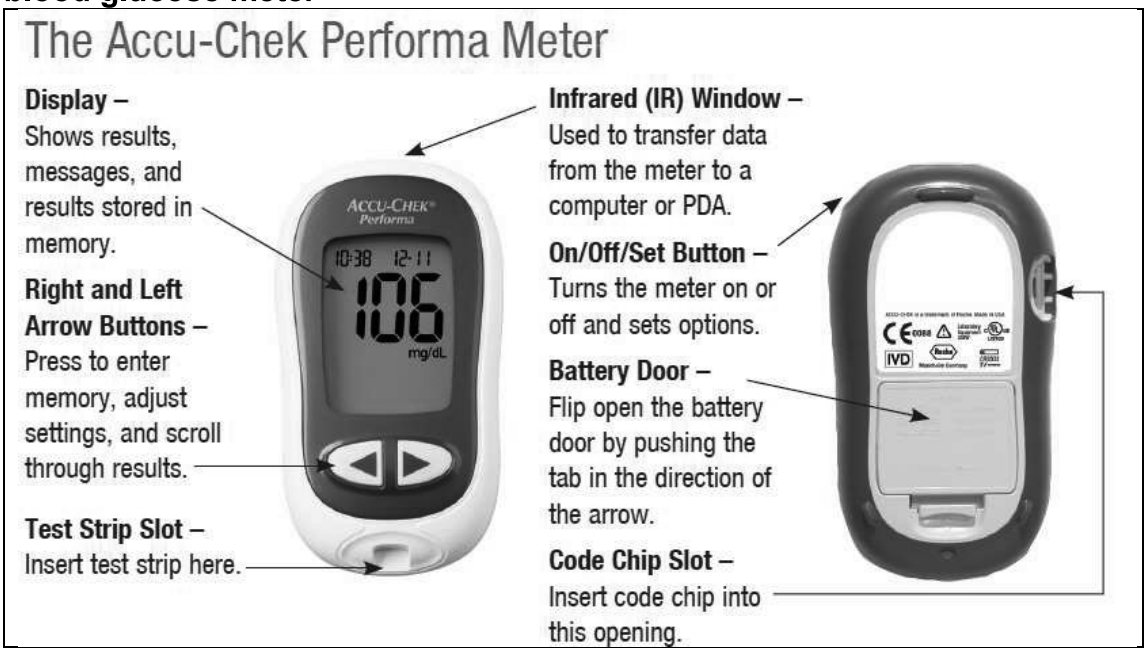


Figure 1

Figure 2

5.5.1 Blood Glucose Testing Procedure (Performa)

a. Blood Testing Equipment:

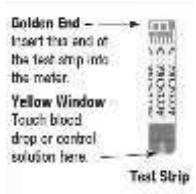
- Accu-Chek™ Performa Blood Glucose Meter (Figure 1)
- Accu-Chek™ Performa test strips (Figures 2 & 3)
- Single use capillary blood sampling lancet device
- Cotton wool or gauze
- Non sterile gloves

b. Preparation:

- Wash and dry patient hands to ensure accurate readings ***(NB:** Do not use alcohol wipes as they can interfere with BGL results).*
- Ensure meter has black code chip number 222 is inserted (new model Performa meters no longer require code chip).
- Ensure that the meter has been Quality Control checked within the last twenty-four (24) hours (*see section 5.5.2*).

- Ensure that the glucose test strips are in date. Check the printed expiry date on the canister of strips
- Ensure glucose test strips have not been exposed to humidity or temperature extremes (i.e. canister lid left open, stored in car, on window sill etc.)

c. Perform Test[5]:

1.	Wash hands with a neutral hand washing solution. Put on non-sterile gloves.	
2.	Insert test strip into meter, gold end first.	 **Figure 3**
3.	Lance the side of patient's finger using a once-use only lancet device	
4.	Gently squeeze the finger until a small drop of blood is produced. Avoid over squeezing the finger as this can result in an inaccurate result.	
5.	Place the end of the strip (yellow test area) into the blood drop. Blood will be drawn into the strip. Ensure that the entire yellow test area of the strip is filled with blood (Figure 4). An hourglass symbol will flash when sufficient blood has been applied.	 **Figure 4**
6.	Use cotton wool or gauze to stop bleeding from the lanced finger site.	
7.	Wait five (5) seconds for the meter to display a result.	
8.	If any symbol other than a BGL is displayed, *see Appendix 1*: Accuchek Performa display symbols and error messages or consult the user's guide booklet located in the blood glucose meter box.	
9.	Wipe down glucose/ketone meter with V-wipe (or similar) before returning to case – do not get moisture inside test port.	
10.	Document the result according to section *5.11 Documentation*.	
11.	**Notify** the treating team MO (or Endocrine Registrar if consulting) if reportable BGLs or BKLs are obtained (see *5.10 Post Procedure Patient Care*). **NOTE:** the operating range for glucose is 0.6 - 33.3mmol/L. The screen will display 'LO' for values < 0.6mmol/L and 'HI' for values > 33.3mmol/L and an urgent formal BGL must be performed. **NOTE:** If an unexpectedly high or low glucose result is obtained, perform a Quality Control test (see 5.5.2) then repeat the blood glucose level.	

5.5.2 Quality Control (QC) Test Procedure (Performa)[5]

a. Frequency of QC Testing:

- Perform daily on all blood glucose/ketone meters, unless the meter is used infrequently (if used less than once per week, perform QC test at minimum weekly).
- An additional QC test is performed when:
  - A new box of test strips is opened.
  - Test strips have been stored incorrectly i.e. (canister not closed properly, or exposure to temperature extremes).
  - The meter is accidently dropped.
  - The battery is changed.
  - An unexpected patient result is obtained.

b. QC Equipment:

- Accu-Chek™ Performa Blood Glucose Meter (Figure 1)
- Accu-Chek™ Performa blood glucose test strips (Figures 2 & 3)
- Accu-Chek™ Performa 'Level 1' and 'Level 2' control test solutions (Figure 5 - stored at room temperature).

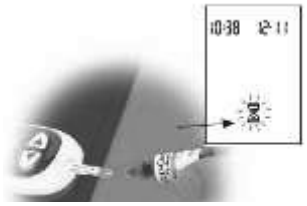
Figure 5

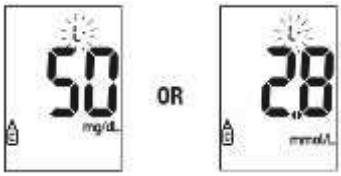
c. Preparation:

Ensure the control solution is in date by checking:

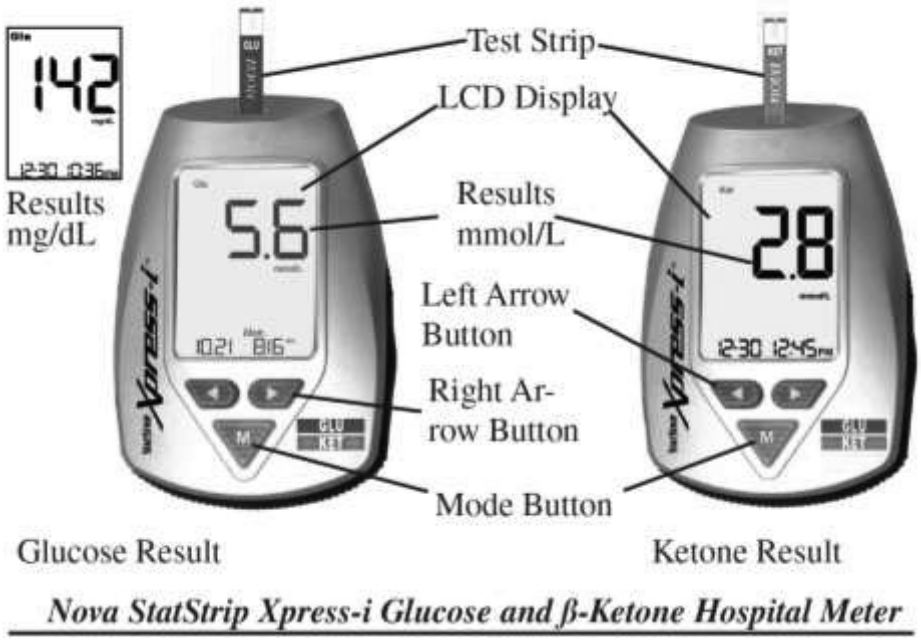
- The printed expiry date on the box **AND**
- The hand-written date that the control solutions were opened. **Do not** use 3- months past the opening date.

d. Perform Control Solution Test:

1.	Wash hands with a neutral hand washing solution.	
2.	If opening a new box of Accu-Chek™ control solution (Figure 5), write the '**date opened**' clearly on each bottle. Control solution must be discarded 3-months after opening.	
3.	Insert a test strip into the meter	
4.	a. Gently mix control solution 'Level 1'. b. Squeeze the control solution bottle until a drop of solution forms on the tip. Discard this first drop. c. Touch the second drop of solution to the end of the yellow test area on the test strip. d. The hourglass symbol will flash when sufficient solution has been applied (Figure 6). Re-cap the bottle tightly.	 **Figure 6**

5.	After 5 seconds the quality control result will be displayed along with a control bottle symbol and a flashing 'L-' (see Figure 7). Record the result (see point 12).	 **Figure 7**
6.	Before removing the test strip, press the *Right Arrow* button **once**, 'L1' will appear. Press the on/off button to set the control.	
7.	If the control result is within range **"OK"** will be displayed intermittently, along with the result (Figure 8). If the result is out of range **'Err'** will be displayed (see *Appendix 1*: Accuchek Performa display symbols and error messages to troubleshoot) then repeat the test.	 **Figure 8**
8.	Remove and discard the test strip.	
9.	Repeat steps 4 to 8 with control solution – 'Level 2', only this time, press the *Right Arrow button* **twice** to ensure 'L2' appears on the display. Record results (see point 12). Press the on/off button to set the control.	
10.	Ensure that 'L1' and 'L2' results fall within the appropriate range printed on the canister of strips (see Figure 9). Refer to Appendix 1: Accuchek Performa display symbols and error messages if the control result is not within the acceptable range, then repeat the test. **Do not perform a blood glucose test on a patient if quality control test not in range.**	 **Figure 9**
11.	Ensure both 'L1' and 'L2' results are recorded and graphed on the Quality Control Chart located in the meter box (see Appendix 3: AccuChek Performa Quality Control Chart).	
12.	At the end of each month return the completed Quality Control Chart to the Diabetes Centre (it is mandatory to keep QC test results for 7 years).	

5.6 Performing a blood glucose or a blood ketone test with a Nova Stat Strip Xpress meter



Nova StatStrip Xpress-i Glucose and ß-Ketone Hospital Meter

5.6.1 Blood Glucose/Ketone Testing Procedure (StatStrip Xpress)[6]

a. Blood Testing Equipment:

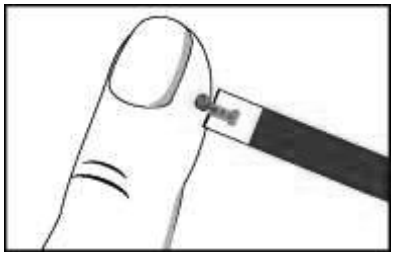
Figure 10

- Nova Stat Strip Xpress Meter™ (Figure 10)
- Nova Stat Strip Xpress™ **glucose** test strips **or**
- Nova Stat Strip Xpress™ **ketone** test strips
- Single use capillary blood sampling lancet device
- Cotton wool or gauze
- Non sterile gloves

b. Preparation:

- Wash and dry patient hands to ensure accurate readings ***NB:*** *Do not use alcohol wipes as they can interfere with BGL results.*
- Ensure that the meter has been Quality Control checked within the last twenty-four (24) hours (see Section 5.6.2).
- Ensure that the glucose or ketone test strips are in date. Check both the printed expiry date and the hand-written opening date (discard after 3 months from opening).
- Ensure glucose/ketone test strips have not been exposed to humidity or temperature extremes (i.e. canister lid left open, stored in car, window sill etc.)

c. Perform Test:

1.	Wash hands with a neutral hand washing solution. Put on non-sterile gloves.	
2.	Insert **the blue glucose strip** (Figure 11), or **green ketone strip** (Figure 12), gold tip first, into the meter. A flashing blood drop will display indicating blood sample required.	 **Figure 11**
3.	Lance the **side** of the patient's finger using a once use only lancet device.	
4.	Gently squeeze the patient's finger until a small drop of blood is produced. Avoid over squeezing the finger as this can result in an inaccurate result.	 **Figure 12**
5.	Touch the end of the test strip to the blood drop **until the test strip fills and the meter beeps** (Figure 13). WARNING: If the test strip does not fill completely, do not try to fill a second time. Discard the test strip and repeat the test with a new strip.	 **Figure 13**
6.	Use cotton wool or gauze to stop bleeding from the lanced finger site.	
7.	The glucose result will display in 6 seconds, the ketone result will display in 10 seconds.	
8.	If any symbol other than a BGL or BKL is displayed, see *Appendix 2: Statstrip Xpress™ Display Symbols and Error Messages* or consult the user's guide booklet located in the meter box.	
9.	Wipe down glucose/ketone meter with V-wipe (or similar) before returning to case – do not get moisture inside test port.	
10.	Document the result according to section *5.11 Documentation*.	
11.	**Notify** the treating team MO (or Endocrine Registrar if consulting) if reportable BGLs or BKLs are obtained (see *5.10 Post Procedure Patient Care*). Inform the MO if the BGL is outside the acceptable range Inform the MO if the BKL is > 0.6mmol/L **NOTE:** the operating range for glucose is 0.6 - 33.3mmol/L. The screen will display 'LO' for values < 0.6 and 'HI' for values > 33.3mmol/L and an urgent formal BGL must be performed. **NOTE:** the operating range for ketones is 0.0 – 8mmol/L. The screen will display 'HI' for values >8mmol/L and an urgent formal BKL must be performed.	

	NOTE: If an unexpectedly high or low glucose result is obtained, perform a control solution test on the meter (*see 5.6.2*) then repeat the blood glucose or ketone level.

5.6.2 Quality Control (QC) Test Procedure (StatStrip Xpress)[6]

a. Frequency of QC Testing:

- Perform daily on all blood glucose/ketone meters, unless the meter is used infrequently (if used less than once per week, perform QC test at minimum weekly).
- An additional QC test is performed when:
  - A new box of test strips is opened.
  - Test strips have been stored incorrectly i.e. (canister not closed properly or exposure to temperature extremes).
  - The meter is accidently dropped.
  - The battery is changed.
  - An unexpected patient result is obtained.

b. Quality Control Equipment:

- Nova StatStrip Xpress Meter(Figure 14)
- Nova StatStrip Xpress blood glucose test strips
- Nova StatStrip Xpress blood ketone test strips
- Nova StatStrip Xpress Meter Control 1 ‘C1’ and Control 3 ‘C3’ control test solutions (Figure 15).

Figure 14

c. Preparation:

- Ensure the control solution is in date by checking:
  - The printed expiry date on the control solution bottles.
  - The hand-written date the control solutions were opened. **Do not** use 3 months past the opening date.

d. Perform Control Solution Test:

1.	Wash hands with a neutral hand washing solution.

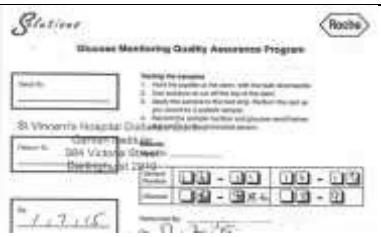
2.	If opening a new box of StatStrip Xpress control solution, clearly write the **'date opened'** on each bottle. Control solution must be discarded 3-months after opening.  **Figure 15**	
3.	Turn on the meter by inserting a **blue glucose strip** (Figure 11), or a **green ketone strip** (Figure 12) into the meter. A flashing blood drop will appear when meter is ready to receive control solution sample.	
4.	~~a.~~ Select control solution 'C1' and gently mix. b. Press the Left or Right arrow buttons on the meter to find the desired level (C1 - see Figure 16. c. Squeeze the control solution bottle until a drop forms on the tip. Discard this first drop. d. Squeeze a second control solution drop and apply it to the end of the test strip until the meter beeps. See Figure 17. e. Re-cap the bottle tightly.	 **Figure 16**  **Figure 17**
5.	After 6 seconds (glucose) or 10 seconds (ketones) the quality control result will be displayed. See Figure 18.	 **Figure 18**
6.	Compare result to the range printed on the control solution bottle. The result is in range if it falls between the 1st and 3rd numbers displayed on the bottle. Record result in Quality Control Log Book located inside meter case. **Do not perform a blood glucose/ketone test on a patient if quality control test not in range.**	
7.	Remove and discard the test strip.	
8.	Repeat steps 3-7, using control solution C3. Press the Left or Right arrow buttons on the meter to find level 'C3' before adding the control solution.	
9.	Ensure both 'C1' and 'C3' results are recorded in the Quality Control Log Book located inside the meter case.	

10.	Forward completed Quality Control Log Books to SVH Diabetes Centre (it is mandatory to keep results for 7 years). **NOTE:** New Quality Control Log Books are available from the Diabetes Centre.

5.7 Quality Assurance (QA) Tests

Quality Assurance tests compares quality control results between multiple sites (hospitals) to provide information on performance. All SVH blood glucose and blood ketone meters are enrolled in the RCPA - Quality Assurance Program. Completing monthly QA tests on all meters is mandatory.

- Each year each clinical area is provided with 12 QA envelopes containing two QA solution samples for both the AccuChek Performa and Novo Stat Xpress meters.
- Each sample is blinded (that is, the expected result is unknown).
- QA tests are performed in the first week of each month. **Result envelopes must be returned to SVH Diabetes Centre by the 7th of each month**. Test results received beyond the due date cannot be entered into the RCPA-QAP data entry applet.

1.	Wash hands with a neutral hand washing solution.	
2.	Select the **correct envelope according to the month**. Tests performed using samples from incorrect months will always be inaccurate.	
3.	Open the QA solutions by cutting the top off the solution nozzles with scissors. QA tests are performed in the same manner as QC tests. See *5.5.2 Quality Control Test Procedure (Performa)* OR *5.6.2 Quality Control Test Procedure (Statstrip Xpress)*.	
4.	**Clearly print** on the QA envelope the: - QA test results - Meter serial number - Ward name - Name of the person performing the test	

5.8 Cleaning of Equipment:

- Turn the meter off.
- After use wipe the meter with a 70 % isopropyl alcohol wipe (e.g. V-wipes).
  Be careful not to allow moisture to enter the strip port.

5.9 Disposal of Waste/Equipment:

- Dispose of equipment in accordance with *SVH Waste Management Policy*
  - Test strips in general waste
  - Lancets in sharps container
  - Cotton ball or gauze in general waste
- Wash hands post procedure.

5.10 Post Procedure Patient Management:

- **Nurse to notify treating team MO** (or Endocrine Registrar if consulting) if:
  - BGL > 10mmol/L[1-3] for 24-hours or more (hyperglycaemia)
  - BGL is < 4mmol/L (hypoglycaemia)[1-3]
  - BGL is ≥ 7mmol/L (fasting or pre-meal) in a person ***without*** pre-existing diabetes (new hyperglycaemia)[3]
  - A blood ketone level (B-OHB) is required (to exclude DKA):
    - In type 1 diabetes: BGL > 20mmol/L ***or*** > 14mmol/L for 12-hrs or more.
    - All other diabetes types: BGL > 30mmol/L
  - BKL is ≥ 0.6mmol/L (ketonaemia)
- **EN to notify RN** if any of the above situations apply AND
  - If BGL >8mmol/L (supplemental insulin may be required)

5.11 Documentation:

Document:

- All BGL results on the appropriate chart:
  - *Adult Subcutaneous Insulin Prescribing Chart SMR130035* (this is the standard chart used in hospital to record blood glucose and blood ketones), or the
  - *Intensive Care Unit Insulin Infusion Chart - P453 (ICU only),* or the
  - *DKA/HHS Intravenous Insulin Infusion Management Chart - P186*
  - A once only admission BGL, or BGLs taken as part of an A-G rapid assessment, **in patients without known diabetes** may be recorded on the *Standard Adult General Observation (SAGO) Chart* – if ongoing BGM is required, all results should be recorded on the appropriate chart above.
- All reportable BGLs or BKLs, notifications and actions taken in the patient's health care record.
- All hypoglycaemia (BGL <4mmol/L) and treatment provided on the 'Hypoglycaemia Treatment Record' of the *Adult Subcutaneous Insulin Prescribing Chart SMR130035.*

6. BGM Competency Assessments:

All nursing staff (ENs & RNs) are required to complete a *once only 'BGM Clinical Competency Assessment'.* Education and assessments are conducted during Nurse Orientation (new staff) or by the clinical area CNE (existing staff yet to complete competency).

- See *Appendix 4 BGM Competency Assessment (Performa) Enrolled Nurses (ENs)*
- See *Appendix 5 BGM Competency Assessment (Performa) Registered Nurses (RNs)*
- See *Appendix 6 BGM Competency Assessment (Nova StatStrip Xpress) Registered Nurses (RNs)*

7. Compliance:

Compliance with this procedure is monitored by the Diabetes Service and reported biannually to the Geriatric Ambulatory Medicine program Meetings. Reported Riskman incidents relating to BGM and BKM will be reviewed quarterly at the Endocrine Morbidity and Mortality meeting.

Practice compliance will be monitored using the Diabetes Prevalence and Management Audit – annually.

8. References:

Supporting Evidence:

1. The Endocrine Society (2012). Management of Hyperglycaemia in Hospitalized Patients in Non-Critical Care Setting: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism; 97 (1):16–38.*
2. Australian Diabetes Society (2012) Guidelines for Glucose Control in Hospital. Cited 29th Feb, 2016. https://diabetessociety.com.au/documents/ADSGuidelinesforRoutineGlucoseControlinHospitalFinal2012_000.pdf
3. American Diabetes Association (2016). Standards of Medical Care in Diabetes. Diabetes Care, Vol 39, Suppl.1, S1-S112.
4. American Diabetes Association (2004). Bedside Blood Glucose Monitoring in Hospitals: Position Statement. Diabetes care, Vol 27, Suppl 1, S104.
5. Roche Diagnostics (2014). AccuChek Performa User's Manual. Mannheim, Germany: Roche Diagnostics.
6. Nova Biomedical (2010). Nova StatStrip® Xpress-I Glucose and ß-Ketone Hospital Meter Instructions for Use Manual. Waltham, USA:Nova Biomedical.

National Standards:

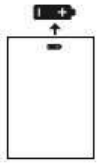
National Safety and Quality Health Service Standards (2012): Standard 4 Medication Safety.

Related SVH, SVHNS and SVHA Policies & Procedures:

- Inpatient Diabetes Management Policy
- Hypoglycaemia Management Protocol
- Hyperglycaemia & Insulin Management Procedure
- Incident Management Policy
- Inpatient Supervised Self Administration of Subcutaneous Insulin or Glucagon-like peptide-1 (GLP-1) analogs Protocol
- Procedure for Management of Diabetic Ketoacidosis (DKA) and Hyperosmolar Hyperglycaemic State (HHS) Protocol
- Waste Management Policy
- Procedures Performed by Enrolled Nurses Protocol
- Parenteral Nutrition Policy.

Appendix 1

Accu-Chek Performa Display Symbols and Error Messages

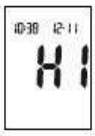


Battery power is low. Change the battery soon.

The meter is ready for you to insert a test strip.

The meter is ready for a drop of blood or control solution.

The meter is in set-up mode, waiting for you to change or confirm settings.



Blood glucose may be higher than the measuring range of the system.

This test result was flagged.

The meter is not coded or the code chip is not inserted. Turn off the meter and recode it.

Blood glucose may be lower than the measuring range of the system.

Blood glucose is below the defined hypo (low blood glucose) level.

The test strips will expire at the end of the month. Before the end of the month, insert a new code chip from a new box of test strips and ensure the code chip number matches the code number on the test strip container. Make sure the time and date in the meter are correct.

The test strip is damaged. Remove the test strip and reinsert it, or replace it if damaged. If the message reappears, call Roche Diagnostics.

The code chip is incorrect. Turn off the meter and insert a new code strip. If this does not fix the problem, call Roche Diagnostics.

An error occurred during the test. Discard the test strip and repeat the test.

Not enough blood or control solution was drawn into the test strip for measurement or was applied after the test has started. Discard the test strip and repeat the test.

The code chip is from an expired lot of test strips. Ensure the code chip number matches the code number on the test container. Make sure the time and date in the meter are correct.

Blood or control solution was applied to the test strip before the flashing drop appeared on the display. Discard the test strip and repeat the test.

An electronic error occurred or, in rare cases, a used test strip was removed and reinserted. Turn the meter off and on, or take the battery out for a few seconds and reinsert it. Perform a blood glucose or control test. If the problem persists, call Roche Diagnostics.

The temperature is above or below the proper range for the meter (6 to 44°C). Move to an area between 6 and 44°C, wait five minutes and repeat the test. Do not artificially heat or cool the meter.

The battery is almost out of power. Change the battery now.

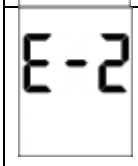
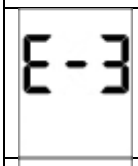
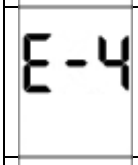
The time and date settings may be incorrect. Make sure the time and date are correct.

Appendix 2

Nova StatStrip Xpress Display Symbols and Error Messages

Error Codes

There are 7 Error Codes to inform you of problems with the meter. This section provides action procedures when these Error Codes are displayed. The error code displays after the test strip is inserted and the all segments screen displays for 2 seconds.

Error Code	Explanation
	**E0 Software Error** A software error has been detected. **Action:** Perform the test again. If you get the same error again, remove and reseat the battery. If the error continues contact Sydpath ext. 9188.
	**E1 System Hardware Error** A system hardware error has been detected. **Action:** Perform the test again. If the error continues contact Sydpath ext. 9188.
	**E2 Operating Temperature Error** The Meter temperature is outside of the range for testing. **Action:** Move the meter to an area where the temperature is acceptable (15°- 40°C), allow meter to adjust to the temperature. Repeat the test.
	**E3 Used Strip Error** The test strip was previously used. **Action:** Repeat the test with a new test strip.
	**E4 Short Sample Error** An insufficient sample volume (Control or blood) was drawn into the test strip. **Action:** Repeat the test with a new test strip.
	**E8 Bad Strip Error** The test strip is defective or bad. **Action:** Repeat the test with a new test strip.
	**E9 Bad Sample Error** A problem was detected with the sample. **Action:** Repeat the test with a new test strip.

Appendix 3: AccuChek Performa Quality Control Chart

Appendix 4: BGM Competency Assessment (Performa) Enrolled Nurses

Appendix 5: BGM Competency Assessment (Performa) Registered Nurses

Appendix 6: BGM Competency Assessment (StatStrip Xpress) Registered Nurses

Appendix 3, 4, 5, 6, see Appendices section:
http://stvjacpps/PolicyProtocol/Display.asp?ID=60D5C6B123B74B6F835B71192302AF0C