Pediatric Glycemic Management Policy Suite

Frequently Asked Questions

Alberta Health Services
Inspiring solutions. Together.
Diabetes, Obesity & Nutrition Strategic Clinical Network™

Apr-23

Contents

Contact

For more information,

Leta Philp
Clinical Practice Lead
DON SCN
don.scn@ahs.ca

Policy Information

Why were the provincial Pediatric Glycemic Management policy and procedures for Hypoglycemia management and Hyperglycemia management developed?

These documents were developed to support glycemic management for pediatric patients in hospital. When the adult Glycemic Management Policy Suite became effective in 2017, a care gap was identified requiring similar documents to be developed for the pediatric population.

The three documents aim to improve pediatric glycemic management in AHS acute care inpatient settings, through a series of coordinated strategies which include:

- establish an acceptable blood glucose range for pediatric patients
- recommend glucose testing regimens for pediatrics
- identify a basal bolus insulin regimen as the most appropriate treatment regimen for pediatric patients requiring subcutaneous insulin
- support the safe management of insulin pump therapy in hospital when appropriate
- support the review of hypoglycemic and hyperglycemic events so as to implement appropriate interventions to achieve recommended blood glucose targets
- to support patient self-management and education needs

Who created these governance documents?

These documents have been developed by a provincial multidisciplinary working group with Pediatricians, Pediatric Endocrinologists, Nurses, Pharmacists, Dietitians, Policy Advisors and Administration representatives from across the five zones, and in consultation with Health Professions Strategy & Practice, and the College and Association of Registered Nurses of Alberta (CARNA). Provincial working group membership is listed in Appendix 1.

Where can I learn more about the definitions used in the policy suite and the difference between policy governance documents?

AHS policy services provides direction, framework and resources to develop provincial governance documents. You can reach out to policy@ahs.ca for more information. The AHS Insite page for Policy Services has resources available for more information.

Glycemic Management Policy Suite

Who does the policy suite apply to?

Pediatric in-patient settings in AHS urban and rural hospitals: Medicine/Surgery, Emergency Departments/Urgent Care, Intensive Care Units (ICUs), Addiction and Mental Health Inpatient Units.

These documents may also be used in non-acute care settings, however the site/unit managers are responsible for determining whether the governance documents in whole or in part are appropriate to their patient care setting and communicating that out to staff.

The policy suite includes pediatric patients between the ages of:

- 6 days of age to one day less 18 years of age.

This Policy Suite excludes:

a) patients equal to or less than 5 days old and infants admitted to the Neonatal Intensive Care Unit (NICU);
b) pediatric patients who have diabetes **and** are pregnant;
c) patients with Diabetic Ketoacidosis (DKA) **on** continuous intravenous insulin infusion.

For these excluded pediatric patients, the health care professional shall consult with the patient's MRHP for direction on ongoing care and treatment, or follow Zone processes. There may be other circumstances where the health care professional uses clinical judgment and consults with the MRHP.

What are blood glucose targets for pediatric patients in hospital?

Diabetes Canada Clinical Practice Guidelines has recommended blood glucose targets of **5.0-10.0mmol/L** for most hospitalized patients. These targets are higher and more liberal than the typical targets for patients with diabetes who are treated in the outpatient setting.

Exceptions include, but may not be limited to:

- patients who have been identified to have hypoglycemia unawareness and patients with multiple co-morbidities (where the individualized target range may be modestly higher)

In critically ill patients the target BG range is **6.0-10.0mmol/L**.

For more information; please see Diabetes Canada Clinical Practice Guidelines chapter 16

Why do health care professionals need to use the AHS POCT Blood Glucose (BG) meter?

The AHS Point of Care Testing (POCT) blood glucose (BG) meter (e.g. Roche Inform II) undergoes daily quality assurance. AHS staff receive education and training to remain competent in the use of the AHS approved BG meter(s). The AHS POCT BG meter device is approved by Health Canada for in hospital use and meets accreditation standards for POCT BG reporting.

There are many factors that may impact the accuracy of interstitial (sensor) readings and home BG meter test strips. Conditions common to the hospital population may affect sensor readings such as real time Continuous Glucose Monitors(rtCGM) or intermittently scanned Continuous Glucose Monitors (isCGM), rendering them inaccurate.

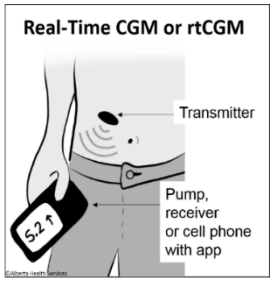
- Low blood pressure, poor tissue perfusion, hydration status, edema.
- Rapidly changing BG: interstitial fluid glucose levels may not accurately reflect BG levels leading to delayed detection of low or high BG.
- Interference from medications & substances (e.g., acetaminophen, heparin, salicylic acid, dopamine, uric acid, ascorbic acid, maltose, hydroxyurea and mannitol; tissue deposits).
- Strong magnetic or electromagnetic radiation e.g. an X-ray, MRI (Magnetic Resonance Imaging), or CT (Computed Tomography) scan is contraindicated. rtCGM and isCGM devices are to be removed prior to the appointment and a new sensor applied after the appointment.
- Sensor positioning (e.g. incorrect insertion, sensor falling out, application of pressure over sensor).

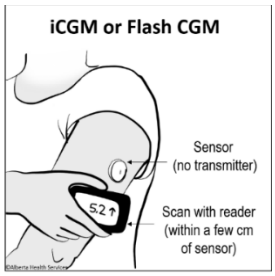
Home glucose monitoring technology is emerging and evolving to better support patients with diabetes in their glycemic management. Patients that want to continue the use of their home device in hospital, for their own information, should be encouraged to do so, however these results should not be used to make treatment decisions such as administration of insulin or treatment of hypoglycemia. Patient-reported self-monitored glucose values and trends from a home glucose monitoring device should be reviewed and discussed with the multidisciplinary health care team, in addition to the in-hospital POCT BG values, where appropriate.

What is the difference between a blood glucose meter and an interstitial glucose monitor?

A blood glucose meter, uses a small amount of capillary blood to provide a blood glucose result for the point in time collected.

A real time Continuous Glucose Monitor (rtCGM) or intermittently scanned Continuous Glucose Monitor (isCGM) provides an interstitial glucose result. These devices support patients living diabetes in reviewing trends in glucose patterns (sensor glucose results) to better manage their day to day glycemic needs.

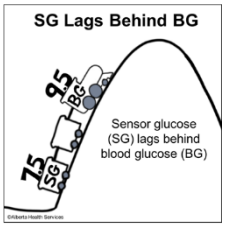




What is the difference between a blood glucose result and an interstitial glucose result?

A blood glucose result is a measurement of the glucose in the blood vessel or capillary.

An interstitial glucose result is a measurement of glucose from the interstitial fluid. Interstitial fluid surrounds the cells of your tissue below your skin.



Typically glucose moves from the blood vessels and capillaries first and then into interstitial fluid. A blood glucose and interstitial (or sensor glucose) result are rarely the same. A lag time may occur, especially when glucose values are changing quickly (e.g. after a meal is eaten or bolus of insulin administered). Blood glucose will rise and fall before an interstitial glucose.
It is important to check a *blood glucose* before initiating treatment for hypoglycemia or hyperglycemia.

Why do I need an order for my patient/family to use their home glucose monitoring devices?

The health care team needs to know the source of the glucose result (blood glucose or interstitial glucose). There are many factors that may impact the accuracy of interstitial (sensor) readings. In the pediatric setting, there may exceptions and an order is required from the Most Responsible Health Practitioner (MRHP).

Home glucose monitoring technology is emerging and evolving to better support patients with diabetes in their glycemic management. Patients that want to continue the use of their home device in hospital, for their own information, should be encouraged to do so, however these results should not be used to make treatment decisions such as administration of insulin or treatment of hypoglycemia.

The AHS Point of Care Testing (POCT) blood glucose meter (e.g. Roche Inform II) undergoes daily quality assurance. AHS staff receive education and training to remain competent in the use of the AHS approved blood glucose meter(s). The AHS POCT blood glucose meter device is approved by Health Canada for in hospital use and meets accreditation standards for POCT blood glucose reporting.

For sites using Connect Care, patients may share the glucose data obtained from their home device in a MyAHS Connect flowsheet during a hospital admission. To activate this functionality in MyAHS Connect, a prescriber must place a *MyChart IP Glucose Recording order*. Data documented in the MyAHS Connect flowsheet will automatically transfer to the Connect Care inpatient chart and is viewable on the Glucose Management Accordion Report, found in the summary activity. If the patient is unable to record their values in MyAHS Connect themselves, the health care provider is able to document patient reported readings on the *Inpatient Vital Signs flowsheet* activity under Point of Care Tests → Patient Reported Glucose row, which appears once the *MyChart IP Glucose Recording* order is placed. Refer to the *Glycemic Management: Quick Start Guide* found on Insite or the Learning Home Dashboard.

For patients/families who prefer to use their home lancing device to obtain a capillary blood (fingertip) sample, home lancing devices and lancets can be used if the patient can provide their own supplies and are able to change and dispose of their lancet independently. When AHS staff are collecting the blood sample, staff are required to use the Workplace Health & Safety (WHS) approved safety lancet. An order is not required for a patient to use their own lancing device.

Is there a resource I can use to share information with patients about why AHS staff need to use the AHS blood glucose (BG) meter while patients are in hospital?

On MyHealth.Alberta.ca you can find the patient handout:
Checking your blood glucose (sugar) level while you're in the hospital (alberta.ca)
This resource is available on the Glycemic Management Policy Resource Page.

Can my patient use their own lancing device to obtain a capillary blood glucose sample?

For patients/families who prefer to use their home lancing device to obtain a capillary blood (fingertip) sample, home lancing devices and lancets can be used if the patient can provide their own supplies and are able to change and dispose of their lancet independently. When AHS staff are collecting the blood sample, staff are required to use the Workplace Health & Safety (WHS) approved safety lancet. An order is not required for a patient to use their own lancing device.

My patient has refused blood glucose (BG) testing with the POCT AHS BG meter. Where do I document their reported glucose result?

The health care team needs to know the source of the glucose result (blood glucose or interstitial glucose). When documenting a patient reported glucose reading, both the patient reported glucose value and the type of device must be indicated on the blood glucose record and insulin administration record. This practice will vary dependent on if a site is using Connect Care, Sunrise Clinical Manager (SCM) or Paper Based Charting.

For sites using Connect Care, patients may share the glucose data obtained from their home device in a MyAHS Connect flowsheet during a hospital admission. To activate this functionality in MyAHS Connect, a prescriber must place a *MyChart IP Glucose Recording order*. Data documented in the MyAHS Connect flowsheet will automatically transfer to the Connect Care inpatient chart and is viewable on the Glucose Management Accordion Report, found in the summary activity. If the patient is unable to record their values in MyAHS Connect themselves, the health care provider is able to document patient reported readings on the *Inpatient Vital Signs flowsheet* activity under Point of Care Tests → Patient Reported Glucose row, which appears once the *MyChart IP Glucose Recording* order is placed. Refer to the *Glycemic Management: Quick Start Guide* found on Insite or the Learning Home Dashboard.

For Connect Care Sites, what do I scan to ensure the AHS BG meter result is accurately uploaded to the patients chart?

Scan the **barcode** on the patient's wrist band, for more information see **Connect Care Tip Sheet for Patient Wristband Scanning** on Insite.

When should blood glucose testing occur?

Timing of Testing

- BG levels are to be tested four times daily, before each meal and before bedtime (or as ordered).
- Test BG if any suspicion of hypoglycemia
- Ideally, testing needs to happen within 30 minutes of the patient's meal. Meal delivery times are unit specific.
- Patients who are fasting, have a continuous tube feed, or parenteral nutrition (PN) require testing at usual scheduled meal times and bedtime, or every 6 hours.
- When the patient will be off unit at a location where blood glucose testing is not readily available, and/or the patient will be engaging in physical activity.

When should a BG test be repeated before providing treatment to a patient?

- When the result is inconsistent with patient's clinical status or
- There is suspected equipment malfunctioning, including expired test strips or visible changes to the test strip.

When does insulin administration occur?

Coordination of BG Testing and Insulin Administration

Both the BG test and insulin administration are to be coordinated with meal delivery. Meal delivery times are unit specific.

- BG testing is done no more 15-30 minutes before the meal.
- Rapid acting insulin is given **no more than 15 minutes prior** to mealtime

Exception: Meal/bolus insulin may be given immediately after the meal/feed in certain situations (e.g. feeding difficulties such as toddlers with meal or snack intake concerns, patients with strong food preferences, or those that may not be able to ingest or retain the full meal). Please discuss with the family and Most Responsible Health Practitioner (MRHP).

When should insulin be held?

The meal/bolus insulin dose should be held if the patient is **not** receiving nutritional intake, NPO or fasting for a test or procedure.

If there is a change in the patient's oral intake (e.g., increased nausea and vomiting or decreased appetite), the prescriber must to be contacted, as the insulin dose may or may not need to be adjusted.

What is meal insulin?

Meal/bolus insulin is given to cover the meal time carbohydrates (the rise in blood glucose from eating). This is rapid acting insulin given prior to meals.

Where do I find the guidelines for Safe Management of Insulin Pump Therapy (IPT) in hospital?

The guidelines for safe management of IPT in Hospital can be found on Insite (search insulin, diabetes, or insulin pump) or www.ipumpit.ca.

These guidelines were developed support clinicians in determining when it is safe and appropriate for patients and families to use an insulin pump in hospital. Many children and families currently use an insulin pump in their day to day management of diabetes. These guidelines provide information for when self-managing with insulin pump is safe and appropriate in the hospital setting. They also support the safe transition to another insulin regimen when patients and families are unable to self-manage using their insulin pump.

Key Message of guidelines- "*If pump stopped, basal insulin must be replaced **within 2 hours** to prevent Diabetic Ketoacidosis (DKA)"*

Please note there are required forms that must be completed. For sites and use Connect Care or SCM, the forms are connected to the order sets.
In-Hospital Orders for Self Management of Insulin Pump
Insulin Pump Information Sheet
Insulin Pump Therapy Patient Bedside Logbook
Patient Agreement to Self-Manage Insulin Pump In-Hospital

Hypoglycemia Procedure

Who does the Hypoglycemia procedure apply to?

Treatment is required for all patients with a blood glucose less than 4.0 millimoles per litre (mmol/L), even those asymptomatic patients who meet the criteria below:

a) patients with diabetes, who are on insulin; or
b) patients without diabetes who have symptomatic hypoglycemia due to insulin or insulin secretagogue overdose (e.g., glyburide, gliclazide, glimepiride or repaglinide), malnutrition, liver failure, or more rare conditions (e.g., Medium chain acyl-CoA dehydrogenase deficiency [MCAD], insulinoma, dumping syndrome, etc.).

This hypoglycemia protocol should **not** be applied to:

a) patients with diabetes who are **not** taking insulin or insulin secretagogues (e.g. glyburide, gliclazide, glimepiride or repaglinide).
b) asymptomatic patients who do **not** have diabetes (since healthy people who are fasting can have blood glucose levels below four (4.0) mmol/L)

Note: *There may be other toxins/poisonings/over doses of medications that cause hypoglycemia (e.g., Betablockers and ASA). Contact the MRHP and PADIS for guidance and orders if this procedure is appropriate for the patient.*

What is hypoglycemia or low blood glucose?

Hypoglycemia is a blood glucose level of less than 4.0 mmol/L. Hypoglycemia requires prompt treatment when drug induced. This is most often seen in patients treated with insulin or an insulin secretagogue (e.g., glyburide, gliclazide, glimepiride or repaglinide).

A hypoglycemic state may be asymptomatic or symptomatic.

Symptoms of hypoglycemia may include, but are not limited to:
Early / non-severe symptoms: headache, mood changes, irritability, tremors, tiredness, tachycardia, excessive hunger, diaphoresis, pallor, paresthesia, and/or inability to concentrate; and
Advanced / severe symptoms (may include all of the above as well as): being unable to recognize and treat hypoglycemia by self, disorientation, altered level of consciousness (including unconscious state), and/or seizure.

People who are **not** taking medications such as insulin or insulin secretagogue may have a fasting blood glucose level below 4.0mmol/L; healthy individuals who are fasting can have blood glucose levels below 4.0 mmol/L.

Should the meal/bolus insulin be held if the patient's pre-meal blood glucose is less than 4.0mmol/L?

When the patient experiences hypoglycemia, before a meal, the hypoglycemia should be treated (according to the hypoglycemia procedure) until their blood glucose is greater than 4.0 mmol/L. The patient should then receive their meal insulin if they are eating their meal. Contact the MRHP if you are concerned about administering the meal insulin.

When should quick acting carbohydrate be given orally to a patient?

- When blood glucose is less than 4.0mmol/L **and** the patient is considered appropriate for this procedure, see FAQ above
- For patients requiring thickened fluids; provide thickened juice based on the thickness indicated in the patient's diet order.
- *Patients who are NPO or have an altered level of consciousness should **not** receive carbohydrate by mouth.

What are some examples of quick acting carbohydrate that can be given orally?

Item	Infant 6 days to 2 years of age	Child between 2 to 5 years of age	Child between 5 to 10 years of age	Child over 10 years of age
Amount of carb needed (or as close as possible)	5 grams (g)	5 grams (g)	10 grams (g)	15 grams (g)
Dextrose (glucose) Tablets*	not applicable	one (1) tablet	three (3) tablets	four (4) tablets
Dextrose Liquid	One-half (1/2) tube	One-half (1/2) tube	One tube	One and one-half (1 ½) tube
Juice or Regular Pop	not applicable	3 tablespoons (TBSP) or 45 milliliters (mL)	one-third (1/3) cup or 85 mL	three-quarter (3/4) cup or 175 mL
Honey Package	not applicable	not applicable	one (1) individual package	one and one-half (1 ½) individual packages
Sugar package	one (1) packet of sugar in 10 mL distilled water	one (1) packet of sugar in 10 mL distilled water	three (3) packets of sugar in 30 mL distilled water	four (4) packets of sugar in 30 mL distilled water

* Dextrose (glucose) tablets are the **preferred treatment** for hypoglycemia. Other options may not be readily available in AHS facilities, as this is unit and site dependent.
** Dextrose (glucose) tablets may be crushed and dissolved in water.

My patient has diabetes and wants to use candy to treat hypoglycemia, what do I do?

Diabetes Canada does provide guidance that candies such as life-savers, rockets and skittles maybe used to treat hypoglycemia. However, candies like these (and the carbohydrate information) are not readily available to health care professionals to treat hypoglycemia in AHS facilities.
If the patient and family have the candy available and the patient is able to swallow, this may be appropriate.

When a conscious patient has a tube feed, how do I treat the hypoglycemia?

If the patient has a tube feed and unable to have nutritional intake by mouth, provide dextrose (glucose) tablets crushed and dissolved in water via tube feed **AND** flush with water (pre and post treatment).

Juice, pop and honey are not acceptable treatment options as they may cause clogging or damage to the tube.

If the patient is NPO or has an altered level of consciousness, follow the treatment recommendations outlined in the AHS procedure treatment of hypoglycemia.

What is a schedule 1 medication?

A Schedule 1 medication is a medication that requires a prescription or order from an authorized prescriber. Controlled drugs and substances are included in Schedule 1. For information on medication schedules please see the Scheduled Drugs Regulation under the Pharmacy and Drug Act (2000).

Can Nurses (RN, RPN, LPN) give IV dextrose without a prescriber's order?

In emergent situations where it is not possible to obtain an order prior to initiating a protocol, contacting the MRHP can happen at the same time as the protocol and interventions within it are being implemented. Confirm the dose of the medication with the MRHP before administration, when possible. *A patient-specific order from the MRHP is required to administer dextrose via IV, as this is a Schedule one (1) medication, however, this should not delay treatment. In an emergent situation, obtaining a telephonic order can happen at the same time as treating the patient with IV dextrose.*

Dextrose IV direct is a schedule 1 medication. In the pediatric population dextrose is provided as a dose range with maximum dose of 25g. Refer to the **provincial parenteral manual: dextrose product monograph**, for more information. The actual weight or estimated weight should be used to calculate the dose range.

CARNA Medication Guideline 10: *Nurses must have a client specific order from an authorized prescriber in order to implement a **protocol** that includes the administering of Schedule 1 medications within the named protocol.*
CLPNA Medication Guideline Protocols: *A **protocol** is an organizationally-approved guide for practice that is to be implemented by health care professionals managing specific client health needs in their practice environment.*

Emergent situations are defined (in the CARNA document) as circumstances that call for immediate action or attention such that a delay in treatment would place an individual at risk of serious harm.

What is the recipe to mix D25W?

Supplies:
250mL D5W IV fluid bag
Dextrose 50%

Recipe:
Remove Volume: **REMOVE** 100mL from a 250mL D5W fluid bag
Preparation Instructions: **ADD** 100 mL (50 g) of Dextrose 50% to the 250 mL D5W bag.
Final Product Appearance: Appearance is clear and colourless. This is a **High Alert Medication**.

Refer to *CSP Approved References* on Compounding and Repackaging Insite page.

What if nurses on our unit are not competent and confident to administer IV direct medications?

If the nurse or MRHP treating the patient who is experiencing hypoglycemia with an altered level of consciousness, is not competent and confident to provide IV direct medication, IV dextrose shall be administered in a minibag (following the dextrose product monograph in **provincial parental monograph** Insite page) as per the procedure and algorithm.

Why is a large vein required for the administration of dextrose?

IV dextrose is a hyperosmolar solution. It should only be administered IV direct via a large vein (i.e. antecubital). Administered into a small vein, it can cause extravasation and consequential complications including tissue injury and loss of limb.

Can I give dextrose IV after I administer glucagon (SC or IM) if an IV is established or do I wait for 15 minutes?

Glucagon is to be administered in the patient that is unable to swallow or has an altered level of consciousness, when IV access is not available. Once IV access is established, dextrose IV is to be administered as the action time is significantly quicker than glucagon.

The BG will be re-assessed 15 minutes after the dextrose is administered.

Where can I find information on how to mix and administer glucagon?

Instructions for mixing glucagon can be found in the box (instruction insert) as well as on the **parenteral monograph- glucagon**.

What do I do for patients with a BG between 4.0-5.0mmol/L?

- The target for most hospitalized patients with diabetes is 5.0-10.0mmol/L.
- Treatment of hypoglycemia is initiated when the blood glucose is less than 4.0mmol/L.
- A BG between 4.0-5.0 mmol/L in the hospital setting does not require intervention **unless the patient is symptomatic of hypoglycemia**. If the patient is experiencing symptoms of hypoglycemia, follow the hypoglycemia procedure.
- A patient with a BG between 4.0-5.0 mmol/L, should be assessed for symptoms of hypoglycemia prior to being sent off the unit for a test, procedure, physical activity, etc., and communication between departments should occur.
- Frequent BG values between 4.0-5.0mmol/L with symptoms of hypoglycemia may require titration of medications for diabetes management and discussion with the health care team and family.

Why shouldn't the patient be sent off the unit when their blood glucose is less than 4.0mmol/L?

When the blood glucose is less than 4.0mmol/L, the patient may feel unwell.

Symptoms of hypoglycemia include: Excessive hunger, Irritability, Tachycardia, Mood changes, Diaphoresis, Tiredness, Tremors/trembling, Inability to concentrate, Headache, Confusion, Nausea

When patients take insulin the medications will continue to lower blood glucose values if not treated appropriately. If a low blood glucose is not treated the patient can develop an altered level of consciousness or have convulsions.

What is the rationale for re-assessing the BG 1 hour after treatment of hypoglycemia?

Reassessing a BG level 1 hour after initial treatment is a safety measure. It is recognized that recurrent hypoglycemia may impair the patient's ability to sense subsequent hypoglycemia.

What is hypoglycemia unawareness?

Hypoglycemia unawareness occurs when the person living with diabetes, taking a medication that may cause hypoglycemia, does not experience the early warning signs

of hypoglycemia and the first symptoms of hypoglycemia are advanced/severe (see FAQ above). This is commonly caused by frequent hypoglycemia leading to defective glucose counter regulation leading hypoglycemia unawareness.

Pediatric patients with Type 1 diabetes in adolescence or preschool aged children unable to detect and/or treat mild hypoglycemia on their own are more at risk of severe or frequent hypoglycemia leading to hypoglycemia unawareness. Severe hypoglycemia can occur frequently during sleep or in the presence of hypoglycemia unawareness.

The hypoglycemia procedure is very lengthy. How can nurses respond in a timely manner in a crisis situation?

This 12 page governance document is summarized in a 2 page algorithm, which is included as an appendix.

The food or menu item recommended in the procedure is not available on my unit or not appropriate for the patient, where do I find information on alternate/ replacement food menu items?

If none of the recommended options are available or appropriate for the patient, discuss the best options with the Dietitian.

Hyperglycemia Procedure

Why shouldn't the patient with Type 1 Diabetes be sent off the unit if their blood glucose is greater than 14.0mmol/L and they are positive for ketones?

When blood glucose levels are significantly elevated the patient may feel unwell. Blood glucose levels will continue to rise if untreated. High blood glucose can put the patient at risk for the development of Diabetic Ketoacidosis (DKA) which is a medical emergency for patients with diabetes.

What is DKA, and why are patients at risk for DKA?

Diabetic Ketoacidosis (DKA) is a diabetes emergency. It is caused by a deficiency of insulin in patients with Type 1 diabetes (autoimmune) or Type 3c (pancreatectomy, etc.) and those with Type 2 diabetes that are insulin deficient. The ensuing hyperglycemia results in a combination of osmotic diuresis (urinary water loss) and electrolyte abnormalities with resultant dehydration. Insulin deficiency and elevated glucagon levels lead to the breakdown of fat, producing ketones/acids. Ketones are an alternate energy source used when glucose is not available. High levels of ketones can lead to a life threatening condition known as Diabetic Ketoacidosis (DKA).

The clinical presentation of DKA includes symptoms of hyperglycemia (see above), nausea, vomiting and abdominal pain, Kussmaul respiration (deep/laboured), acetone-odoured breath (sweet/fruity breath) and ECFV (extra cellular fluid volume) contraction (dehydration). There also may be a decreased level of consciousness. DKA is associated with significant morbidity and mortality and so should be prevented whenever possible.

How are ketones tested?

The patient's urine or blood serum (may be known as beta-hydroxybutyrate) can be tested for ketones. If patient has Type 1 diabetes and blood glucose is greater than 14.0mmol/L, stat ketone testing is recommended (to be ordered by the most responsible health provider).

Available method of ketone testing varies across acute care sites and will be site dependent.

Where can nurses find a quick reference for treatment & management of hyperglycemia?

See algorithm attached to the hyperglycemia procedure.

General Information

What is the difference between Type 1 and Type 2 diabetes?

Type 1 Diabetes Mellitus (T1DM)
T1DM is caused by destruction of the insulin producing beta cells in the Islets of Langerhans, most commonly from an autoimmune process. The pancreas therefore produces very little or no insulin, so blood glucose rises (hyperglycemia). If the body cannot use glucose as an energy source, because of a lack of insulin, it breaks down fat and produces ketones, which are acidic. High levels of ketones can lead to a life threatening condition known as Diabetic Ketoacidosis (DKA).

People with T1DM need insulin therapy to survive, typically with a basal bolus insulin regimen (may also be referred to as multiple daily injections). They tend to be less insulin resistant (require lower total daily doses [TDD] of insulin) and have a higher risk of developing severe hypoglycemia (the beta cells can no longer work in conjunction with the alpha cells that produce Glucagon).

People who live with T1DM are taught to carefully monitor their diet (carbohydrate intake), exercise and blood glucoses levels, and to administer insulin to help manage their blood glucose levels at home.

Type 2 Diabetes Mellitus (T2DM)
T2DM is a progressive chronic disease, with varying degrees of insulin resistance and insulin deficiency. The pancreas produces some insulin, but the cells in the body fail to respond to the insulin properly (insulin resistance). The pancreas often cannot produce enough insulin to overcome this resistance without treatment. However, the pancreas is usually still able to make glucagon in response to insulin production, lowering the risk of severe hypoglycemia.

Initially when individuals are diagnosed with T2DM, diet and exercise lifestyle modifications are an important part of their long term treatment. Pediatric patients with T2DM will require insulin if they are not meeting their glycemic targets. The medications used to help manage T2DM include oral, non-insulin injections and insulin, however these medications (except insulin) are not recommended in pediatric patients.

Summary:

Type 1 Diabetes (T1 DM)

- Autoimmune in nature; the pancreas produces very little to no insulin
- These patients always require basal insulin
- At risk for Diabetic Ketoacidosis (DKA)
- At significant risk for hypoglycemia

Type 2 Diabetes (T2 DM)

- A combination of insulin resistance and insulin deficiency
- The pancreas produces some insulin, but the body is resistant to its own insulin production
- Most patients will benefit from supplemental insulin in hospital

For more information; please visit the Diabetes Canada website

In what aspects are the management of Type 1 and Type 2 diabetes similar?

The management of T1DM or T2DM in the hospital can be similar if a patient requires insulin to manage their blood glucose levels. A patient with T1DM will **ALWAYS** require insulin. A pediatric patient with T2DM will benefit from insulin in the hospital when the blood glucose is out of target.

Resource and Reference

Alberta Health Services Resources

- Glycemic Management Policy Resource Page:
  - Patient handout: Checking your blood glucose (sugar) level while you're in the hospital (alberta.ca)
- Clinical Knowledge Topic
  Diabetic Ketoacidosis, Pediatric - Emergency & Inpatient
  - DKA Calculator using D10W January 2020
  - Diabetic Ketoacidosis Pediatric Emergency Order Set (for Sites Using D10W Solutions)
  - Diabetic Ketoacidosis Pediatric Inpatient Order Set (for Sites Using D10W Solutions)
  - DKA Calculator using D12.5W January 2020
  - Diabetic Ketoacidosis Pediatric Emergency Order Set (for Sites Using D12.5W Solutions)
  - Diabetic Ketoacidosis Pediatric Inpatient Order Set (for Sites Using D12.5W Solutions)
- Insite
  - Insulin Safety & Diabetes Management; search *insulin or diabetes*
  - Provincial Parenteral Monograph*; parenteral*
  - The Stollery Children's Hospital Guide: Management of the pediatric patient with Diabetes Mellitus
- www.ipumpit.ca
  - Required Forms
  - Guidelines for the Safe Management of Insulin Pump Therapy in Hospital
- My Learning Link
  - Search "Basic Diabetes" for an interactive learning module on basic diabetes education, with a focus on adult in-hospital diabetes management.
- Safer Practice Notices:
  - Safer Practice Notice- Safety Concerns regarding us of Home Glucose Monitoring Devices in Acute Care (albertahealthservices.ca)
  - Safer Practice Notice updated-safe use of insulin pens (albertahealthservices.ca)
  - Safer Practice Notice - ensuring safe use of insulin pens and demonstration devices during patient education (albertahealthservices.ca)
  - Safer Practice Notice - Safe Insulin Pump Therapy in Acute Care (albertahealthservices.ca)

Non-Alberta Health Services Documents

Checking your blood glucose (sugar) level while you're in the hospital. Patient Handout
https://myhealth.alberta.ca/Alberta/Pages/blood-glucose-hospital.aspx

Medication Guidelines 2019 (College and Association of Registered Nurses of Alberta [CARNA])

Medication Guidelines 2018 (College of Licensed Practical Nurses of Alberta [CLPNA])

Diabetes Canada Clinical Practice Guidelines Expert Committee. Diabetes Canada 2018 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. Can J Diabetes. 2018;42(Suppl 1):S1-S325.

Appendix 1: Pediatric Glycemic Management Policy Working Group

Name	Role	Site/Department	Zone
Co-Chairs			
Leta Philp	Practice Lead	DON SCN	Provincial
Krystle Heikkinen	Policy Advisor	Policy	Provincial
Working Group			
Shannon O'Connor	Clinical Educator	NLRHC/ Pediatrics and ER	North
Jennifer Courtney (alternate)	Manager, Clinical Support	NLRHC	North
Greg Schmidt	Manager of Peds/NICU	QEII	North
Jennifer Ouellette (alternate)	CNE Peds/NICU	QE II	North
Kathy Reid	CNS: policy and practice	Stollery	Edmonton
Denise Thorsley (alternate)	Team Lead – patient flow	Quality and Education: Stollery	Edmonton
Carolyn Roy	Assistant Head Nurse (pediatrics)	Red Deer Regional Hospital	Central
Leanne Haines-Doig	Rural Practice Lead	Rural Clinical Learning	Central
Tara Manzer	CNE Inpatients	Alberta Children's Hospital	Calgary
Erin Lalande	CNE ER	Alberta Children's Hospital	Calgary
Shannon Cassar	Diabetes Educator	Alberta Children's Hospital	Calgary
Linda Gust	CNE pediatrics	Chinook Regional Hospital & South Zone	South
Rhonda Roedler	Professional Practice Lead	Provincial Pharmacy (Diabetes)	Provincial- South
Deonne Dersch-Mills	Clinical Pharmacist	Provincial Pharmacy (Peds)	Provincial- ACH
Melissa Lachapelle (ADHOC)	Provincial Practice Lead-Pediatrics	Nutrition Services	Provincial
Linda Juse	Practice Consultant	Health Professions Strategy and Practice	Provincial
Paula Sharman	Clinical Education	Covenant Corporate	Provincial
Stephanie Zettle	Patient/Family Advisor		
Medical Advisors			
Dr. Jessica Foulds	Pediatrician (acute medical)	Stollery	Edmonton
Dr. Daniele Pacaud	Peds Endocrinologist	Alberta Children's Hospital	Calgary
Dr. Elizabeth Rosolowsky	Peds Endocrinologist	Stollery	Edmonton

The co-chairs would like to thank the members of this working group for their time and expertise in the development of these documents.