Diabetes Obesity Nutrition Strategic Clinical Network (DON SCN™)
Provincial Diabetes Inpatient Management Initiative

Basal Bolus Insulin Therapy (BBIT)
and improved glycemic management in hospital

Self-Study Guide

Diabetes, Obesity & Nutrition Strategic Clinical Network
Date: April 2021, Version 3.3

Target Audience

All health care providers involved in glycemic management and administration of subcutaneous insulin to the adult patient population.

Instructions for Completion

- Read the module
- Complete case study

Table of Contents

Learning Objectives **5**
Introduction **6**
Diabetes in Hospitalized Patients *6*
The Need for Improved Glycemic Management *6*
Current Practice *7*
What is Diabetes? **8**
Normal Physiology *8*
Types of Diabetes Mellitus (DM) *9*
Type 1 DM (T1DM) 9
Type 2 DM (T2DM) 10
Other Specific Types of Diabetes 11
Physiologic Insulin Secretion **12**
Mimicking Normal Physiology with Basal Bolus Insulin Therapy (BBIT) **13**
Basal insulin *13*
Bolus (meal) insulin *13*
Correction (supplemental) insulin *13*
Physiologic Insulin Replacement: Distribution of Basal vs. Bolus Insulin *14*
How is insulin ordered using BBIT? **15**
Types of Insulin used with the AHS provincial BBIT Order Set *15*
Ordering Insulin using BBIT *16*
Titrating Insulin is an Important Aspect of BBIT *16*
Target Blood Glucose In-Hospital **17**
Blood Glucose (BG) testing **18**
Testing Technique *18*
Timing of Testing *19*
Coordination of BG Testing and Insulin Administration *19*
Diet Considerations **20**
Administration of Insulin **21**
Injection Sites *21*
Disposable insulin pens and safety pen needles *21*
Managing injections of large doses of subcutaneous insulin *22*
Hypoglycemia Management **23**
Hyperglycemia Management **25**
Diabetic Ketoacidosis (DKA) **26**
How to prevent DKA *26*
Summary of Key Points in the BBIT Self Study Guide **27**
Appendix A: Glossary of Terms **29**
Appendix B: AHS Provincial BBIT order set *(form #20889 electronic or form #19885 NCR)* **30**
Appendix C: Provincial Pharmacy Formulary Insulin used with BBIT **32**
Appendix D: AHS Blood Glucose and Insulin Administration Record *(form #20115)* **33**
Appendix E: AHS Proper Use of Insulin Pens **35**
Appendix F: Adult Hypoglycemia Treatment Algorithm **36**
Appendix G: Adult Hyperglycemia Treatment Algorithm **38**
Appendix H: Case Studies **39**
Answer Guide for Case Studies 1 - 4 ..... **50**
References **55**

Learning Objectives

On completion of this study guide and the case studies, the learner will be able to:

1. **Identify the blood glucose targets for patients with diabetes in hospital**

2. **Describe basic pathophysiology of diabetes**
    a. Understand the normal physiology of the digestive and endocrine systems
    b. Understand the different types of diabetes
    c. Describe the physiology of normal insulin secretion

3. **Name the 3 components of Basal Bolus Insulin Therapy (BBIT)**
    a. Understand how the prescriber orders a basal bolus insulin regime
    b. Understand the different types of insulin that are on the provincial pharmacy formulary

4. **Describe the complexities of Diabetes and Glycemic Management in hospital.**

5. **Understand Appropriate Blood Glucose Monitoring (testing and timing, diet considerations)**

6. **Apply Practical Tips for Insulin Administration using disposable pens with safety needle**

7. **Understand the importance of early recognition and treatment of Hypoglycemia and Hyperglycemia**

8. **Apply the BBIT order set to patient care.** *See attached case studies*

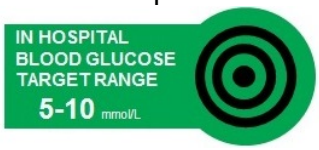
9. **Document blood glucose values and insulin doses on the blood glucose and insulin administration record.** *See attached case studies*

Introduction

The Diabetes Obesity and Nutrition Strategic Clinical Network (DON SCN™) in collaboration with AHS Provincial Pharmacy, AHS Provincial Nutrition and Food Services, AHS and Covenant Health Operations has been leading a multifaceted initiative to standardize and improve diabetes management in hospitalized patients. A priority of this initiative is the use of Basal Bolus Insulin Therapy (BBIT) to improve glycemic management in hospital.

Diabetes in Hospitalized Patients

Diabetes is a common condition, affecting an estimated one in twenty Canadians. One in five adult patients admitted to hospital in Alberta has diabetes and those patients with diabetes stay in hospital 40% longer than patients without diabetes. Hyperglycemia is associated with poor outcomes, so maintaining blood glucose (BG) targets of **5.0 – 10.0 mmol/L** in most patients with diabetes is recommended.



If clinicians fail to recognize and treat hyperglycemia appropriately, patients with diabetes are at risk for:

- Delayed wound healing
- Surgical site infections
- Hospital acquired infections (i.e. pneumonia)
- Mortality

Hyperglycemia in hospital has been associated with a worse prognosis in patients with:

- Stroke
- COPD exacerbations
- Community acquired pneumonia
- Trauma
- Acute coronary syndrome
- Stem cell transplantation
- Post-surgery

Did you know?

- **1 in 5 patients** in hospital have diabetes
  - **90%** of these patients have Type 2 Diabetes
  - **10%** of these patients have Type 1 Diabetes
- **40%** of all patients with diabetes admitted to hospital use insulin to manage their diabetes at home
- Even those patients not on insulin at home may benefit from insulin therapy in hospital

The Need for Improved Glycemic Management

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

Hospitalized patients with diabetes have multiple factors that affect their blood glucose levels, including their acuity of illness, nutritional intake and level of physical activity.

Hyperglycemia (blood glucose levels above 10.0 mmol/L) is prevalent in hospital. Approximately one third (33%) of all BG levels tested in hospital are above target (5.0 – 10.0 mmol/L). Improving blood glucose levels in hospital has been shown to result in a reduction in hospital complications in patients with diabetes.

Current Practice

Data collected in 2014 across four urban hospitals in Alberta demonstrated the following:

- Insulin, as a medication, caused challenges across all units observed
- There was inappropriate holding of insulin (nurses holding insulin without an order)
- The delivery of meals often was not coordinated with the administration of insulin
- There was a lack of recognition of insulin errors, and a lack of understanding of what errors should be reported
- Overtreatment of hypoglycemia was often observed
- Sliding Scale Insulin for subcutaneous insulin administration was commonly ordered

Subcutaneous Sliding Scale Insulin (SSI) has been commonly used in the treatment of diabetes within the inpatient setting. The use of SSI was initially recommended in 1937, Umperriez, 2007. There is no recent published evidence that suggests any improvement in outcomes with SSI to support its ongoing use. Clinical studies and reviews have concluded that subcutaneous SSI is not an appropriate approach to managing hyperglycemia in the hospital setting, and that the hazards of its use exceed the convenience. Subcutaneous sliding scale insulin treats hyperglycemia after it occurs and is not individualized to the patient. The use of SSI can result in large blood glucose fluctuations throughout the day. These fluctuations make the patient feel unwell and can increase morbidity, mortality and length of stay.

Since 2003, Diabetes Canada has recommended the use of multiple daily injections or a Basal Bolus Insulin Therapy (BBIT) for patients with diabetes in the hospital requiring insulin therapy. BBIT is a method of ordering subcutaneous insulin that mimics the normal physiologic secretion of insulin, helping to safely achieve target blood glucose levels.

What is BBIT?

Basal Insulin - covers the glucose the liver (and to a lesser extent the kidneys) makes around the clock

Bolus Insulin - covers the meal time carbohydrates

Insulin Correction - corrects the patient's BG back into target range if it is high

Titrate - Every patient is different! The blood glucose (BG) needs to be checked regularly, and insulin doses adjusted every 1-3 days!

What is Diabetes?

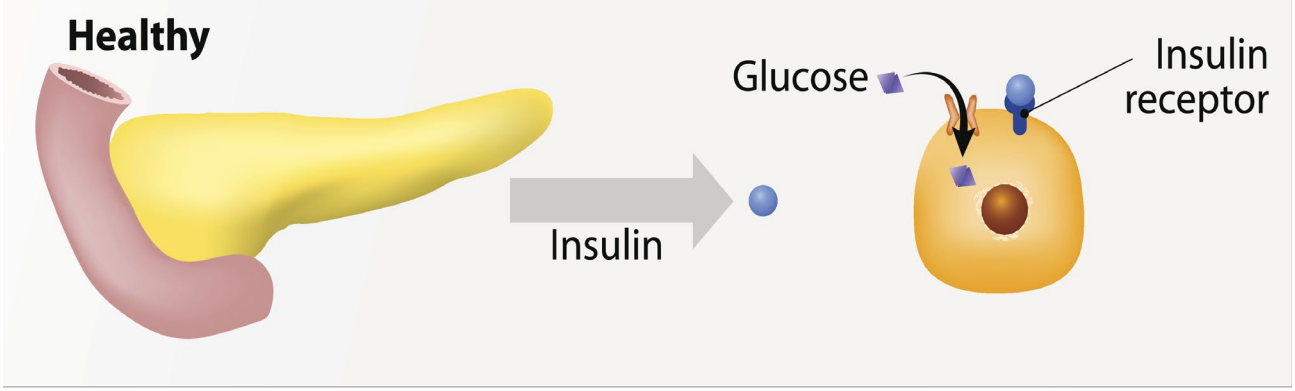
Normal Physiology

The pancreas is a gland that has both digestive and endocrine functions. Within the process of digestion, the pancreas produces enzymes that digest the fats, proteins and carbohydrates in the food that is consumed. Carbohydrates are broken down into glucose. Glucose is used by the body for energy.

As part of its endocrine function, the pancreas produces the hormones **insulin** (produced by the beta cells) and **glucagon** (produced by the alpha cells), which regulate glucose levels in the bloodstream. The beta cells and alpha cells, located within the Islets of Langerhans, work together to maintain normal blood glucose (BG) levels. The b
eta cells sense glucose levels in the blood and when BG rises, insulin secretion increases and glucagon is inhibited. When BG is low, the opposite occurs, insulin is inhibited and glucagon is released.

Insulin: helps cells in our body to take up glucose to be used for energy or to store excess glucose in the form of glycogen, primarily in the liver.

Glucagon: increases the amount of glucose in the bloodstream by stimulating the liver to produce glucose (gluconeogenesis) and by stimulating the liver and other body tissues to breakdown glycogen, the stored form of glucose (glycogenolysis). This happens when blood glucose is needed by cells in the body and plays a role in preventing hypoglycemia.



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Normal Physiology: *Insulin being released from the pancreas in response to rising blood glucose levels. Insulin moves the glucose into the cell so the body can use the glucose for energy*

Types of Diabetes Mellitus (DM)

It is very important to differentiate between the types of diabetes when patients are using insulin. Not every patient on basal and bolus insulin has Type 1 DM.

Type 1 DM (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).

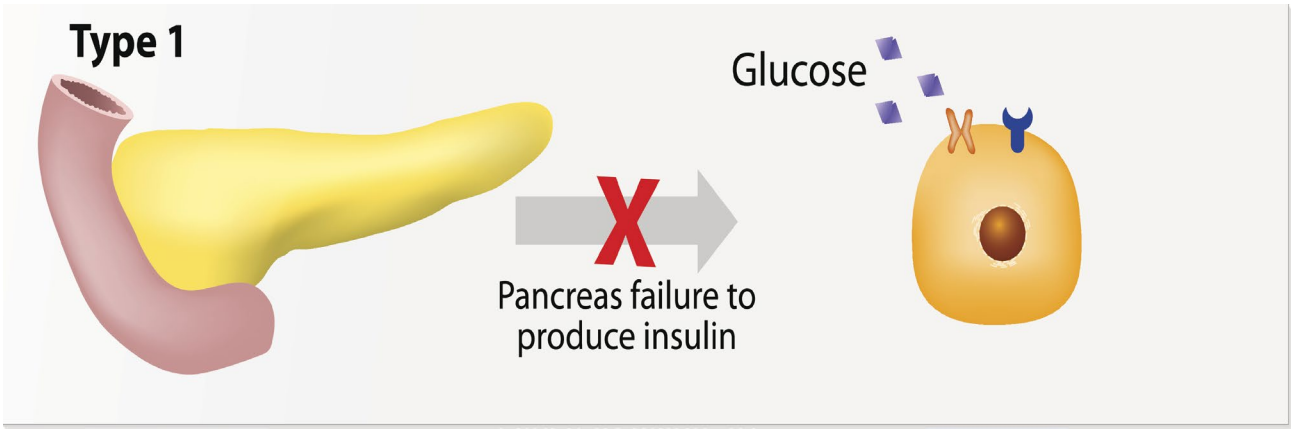
Key Point:

Patients with T1DM **always** need basal insulin; including when fasting

People with T1DM need insulin therapy to survive, typically 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).

Symptoms of hyperglycemia seen in new onset T1DM or inadequately treated diabetes include: fatigue and frequent urination, which can lead to dehydration, thirst, and weight loss despite hunger. When insulin is not replaced adequately, patients with T1DM are at risk of DKA. Some individuals who manage their T1DM with an insulin pump are at greater risk for developing Diabetic Ketoacidosis (DKA) if insulin delivery is interrupted for any reason.

People who live with T1DM are also 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.



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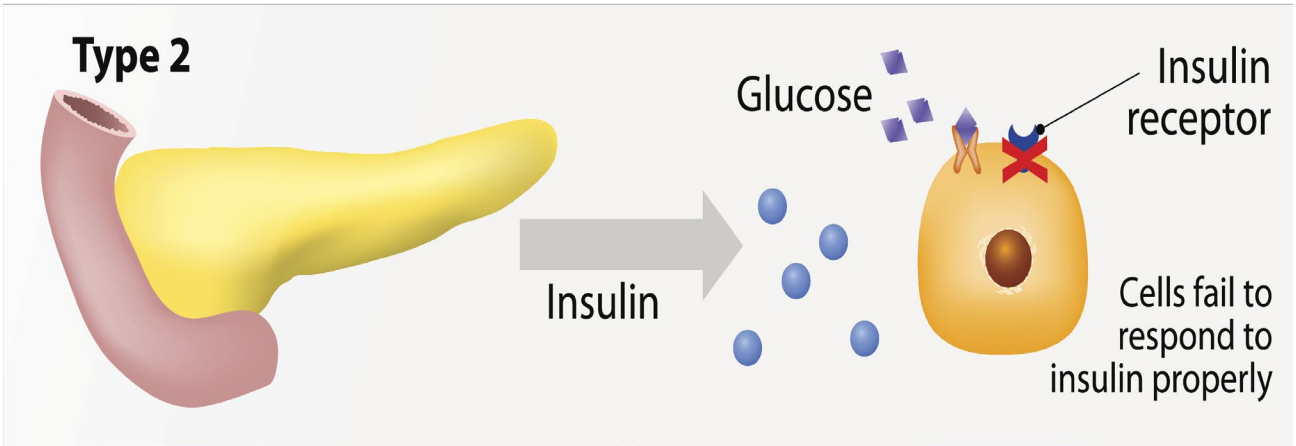
T1DM Physiology: *Through an autoimmune process the pancreas has stopped producing insulin leading to excess glucose in the blood. The body is unable to use this glucose for energy.*

Type 2 DM (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 hypoglycemia, so there is a lesser risk of severe hypoglycemia as compared to those with T1DM.

Symptoms of T2DM (hyperglycemia) are the same as those with T1DM, however many people may be asymptomatic. Initially when individuals are diagnosed with T2DM, diet and exercise are important parts of their treatment. There are now many medications to help treat T2DM. Some medications reduce insulin resistance, others increase insulin production, others reduce glucagon and still others increase glucose loss in the urine. People living with T2DM for a long period of time will often need supplemental insulin therapy.

Patients with T2DM who do not use insulin to manage their diabetes at home may require and benefit from insulin temporarily in hospital.



T2DM Physiology: L*ess insulin being released from the pancreas in response to high blood glucoses. And the body's cells are* ***resistant*** *to the insulin.*

Type 1 Diabetes (T1 DM)
- Most often 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 cells in the body fail to respond to the insulin properly (insulin resistance)
- Most patients will benefit from insulin supplementation in hospital

Other Specific Types of Diabetes

Gestational Diabetes (GDM)

Gestational Diabetes is the onset or recognition of glucose intolerance during pregnancy. All women should be screened for GDM between 24-28 weeks gestation. Insulin resistance caused by the hormones produced by the placenta continually rise during the second and third trimester. Women with GDM are not able to make enough insulin to meet this increased insulin demand, resulting in glucose intolerance. Once the fetus and placenta are delivered, the diabetes should resolve. Women with GDM need to be screened postpartum to ensure the diabetes has resolved. Screening should continue annually, as these women are at an increased risk of developing overt diabetes in the future.

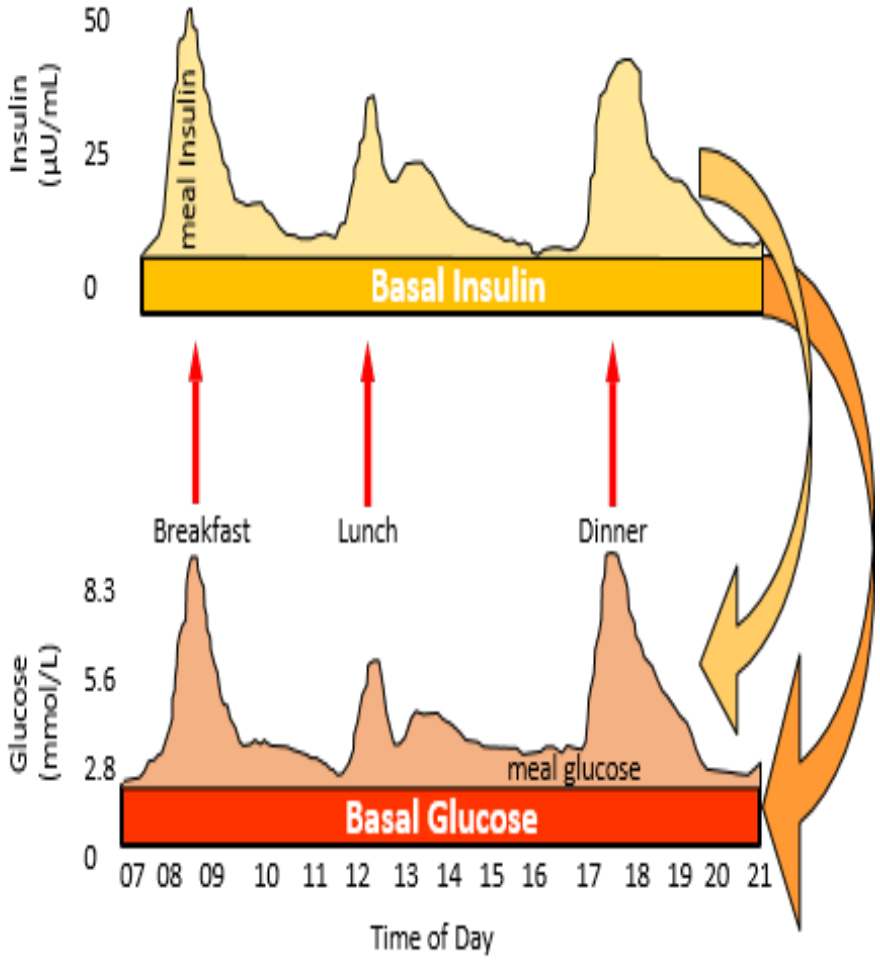
Other specific types of diabetes include a wide variety of relatively uncommon conditions, primarily specific genetically defined forms of diabetes or diabetes associated with other diseases or drug use (e.g. steroid induced hyperglycemia). See Diabetes Canada | Clinical Practice Guidelines - Appendix 2: Etiologic Classification of Diabetes Mellitus for more information.

Physiologic Insulin Secretion

Basal Insulin (Background Insulin) - In patients without diabetes, there is always a background or basal level of circulating insulin, which serves to suppress glucose (produced by the liver and to a lesser extent the kidneys) and ketone production in periods of fasting. Basal insulin is relatively constant.

Bolus insulin (Meal insulin) -After meals, insulin levels rise above the basal level in response to the increase in blood glucose from the ingested and absorbed carbohydrate. In the graph below, note how closely after a meal, the curves for glucose and insulin levels match.

The graph below shows normal insulin profile for a person without diabetes, eating 3 meals a day.



Normal insulin secretion and glucose production in a person without diabetes

Adapted with permission from Galloway, 1991

Note similar curves of glucose and insulin in response to nutritional intake during the day

The 50/50 Rule

Understanding physiologic insulin secretion helps in creating a flexible and more physiologic insulin regimen for the hospitalized patient. Basal insulin accounts for about 50% of the total daily insulin secretion and the remaining 50% is secreted as bolus (meal) insulin.

Mimicking Normal Physiology with Basal Bolus Insulin Therapy (BBIT)

Principles of Insulin Dosing includes 3 insulin components:

Basal insulin

- Long or intermediate-acting insulin ordered once or twice daily to cover basal insulin needs
- Covers the glucose the liver (and to a lesser extent the kidneys) makes around the clock
- Required for all patients with T1DM
- Patients with T2DM may require basal insulin
- **Approximately 50% of the Total Daily Dose (TDD) of insulin**
- Should **not** be held, including times when the patient is fasting

Bolus (meal) insulin

- Rapid or short acting insulin given prior to meals
- Covers the mealtime carbohydrates (the rise in blood glucose from eating)
- May also be used to cover continuous parenteral or enteral feeds
- **About 50% of Total Daily Dose (TDD) of insulin**

Correction (supplemental) insulin

- Rapid or short-acting insulin given to correct unanticipated hyperglycemia
- Ensures high glucose values are not left untreated
- To be given with meal insulin (patient eating) or on its own (patient NPO) when the blood glucose measurement is above target for that patient at that time
- Correction insulin is not routinely recommended at bedtime; the basal insulin administered at bedtime will cover the body's natural production of glucose.
- If correction insulin is required consistently or in high doses – the basal and/or bolus (meal) insulin doses may need to be modified

What is BBIT?

Basal Insulin - covers the glucose the liver (and to a lesser extent the kidneys) makes around the clock

Bolus Insulin - covers the mealtime carbohydrates

Insulin Correction - corrects the patient's BG back into target range if it is high

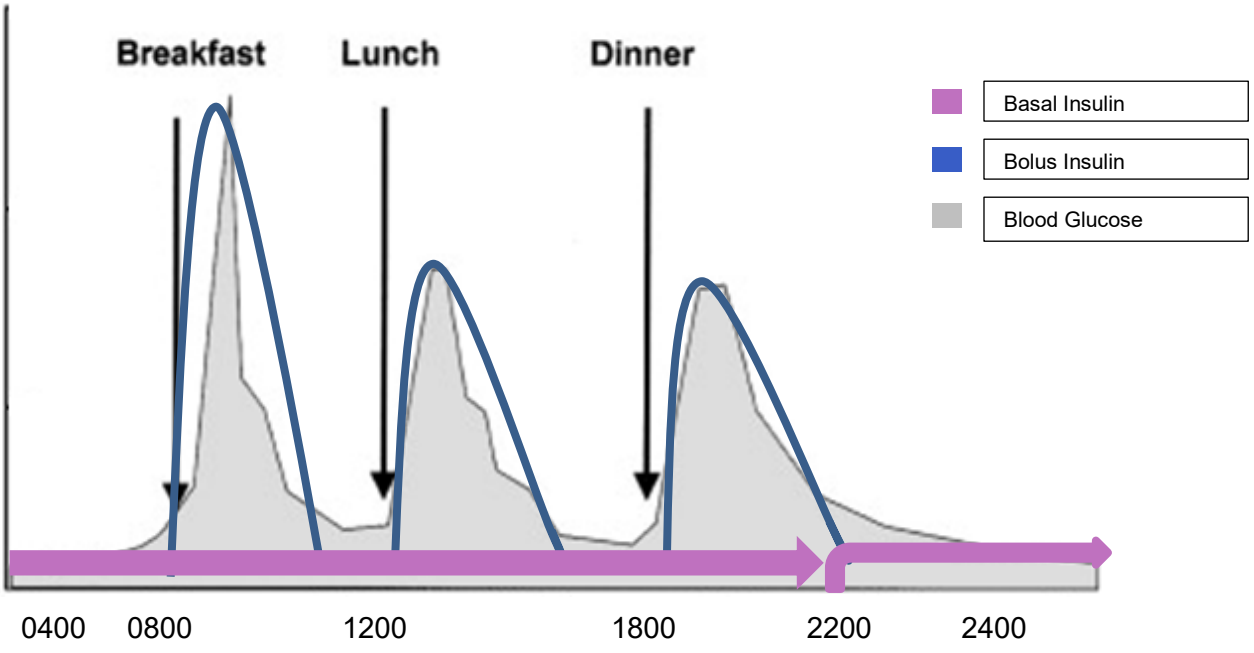
Titrate - Every patient is different! The blood glucose (BG) needs to be checked regularly, and insulin doses adjusted every 1-3 days!

Physiologic Insulin Replacement: Distribution of Basal vs. Bolus Insulin

When replacing insulin for a patient with diabetes, basal bolus insulin therapy best replicates how a functioning pancreas would secrete insulin in response to glucose production.

Basal insulin is given once or twice daily to support the glucose production from the liver (and to a lesser extent the kidneys). Bolus insulin is administered prior to meals based on the blood glucose level prior to eating the meal, as well as the amount of food intake anticipated. Correction insulin is administered if the BG is above target prior to the meal.

The graph below demonstrates the glucose production for a person with diabetes eating three meals a day. As the pancreas is not able to make insulin, insulin is injected to mimic natural insulin secretion in response to the rise in glucose. Note: the basal insulin for this patient is administered once daily at approximately 2200 hours and bolus insulin administered with meals.



Adapted with permission from: Edelman, 2005

How is insulin ordered using BBIT?

Types of Insulin used with the AHS provincial BBIT Order Set

Various types of insulin are available within AHS and Covenant. To reduce insulin errors in hospital, a simplified insulin formulary was established in 2015, with a reduced number of brands and types of insulin. Types of insulin differ by how quickly they start working, when they are most effective and how long their effect lasts.
See Appendix B for provincial order set (AHS form #19885 & Covenant Health form #CV 0701).
See Appendix C for more detailed information about provincial pharmacy insulin formulary used with BBIT.

Basal Insulin
For the BBIT order set, the prescriber will choose one of the following:

Intermediate-Acting Insulins **Onset: 1-3 hours** **Peak: 5-8 hours** **Duration: up to 18 hours**	**Long-Acting Basal Insulin** **Onset: 1-2 hours** **Peak: Not applicable** **Duration: 16-24 hours**
Insulin NPH (HumuLIN N®)	Insulin detemir (Levemir®) Insulin glargine (Lantus® OR *Basaglar®)

* A biosimilar medicine is developed to be similar to an existing biological medicine (reference product already approved for use). Many medications have exclusive patents and periods of marketing. When these patents expire, a biosimilar version of the medicine may become more widely available, for example insulin glargine (Basaglar). These biosimilar medications go through rigorous scientific testing to ensure the product is highly similar with no clinically meaningful differences from the original reference medication, for example glargine (Lantus).

Ultra long –acting basal insulin, ***degludec insulin (Tresiba®)*** (see appendix C), is on AHS formulary with a classification of "formulary-restricted with prescribing guidelines" for the acute care setting. Degludec is a peakless insulin with a duration of 42 hours; titration occurs every 3-4 days, **not** daily. The pharmacokinetics of this insulin makes titration difficult in response to changing blood glucose values in the acute care setting. If a patient requires a switch to one of the other formulary basal insulin options, there may be a delay in the start of the new formulary basal insulin for 2 days. Starting a different formulary basal insulin while the degludec is still in the body (without the two day waiting period) may put the patient at risk of hypoglycemia. For individuals with T1DM, delaying the start of a different formulary basal insulin for longer than 2 days may increase the risk for developing Diabetic Ketoacidosis (DKA) due to declining basal insulin concentrations.

Bolus and Correction Insulin
For the BBIT order set the prescriber will choose one of the following:

Rapid-Acting Insulins **Onset: 10-15 mins** **Peak: 1-2 hours** **Duration: 3-5 hours**	**Short-Acting Insulins** **Onset: 30 mins** **Peak: 2-3 hours** **Duration: 6.5 hours**
Insulin aspart (NovoRapid®) Insulin lispro (HumaLOG®)	Insulin regular (HumuLIN R®)

Ordering Insulin using BBIT

Before ordering insulin, many factors are taken into account including the patient's weight and their comorbidities (see table below). The prescriber begins by calculating the Total Daily Dose (TDD) of insulin, which is the total number of units of insulin given in a day. The TDD will then be divided into basal and mealtime bolus doses, and a correction scale will be selected based on the TDD. Insulin doses should be assessed daily. In acute illness, the total daily insulin requirement may actually increase, even if the patient's caloric intake decreases. As the patient recovers from their illness, their insulin requirements may lessen.

Considerations when Prescribing Insulin

The table below is used by a prescriber when calculating insulin requirements:

Use **LOWER** TDD IF	*Type 1 DM, slim Type 2 DM, history of hypoglycemia unawareness, reduced renal function (eGFR < 30 mL/min), liver failure, age >70; moderate/severe frailty*	***TDD=Weight (kg) x 0.3 to 0.5 Units/kg/day***
Use **HIGHER** TDD IF	*Insulin resistance, overweight Type 2 DM, steroid treatment, infection*	***TDD=Weight (kg) x 0.5 to 1 Units/kg/day***

Titrating Insulin is an Important Aspect of BBIT

Generally speaking, as the patient's medical status changes, so will the glucose levels. Therefore, the initial calculated dose of insulin may need titration to achieve target blood glucoses. Assessment and titration of insulin doses by the prescriber should be considered every 1-3 days, especially if BG levels remain above or below target.

How Insulin Doses are titrated by Prescribers

If **Breakfast** BG is:		If **Lunch** BG is:		If **Supper** BG is:		If **Bedtime** BG is:		If **Overnight** BG is:
LOW (below 5.0 mmol/L)	HIGH (above 10.0 mmol/L)	LOW (below 5.0 mmol/L)	HIGH (above 10.0 mmol/L)	LOW (below 5.0 mmol/L)	HIGH (above 10.0 mmol/L)	LOW (below 5.0 mmol/L)	HIGH (above 10.0 mmol/L)	LOW (below 5.0 mmol/L)
Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Bedtime BASAL		**Breakfast** BOLUS		**Lunch** BOLUS or **Breakfast** BASAL		**Supper** BOLUS		**Bedtime** BASAL
If ALL BG are HIGH (greater than 10.0 mmol/L), Calculate TDD from last 24 hours, Increase TDD by 10-20% and Recalculate all Basal, Bolus and Correction Doses								

- If **HYPER**GLYCEMIA **OR HYPO**GLYCEMIA**:** Discuss with patient to determine if change in activity or oral intake was the cause. If yes, monitor carefully. If otherwise unexplained, increase or decrease doses by 10-20% as per Titration Table above.

Target Blood Glucose In-Hospital

Refer to the Provincial Glycemic Management Policy Suite for more information.
Blood Glucose (BG) values of **5.0 – 10.0 mmol/L** are recommended for most patients in hospital.

Higher values (**5.0 – 12.0 mmol/L**) are acceptable for:

- The frail elderly and/or those with dementia (o*lder adults assessed as physically and/or cognitively frail at risk for confusion, agitation or falls)*
- Patients with limited life expectancy
- Patients at risk for severe hypoglycemia (e.g. hypoglycemia unawareness)

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

- Exception: patients with acute coronary syndrome the BG target range is 7.0-10.0 mmol/L.

Modestly lower, individualized, blood glucose targets are recommended for women with diabetes in pregnancy. For women in active labour, the BG range 4.0-7.0 mmol/L

Factors that may affect the patient's blood glucose include:

- Use of a subcutaneous Sliding Scale Insulin (SSI) regimen alone
- Inappropriate holding of diabetes medications
- Overtreatment of hypoglycemia
- Missing meals while off unit for procedures
- NPO status – often for pre- and peri-operative procedures
- Continuous or bolus enteral feeds
- Parenteral Nutrition (PN)
- Patient's underlying illness
- High dose corticosteroids
- Patient's activity level

Recommendations for optimal glycemic management:

- Target BG levels of **5.0 – 10.0 mmol/L** in most patients with diabetes in hospital
- Early recognition and treatment of hypoglycemia, defined as a BG below 4.0 mmol/L
- For patients at risk for severe hypoglycemia, a lower, more conservative dose of scheduled insulin may be considered by the prescriber
- Regular review of BG record and titration of insulin doses every 1-3 days, especially if BG levels are consistently above target and/or patient is consistently requiring the addition of correction insulin

Blood Glucose (BG) testing

For the BBIT order set:

- BG testing is ordered four times daily and anytime hypoglycemia is suspected.
- Patients that are fasting, have an NPO status or have reduced dietary intake need to continue four times daily BG testing.

Patients may use their home interstitial glucose monitoring devices, such as Continuous Glucose Monitors (CGM) or Flash Glucose Monitors (Flash), or other blood glucose monitors during their hospital stay. **BUT**, health care professionals shall perform blood glucose point-of-care testing (POCT) with the AHS blood glucose meter to determine:

- administration of medication doses;
- adjustment of insulin doses and/or other diabetes medication(s); and
- the treatment for hypoglycemia.

For more information: AHS Provincial Glycemic Management Policy Resource Website.

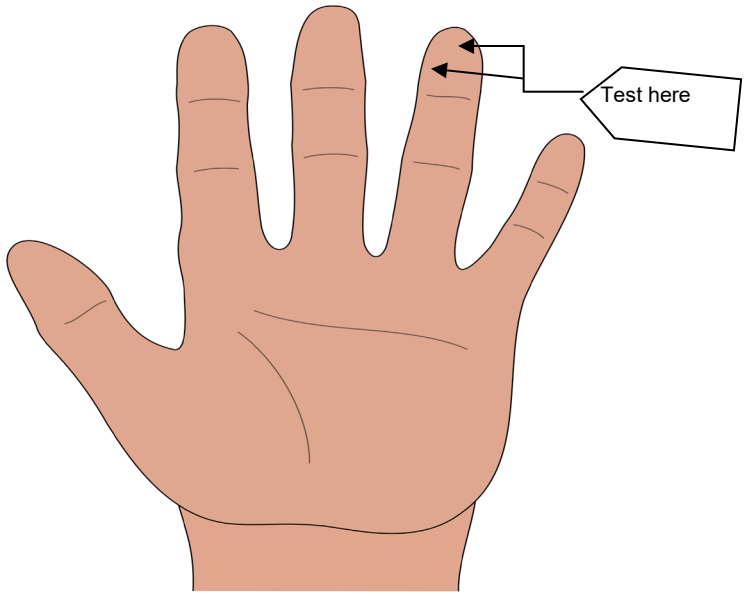
Testing Technique

The Roche Accuchek® Inform II meter is available in all acute care facilities within Alberta. Please see link below for Alberta Precision Laboratory provincial policy for more information POCT BG monitoring. **https://ahs.labqms.com/labFrame.asp?DID=9062.**

It is important to remember:

- The patient's puncture site is to be cleaned with a skin antiseptic wipe and allowed to dry
- The first drop of blood is wiped away and a second drop is used to perform the test
- The health care worker has five minutes to apply sample to the strip

Fingertip testing is recommended. It is not recommended to "milk" the finger to get a sample. Testing sites of the fingers is to be off center of the middle of the fingertip pad. This will cause less pain when obtaining the sample.



Tips for Painless Fingertip Testing:

- Avoid the fingertip pad and outer edge (over bone) of the finger.
- Avoid areas of swelling, calluses, bruising or cyanosis.
- Using warm wash cloth & have the patient hang their hand below their waist *(Encourages blood flow to the fingertip to ensure a good sample)*

Timing of Testing

- BG levels are to be tested four times daily, before each meal and before bedtime.
- Ideally testing needs to happen within 30 minutes of the patient's meal. Meal delivery times are unit specific.
- Patients that are fasting, have a continuous tube feed, or parenteral nutrition (PN) require testing at usual meal times and bedtime, or every 6 hours.

What time are meals served on your unit?

Coordination of BG Testing and Insulin Administration

Both the BG test and insulin administration are to be coordinated with meal delivery and occur 15 - 30 minutes before the meal. Recording of the BG and the insulin dose will occur on the same form. *See Appendix D for a sample of the provincial Blood Glucose and Insulin Administration Record (AHS form #20115 and Covenant Health form # CV-0609). To support documentation workflow in the AHS electronic health record "Connect Care" refer into the inpatient glycemic management tip sheet in the Universal Learning Home Dashboard.*

- **Exception:** meal/bolus insulin may be given immediately after the meal/feed in certain situations (e.g., gastroparesis or concern that the patient may not be able to ingest or retain the full meal).

- **Short acting** insulin is given **30 minutes prior** to mealtime
- **Rapid acting** insulin is given no more than **15 minutes prior** to mealtime

Diet Considerations

Patients in hospital often have significant change in their food intake as compared to home. The patient may be fasting (NPO), nauseated, have decreased or variable appetite, and/or have a medical condition that may affect their oral intake or absorption.

If the patient is eating: Assess if eating is consistent or reduced as this **may** affect the bolus insulin dose. If a change in oral intake (increased nausea and vomiting or decreased appetite) is observed, the most responsible health practitioner needs to be contacted, as the insulin dose may or may not need to be adjusted.

If a patient is fasting (NPO) for a test and/or procedure, BG monitoring continues before meals and bedtime. Once the patient can return to a consistent or reduced diet, contact the most responsible health practitioner if the meal is to be consumed between scheduled unit meal delivery times. Administer insulin as ordered. Administration of bolus insulin in between meals could increase the patient's risk for hypoglycemia.

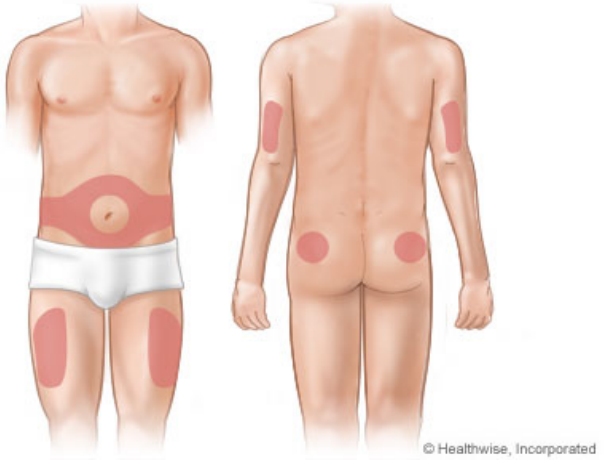
Diet	Definition	Adjustment to Bolus insulin
Consistent	At least 75% of the tray is consumed by the patient at mealtime	Continue scheduled bolus insulin
Reduced	No more than 50% of the tray is consumed by patient at mealtime	**Notify MRHP** to consider reducing bolus (meal) insulin by ~50%
NPO	Patient is receiving no oral nutrition	Hold bolus insulin and give correction insulin as per orders

Administration of Insulin

Injection Sites

Insulin is administered into the subcutaneous tissue of:

- the abdomen avoiding 5cm around the umbilicus
- outer thigh
- top of the buttock
- outer upper arm



Healthwise (2019). Diabetes: Giving Yourself an Insulin Shot (alberta.ca)

Disposable insulin pens and safety pen needles

Most hospital sites in Alberta have transitioned to patient specific dispensing of insulin, and the use of disposable insulin pens, as part of a provincial pharmacy initiative to improve patient safety. Safety pen needles are used to prevent needle stick injuries for staff when administering insulin. Proper technique for insulin administration is important to ensure the patient is receiving the correct dose of insulin. Improper use of the pen and safety pen needle can result in the patient not getting enough insulin and becoming hyperglycemic.

The following are important steps for successful insulin administration using a disposable pen with a safety needle:

1. Proper attachment of the safety pen needle to the disposable insulin pen
2. Prime of the needle (2 units) and shake off
3. No pinch up of the skin required
4. Insert at a 90 degree angle on flat skin, until the clear outer shield retracts and the white sleeve is flush with the skin, maintain constant pressure.
5. Wait to hear a **"*click*"** before depressing plunger with thumb
6. Wait for 10 seconds after plunger has been depressed to ensure full dose administered
7. Remove needle from skin- *note red line on the safety shield before removing the needle*
8. Disposal of the pen needle in a sharps container

Safety pen needles: Wait to hear the "***click***" before beginning to deliver the insulin dose

Note: If a patient has the supplies and is able to self-inject their insulin, this should be encouraged. The patient does not require a safety pen needle if they are self-administering.

Disposable insulin pens are patient specific and are not to be shared between patients.
AHS recommends “One Pen, One Patient”.
See *Appendix E for summary of safe administration of insulin using disposable pens*

For detailed information and videos on proper use of insulin pens and safety pen needles; AHS employees can go to Insite and search “insulin safety and diabetes management toolkit”, and they will be directed to the pharmacy provincial medication safety website.

Managing injections of large doses of subcutaneous insulin

When a dose is 50 units or greater, administer the dose in two equally divided injections at separate sites.

For example:

- HumuLIN N 66 units at bedtime
- Given in two separate injections of 33 units each at two different injection sites at bedtime

Hypoglycemia Management

See Appendix F for Adult Hypoglycemia Treatment Algorithm
Please note: a provincial Glycemic Management policy including procedures for Hypoglycemia and Hyperglycemia management for adult patients in acute care is available online for AHS and Covenant Health.

Hypoglycemia can happen during the day or at night. Hypoglycemia is defined as a **BG level below 4.0 mmol/L**. Patients may or may not be symptomatic of hypoglycemia.

Recognition

Symptoms include but are not limited to:

- Excessive hunger
- Tachycardia
- Diaphoresis
- Tremors/trembling
- Headache
- Nausea
- Irritability
- Mood changes
- Fatigue
- Inability to concentrate
- Confusion

BG less than **4.0 mmol/L** requires treatment

Severe hypoglycemia is defined as a BG level below 4.0 mmol/L **and** the patient has an altered level of consciousness.

Treatment

The hypoglycemia protocol should be implemented any time a BG is less than **4.0 mmol/L.** Treatment should be given without delay.

Note: The patient should not be sent off the unit, especially for physical activity, until their blood glucose is greater than or equal to 4.0 mmol/L after treatment; and they have had the opportunity to have a snack or meal containing carbohydrate and protein (or Parenteral Nutrition [PN] or tube feed re-established).

For the conscious patient and able to swallow:

Note: *Patients who are ordered nothing by mouth (NPO) should be treated the same as the patient with Altered Consciousness or those Unable to Swallow.*

- As soon as hypoglycemia is recognized; give 15 grams or as close as possible, of fast acting carbohydrate. Choose one (1) of the following:
  - 4 dextrose tablets (16 grams [g] of carbohydrate); or
  - three-quarters (3/4) cup or 175 mL juice or regular pop; or
  - 1 ½ individual packages (or 15 mL) of honey
  - 4 packages of sugar dissolved in water (16 grams [g] of carbohydrate)

Did you know?

15 grams of fast acting glucose will typically raise the blood glucose 2.1mmol/L in 20 minutes!

- Repeat the BG 15 minutes after treatment;
  - if below 4.0 mmol/L repeat the administration of 15 grams of fast acting carbohydrate (as above)
  - if the BG is equal to or greater than 4.0 mmol/L; and
    - the meal *is more than an hour away*; provide one snack of 15 grams carbohydrate and a protein source
    - the meal *is less than an hour away*; provide the meal when arrives (no additional snack required). Administer the bolus insulin as ordered based on the most recent BG reading.
- If the patient does not respond to the above treatment and deteriorates to have an altered level of consciousness; follow the procedure for treatment of altered consciousness/unable to swallow.

Overtreatment of hypoglycemia will often result in **rebound hyperglycemia**. This drastic change in blood glucose will often **cause the patient to feel unwell**

For the patient with altered consciousness and unable to swallow (including NPO):

- Refer to current site policy
- These patients will require intravenous dextrose, or an injection of glucagon.
- Contact the most responsible health practitioner.
- Repeat BG 15 minutes after the treatment is given, and follow site/unit protocol for the medical management after treatment of hypoglycemia.

Follow Up

After treatment of hypoglycemia, and the patient's blood glucose is equal to or greater than 4.0 mmol/L:

- **Reassess**: the BG level in one hour to ensure it remains above 4.0 mmol/L. If BG is below 4.0 mmol/L initiate hypoglycemia treatment again.
- **Evaluate**: review with patient for a cause e.g. missed meal, exercise or change in medication.
- **Document**: the symptoms, treatment, evaluation, patient teaching and notification of the health care team members. **Discuss**: the nutrition plan and medications with the most responsible health practitioner.

When to contact the most responsible health practitioner:

- Hypoglycemia in a conscious patient should be reported to the most responsible health practitioner within 24 hours.
- Hypoglycemia with an altered state of consciousness is a medical emergency and the most responsible health practitioner should be notified immediately. Treatment for the patient occurs without delay.

Holding of Insulin

When a patient is hypoglycemic, it is important to remember that the **holding of insulin requires an order** from the most responsible health practitioner. Holding basal or bolus insulin after an episode of hypoglycemia commonly results in significant hyperglycemia 3-4 hours later.

Causes

Reviewing potential causes of hypoglycemia with the patient can help to prevent future hypoglycemic events. Hypoglycemia can be caused by but not limited to:

- a missed meal or not eating enough
- too much medication
- exercise

Hyperglycemia Management

See Appendix G for Adult Hyperglycemia Treatment Algorithm
Please note: Please note: a provincial Glycemic Management policy including procedures for Hypoglycemia and Hyperglycemia management for adult patients in acute care is available online for AHS and Covenant Health.

Hyperglycemia (a BG level above 10.0 mmol/L) is common in hospital.

The most responsible health practitioner needs to be contacted for additional orders when BG above **18.0 mmol/L**

Recognition

Hyperglycemia in the acute care setting can be defined as:

- Mild- BG levels between 10.1-14.0 mmol/L
- Moderate- BG levels between 14.1-18.0 mmol/L
- Severe- BG levels greater than 18.1 mmol/L

Symptoms of significant hyperglycemia may include, but are not limited to:

- Polydipsia (thirst)
- Polyuria (frequent urination)
- Fatigue
- Lethargy
- Dizziness
- Nausea & Vomiting
- Blurred Vision
- Hyperventilation
- Sweet Smelling Breath

Treatment

- Provide insulin or other anti-hyperglycemic medications as ordered.
- Blood glucose levels above 18.0 mmol/L should be reported to the most responsible health practitioner immediately.
  - **Exception:** The most responsible health practitioner should be notified when the BG is above 14.0 mmol/L for patients who are on insulin pump therapy or taking an SGLT2 oral medication
- Some patients should not be sent off the unit, especially for physical activity, when their blood glucose is greater than 18.0 mmol/L. These include:
  - Patients with type 1 diabetes and positive ketones; and
  - Patients on a Sodium-glucose co-transporter 2 (SGLT2) inhibitor and positive ketones.
- Review chart with patient for possible causes of hyperglycemia (last dietary intake or missed medications).
- In patients with T1DM and blood glucose is greater than 18.0 mmol/L, STAT ketone testing is recommended (available method of ketone testing varies across acute care sites; and is site dependent).
  - If ketones are positive, the most responsible health practitioner should consider physical and/or lab assessment to rule out DKA.
  - **Exception:** if patient on an SGLT2 inhibitor or using an insulin pump, assessment for DKA should be considered if BG is above 14.0 mmol/L and positive ketones.

Follow Up

- After treatment of hyperglycemia, resume routine BG testing once glycemic levels have stabilized.
- Provide patient teaching if required.
- Refer patient for diabetes education and/or to a diabetes specialist, when available and appropriate.
- Documentation of the hyperglycemic event includes: all BG test results, associated symptoms, all treatment provided including medications, patient/family teaching, and notification of team members and report of findings for possible causes of hyperglycemia.

Causes

Hyperglycemia in the hospital setting can be related to but not limited to:

- Physiological changes (e.g. increases in circulating concentrations of stress hormones)
- Some medications (e.g. glucocorticoid use)
- Incorrect technique in the use of disposable insulin pens and safety pen needles
- Missed insulin (insulin omission)
- Insufficient insulin: the initial calculated dose of insulin may need titration to achieve therapeutic results. Assessment and titration of insulin doses by the prescriber should be considered every 1-3 days if BG levels remain above target.

Diabetic Ketoacidosis (DKA)

Diabetic Ketoacidosis (DKA) is a diabetes emergency. DKA is due to a deficiency of insulin in patients with Type 1 diabetes (autoimmune), Type 3c (impaired pancreatic endocrine function due to conditions like pancreatectomy, pancreatitis, 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 should be prevented whenever possible.

How to prevent DKA

Basal insulin should always be administered in insulin deficient patients.

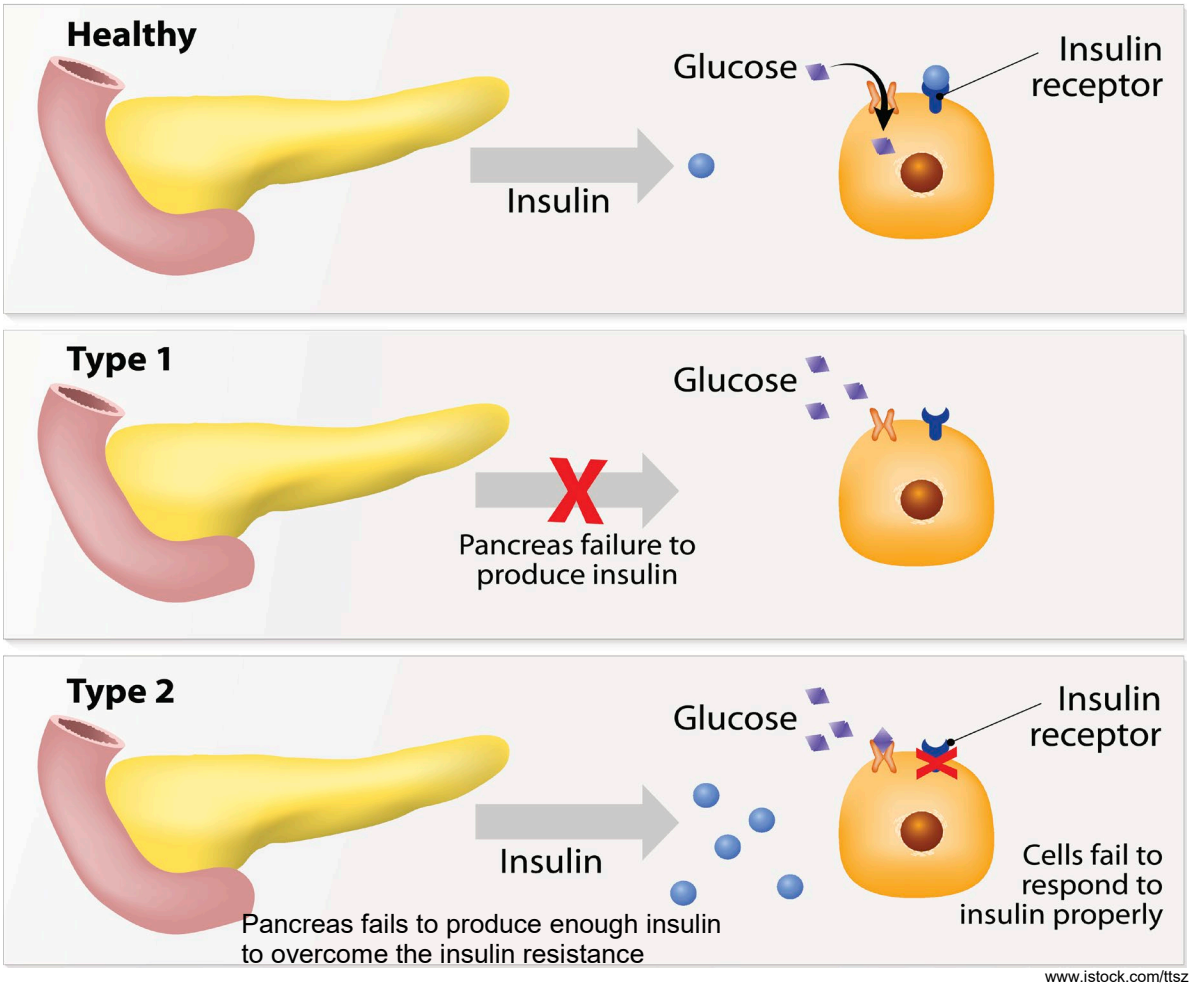
A blood glucose levels above 18.0 mmol/L should be reported to the most responsible health practitioner and testing for ketones should be considered if the patient has Type 1 diabetes or Type 2 diabetes and insulin deficient.

- **Exception:** The most responsible health practitioner should be notified when the BG is above 14.0 mmol/L for patients who are on insulin pump therapy or taking an SGLT2 oral medication for stat ketone testing, as per the Hyperglycemia protocol. See Appendix G.

If ketones are present, extra insulin may be required to prevent DKA from occurring. Contact the most responsible health practitioner immediately if ketones are present for further orders. Refer to the Clinical Knowledge Topic for *Diabetic Ketoacidosis, Inpatient* for more information.

Summary of Key Points in the BBIT Self Study Guide

- Diabetes Mellitus is a complex chronic disease.
- In hospital blood glucose targets are 5.0 – 10.0 mmol/L, for most patients.
- There is benefit in understanding the basic physiologic and pathophysiologic differences between normal pancreatic function, T1DM and T2DM



- Basal Bolus Insulin Therapy (BBIT) is a subcutaneous insulin regime that mimics the normal physiologic secretion of insulin, helping to proactively and safely achieve target blood glucose levels of 5.0 -10.0 mmol/L in hospital.

Basal Insulin - covers the glucose the liver (and to a lesser extent the kidneys) makes around the clock
Bolus Insulin - covers the mealtime carbohydrates
Insulin Correction - corrects the patient's BG back into target range if it is high
Titrate - Every patient is different! The blood glucose (BG) needs to be checked regularly, and insulin doses adjusted every 1-3 days!

- Coordination of blood glucose testing, meal consumption and insulin administration is important. A customized care plan is needed for each patient.

- Hypoglycemia is a BG less than 4.0 mmol/L. The patient may or may not be symptomatic. Recognizing the signs and symptoms of hypoglycemia along with routine testing can support early recognition and treatment of a hypoglycemic event. Treatment of hypoglycemia in a conscious patient with 15 grams of fast-acting carbohydrate is typically sufficient for most patients. Early recognition and treatment can prevent a severe hypoglycemic event for the patient.

- Hyperglycemia is a BG above 10.0 mmol/L in hospital. Severe hyperglycemia (18.0 mmol/L and above) requires medical attention. Hyperglycemia can increase the patient's risk for: delayed wound healing, surgical site infections, hospital acquired infections (e.g. pneumonia) and mortality.

- The case studies provided, *Appendix H*, are a tool to help support these learnings and increase awareness of the use of subcutaneous BBIT.

Appendix A: Glossary of Terms

Basal Bolus Insulin therapy (BBIT)	Scheduled insulin dosing mimicking normal physiologic insulin secretion. Involves giving the right type of insulin, in the right dose, at the right time to meet the needs of a patient.
Basal Insulin	Scheduled long or intermediate-acting insulin given once or twice daily to cover the blood glucose the liver (and to a lesser extent the kidneys) makes naturally 24 hours a day.
Bolus (meal) Insulin	Scheduled rapid or short-acting insulin given prior to meals to cover the carbohydrate that will be broken down into glucose from the upcoming meal. It may also be used to cover glucose provided continuously, as in the case of continuous parenteral or enteral feeds.
Correction (supplemental) Insulin	Rapid or short-acting insulin given to correct unanticipated hyperglycemia. Can be given with meal insulin (patient eating) or on its own (patient NPO) when the blood glucose measurement is above target for that patient at that time. Ensures high glucose values are not left untreated.
Blood Glucose (BG)	The amount of available circulating glucose in the blood stream.
Diabetes Ketoacidosis (DKA)	Diabetic Ketoacidosis (DKA) is a diabetes emergency It is caused by a deficiency of insulin and elevated levels of counter-regulatory hormones. This ensuing hyperglycemia (resulting in a combination of osmotic diuresis, electrolyte abnormalities) and ketone production/acidosis, can lead to significant morbidity and mortality.
Frail Elderly Patients	Older adults assessed as physically and/or cognitively frail at risk for confusion, agitation or falls.
Hemoglobin A1c	Glycosylated hemoglobin – measure of glycemic control in previous 2-3 months. (Target for most patients is ≤ 7.0 %.)
Hypoglycemia	A Blood Glucose less than 4.0 mmol/L
Hypoglycemia Unawareness	The person has absent or diminished early warning signs and symptoms of hypoglycemia; loss of the adrenergic symptoms. Associated with recurrent hypoglycemia and increases risk of severe hypoglycemia. More common in T1DM.
Hyperglycemia	A Blood Glucose above 10.0 mmol/L, in hospital
Insulin Deficient Patients	Patients with Type 1 DM, Type 2 DM on insulin for more than 5 years, history of Diabetic ketoacidosis or pancreatectomy. *Prone to diabetic ketoacidosis (DKA) so they MUST always receive some exogenous (basal) insulin, even if fasting.*
Sliding Scale Insulin (SSI)	An insulin dosing regimen that treats hyperglycemia after it occurs.
Total Daily Dose (TDD) of insulin	The total number of all units of basal + bolus + correction insulin used in a 24 hour period.

Appendix B: AHS Provincial BBIT order set *(form #20889 electronic or form #19885 NCR)*

Alberta Health Services

Affix patient label within this box

Basal Bolus Insulin Therapy (BBIT)

Adult Inpatient Subcutaneous Insulin Order Set

1. Discontinue all previous insulin and blood glucose monitoring orders.
2. All adult subcutaneous BBIT insulin orders (except STAT orders) must be documented using this order set. Any change in insulin orders requires completion of a new BBIT order set (Stroke out entire page and initial, when starting new order set).
3. Orders marked with ☑ are active by default, unless crossed out and initialed by prescriber. Boxed orders (☐) require prescriber check mark (☑) to be initiated.

Blood Glucose (BG) Monitoring

☑ 4 times per day (15 - 30 minutes before scheduled meals and at bedtime), as well as PRN for suspected hypoglycemia
and: ☐ 0200h x _____ days ☐ 2 hours after meal time ☐ Other *(specify)* _____

☑ If BG less than 4.0 mmol/L initiate **Hypo**glycemia Procedure. **Do Not Hold Insulin without prescriber order**

☑ If BG greater than 18.0 mmol/L initiate **Hyper**glycemia Procedure and call prescriber

Total Daily Dose (TDD) ***See calculation instructions on reverse for Prescriber Guidance only***

Calculated TDD for this order *(Physician to use as guide for Basal, Bolus & Correction Calculations)* →

Basal Insulin

Home dose or ½ TDD (given initially as equal, twice daily doses at breakfast and bedtime; glargine may be given once daily)

Choose One Basal Insulin

☐ glargine *(Lantus®)*
☐ glargine *(Basaglar®)*
☐ detemir *(Levemir®)*
☐ HumuLIN® N

Units _____	Units _____
☐ With Breakfast or	☐ At Bedtime or
☐ Time *(hh:mm)* _____	☐ Time *(hh:mm)* _____

Bolus and Correction Insulin *Use the same insulin (rapid or short-acting) for bolus and correction.*

Choose One Bolus/Correction Insulin

☐ lispro *(HumaLOG®)* sc with meal
☐ aspart *(Novorapid®)* sc with meal
☐ HumuLIN® R sc 30 min before meal

Bolus Insulin *Home dose (consider reduction of 25-50% for hospital diet) or ⅓ TDD divided initially into 3 equal doses*

☑ **Hold if no caloric intake, NPO or bolus feeds stopped. Continue basal and correction insulin.**
☐ Patient may determine and administer own dose and report dose to nurse *(Order insulin type and acceptable dose range)*

Units _____	Units _____	Units _____	Units _____
☐ With Breakfast or feed at time *(hh:mm)* _____	☐ With Lunch or feed at time *(hh:mm)* _____	☐ With Dinner or feed at time *(hh:mm)* _____	☐ With Other _____ at time *(hh:mm)* _____

Correction for hyperglycemia: *Choose one based on current Total Daily Dose (TDD)*

☑ Correction dose to be determined and administered with/before meal/feed OR at scheduled mealtime if NPO. Bedtime dose not routinely recommended. Correction and bolus doses can be combined and administered as a single subcutaneous injection.

☐ TDD 15-30 units		☐ TDD 31-50 units		☐ TDD 51-80 units		☐ TDD 81 units or more		☐ Custom	
BG	Units	BG	Units	BG	Units	BG	Units	BG	Units
4.1-10.0	+0	4.1-9.0	+0	4.1-10.0	+0	4.1-9.0	+0		
10.1-14.0	+1	9.1-12.0	+1	10.1-12.0	+2	9.1-11.0	+2		
14.1-18.0	+2	12.1-15.0	+2	12.1-14.0	+3	11.1-13.0	+4		
		15.1-18.0	+3	14.1-16.0	+4	13.1-15.0	+6		
				16.1-18.0	+5	15.1-17.0	+8		
						17.1-18.0	+10		

Prescriber Name *(print)*	Signature	Date *(yyyy-Mon-dd)*	Time *(hh:mm)*

20889(Rev2019-04)

Covenant Health BBIT Order Set *(form #CV 0701)*

Covenant Health

Basal Bolus Insulin Therapy (BBIT)
Adult Inpatient Subcutaneous Insulin Order Set

Affix patient label within this box

1. **Allergies**: Check Caution Record before ordering.
2. Shaded box ■ indicates mandatory orders.
3. Open boxes left blank ☐ will not be processed.
4. Orders may be deleted by a single stroke through the order and initialing the deletion.

Do Not Write in This Space – Will Not Scan

Do Not Write in This Space – Will Not Scan

Date: _____ Time: _____ Weight (kg): _____

■ Discontinue ALL previous insulin and bedside blood glucose monitoring orders
■ **IF** previous BBIT order set filled out: Stroke out entire page and Initial, before starting new BBIT order set

Blood Glucose (BG) Monitoring:

■ 4 times per day (15 – 30 minutes before scheduled mealtimes or time of feed and at bedtime)
AND as needed for suspected **hypo**glycemia
AND ☐ at 0200 hours X _____ days ☐ 2 hours after meals ☐ Other: _____

ALERT	■ **IF** BG less than 4.0 mmol/L, initiate **Hypo**glycemia Procedure DO NOT HOLD INSULIN WITHOUT PRESCRIBER ORDER ■ **IF** BG greater than 18.0 mmol/L, initiate **Hyper**glycemia Procedure, **AND** Call Prescriber

Total Daily Dose (TDD) of Insulin: *An **ESTIMATION** for Basal, Bolus & Correction Calculations, see reverse for instructions*

Calculated Total Daily Dose (TDD) for this order → _____ units

Basal Insulin: *Do NOT hold Basal Insulin if skipping a meal, or for hypoglycemia* WITHOUT PRESCRIBER ORDER
(Home dose or ½ TDD)

Choose **ONE** Basal Insulin:	_____ Units subcutaneous	_____ Units subcutaneous
☐ insulin glargine (Lantus®) ☐ insulin glargine (Basaglar®) ☐ insulin detemir (Levemir®) ☐ insulin NPH (human) (HumuLIN® N)	☐ With Breakfast **OR** ☐ at _____ hours	☐ At Bedtime **OR** ☐ at _____ hours

Bolus and Correction Insulin:

Choose **ONE** insulin **for BOTH** Bolus **and** Correction Insulin:
☐ insulin lispro (HumaLOG®) subcutaneous with meal
☐ insulin aspart (Novorapid®) subcutaneous with meal
☐ insulin regular (human) (HumuLIN® R) subcutaneous 30 minutes before meal

Bolus Insulin: *Home dose (consider reduction of 25-50% for hospital diet) or ½ TDD divided initially into 3 equal doses*

■ **IF** no caloric intake, or nothing by mouth (NPO), or feeds stopped, **HOLD** Bolus Insulin dose
AND ■ **Continue** Basal Insulin, *AND* Correction Insulin (*if required*)

_____ Units	_____ Units	_____ Units	_____ Units
☐ With Breakfast	☐ With Lunch	☐ With Dinner	☐ With Other _____
OR ☐ feed at _____ hours	**OR** ☐ feed at _____ hours	**OR** ☐ feed at _____ hours	at _____ hours

Correction Dosing for Hyperglycemia: Choose **ONE** Correction Regimen based on calculated TDD

☐ TDD **15 – 30** units		☐ TDD **31 – 50** units		☐ TDD **51 – 80** units		☐ TDD **81 units or more**		☐ Custom	
BG	Units	BG	Units	BG	Units	BG	Units	BG	Units
4.1 – 10.0	+ 0	4.1 – 9.0	+ 0	4.1 – 10.0	+ 0	4.1 – 9.0	+ 0		
10.1 – 14.0	+ 1	9.1 – 12.0	+ 1	10.1 – 12.0	+ 2	9.1 – 11.0	+ 2		
14.1 – 18.0	+ 2	12.1 – 15.0	+ 2	12.1 – 14.0	+ 3	11.1 – 13.0	+ 4		
		15.1 – 18.0	+ 3	14.1 – 16.0	+ 4	13.1 – 15.0	+ 6		
				16.1 – 18.0	+ 5	15.1 – 17.0	+ 8		
						17.1 – 18.0	+ 10		

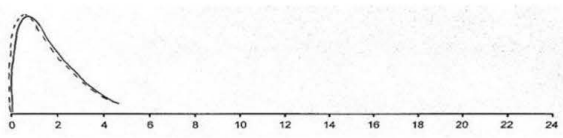
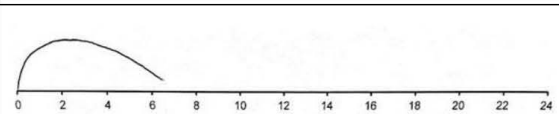
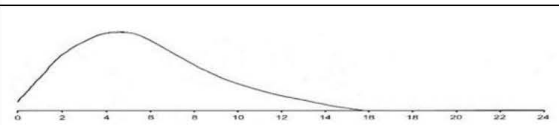
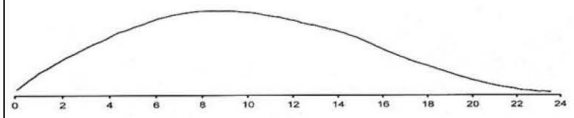
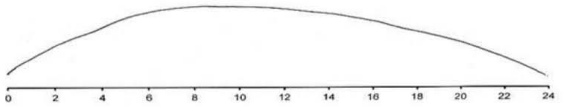
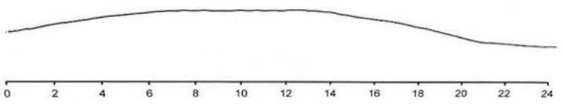
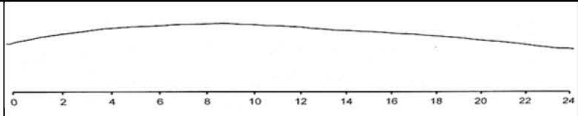
■ **Combine** the Correction dose (*if required*) AND Bolus dose
and **Administer** as ONE single subcutaneous injection with/before mealtime OR time of feed.
(Bedtime Correction Dose is not routinely recommended)
■ **IF** NPO, Hold Bolus Insulin dose
AND Continue Basal Insulin, *AND* Correction Insulin (*if required*) with/before mealtime OR time of feed.

Prescriber's Printed Name: _____ Prescriber's Signature: _____

Appendix C: Provincial Pharmacy Formulary Insulin used with BBIT

Alberta Health Services

Insulin Action Comparison Chart

Insulin Types	Average Insulin Action Profile
Rapid Acting (Clear) • **Insulin aspart (*NovoRapid®)** • Insulin glulisine (Apidra®) • **Insulin lispro** (Admelog®, ***Humalog®**) Onset 15 minutes, Action peaks 1-3 hours, Duration 3-5 hours • Faster insulin aspart (Fiasp® - dashed line) Onset 5-15 minutes, Peak 1-3 hours, Duration 3-5 hours	
Short Acting (Clear) • Insulin regular (human) (***Humulin R®,** Novolin ge Toronto®) Onset ½ -1 hour, Peak 2-4 hours, Duration 6-8 hours	
Intermediate Acting (Cloudy) • **Insulin isophane** (***Humulin N®,** Novolin ge NPH®) Onset 1-2 hours, Peak 5-8 hours, Duration 14-18 hours	
Long Acting- Detemir (Clear) • **Insulin detemir (*Levemir®)** Onset 1.5 hours, No peak, Duration 16-24 hours	
Long Acting- Glargine (Clear) • **Insulin glargine (*Lantus®, *Basaglar ®)** Onset 1.5 hours, No peak, Duration 24 hours	
Long Acting- Glargine 300 (Clear) • Insulin glargine, 300 units/mL (Toujeo®) No peak, Duration up to 36 hours	
Ultra-long Acting (Clear) • Insulin degludec (Tresiba®) No peak, Duration 42 hours	

***Available on AHS formulary**

Appendix D: AHS Blood Glucose and Insulin Administration Record *(form #20115)*

Alberta Health Services

Blood Glucose and Subcutaneous Insulin Record

Affix patient label within this box

Reminder: Blood Glucose Target: **5.0 - 10.0 mmol/L**;
Physician to titrate insulin every 1-2 days to achieve targets
BG = blood glucose MPR = multidisciplinary progress record
*Bolus and correction insulin is not routinely recommended at bedtime unless it is given with an overnight scheduled feed or a specific MD STAT order

Date *(yyyy-Mon-dd)*	**Breakfast** *(or morning feed)*	**Lunch** *(or lunch feed)*	**Dinner** *(or evening feed)*	**Bedtime** *(or overnight feed)*	**Additional**
Time BG Taken *(hh:mm)*					
Glucometer Result					
Basal Insulin ***(choose one)*** ☐ Glargine *(Lantus®)* ☐ HumuLIN® N ☐ Glargine *(Basaglar®)* ☐ Detemir *(Levemir®)*	_____ units	_____ units	_____ units	_____ units	
Bolus and Correction Insulin* ***(choose one)***					
☐ Lispro ☐ Aspart ☐ HumuLIN® R — **Bolus Insulin**	_____ units	_____ units	_____ units	_____ units*	
☐ Lispro ☐ Aspart ☐ HumuLIN® R — **Correction Insulin**	_____ units	_____ units	_____ units	_____ units*	_____ units
Other Insulin *(specify)*	_____ units	_____ units	_____ units	_____ units	_____ units
Time Administered *(hh:mm)*					
Site Administered					
Signature					
Comments/Additional Tests *(Snacks,changes in meals due to test, etc.) Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.*	☐ See MPR for additional information				

Date *(yyyy-Mon-dd)*	**Breakfast** *(or morning feed)*	**Lunch** *(or lunch feed)*	**Dinner** *(or evening feed)*	**Bedtime** *(or overnight feed)*	**Additional**
Time BG Taken *(hh:mm)*					
Glucometer Result					
Basal Insulin ***(choose one)*** ☐ Glargine *(Lantus®)* ☐ HumuLIN® N ☐ Glargine *(Basaglar®)* ☐ Detemir *(Levemir®)*	_____ units	_____ units	_____ units	_____ units	
Bolus and Correction Insulin* ***(choose one)***					
☐ Lispro ☐ Aspart ☐ HumuLIN® R — **Bolus Insulin**	_____ units	_____ units	_____ units	_____ units*	
☐ Lispro ☐ Aspart ☐ HumuLIN® R — **Correction Insulin**	_____ units	_____ units	_____ units	_____ units*	_____ units
Other Insulin *(specify)*	_____ units	_____ units	_____ units	_____ units	_____ units
Time Administered *(hh:mm)*					
Site					
Signature					
Comments/Additional Tests *(Snacks,changes in meals due to test, etc.) Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.*	☐ See MPR for additional information				

20115(Rev2019-04) Side A

Covenant Health Blood Glucose and Insulin Administration Record *(form #CV 0609)*

Covenant Health

Affix patient label within this box

Blood Glucose and Subcutaneous Insulin Record

Reminder: Blood Glucose Target: **5.0 - 10.0 mmol/L**;
Prescriber to titrate insulin every 1-2 days to achieve blood glucose target
MPR = multidisciplinary progress record
*Bolus and correction insulin is not routinely recommended at bedtime unless it is given with an overnight scheduled feed or a specific prescriber STAT order

Date *(yyyy-Mon-dd)*	**Breakfast** *(or morning feed)*	**Lunch** *(or lunch feed)*	**Dinner** *(or evening feed)*	**Bedtime** *(or overnight feed)*	**Additional**
Time Blood Glucose Taken *(hh:mm)*					
Glucometer Result					
Basal Insulin *(choose one)* ☐ glargine *(Lantus®)* ☐ HumuLIN® N ☐ glargine *(Basaglar®)* ☐ detemir *(Levemir®)*	_____ units	_____ units	_____ units	_____ units	
Bolus and Correction Insulin* *(choose one)*					
☐ lispro ☐ aspart ☐ HumuLIN® R — **Bolus Insulin**	_____ units	_____ units	_____ units	_____ units*	
☐ lispro ☐ aspart ☐ HumuLIN® R — **Correction Insulin**	_____ units	_____ units	_____ units	_____ units*	_____ units
Other Insulin *(specify)*	_____ units	_____ units	_____ units	_____ units	_____ units
Time Administered *(hh:mm)*					
Site Administered					
Signature					
Comments/Additional Tests *(Snacks,changes in meals due to test, etc.)* ***Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.***	☐ See MPR for additional information				

Date *(yyyy-Mon-dd)*	**Breakfast** *(or morning feed)*	**Lunch** *(or lunch feed)*	**Dinner** *(or evening feed)*	**Bedtime** *(or overnight feed)*	**Additional**
Time Blood Glucose Taken *(hh:mm)*					
Glucometer Result					
Basal Insulin *(choose one)* ☐ glargine *(Lantus®)* ☐ HumuLIN® N ☐ glargine *(Basaglar®)* ☐ detemir *(Levemir®)*	_____ units	_____ units	_____ units	_____ units	
Bolus and Correction Insulin* *(choose one)*					
☐ lispro ☐ aspart ☐ HumuLIN® R — **Bolus Insulin**	_____ units	_____ units	_____ units	_____ units*	
☐ lispro ☐ aspart ☐ HumuLIN® R — **Correction Insulin**	_____ units	_____ units	_____ units	_____ units*	_____ units
Other Insulin *(specify)*	_____ units	_____ units	_____ units	_____ units	_____ units
Time Administered *(hh:mm)*					
Site					
Signature					
Comments/Additional Tests *(Snacks,changes in meals due to test, etc.)* ***Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.***	☐ See MPR for additional information				

CV-0690 (2019/5)

Page 1 of 2

Appendix E: AHS Proper Use of Insulin Pens

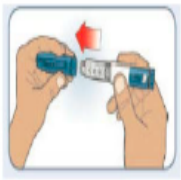
ONE PEN, ONE PATIENT

Insulin Pen – Quick Reference Guide
(for administration of dose by staff)

Alberta Health Services

1. Prepare pen for use

a. Break safety seal and pull off cap.



b. Check correct insulin type, expiry date and appearance.

If insulin is cloudy, gently roll pen and invert 10-20 times to ensure even mixing.

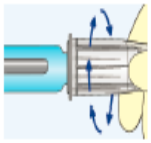
c. Swab rubber seal on end of pen with alcohol swab.

2. Attach BD AutoShield ™ Duo safety engineered needle

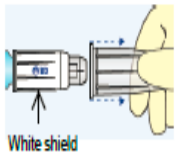
a. Remove peel tab from pen needle.

b. Holding the outer cover, push and twist the pen needle onto the pen in a clockwise direction until it meets resistance.

c. Do not overtighten.



d. Pull ONLY the outer cover straight off.



DO NOT touch the white shield prior to injection. Any pressure on the shield may cause the safety mechanism to lock, making the needle unusable.

3. Prprime pen

a. Before every injection the insulin flow must be checked.

b. Set dose to 2 units by turning dose button at end of pen.

c. Hold pen with needle pointing upwards. Tap gently to remove air bubbles.

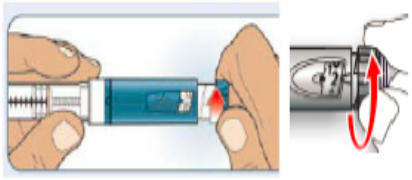
d. Push the injection button on the end of pen.

e. Look for a stream or drop of insulin.

If no insulin is seen at needle tip, repeat priming process.

4. Select insulin dose

a. Turn dose button until the prescribed dose lines up with the dose indicator.



Adapted from a toolkit developed by University Health Network (UHN) and Hamilton Health Sciences (HHS)

5. Perform injection

a. Insert the needle straight into flat skin at a 90-degree angle until the clear outer shield retracts and the white sleeve is flush with the skin.

Wait to hear a click before beginning to deliver the dose.

b. Maintain constant pressure against skin, then deliver dose by depressing dose button with your thumb.

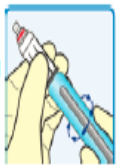
c. Hold for 10 seconds while continuing to press the button.

d. Ensure entire dose has been given (check dial is at zero) then lift pen away from skin.

6. Remove and dispose of pen needle

a. The needle shield will automatically lock in place. A red band shows the safety shield is locked.

b. Remove needle from pen by holding the white shield and twisting the pen counter-clockwise.



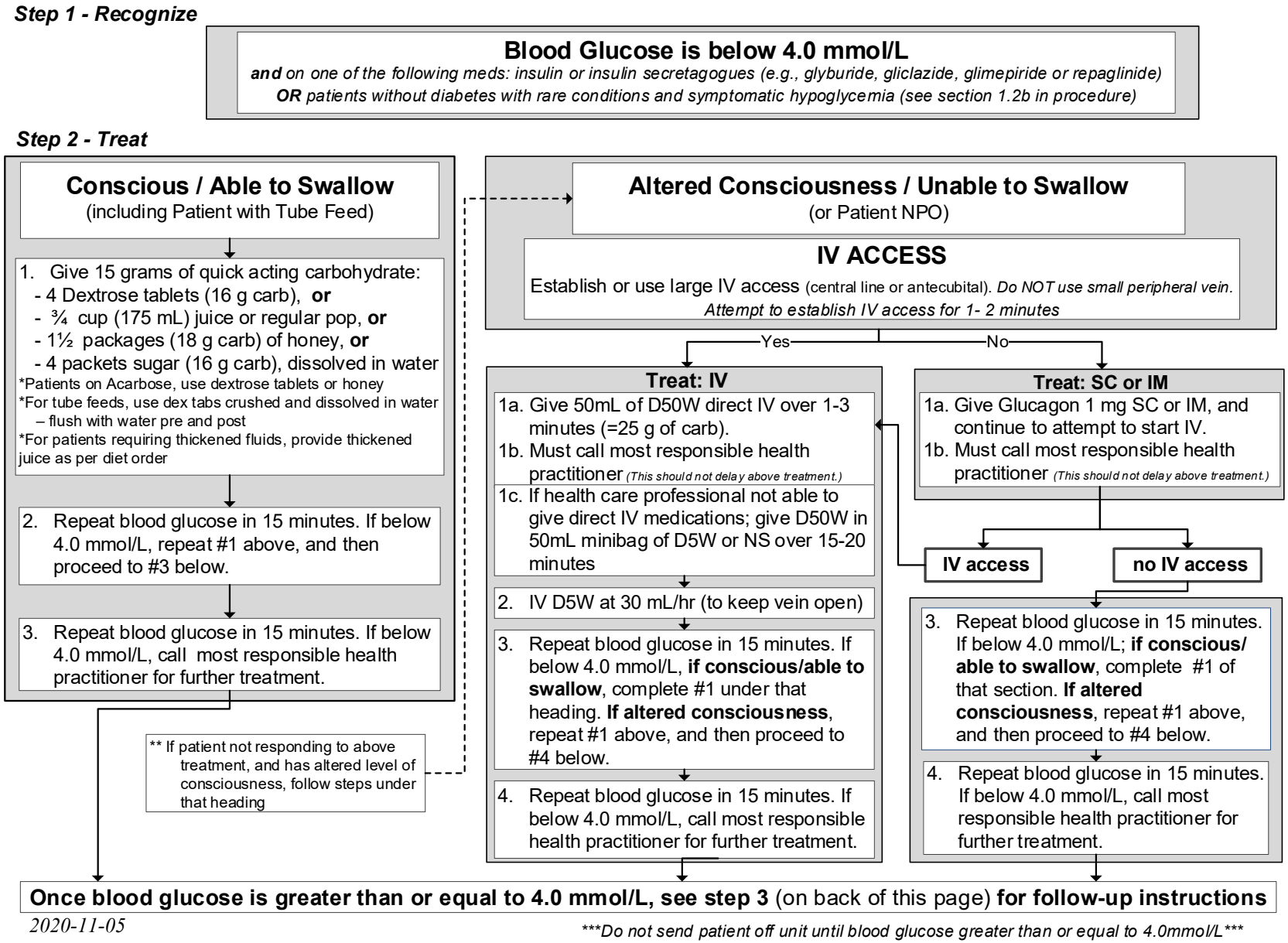
Do NOT place your fingers on either end of the pen needle shields.

c. Dispose of used needle in sharps container.

d. Recap the pen, clean as per site processes, and return to storage location.

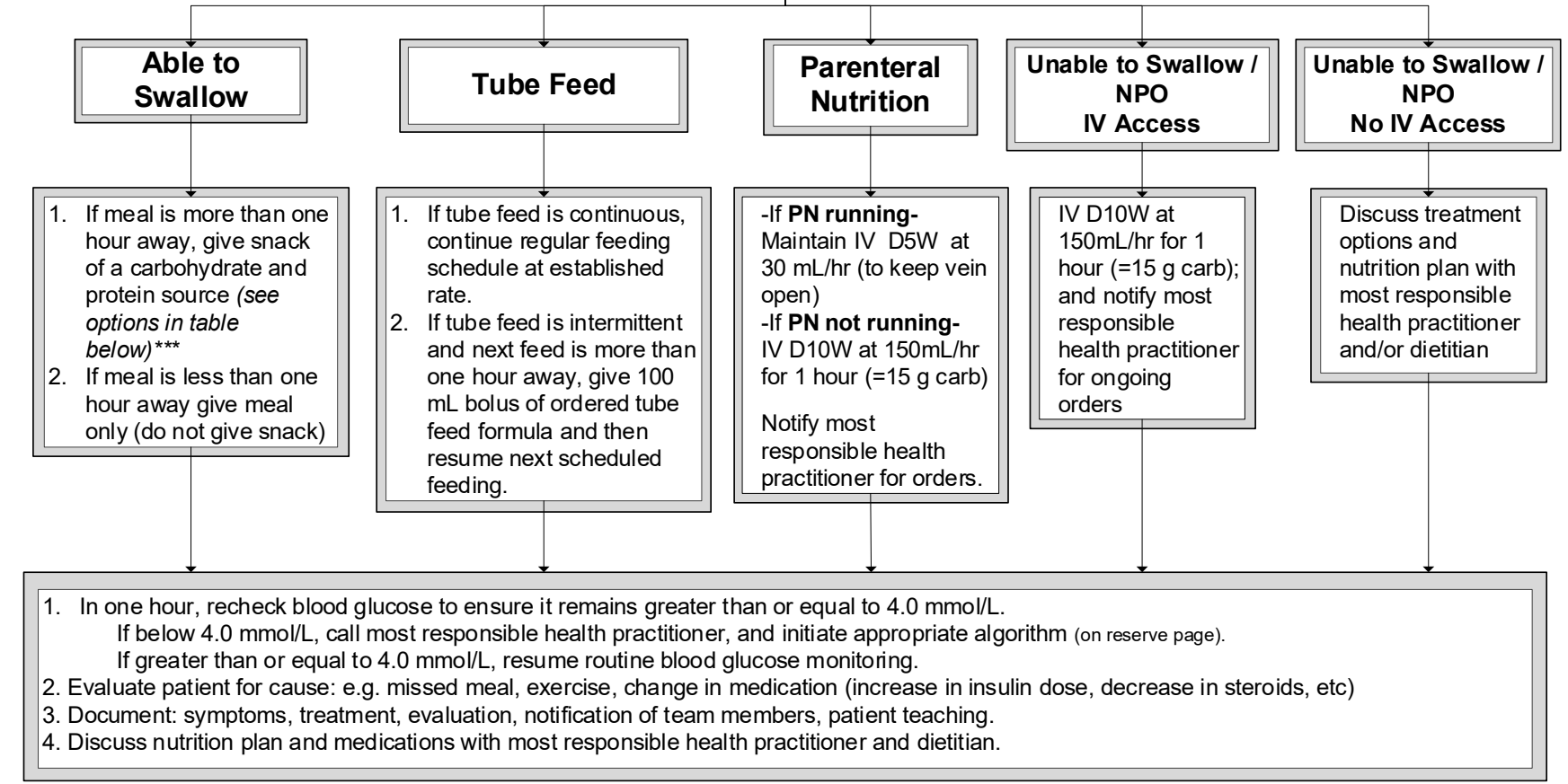
Appendix F: Adult Hypoglycemia Treatment Algorithm

*** This algorithm is part of the provincial glycemic management policy suite.*



Step 3 – Follow-Up

This section outlines follow-up instructions for patients who have blood glucose **greater than or equal to 4.0 mmol/L** after hypoglycemia treatment.



1. In one hour, recheck blood glucose to ensure it remains greater than or equal to 4.0 mmol/L.
   If below 4.0 mmol/L, call most responsible health practitioner, and initiate appropriate algorithm (on reserve page).
   If greater than or equal to 4.0 mmol/L, resume routine blood glucose monitoring.
2. Evaluate patient for cause: e.g. missed meal, exercise, change in medication (increase in insulin dose, decrease in steroids, etc)
3. Document: symptoms, treatment, evaluation, notification of team members, patient teaching.
4. Discuss nutrition plan and medications with most responsible health practitioner and dietitian.

*** **SUGGESTED SNACK OPTIONS OF APPROXIMATELY 15 grams OF CARBOHYDRATE AND A PROTEIN SOURCE**: Choose only 1 of the following:

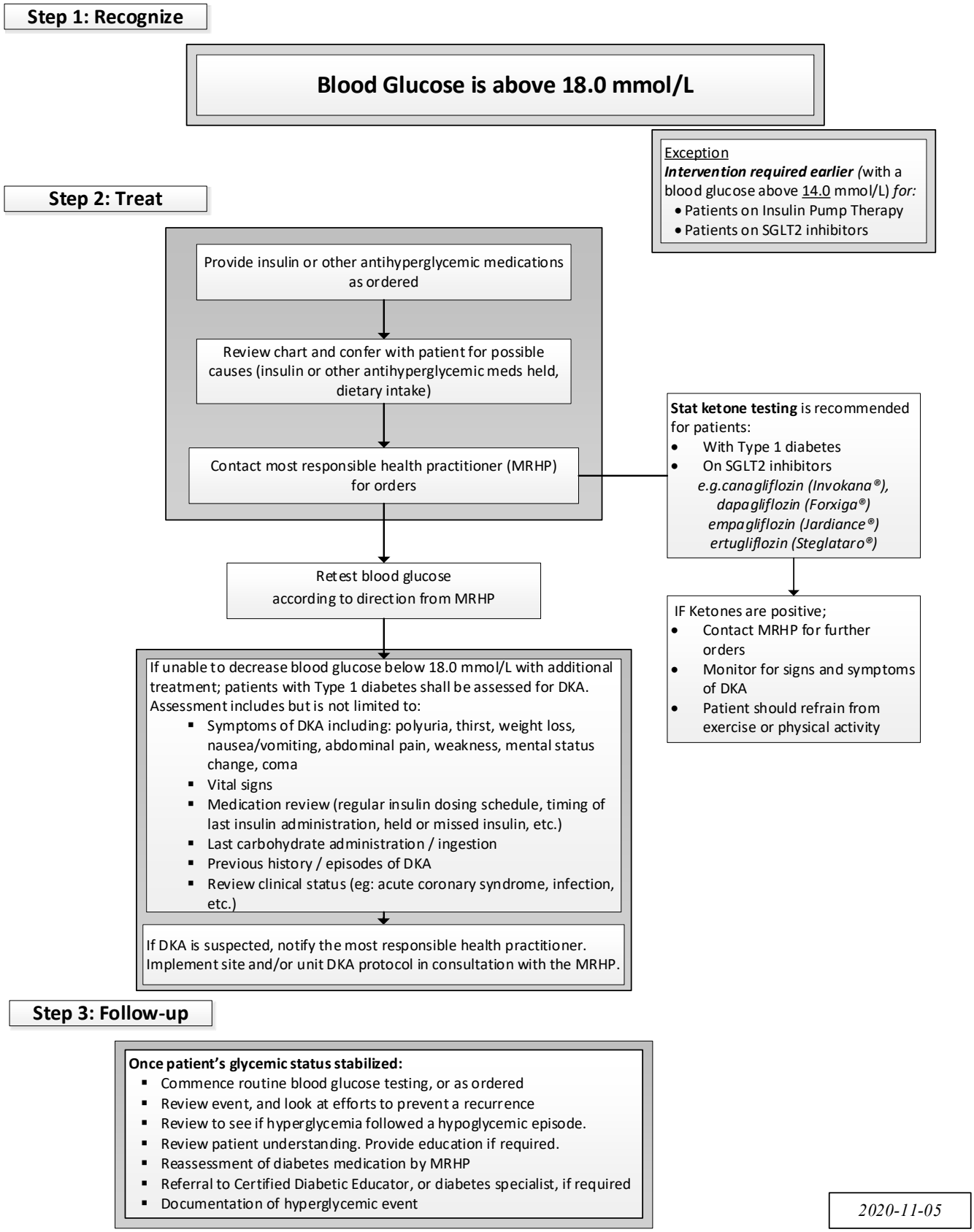
- 3 packages of soda crackers (2 crackers per package) with 1 package of peanut butter (1 Tbsp or 15 g) or 1 package of cheese (1 oz or 30 g)
- 2 packages of arrowroot cookies (2 cookies per package) with 1 package of peanut butter (1 Tbsp or 15 g) or 1 package of cheese (1 oz or 30 g)
- 1 slice of toast/bread with 1 package of peanut butter (1 Tbsp or 15 g) or 1 package of cheese (1 oz or 30 g)
- Half a meat or cheese sandwich (1 slice of bread and 1oz [30g] of meat or cheese) –*may not be available at all locations*
- 1 container of smooth Greek yogurt (100g)

***For patients with dysphagia on a dysphagia soft/ minced /pureed diet(s) provide if available: 1 container Ensure/Boost pudding (113g/142g) or 1 container of smooth Greek yogurt (100 g). If not available; discuss appropriate snack options with dietitian and/or food service.

2020-11-05

Appendix G: Adult Hyperglycemia Treatment Algorithm

** This algorithm is part of the provincial glycemic management policy suite.*



Appendix H: Case Studies

Case Study 1 - Mr. Young

Day 1

Mr. Young, is a 59 year old male admitted to your unit for an upcoming GI scope. His medical history includes a diagnosis of Type 2 Diabetes Mellitus (T2DM). He is on BBIT for his insulin regime, see page 39.
Insulin orders as follows:

- Basal insulin is 24 units of insulin NPH (HumuLIN N) at breakfast and bedtime.
- Bolus insulin is 16 units of lispro (HumaLOG) with meals.

At 2130, his blood glucose is 7.8mmol/L.

1. *What insulin dose(s) are to be administered?*

2. *Explain the steps of using the patient specific insulin pen to administer the insulin dose. (Refer to appendix B and C of the Self-Study Guide)*

Case Study 1- Mr. Young Order Set

Alberta Health Services

CASE STUDY #1

Affix patient label within this box

MR. YOUNG

Basal Bolus Insulin Therapy (BBIT)

Adult Inpatient Subcutaneous Insulin Order Set

1. Discontinue all previous insulin and blood glucose monitoring orders.
2. All adult subcutaneous BBIT insulin orders (except STAT orders) must be documented using this order set. Any change in insulin orders requires completion of a new BBIT order set (Stroke out entire page and initial, when starting new order set).
3. Orders marked with ☑ are active by default, unless crossed out and initialed by prescriber. Boxed orders (☐) require prescriber check mark (☑) to be initiated.

Blood Glucose (BG) Monitoring

☑ 4 times per day (15 - 30 minutes before scheduled meals and at bedtime), as well as PRN for suspected hypoglycemia
and: ☐ 0200h x _____ days ☐ 2 hours after meal time ☐ Other *(specify)* _____
☑ If BG less than 4.0 mmol/L initiate **Hypo**glycemia Procedure. **Do Not Hold Insulin without prescriber order**
☑ If BG greater than 18.0 mmol/L initiate **Hyper**glycemia Procedure and call prescriber

Total Daily Dose (TDD) ***See calculation instructions on reverse for Prescriber Guidance only***

Calculated TDD for this order *(Physician to use as guide for Basal, Bolus & Correction Calculations)* → 96

Basal Insulin

Home dose or ½ TDD (given initially as equal, twice daily doses at breakfast and bedtime; glargine may be given once daily)

Choose One Basal Insulin

☐ glargine *(Lantus®)*
☐ glargine *(Basalgar®)*
☐ detemir *(Levemir®)*
☒ HumuLIN® N

Units 24	Units 24
☒ With Breakfast or	☒ At Bedtime or
☐ Time *(hh:mm)* _____	☐ Time *(hh:mm)* _____

Bolus and Correction Insulin *Use the same insulin (rapid or short-acting) for bolus and correction.*

Choose One Bolus/Correction Insulin

☒ lispro *(HumaLOG®)* sc with meal
☐ aspart *(Novorapid®)* sc with meal
☐ HumuLIN® R sc 30 min before meal

Bolus Insulin *Home dose (consider reduction of 25-50% for hospital diet) or ½ TDD divided initially into 3 equal doses*

☑ **Hold if no caloric intake, NPO or bolus feeds stopped. Continue basal and correction insulin.**
☐ Patient may determine and administer own dose and report dose to nurse *(Order insulin type and acceptable dose range)*

Units 16	Units 16	Units 16	Units _____
☒ With Breakfast or feed at time *(hh:mm)* _____	☒ With Lunch or feed at time *(hh:mm)* _____	☒ With Dinner or feed at time *(hh:mm)* _____	☐ With Other _____ at time *(hh:mm)* _____

Correction for hyperglycemia: *Choose one based on current Total Daily Dose (TDD)*

☑ Correction dose to be determined and administered with/before meal/feed OR at scheduled mealtime if NPO. Bedtime dose not routinely recommended. Correction and bolus doses can be combined and administered as a single subcutaneous injection.

☐ TDD 15-30 units		☐ TDD 31-50 units		☐ TDD 51-80 units		☒ TDD 81 units or more		☐ Custom	
BG	Units	BG	Units	BG	Units	BG	Units	BG	Units
4.1-10.0	+0	4.1-9.0	+0	4.1-10.0	+0	4.1-9.0	+0		
10.1-14.0	+1	9.1-12.0	+1	10.1-12.0	+2	9.1-11.0	+2		
14.1-18.0	+2	12.1-15.0	+2	12.1-14.0	+3	11.1-13.0	+4		
		15.1-18.0	+3	14.1-16.0	+4	13.1-15.0	+6		
				16.1-18.0	+5	15.1-17.0	+8		
						17.1-18.0	+10		

Prescriber Name *(print)*	Signature	Date *(yyyy-Mon-dd)*	Time *(hh:mm)*

20889(Rev2019-04)

Case Study 1: Day 2 - Mr. Young 59 year old male, T2DM

Mr. Young is **NPO** for an upcoming GI scope. His BBIT insulin regimen remains the same.

- Basal insulin is 24 units of N (HumuLIN N) at breakfast and bedtime.
- Bolus insulin is 16 units of lispro (HumaLOG) with meals.

At 0815 his blood glucose reading is 9.2 mmol/L. The meal tray is to arrive on the unit at 0830. *Based on the BBIT order set and patient's nutritional status:*

1. What insulin or insulins will be administered with breakfast?

2. When will the next bolus/correction dose of insulin be required?

Upon return from his scope the patient has an order to resume his regular diet once his gag reflex returns. At 1755, Mr. Young requests if he can have something to drink and tells you he is very thirsty and has peed twice in the last hour. Meal tray is to be delivered at 1800h (*Mr. Young has been assessed and his gag reflex has returned)*.

3. What do you think is occurring?

4. At 1755h, his blood glucose is 14.6 mmol/L. What further action is needed?

5. At 2200h before bed the BG level is 10.3 mmol/L. What insulin doses will be administered?

Case Study 2 - Ms. Smith

Day 1

Ms. Smith is a 36 year old woman admitted to your unit with pneumonia. Her medical history includes a diagnosis of Type 1 Diabetes Mellitus (T1DM). She is on a BBIT insulin regimen, based on her home insulin doses. See page 42.

- Basal insulin is 14 units of glargine (Lantus) once daily at bedtime.
- Bolus insulin is 5 units of lispro (HumaLOG) with meals.

1. What information would you need to include as part of your nursing assessment data?

At 1725, you come into check Ms. Smith's blood glucose she tells you she feels sick and nauseated and does not want to eat supper

2. What could be the cause of the nausea?

3. At 1725, her blood glucose is 9.1 mmol/L. *Based on the BBIT order set and patient not eating:*
    a. What insulin or insulins will be administered with supper?

    b. When will the next insulin(s) be required?

At 2130, you check her bedtime blood glucose and it is 9.5 mmol/L. Ms. Smith tells you she is still sick and nauseated but is able to drink some water.

4. Based on the BBIT order set, what insulin or insulins will be administered at bedtime?

Case Study 2- Ms. Smith

Alberta Health Services

CASE STUDY #2

Affix patient label within this box

MS. SMITH

Basal Bolus Insulin Therapy (BBIT)

Adult Inpatient Subcutaneous Insulin Order Set

1. Discontinue all previous insulin and blood glucose monitoring orders.
2. All adult subcutaneous BBIT insulin orders (except STAT orders) must be documented using this order set. Any change in insulin orders requires completion of a new BBIT order set (Stroke out entire page and initial, when starting new order set).
3. Orders marked with ☑ are active by default, unless crossed out and initialed by prescriber. Boxed orders (☐) require prescriber check mark (☑) to be initiated.

Blood Glucose (BG) Monitoring

☑ 4 times per day (15 - 30 minutes before scheduled meals and at bedtime), as well as PRN for suspected hypoglycemia
and: ☐ 0200h x _____ days ☐ 2 hours after meal time ☐ Other *(specify)* _____
☑ If BG less than 4.0 mmol/L initiate **Hypo**glycemia Procedure. **Do Not Hold Insulin without prescriber order**
☑ If BG greater than 18.0 mmol/L initiate **Hyper**glycemia Procedure and call prescriber

Total Daily Dose (TDD) ***See calculation instructions on reverse for Prescriber Guidance only***

Calculated TDD for this order *(Physician to use as guide for Basal, Bolus & Correction Calculations)* → 29

Basal Insulin

Home dose or ½ TDD (given initially as equal, twice daily doses at breakfast and bedtime; glargine may be given once daily)

Choose One Basal Insulin

☒ glargine *(Lantus®)*
☐ glargine *(Basalgar®)*
☐ detemir *(Levemir®)*
☐ HumuLIN® N

Units _____	Units 14
☐ With Breakfast or	☒ At Bedtime or
☐ Time *(hh:mm)* _____	☐ Time *(hh:mm)* _____

Bolus and Correction Insulin *Use the same insulin (rapid or short-acting) for bolus and correction.*

Choose One Bolus/Correction Insulin

☒ lispro *(HumaLOG®)* sc with meal
☐ aspart *(Novorapid®)* sc with meal
☐ HumuLIN® R sc 30 min before meal

Bolus Insulin *Home dose (consider reduction of 25-50% for hospital diet) or ⅓ TDD divided initially into 3 equal doses*

☑ **Hold if no caloric intake, NPO or bolus feeds stopped. Continue basal and correction insulin.**
☐ Patient may determine and administer own dose and report dose to nurse *(Order insulin type and acceptable dose range)*

Units 5	Units 5	Units 5	Units _____
☒ With Breakfast or feed at time *(hh:mm)* _____	☒ With Lunch or feed at time *(hh:mm)* _____	☒ With Dinner or feed at time *(hh:mm)* _____	☐ With Other _____ at time *(hh:mm)* _____

Correction for hyperglycemia: *Choose one based on current Total Daily Dose (TDD)*

☑ Correction dose to be determined and administered with/before meal/feed OR at scheduled mealtime if NPO. Bedtime dose not routinely recommended. Correction and bolus doses can be combined and administered as a single subcutaneous injection.

☒ TDD 15-30 units		☐ TDD 31-50 units		☐ TDD 51-80 units		☐ TDD 81 units or more		☐ Custom	
BG	Units	BG	Units	BG	Units	BG	Units	BG	Units
4.1-10.0	+0	4.1-9.0	+0	4.1-10.0	+0	4.1-9.0	+0		
10.1-14.0	+1	9.1-12.0	+1	10.1-12.0	+2	9.1-11.0	+2		
14.1-18.0	+2	12.1-15.0	+2	12.1-14.0	+3	11.1-13.0	+4		
		15.1-18.0	+3	14.1-16.0	+4	13.1-15.0	+6		
				16.1-18.0	+5	15.1-17.0	+8		
						17.1-18.0	+10		

Prescriber Name *(print)*	Signature	Date *(yyyy-Mon-dd)*	Time *(hh:mm)*
—	—	—	—

20889(Rev2019-04)

Case Study 2: Day 2 - Ms. Smith, 36 year old female with T1DM

The next day you come on to your shift and Ms. Smith rings the call bell around 1110 about 20 minutes before lunch. She complains of feeling unwell. You notice she is shaky and is diaphoretic.

1. What do you think is happening to your patient?

At 1115, her blood glucose is 3.8 mmol/L

2. What are the next steps?

You ask a colleague to bring you 4 Dextrose tabs. He comes back with 4 Dextrose tabs, 175 mL (3/4cup) of apple juice with 2 packages of added sugar and white toast with jam.

3. What are the steps for treatment of hypoglycemia? *1125- repeat BG level is 8.1 mmol/L*

4. What would you do if the patient developed an altered level of consciousness?

Case Study 2: Day 3 - Ms. Smith 36 year old female T1DM

The next day at 1140 you go into test Ms. Smith's blood glucose before lunch. Her blood glucose is 3.6 mmol/L. The patient tells you "I feel fine – not like how I felt yesterday - this happens sometimes".

1. What are your next steps?

2. What insulin dose will you administer when her lunch tray arrives at 1200 and what steps do you take after that?

3. What other actions would you consider as your patient has been hypoglycemic at the same time two days in a row?

Case Study 3 - Complete the Blood Glucose and Insulin Administration Record

Complete the blood glucose and insulin administration record with the information below and using the attached order set, see appendix C. The patient is able to eat all meals. On Day 2 the low blood glucose was treated with 4 Dextrose tabs.

Before Breakfast (Time)	0740	0745	0735	0737
BG	8.6 mmol/L	7.8 mmol/L	6.7 mmol/L	7.7 mmol/L
Before Lunch (Time)	1145	1130	1139	1142
BG	11.2 mmol/L	3.8 mmol/L	5.1 mmol/L	6.1 mmol/L
Before Supper (Time)	1724	1730	1730	1728
BG	10.2 mmol/L	9.6 mmol/L	13.1 mmol/L	9.1 mmol/L
Before Bedtime (Time)	2155	2150	2140	Discharged Home
BG	8.2 mmol/L	7.8 mmol/L	7.5 mmol/L	x
Other (Time)		1150		
BG		5.6 mmol/L		

Case Study 3- Order Set required to complete the BG and Insulin Administration Record

Alberta Health Services

CASE STUDY #3

Affix patient label within this box

Basal Bolus Insulin Therapy (BBIT)

Adult Inpatient Subcutaneous Insulin Order Set

1. Discontinue all previous insulin and blood glucose monitoring orders.
2. All adult subcutaneous BBIT insulin orders (except STAT orders) must be documented using this order set. Any change in insulin orders requires completion of a new BBIT order set (Stroke out entire page and initial, when starting new order set).
3. Orders marked with ☑ are active by default, unless crossed out and initialed by prescriber. Boxed orders (☐) require prescriber check mark (☑) to be initiated.

Blood Glucose (BG) Monitoring

☑ 4 times per day (15 - 30 minutes before scheduled meals and at bedtime), as well as PRN for suspected hypoglycemia
and: ☐ 0200h x _____ days ☐ 2 hours after meal time ☐ Other *(specify)* _____
☑ If BG less than 4.0 mmol/L initiate **Hypo**glycemia Procedure. **Do Not Hold Insulin without prescriber order**
☑ If BG greater than 18.0 mmol/L initiate **Hyper**glycemia Procedure and call prescriber

Total Daily Dose (TDD) ***See calculation instructions on reverse for Prescriber Guidance only***

Calculated TDD for this order *(Physician to use as guide for Basal, Bolus & Correction Calculations)* → 54

Basal Insulin

Home dose or ½ TDD (given initially as equal, twice daily doses at breakfast and bedtime; glargine may be given once daily)

Choose One Basal Insulin

☐ glargine *(Lantus®)*
☐ glargine *(Basalgar®)*
☒ detemir *(Levemir®)*
☐ HumuLIN® N

Units _____	Units 27
☐ With Breakfast or	☒ At Bedtime or
☐ Time *(hh:mm)* _____	☐ Time *(hh:mm)* _____

Bolus and Correction Insulin *Use the same insulin (rapid or short-acting) for bolus and correction.*

Choose One Bolus/Correction Insulin

☐ lispro *(HumaLOG®)* sc with meal
☐ aspart *(Novorapid®)* sc with meal
☐ HumuLIN® R sc 30 min before meal

Bolus Insulin *Home dose (consider reduction of 25-50% for hospital diet) or ⅓ TDD divided initially into 3 equal doses*

☑ **Hold if no caloric intake, NPO or bolus feeds stopped. Continue basal and correction insulin.**
☐ Patient may determine and administer own dose and report dose to nurse *(Order insulin type and acceptable dose range)*

Units 9	Units 9	Units 9	Units /
☒ With Breakfast or feed at time *(hh:mm)* _____	☒ With Lunch or feed at time *(hh:mm)* _____	☒ With Dinner or feed at time *(hh:mm)* _____	☐ With Other _____ at time *(hh:mm)* _____

Correction for hyperglycemia: *Choose one based on current Total Daily Dose (TDD)*

☑ Correction dose to be determined and administered with/before meal/feed OR at scheduled mealtime if NPO. Bedtime dose not routinely recommended. Correction and bolus doses can be combined and administered as a single subcutaneous injection.

☐ TDD 15-30 units		☐ TDD 31-50 units		☒ TDD 51-80 units		☐ TDD 81 units or more		☐ Custom	
BG	Units	BG	Units	BG	Units	BG	Units	BG	Units
4.1-10.0	+0	4.1-9.0	+0	4.1-10.0	+0	4.1-9.0	+0		
10.1-14.0	+1	9.1-12.0	+1	10.1-12.0	+2	9.1-11.0	+2		
14.1-18.0	+2	12.1-15.0	+2	12.1-14.0	+3	11.1-13.0	+4		
		15.1-18.0	+3	14.1-16.0	+4	13.1-15.0	+6		
				16.1-18.0	+5	15.1-17.0	+8		
						17.1-18.0	+10		

Prescriber Name *(print)*	Signature	Date *(yyyy-Mon-dd)*	Time *(hh:mm)*
—	—	—	—

20889(Rev2019-04)

Case Study 4 - Mr. Jones

Day 1

Mr. Jones is a 74 year old man admitted to your unit following a Coronary Artery Bypass Graph Surgery. He is day 3 post-operative. He has a medical history that includes Type 2 Diabetes (T2DM). He is on BBIT for his insulin regime, see page 48. Meals on this unit are served at 0815, 1145, 1715.

Insulin orders as follows:

- Basal insulin is 20 units of N (HumuLIN N) at breakfast and bedtime.
- Bolus insulin is 13 units of aspart (NovoRapid) with meals.

Mr. Jones is NPO this morning for a procedure. Mr. Jones' BG reading at 0755 is 7.8 mmol/L.

1. What insulin dose(s) is required this morning before the procedure?

Mr. Jones returns to his room at 0930 from his procedure. He is able to eat and would like his breakfast tray. What would you do?

When to Administer Insulin Outside of meal times:

- Check BG
- Administer bolus insulin + correction
- Give breakfast meal tray

- Lunch (2 hours later)
- Check BG
- Administer bolus insulin + correction
- Give lunch meal tray
- Monitor patient for symptoms of hypoglycemia

Case Study 4 - Mr. Jones Order set

Alberta Health Services

CASE STUDY #4

Affix patient label within this box

MR. JONES

Basal Bolus Insulin Therapy (BBIT)

Adult Inpatient Subcutaneous Insulin Order Set

1. Discontinue all previous insulin and blood glucose monitoring orders.
2. All adult subcutaneous BBIT insulin orders (except STAT orders) must be documented using this order set. Any change in insulin orders requires completion of a new BBIT order set (Stroke out entire page and initial, when starting new order set).
3. Orders marked with ☑ are active by default, unless crossed out and initialed by prescriber. Boxed orders (☐) require prescriber check mark (☑) to be initiated.

Blood Glucose (BG) Monitoring

☑ 4 times per day (15 - 30 minutes before scheduled meals and at bedtime), as well as PRN for suspected hypoglycemia
and: ☐ 0200h x _____ days ☐ 2 hours after meal time ☐ Other *(specify)* _____
☑ If BG less than 4.0 mmol/L initiate **Hypo**glycemia Procedure. **Do Not Hold Insulin without prescriber order**
☑ If BG greater than 18.0 mmol/L initiate **Hyper**glycemia Procedure and call prescriber

Total Daily Dose (TDD) ***See calculation instructions on reverse for Prescriber Guidance only***

Calculated TDD for this order *(Physician to use as guide for Basal, Bolus & Correction Calculations)* → 79

Basal Insulin
Home dose or ½ TDD (given initially as equal, twice daily doses at breakfast and bedtime; glargine may be given once daily)

Choose One Basal Insulin
☐ glargine *(Lantus®)*
☐ glargine *(Basalgar®)*
☐ detemir *(Levemir®)*
☒ HumuLIN® N

Units 20 ☒ With Breakfast or ☐ Time *(hh:mm)* _____

Units 20 ☒ At Bedtime or ☐ Time *(hh:mm)* _____

Bolus and Correction Insulin *Use the same insulin (rapid or short-acting) for bolus and correction.*

Choose One Bolus/Correction Insulin
☐ lispro *(HumaLOG®)* sc with meal
☒ aspart *(Novorapid®)* sc with meal
☐ HumuLIN® R sc 30 min before meal

Bolus Insulin *Home dose (consider reduction of 25-50% for hospital diet) or ½ TDD divided initially into 3 equal doses*

☑ **Hold if no caloric intake, NPO or bolus feeds stopped. Continue basal and correction insulin.**
☐ Patient may determine and administer own dose and report dose to nurse *(Order insulin type and acceptable dose range)*

Units 13 ☒ With Breakfast or feed at time *(hh:mm)* _____	Units 13 ☒ With Lunch or feed at time *(hh:mm)* _____	Units 13 ☒ With Dinner or feed at time *(hh:mm)* _____	Units _____ ☐ With Other _____ at time *(hh:mm)* _____

Correction for hyperglycemia: *Choose one based on current Total Daily Dose (TDD)*

☑ Correction dose to be determined and administered with/before meal/feed OR at scheduled mealtime if NPO. Bedtime dose not routinely recommended. Correction and bolus doses can be combined and administered as a single subcutaneous injection.

☐ TDD 15-30 units		☐ TDD 31-50 units		☒ TDD 51-80 units		☐ TDD 81 units or more		☐ Custom	
BG	Units	BG	Units	BG	Units	BG	Units	BG	Units
4.1-10.0	+0	4.1-9.0	+0	4.1-10.0	+0	4.1-9.0	+0		
10.1-14.0	+1	9.1-12.0	+1	10.1-12.0	+2	9.1-11.0	+2		
14.1-18.0	+2	12.1-15.0	+2	12.1-14.0	+3	11.1-13.0	+4		
		15.1-18.0	+3	14.1-16.0	+4	13.1-15.0	+6		
				16.1-18.0	+5	15.1-17.0	+8		
						17.1-18.0	+10		

Prescriber Name *(print)*	Signature	Date *(yyyy-Mon-dd)*	Time *(hh:mm)*
—	—	—	—

20889(Rev2019-04)

Answer Guide for Case Studies 1 - 4

Case Study 1 - Mr. Young Day 1 - Answer reference page 14, 20, Appendix B, Appendix E

1. Total Daily Dose= 96 units of insulin
   a. Basal= 24+24= 48
   b. Bolus= 16+16+16=48

   Mr. Young is to receive 24 units of HumuLIN N at bedtime. No correction or bolus needed at bedtime. BG is within target.

2. Steps to administering HumuLIN N
   - Find patient specific insulin pen- confirm correct medication
   - Gently roll the pen 10-20 times as medication is cloudy
   - Clean top of pen
   - Attach safety pen tip
   - Prime pen with 2 units
   - Shake off drops
   - Ensure the safety shield is retracted and the white area is flush with the skin a "**CLICK**" can be heard prior to delivering the dose
   - Administer dose to appropriate area
   - Count for 10 seconds
   - Remove device from administration site
   - Discard safety pen tip
   - Return pen
   - Document

Case Study 1- Day 2: Mr. Young- Answer reference page 14, 18, 19, Appendix B

1. What insulin will be administered with breakfast?
   - Basal: HumuLIN N 24 units
   - Bolus: 0 units
   - Correction: HumaLOG 2 units

2. Next bolus/correction insulin dose will be dependent on BG level at lunch. If BG in target no insulin required, if BG above target correction insulin to be administered. When gag reflex returns and assessed patient will need bolus insulin with meal.

3. Patient is symptomatic of hyperglycemia (moderate hyperglycemia BG 14.1-18.0 mmol/L)

4. 1755 - Patient requires insulin→ as patient able to eat, bolus + correction insulin to be administered. Basal insulin not scheduled until bedtime.
   - Basal: 0 units
   - Bolus: 16 units
   - Correction: 6 units

5. 2200- Patient requires basal insulin, no bolus, no correction
   - Basal: 24 units

- Bolus: 0 units
- Correction: Correction insulin is not typically recommended at bedtime.

Case Study 2 - Day 1: Ms. Smith - Answer reference page 8, 14, Appendix B

1. Patients with Type 1 Diabetes are at increased risk for:
    a. Hypoglycemia
    b. Diabetic Ketoacidosis (DKA)
    c. These patients always require basal insulin

2. What can cause Nausea & Vomiting?
    a. Hypoglycemia or hyperglycemia symptoms
    b. IV antibiotics or other medications
    c. Illness

3. 1725
    a. No insulin required. Call MD as patient dietary intake has changed. Holding insulin requires an order
        i. Basal: not needed until bedtime
        ii. Bolus: 0 units as patient refuses her meal tray
        iii. Correction: 0 units

    b. Insulin will be required at bedtime

4. Basal insulin Lantus 14 units required at bedtime
    Bolus- 0 units
    Correction- 0 units

Case Study 2 - Day 2: Ms. Smith- Answer reference page 23, Appendix F

1. The patient is symptomatic of hypoglycemia

2. Call for help and follow the hypoglycemia protocol

3. Follow the Hypoglycemia protocol… overtreatment of hypoglycemia can result in rebound hyperglycemia.
    - Recognize- Patient is symptomatic and has a low BG. Patient able to swallow and alert
    - Treatment- Provide 15 gram of quick acting carb (1 choice only)
    - Reassess- BG in 15 min (8.1 mmol/L as noted above)
    - It is lunch time; the patient should eat their meal and be given the bolus insulin (no correction required)
    - Repeat BG in 1 hour to ensure blood glucose remains above 4.0 mmol/L
    - Document and discuss with patient for possible causes:
        - Decreased meal intake in the morning
        - Illness
        - Medication

4. Follow protocol and administer glucagon OR D50W IV direct push – site/unit/area specific protocol
    - Contact Most responsible health practitioner immediately without delay of treatment

Case Study 2 - Day 3: Ms. Smith - Answer reference page 23, Appendix F

1. Follow the hypoglycemia protocol:
   - Recognize: Patient has no symptoms of hypoglycemia but is alert and able to be treated orally
   - Treat: 15 gm fast acting carbohydrate
   - Repeat BG in 15 min (BG is now 5.1 mmol/L)
   - Provide lunch tray

2. Provide lunch insulin and follow-up:
   - Basal- 0 units
   - Bolus- 5 units
   - Correction- 0 units
   - Follow Up:
     - Repeat a BG in 1 hour after hypoglycemic event
     - Document

3. Other actions:
   a. Follow up with patient for possible causes:
      - Diet
      - Nausea
      - Activity – e.g. physiotherapy
      - Medication
   b. Review hypoglycemic episodes with most responsible health practitioner for possible titration of insulin doses (possible decrease in morning bolus dose)

Case Study 3 - See page 52 and 53

Case Study 4 - Mr. Jones - Answer reference page 14 and 19

1. Morning of procedure:
   - Basal Insulin - 20 units HumuLIN N (unless most responsible health practitioner has ordered a different dose pre-procedure)
   - Bolus Insulin- 0 units on HOLD
   - Correction Insulin- 0 units

2. What would you do?
   - If unsure speak to charge RN or call MD for clarification
   - Check BG
   - Administer bolus insulin + correction
   - Eat breakfast meal tray
   - Lunch (2 hours later)
     - Check BG
     - Administer Lunch bolus + correction
     - Give lunch meal tray
   - Monitor patient for symptoms of hypoglycemia

Case Study 3- Completed BG and Insulin Administration Record

Alberta Health Services

Blood Glucose and Subcutaneous Insulin Record

CASE STUDY #3

Affix patient label within this box

1/2

Reminder: Blood Glucose Target: **5.0 - 10.0 mmol/L**;
Physician to titrate insulin every 1-2 days to achieve targets
BG = blood glucose MPR = multidisciplinary progress record
*Bolus and correction insulin is not routinely recommended at bedtime unless it is given with an overnight scheduled feed or a specific MD STAT order

Date (yyyy-Mon-dd) DAY 1	Breakfast (or morning feed)	Lunch (or lunch feed)	Dinner (or evening feed)	Bedtime (or overnight feed)	Additional
Time BG Taken (hh:mm)	0740	1145	1724	2155	
Glucometer Result	8.6	11.2	10.2	8.2	
Basal Insulin (choose one) ☐ Glargine (Lantus®) ☐ HumuLIN® N ☐ Glargine (Basalgar®) ☒ Detemir (Levemir®)	___ units	___ units	___ units	27 units	
Bolus and Correction Insulin* (choose one)					
☒ Lispro ☐ Aspart ☐ HumuLIN® R — Bolus Insulin	9 units	9 units	9 units	___ units*	
☐ Lispro ☐ Aspart ☐ HumuLIN® R — Correction Insulin	0 units	2 units	2 units	___ units*	___ units
Other Insulin (specify)	___ units	___ units	___ units	___ units	___ units
Time Administered (hh:mm)	0748	1152	1735	2206	
Site Administered	R Abdo	L abdo	R abdo	L abdo	
Signature	—	—	—	—	
Comments/Additional Tests (Snacks, changes in meals due to test, etc.) Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.	☐ See MPR for additional information				

Date (yyyy-Mon-dd) DAY 2	Breakfast (or morning feed)	Lunch (or lunch feed)	Dinner (or evening feed)	Bedtime (or overnight feed)	Additional
Time BG Taken (hh:mm)	0745	1130	1730	2150	1150
Glucometer Result	7.8	3.8	9.6	7.8	5.6
Basal Insulin (choose one) ☐ Glargine (Lantus®) ☐ HumuLIN® N ☐ Glargine (Basalgar®) ☐ Detemir (Levemir®)	___ units	___ units	___ units	27 units	
Bolus and Correction Insulin* (choose one)					
☐ Lispro ☐ Aspart ☐ HumuLIN® R — Bolus Insulin	9 units	9 units	9 units	___ units*	
☐ Lispro ☐ Aspart ☐ HumuLIN® R — Correction Insulin	0 units	0 units	0 units	___ units*	___ units
Other Insulin (specify)	___ units	___ units	___ units	___ units	___ units
Time Administered (hh:mm)	0800	1200	1738	2205	
Site	L abdo	R arm	R abdo	L abdo	
Signature					
Comments/Additional Tests (Snacks, changes in meals due to test, etc.) Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.	Symptomatic of low - shakey, hungry, pale → treatment given = 4 dex tabs. @ 1130. ☐ See MPR for additional information				

20115(Rev2019-04) Side A

Alberta Health Services

Blood Glucose and Subcutaneous Insulin Record

CASE STUDY #3

Affix patient label within this box

2/2

Reminder: Blood Glucose Target: **5.0 - 10.0 mmol/L**;
Physician to titrate insulin every 1-2 days to achieve targets
BG = blood glucose MPR = multidisciplinary progress record
*Bolus and correction insulin is not routinely recommended at bedtime unless it is given with an overnight scheduled feed or a specific MD STAT order

Date (yyyy-Mon-dd) DAY 3	Breakfast (or morning feed)	Lunch (or lunch feed)	Dinner (or evening feed)	Bedtime (or overnight feed)	Additional
Time BG Taken (hh:mm)	0735	1139	1730	2140	
Glucometer Result	6.7	5.1	13.1	7.5	
Basal Insulin (choose one) ☐ Glargine (Lantus®) ☐ HumuLIN® N ☐ Glargine (Basalgar®) ☒ Detemir (Levemir®)	___ units	___ units	___ units	27 units	
Bolus and Correction Insulin* (choose one) ☒ Lispro ☐ Aspart ☐ HumuLIN® R — Bolus Insulin	9 units	9 units	9 units	___ units*	
Correction Insulin	0 units	0 units	3 units	___ units*	___ units
Other Insulin (specify)	___ units	___ units	___ units	___ units	___ units
Time Administered (hh:mm)	0742	1145	1736	2150	
Site Administered	L abdo	L abdo	R abdo	R abdo	
Signature	—	—	—	—	
Comments/Additional Tests (Snacks, changes in meals due to test, etc.) Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.	☐ See MPR for additional information				

Date (yyyy-Mon-dd) DAY 4	Breakfast (or morning feed)	Lunch (or lunch feed)	Dinner (or evening feed)	Bedtime (or overnight feed)	Additional
Time BG Taken (hh:mm)	0737	1142	1728		
Glucometer Result	7.7	6.1	9.1		
Basal Insulin (choose one) ☐ Glargine (Lantus®) ☐ HumuLIN® N ☐ Glargine (Basalgar®) ☒ Detemir (Levemir®)	___ units	___ units	___ units	___ units	
Bolus and Correction Insulin* (choose one) ☒ Lispro ☐ Aspart ☐ HumuLIN® R — Bolus Insulin	9 units	9 units	9 units	___ units*	
Correction Insulin	0 units	0 units	0 units	___ units*	___ units
Other Insulin (specify)	___ units	___ units	___ units	___ units	___ units
Time Administered (hh:mm)	0741	1151	1734		
Site	R abdo	R abdo	L abdo		
Signature	—	—	—		
Comments/Additional Tests (Snacks, changes in meals due to test, etc.) Less than 4.0 mmol/L, hypoglycemia procedure. Greater than 18.0 mmol/L, hyperglycemia procedure.	☐ See MPR for additional information				

Side B

20115(Rev2019-04)

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8. AHS BBIT website (www.bbit.ca)

9. AHS Glycemic Management Policy with procedures for treatment of Hypoglycemia and Hyperglycemia (Glycemic Management Policy Suite | Alberta Health Services)

Acknowledgements

We would like to acknowledge the following individuals for their contribution to this education document, to support Basal Bolus Insulin Therapy (BBIT) in acute care:

Dr. Julie McKeen	Clinical Assistant Professor, Department of Medicine, University of Calgary; Medical Director, Diabetes Centre Calgary, Alberta Health Services, Calgary
Leta Philp	Clinical Practice Lead, Diabetes, Obesity & Nutrition Strategic Clinical Network, Alberta Health Services
Glenda Moore	Manager, Diabetes, Obesity & Nutrition Strategic Clinical Network, Alberta Health Services
Leian Petersen	Clinical Practice Lead, Diabetes, Obesity & Nutrition Strategic Clinical Network, Alberta Health Services
Dr. Karmon Helmle	Clinical Assistant Professor, Division of Endocrinology and Metabolism, University of Calgary
Rhonda Roedler	Clinical Practice Leader, Pharmacy, South Health Campus, Alberta Health Services, Calgary