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

Self-Study Guide

*Diabetes, Obesity & Nutrition Strategic Clinical Network*
*Date:* March 2017
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
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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 AHS 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 are leading a multifaceted initiative to standardize and improve diabetes management in hospitalized patients. The initial 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 5-10mmol/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

The Need for Improved Glycemic Management

The Canadian Diabetes Association (CDA) has recommended blood glucose targets of 5-10mmol/L for most hospitalized patients. These targets are higher and more liberal than the typical targets for patients with diabetes who are treated in the outpatient setting.

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 10mmol/L) is prevalent in hospital. Approximately one third (33%) of all BG levels tested in hospital are above target (5-10mmol/L). Improving blood glucose levels in hospital has been shown to result in a reduction in hospital complications in patients with diabetes.

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
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
- Over-treatment of hypoglycemia was often observed
- Sliding Scale Insulin for subcutaneous insulin administration was commonly ordered

Subcutaneous Sliding Scale Insulin (SSI) is commonly used in the treatment of diabetes within the inpatient setting. The use of SSI was initially recommended in 1934. 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. It can result in large blood glucose fluctuations throughout the day. These fluctuations make the patient feel unwell and can also increase morbidity, mortality and length of stay.

Since 2003, the CDA has recommended the use of multiple daily injections or a Basal Bolus Insulin Therapy (BBIT) style management for hyperglycemia in the hospital. 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
Titrater - 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 help to digest fat, carbohydrates and protein in the food that is consumed. Carbohydrates are broken down into glucose, which is utilized by the body as an energy source. As part of its endocrine function, the pancreas produces the hormones insulin and glucagon (produced by the beta and alpha cells, respectively, located in Islets of Langerhans) which regulate glucose in the bloodstream.

**Insulin:** This hormone helps to control blood glucose. Insulin helps all cells in our body to take in glucose to be used for energy and store excess glucose in the liver as glycogen. Insulin is produced by beta Cells.

**Glucagon:** This hormone increases the amount of glucose in the bloodstream by stimulating the liver and other body tissues to release stored glucose (glycogen) and produce glucose (gluconeogenesis) when blood glucose is needed. Glucagon is produced by Alpha cells.
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).

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 glucose levels, and to administer insulin to help manage their blood glucose levels at home.

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 insulin production, 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.

T2DM Physiology: Less 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 body is resistant to its own insulin production
- 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 the Canadian Diabetes Association Appendix 1 for more information. [http://guidelines.diabetes.ca/Browse/Appendices/Appendix1](http://guidelines.diabetes.ca/Browse/Appendices/Appendix1)
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.

*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 meal time 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

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**What is BBIT?**

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

**B**olus Insulin - covers the meal time carbohydrates

**I**nsulin Correction - corrects the patient’s BG back into target range if it is high

**T**itrare - 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.

![Graph showing glucose production](image)

Adapted from: White 2003
How Insulin is ordered using BBIT

Types of Insulin used with the AHS provincial BBIT Order Set

Various types of insulin are available within AHS. To reduce insulin errors in hospital, a simplified insulin formulary (reduced number of brands and types of insulin) was established in 2015. 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 AHS BBIT provincial order set (form #19885). See Appendix C for more detailed information about AHS insulin formulary used with BBIT.

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

<table>
<thead>
<tr>
<th>Intermediate-Acting Insulins</th>
<th>Long-Acting Basal Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset: 1-3 hours</td>
<td>Onset: 1-2 hours</td>
</tr>
<tr>
<td>Peak: 5-8 hours</td>
<td>Peak: Not applicable</td>
</tr>
<tr>
<td>Duration: up to 18 hours</td>
<td>Duration: 16-24 hours</td>
</tr>
</tbody>
</table>

- Insulin NPH (Humulin®-N)
- Insulin detemir (Levemir®)
- Insulin glargine (Lantus®)

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

<table>
<thead>
<tr>
<th>Rapid-Acting Insulins</th>
<th>Short-Acting Insulins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset: 10-15 mins</td>
<td>Onset: 30 mins</td>
</tr>
<tr>
<td>Peak: 1-2 hours</td>
<td>Peak: 2-3 hours</td>
</tr>
<tr>
<td>Duration: 3-5 hours</td>
<td>Duration: 6.5 hours</td>
</tr>
</tbody>
</table>

- Insulin aspart (NovoRapid®)
- Insulin lispro (Humalog®)
- Insulin regular (Humulin®-R)

Ordering Insulin using BBIT

Prior to ordering insulin, many factors are taken into account including the patient’s weight and their comorbidities (please see table below). The prescriber begins by calculating the Total Daily Dose (TDD) of insulin, defined as 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 as well. 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. The physiologic increase in insulin reverts to baseline as recovery takes place.
Considerations when Prescribing Insulin

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

<table>
<thead>
<tr>
<th>Use LOWER TDD IF</th>
<th>Titrating Insulin is an Important Aspect of BBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 DM, slim Type 2 DM, history of hypoglycemia unawareness, reduced renal function (eGFR &lt; 30 mL/min), liver failure, age &gt;70; moderate/severe frailty</td>
<td>TDD=Weight (kg) x 0.3 to 0.5 Units/kg/day</td>
</tr>
<tr>
<td>Insulin resistance, overweight T2 DM, steroid treatment, infection</td>
<td>TDD=Weight (kg) x 0.5 to 1 Units/kg/day</td>
</tr>
</tbody>
</table>

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 glucose. 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

<table>
<thead>
<tr>
<th>If Breakfast BG is:</th>
<th>If Lunch BG is:</th>
<th>If Supper BG is:</th>
<th>If Bedtime BG is:</th>
<th>If Overnight BG is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW (&lt;5mmol/L)</td>
<td>LOW (&lt;5mmol/L)</td>
<td>LOW (&lt;5mmol/L)</td>
<td>LOW (&lt;5mmol/L)</td>
<td>LOW (&lt;5mmol/L)</td>
</tr>
<tr>
<td>Decrease</td>
<td>Decrease</td>
<td>Decrease</td>
<td>Decrease</td>
<td>Decrease</td>
</tr>
<tr>
<td>Breakfast BASAL</td>
<td>Breakfast BOLUS</td>
<td>Lunch BOLUS or Supper BOLUS</td>
<td>Bedtime BASAL</td>
<td></td>
</tr>
<tr>
<td>If ALL BG are HIGH (&gt;10mmol/L), Calculate TDD from last 24 hours, Increase TDD by 10-20% and Recalculate all Basal, Bolus and Correction Doses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Target Blood Glucose In-Hospital

Blood Glucose (BG) values of 5-10mmol/L are recommended for most patients in hospital.

Higher values (5-12mmol/L) are acceptable for:
- The frail elderly (older 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 8-10mmol/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 5-10mmol/L in most patients with diabetes in hospital
- Early recognition and treatment of hypoglycemia, defined as a BG below 4.0mmol/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, 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, NPO status or have reduced dietary intake need to continue four times daily BG testing.

Testing Technique

The Roche Accuchek Inform II meter is available in all acute care facilities within Alberta. Please see link below for AHS provincial lab policy for patient testing. 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 AHS Blood Glucose and Insulin Administration Record

- **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 prescriber 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 care provider 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 patients risk for hypoglycemia.

<table>
<thead>
<tr>
<th>Diet</th>
<th>Definition</th>
<th>Adjustment to Bolus insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistent</td>
<td>At least 75% of the tray is consumed by the patient at mealtime</td>
<td>Continue scheduled bolus insulin</td>
</tr>
<tr>
<td>Reduced</td>
<td>No more than 50% of the tray is consumed by patient at mealtime</td>
<td>Notify MD/NP to consider reducing bolus (meal) insulin by ~50%</td>
</tr>
<tr>
<td>NPO</td>
<td>Patient is receiving no oral nutrition</td>
<td>Hold bolus insulin and give correction insulin as per orders</td>
</tr>
</tbody>
</table>
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

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 become 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
2. Prime of the needle (2 units)
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—*wait to hear the “click” before administering the insulin dose*
5. Wait for 10 seconds after plunger has been depressed then remove needle

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. http://insite.albertahealthservices.ca/13292.asp

Managing injections of large doses of subcutaneous insulin

When a dose is 50 units or greater, administer the dose in two equally divided injections administered in 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 Algorithm

Please note: a provincial AHS Glycemic management policy along with procedures for Hypoglycemia and Hyperglycemia management are in draft, and pending approval.

Hypoglycemia can happen during the day or at night. Hypoglycemia is defined as a BG level below 4.0mmol/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

Recognition: BG less than 4.0mmol/L requires treatment

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

Treatment

The hypoglycemia protocol should be implemented anytime a BG is less than 4.0mmol/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 4.0mmol/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
  - 2 individual packages (or 15 mL) of honey

Overtreatment of hypoglycemia will often result in rebound hyperglycemia. This drastic change in blood glucose will often cause the patient to feel unwell.
Repeat the BG 15 minutes after treatment;
  - if below 4.0mmol/L repeat the administration of 15 grams of fast acting carbohydrate (as above)
  - if the BG is equal to or greater than 4.0mmol/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.
  - 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.

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 4.0mmol/L:
  - Reassess: the BG level in one hour to ensure it remains above 4.0mmol/L. If BG is below 4.0mmol/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 care provider.

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

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 Algorithm

Please note: a provincial AHS Glycemic management policy along with procedures for Hypoglycemia and Hyperglycemia management are in draft, and pending approval.

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

Recognition

Hyperglycemia in the acute care setting can be defined as:
- Mild- BG levels between 10.1-14.0mmol/L
- Moderate- BG levels between 14.1-18.0mmol/L
- Severe- BG levels greater than 18.1mmol/L

Symptoms of significant hyperglycemia may include, but are not limited to:
- Polydipsia (thirst)
- Polyuria (frequent urination)
- Tiredness
- Lethargy
- Dizziness
- Nausea & Vomiting
- Blurred Vision
- Hyperventilation
- Sweet Smelling Breath

Treatment
- Provide insulin or other anti-hyperglycemic medications as ordered.
- The patient should refrain from physical activity until BG is below 18.0mmol/L, unless cleared by their most responsible health practitioner.
- Review chart with patient for possible causes of hyperglycemia (last dietary intake or missed medications).
- Blood glucose levels above 18.0mmol/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 14.0mmol/L for patients who are on insulin pump therapy or taking an SGLT2 oral medication.
- In patients with Type 1 diabetes, the most responsible health practitioner should consider physical and/or lab assessment to rule out DKA.
  - If the patient has Type 1 diabetes and blood glucose is greater than 18.0mmol/L; stat ketone testing is recommended. (Available method of ketone testing varies across acute care sites; so will be site dependent).

Follow Up
- After treatment of hyperglycemia, resume routine BG testing once glycemic levels have stabilized.
- Provide patient teaching if required.
- Contact the Certified Diabetes Educator (CDE) or diabetes specialist, if available, for
support with teaching as needed.

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

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

**How to prevent DKA**
Basal insulin should always be administered in insulin deficient patients.

A blood glucose levels above 18.0mmol/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 14.0mmol/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 care practitioner immediately if ketones are present for further orders.
Summary of Key Points in the BBIT Self Study Guide

- Diabetes is a complex chronic disease.
- In hospital blood glucose targets are 5-10mmol/L, for most patients.
- Understanding the basic physiologic and pathophysiologic differences between normal pancreatic function, T1DM and T2DM supports the use of Basal Bolus Insulin Therapy (BBIT) in hospital.

- 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 5-10mmol/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 meal time carbohydrates

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

**Titrator** - 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 4.0mmol/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 10.0mmol/L in hospital. Severe hyperglycemia (18.0mmol/L and above) requires medical attention. Hyperglycemia can increase the patient’s risk for: delayed wound healing, surgical site infections, hospital acquired infections (i.e. 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

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal Bolus Insulin therapy (BBIT)</td>
<td>Scheduled insulin dosing mimicking normal physiologic insulin secretion.</td>
</tr>
<tr>
<td></td>
<td>Involves giving the right type of insulin, in the right dose, at the right</td>
</tr>
<tr>
<td></td>
<td>time to meet the needs of a patient.</td>
</tr>
<tr>
<td>Basal Insulin</td>
<td>Scheduled long or intermediate-acting insulin given once or twice daily</td>
</tr>
<tr>
<td></td>
<td>to cover the blood glucose the liver (and to a lesser extent the kidneys)</td>
</tr>
<tr>
<td></td>
<td>makes naturally 24 hours a day.</td>
</tr>
<tr>
<td>Bolus (meal) Insulin</td>
<td>Scheduled rapid or short-acting insulin given prior to meals to cover the</td>
</tr>
<tr>
<td></td>
<td>carbohydrate that will be broken down into glucose from the upcoming meal.</td>
</tr>
<tr>
<td></td>
<td>It may also be used to cover glucose provided continuously, as in the case</td>
</tr>
<tr>
<td></td>
<td>of continuous parenteral or enteral feeds.</td>
</tr>
<tr>
<td>Correction (supplemental) Insulin</td>
<td>Rapid or short-acting insulin given to correct unanticipated hyperglycemia.</td>
</tr>
<tr>
<td></td>
<td>Can be given with meal insulin (patient eating) or on its own (patient</td>
</tr>
<tr>
<td></td>
<td>NPO) when the blood glucose measurement is above target for that patient</td>
</tr>
<tr>
<td></td>
<td>at that time.</td>
</tr>
<tr>
<td></td>
<td>Ensures high glucose values are not left untreated.</td>
</tr>
<tr>
<td>Blood Glucose (BG)</td>
<td>The amount of available circulating glucose in the blood stream.</td>
</tr>
<tr>
<td>Diabetes Ketoacidosis (DKA)</td>
<td>Diabetic Ketoacidosis (DKA) is a diabetes emergency</td>
</tr>
<tr>
<td></td>
<td>It is caused by a deficiency of insulin and elevated levels of</td>
</tr>
<tr>
<td></td>
<td>counter-regulatory hormones. This ensuing hyperglycemia, resulting in</td>
</tr>
<tr>
<td></td>
<td>a combination of osmotic diuresis, electrolyte abnormalities, and ketone</td>
</tr>
<tr>
<td></td>
<td>production.acidosis, can lead to significant morbidity and mortality.</td>
</tr>
<tr>
<td>Frail Elderly Patients</td>
<td>Older adults assessed as physically and/or cognitively frail at risk for</td>
</tr>
<tr>
<td></td>
<td>confusion, agitation or falls.</td>
</tr>
<tr>
<td>Hemoglobin A1c</td>
<td>Glycosylated hemoglobin – measure of glycemic control in previous 2-</td>
</tr>
<tr>
<td></td>
<td>3 months. (Target for most patients is ≤ 7.0 %.)</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>A Blood Glucose less than 4mmol/L</td>
</tr>
<tr>
<td>Hypoglycemia Unawareness</td>
<td>The person has absent or diminished early warning signs and symptoms of</td>
</tr>
<tr>
<td></td>
<td>hypoglycemia; loss of the adrenergic symptoms. Associated with recurrent</td>
</tr>
<tr>
<td></td>
<td>hypoglycemia and increases risk of severe hypoglycemia. More common in</td>
</tr>
<tr>
<td></td>
<td>T1DM.</td>
</tr>
<tr>
<td>Hyperglycemia</td>
<td>A Blood Glucose above 10mmol/L, in hospital</td>
</tr>
<tr>
<td>Insulin Deficient Patients</td>
<td>Patients with Type 1 DM, Type 2 DM on insulin for more than 5 years,</td>
</tr>
<tr>
<td></td>
<td>history of Diabetic ketoacidosis or pancreatectomy.</td>
</tr>
<tr>
<td></td>
<td>Prone to diabetic ketoacidosis (DKA) so they MUST always receive some</td>
</tr>
<tr>
<td></td>
<td>exogenous (basal) insulin, even if fasting.</td>
</tr>
<tr>
<td>Sliding Scale Insulin (SSI)</td>
<td>An insulin dosing regimen that treats hyperglycemia after it occurs.</td>
</tr>
<tr>
<td>Total Daily Dose (TDD) of insulin</td>
<td>The total number of all units of basal + bolus + correction insulin used</td>
</tr>
<tr>
<td></td>
<td>in 24 hour period.</td>
</tr>
</tbody>
</table>
Appendix B: AHS Provincial BBIT order set (form #19885)

**Basal Bolus Insulin Therapy (BBIT)**

**Adult Inpatient Order Set**

1. Discontinue all previous insulin and bedside blood glucose monitoring orders.

2. All adult subcutaneous 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

<table>
<thead>
<tr>
<th>Blood Glucose (BG) Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ 4 times per day (15 - 30 minutes before meals and at bedtime), as well as PRN for suspected hypoglycemia and: ☑ 0200h x [ ] days ☐ 2 hours after meals ☐ Other (specify) [ ]</td>
</tr>
<tr>
<td>☑ If BG less than 4.0 mmol/L initiate Hypoglycemia Procedure</td>
</tr>
<tr>
<td>☑ If BG greater than 18 mmol/L initiate Hyperglycemia Procedure and call MD</td>
</tr>
</tbody>
</table>

**Total Daily Dose (TDD)** See calculation instructions on reverse for Physician 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®)
- [ ] detemir (Levemir®)
- [ ] Humulin® N

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 mm ac 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 & Correction Insulin). If reduced dietary intake, call MD for reduction in bolus dose.

- [ ] Patient may adjust own dose and report dose to nurse (Order insulin type and specify acceptable dose range)

<table>
<thead>
<tr>
<th>Units</th>
<th>With Breakfast or Time (hh:mm)</th>
<th>With Lunch or Time (hh:mm)</th>
<th>With Dinner or Time (hh:mm)</th>
<th>With Other Time (hh:mm)</th>
</tr>
</thead>
</table>

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

Correction dose (if requiring) and Bolus dose to be combined and administered as a single sc injection with meal or feed

**ONLY Bedtime Correction dose not routinely recommended.**

<table>
<thead>
<tr>
<th>TDD 15-30 units</th>
<th>TDD 31-50 units</th>
<th>TDD 51-80 units</th>
<th>TDD 81 units or more</th>
<th>Custom</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
</tr>
<tr>
<td>4.1-10</td>
<td>+0</td>
<td>4.1-10</td>
<td>+0</td>
<td>4.1-9</td>
</tr>
<tr>
<td>10.1-14</td>
<td>+1</td>
<td>9.1-12</td>
<td>+1</td>
<td>10.1-12</td>
</tr>
<tr>
<td>16.1-18</td>
<td>+5</td>
<td>15.1-17</td>
<td>+5</td>
<td>15.1-17</td>
</tr>
<tr>
<td>17.1-18</td>
<td>+10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Physician Name (print)**

**Signature**

**Date (yyyy-mm-dd)**

**Time (hh:mm)**
## Appendix C: AHS Formulary Insulin used with BBIT

<table>
<thead>
<tr>
<th>Insulin Type (trade name)</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
<th>Action Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolus (prandial) Insulins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rapid-acting insulin analogues (clear):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Insulin aspart (NovoRapid®)</td>
<td>10-15 min</td>
<td>1-1.5 h</td>
<td>3-5 h</td>
<td></td>
</tr>
<tr>
<td>• Insulin lispro (Humalog®)</td>
<td>10-15 min</td>
<td>1 - 2 h</td>
<td>3.5-4.75 h</td>
<td></td>
</tr>
<tr>
<td><strong>Short-acting insulin (clear):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Insulin regular (Humulin®-R)</td>
<td>30 min</td>
<td>2 - 3 h</td>
<td>6.5 h</td>
<td></td>
</tr>
<tr>
<td><strong>Basal Insulins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intermediate-acting insulin (cloudy):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Insulin NPH (Humulin®-N)</td>
<td>1 - 3 h</td>
<td>5 - 8 h</td>
<td>Up to 18 h</td>
<td></td>
</tr>
<tr>
<td><strong>Long-acting basal insulin analogues (clear)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Insulin detemir (Levemir®)</td>
<td>90 min</td>
<td>Not applicable</td>
<td>16-24 hours</td>
<td></td>
</tr>
<tr>
<td>• Insulin glargine (Lants®)</td>
<td>90 min</td>
<td>Not applicable</td>
<td>24 hours</td>
<td></td>
</tr>
</tbody>
</table>
Appendix D: AHS Blood Glucose and Insulin Administration Record (form #20115)

### Blood Glucose and Subcutaneous Insulin Record

Reminder: Blood Glucose Target: 5-10 mmol/L; Physician to titrate insulin every 1-2 days to achieve targets
BG = blood glucose  MPR = multidisciplinary progress record

*Basal and correction insulin not routinely recommended at bedtime unless it is given with an overnight scheduled feed or a specific MD STAT order

<table>
<thead>
<tr>
<th>Date (yyyy-mm-dd)</th>
<th>Time BG Taken (h:m)</th>
<th>Time Administered (h:m:mm)</th>
<th>Comments / Additional Tests</th>
</tr>
</thead>
</table>

#### Basal Insulin (choose one)
- Glargine
- Detemir
- Humulin® N

#### Bolus and Correction Insulin* (choose one)
- Lispro
- Aspart
- Humulin® R
  - Bolus Insulin
  - Correction Insulin

#### Other Insulin (specify)

<table>
<thead>
<tr>
<th>Date (yyyy-mm-dd)</th>
<th>Time BG Taken (h:m)</th>
<th>Time Administered (h:m:mm)</th>
<th>Comments / Additional Tests</th>
</tr>
</thead>
</table>

Sample
Appendix E: AHS Proper Use of Insulin Pens

ONE PEN, ONE PATIENT

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

1. Prepare pen for use
   a. Break safety seal and pull off cap.
   b. Check correct insulin type, expiry date and appearance.
   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.

3. Prime 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.

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

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.
   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.
   c. Dispose of used needle in sharps container.
   d. Recap the pen, clean as per site processes, and return to storage location.

Adapted from a toolkit developed by University Health Network (UHN) and Hamilton Health Sciences (HHS)
Appendix F: Adult Hypoglycemia Algorithm

Step 1 - Recognize

Blood Glucose is below 4 mmol/L

Step 2 - Treat

Conscious / Able to Swallow or Tube Feed

1. Give 15 grams of quick acting carbohydrate:
   - 4 Dextrose tablets (16 g of carb), or
   - ¾ cup (175 mL) juice or regular pop, or
   - 2 packages (or 15 ml) of honey, or
   - 4 packets sugar, dissolved in water
   *Patients on Acarbose, use dextrose tablets or honey
   *For tube feeds, use juice or dextrose tablets
   *For dysphagia patients, use honey

2. Repeat blood glucose in 15 minutes. If below 4 mmol/L, repeat #1 above, and then proceed to #3 below.

3. Repeat blood glucose in 15 minutes. If below 4 mmol/L, call most responsible health practitioner for further treatment.

Altered Consciousness / Unable to Swallow (or Patient NPO)

IV ACCESS

Establish or use large IV access (central line or antecubital). Do NOT use small peripheral vein.

Attempt to establish IV access for 1-2 minutes

Treat: IV

1a. Give 50 mL of D50W direct IV (push) over 1-3 minutes (=25 g of carb).
1b. Must call most responsible health practitioner (This should not delay above treatment.)
1c. If health care professional not able to give IV push; give D50W in 50cc minibag of D5W or NS over 15-20 minutes

2. IV D5W at 30 mL/hr (to keep vein open)
3. Repeat blood glucose in 15 minutes. If below 4 mmol/L, if conscious/able to swallow, complete #1 under that heading. If altered consciousness, repeat #1 above, and then proceed to #4 below.
4. Repeat blood glucose in 15 minutes. If below 4 mmol/L, call most responsible health practitioner for further treatment.

Treat: SC or IM

1a. Give Glucagon 1 mg SC or IM, and continue to attempt to start IV.
1b. Must call most responsible health practitioner (This should not delay above treatment)

IV access

** If patient not responding to above treatment, and has altered level of consciousness, follow steps under that heading

Once blood glucose is greater than or equal to 4 mmol/L, see step 3 (on back of this page) for follow-up instructions

2017-01-16

***Do not send patient off unit until blood glucose greater than or equal to 4 mmol/L***
Step 3 – Follow-Up

This section outlines follow-up instructions for patients who have blood glucose greater than or equal to 4 mmol/L after hypoglycemia treatment.

### Able to Swallow

1. If meal is more than one hour away, give snack of a carbohydrate and protein source (see options in table below)***
2. If meal is less than one hour away give meal only (do not give snack)

### Tube Feed

1. If tube feed is continuous, continue regular feeding schedule at established rate.
2. If tube feed is intermittent and next feed is more than one hour away, give 100 ml bolus of ordered tube feed formula and then resume next scheduled feeding.

### TPN

- **If TPN running**
  - Maintain IV D5W at 30 ml/hr
- **If TPN not running**
  - IV D10W at 150cc/hr for 1 hour
  - Notify most responsible health practitioner for ongoing orders

### Unable to Swallow / NPO

- **IV Access**
  - IV D10W at 150cc/hr for 1 hour; and notify most responsible health practitioner and/or dietitian

- **No IV Access**
  - Discuss treatment options and nutrition plan with most responsible health practitioner and/or dietitian

1. In one hour, recheck blood glucose to ensure it remains greater than or equal to 4 mmol/L.
   - If below 4 mmol/L, call most responsible health practitioner, and initiate appropriate algorithm (on reserve page).
   - If greater than or equal to 4 mmol/L, resume routine blood glucose monitoring.
2. Evaluate patient for cause: e.g. missed meal, exercise, change in medication (↑increase in insulin dose, ↓in steroids, etc)
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

***for Dysphagia patients (those on minced/pureed diets only) if available: 1 container Ensure/Boost pudding (115g) or 1 container of smooth Greek yogurt (100 g).
If not available; discuss appropriate snack options with dietitian and/or food service.

2017-01-16
Appendix G: Adult Hyperglycemia Algorithm

**Step 1: Recognize**

**Blood Glucose is above 18mmol/L**

- Provide insulin or other antihyperglycemic medications as ordered
- Patient should refrain from exercise (ie physiotherapy)
- Review chart and confer with patient for possible causes (insulin or other antihyperglycemic meds held, dietary intake)
- Contact most responsible health practitioner (MRHP) for orders

**Exception**

*Intervention required earlier* (with a blood glucose above 14mmol/L) for:
- Patients on Insulin Pump Therapy
- Patients on SGLT2 inhibitors

**Step 2: Treat**

- Stat ketone testing is recommended for patients:
  - With Type 1 diabetes
  - On SGLT2 inhibitors *eg canagliflozin (Invokana), dapagliflozin (Fortziga) and empagliflozin (Jardiance)*
  - IF Ketones are positive;
    - Contact MRHP for further orders
    - Monitor for signs and symptoms of DKA

**Step 3: Follow-up**

- If unable to decrease blood glucose below 18.0 mmol/L with additional treatment; patients with type 1 diabetes shall be assessed for DKA. Assessment includes but is not limited to:
  - Symptoms of DKA including: polyuria, thirst, weight loss, nausea/vomiting, abdominal pain, weakness, mental status change, coma
  - Vital signs
  - Medication review (regular insulin dosing schedule, timing of last insulin administration, held or missed insulin, etc.)
  - Last carbohydrate administration/ingestion
  - Previous history/episodes of DKA

- IF DKA is suspected, notify the most responsible health practitioner. Implement site and/or unit DKA protocol in consultation with the MRHP.

- Once patient’s glycemic status stabilized
  - Commence routine blood glucose testing, or as ordered
  - Review event, and look at efforts to prevent a recurrence
  - Review to see if hyperglycemia followed a hypoglycemic episode
  - Review patient understanding. Provide education if required
  - Reassessment of diabetes medication by MRHP
  - Referral to Certified Diabetic Educator, or diabetes specialist, if required
  - Documentation of hyperglycemic event

2017-01-11
Appendix H- Case Studies

Case Study 1- Mr. Young

Day 1

Mr. Young, 59 year old male is 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 27.

Insulin orders as follows:

- Basal insulin is 24 units of N (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

**Basal Bolus Insulin Therapy (BBIT)**

**Adult Inpatient Order Set**

1. Discontinue all previous insulin and bedside blood glucose monitoring orders.
2. All adult subcutaneous 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 initiated by prescriber. Boxed orders (☐) require prescriber check mark (☒) to be initiated.

#### Blood Glucose (BG) Monitoring

- 4 times per day (15 - 30 minutes before meals and at bedtime), as well as PRN for suspected hypoglycemia and:
  - 0200h
  - 2 hours after meals
  - Other (specify)
- If BG less than 4.0 mmol/L, initiate Hypoglycemia Procedure and call MD
- If BG greater than 18 mmol/L, initiate Hyperglycemia Procedure and call MD

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

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

- 96 units

#### Basal Insulin

- Home dose or 1/3 TDD (given initially as epi, twice daily doses at breakfast and bedtime; glargine may be given once daily)

Choose one Basal Insulin:
- glargine (Lantus®)
- detemir (Levemir®)
- Humulin R

<table>
<thead>
<tr>
<th>Units</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Breakfast or Time (Morning)</td>
<td>24</td>
</tr>
</tbody>
</table>

#### Bolus and Correction Insulin

- Use the same insulin poducts or short acting for bolus and correction

Choose one Bolus/Correction Insulin:
- lispro (Novolog®) 50:50 with meal
- aspart (Humalog®) 75:25 with meal
- Humulin R 30:70 in meal

**Bolus Insulin**

- Home dose (consider reduction of 25-50% for hospital diet), or 1/3 TDD divided initially into 3 equal doses

Hold if no caloric intake, NPO or bolus feeds stopped (continue basal & correction insuline). If reduced dietary intake, call MD for reduction in bolus dose.

- Patient may adjust own dose and report dose to nurse (Order insulin type and specify acceptable dose range)

<table>
<thead>
<tr>
<th>Units</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Breakfast or feed at time (Morning)</td>
<td>16</td>
</tr>
<tr>
<td>With Lunch or feed at time (Noon)</td>
<td>16</td>
</tr>
<tr>
<td>With Dinner or feed at time (Evening)</td>
<td>16</td>
</tr>
<tr>
<td>With Other at time (PM)</td>
<td>16</td>
</tr>
</tbody>
</table>

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

- Correction dose frequency and bolus dose to be combined and administered as a single sc injection with meal or feed only. Bedtime correction dose not routinely recommended.

<table>
<thead>
<tr>
<th>TDD 15-30 units</th>
<th>TDD 31-50 units</th>
<th>TDD 51-80 units</th>
<th>TDD 81+ units</th>
<th>Custom</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
</tr>
<tr>
<td>4.1-10</td>
<td>+0</td>
<td>4.1-10</td>
<td>+0</td>
<td>4.1-10</td>
</tr>
<tr>
<td>10.1-16</td>
<td>+1</td>
<td>14.1-16</td>
<td>+2</td>
<td>16.1-16</td>
</tr>
<tr>
<td>15.1-18</td>
<td>+3</td>
<td>18.1-18</td>
<td>+5</td>
<td>17.1-18</td>
</tr>
</tbody>
</table>

Physician Name (print) ____________________________
Signature ____________________________
Date (MM/DD/YE) ____________________________
Time (h:mm) ____________________________
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 9.2mmol/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 14.6mmol/L. What further action is needed?

5. At 2200h before bed the BG level is 10.3mmol/L. What insulin doses will be administered?
Case Study 2- Ms. Smith

Day 1: Ms. Smith, 36 year old female

Ms. Smith is 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 30.

- 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 9.1mmol/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 9.5mmol/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?
**Basal Bolus Insulin Therapy (BBIT)**

**Adult Inpatient Order Set**

1. Discontinue all previous insulin and bedside blood glucose monitoring orders.

2. All adult subcutaneous 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 R are active by default, unless crossed out and initiated by prescriber. Boxed orders (☐) require prescriber check mark (✓) to be initiated.

### Blood Glucose (BG) Monitoring

- 4 times per day (15 - 30 minutes before meals and at bedtime), as well as PRN for suspected hypoglycemia and: 02:00h x days, 2 hours after meals, Other (specify)
- If BG less than 4.0 mmol/L initiate Hypoglycemia Procedure
- If BG greater than 18 mmol/L initiate Hyperglycemia Procedure and call MD

### Total Daily Dose (TDD)

See calculation instructions on reverse for Physician Guidance only

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

→ 29 units

**Basal Insulin**

- Basal insulin or % TDD (given initially as equal, twice daily doses at breakfast and bedtime. Glargine may be given once daily)

**Choose One Basal Insulin**

- glargine (Lantus®)
- detemir (Levemir®)
- Humulin® N

**Units**

- At breakfast or
- At bedtime or
- Time (24h)

**Bolus and Correction Insulin**

Use the same insulin (rapid or short acting) for bolus and correction.

**Choose One Bolus/Correction Insulin**

- Humulin® R (NPH) sc with meal
- aspart (NovoRapid®) sc with meal
- Humulin® R sc 30 min ac meal

**Bolus Insulin**

- NPO or bolus feeds stopped (continue Basal & Correction insulin). If reduced dietary intake, call MD for reduction in bolus dose.
- Patient may adjust own dose and report dose to nurse (Order insulin type and specify acceptable dose range)

- Units

  - With Breakfast or
  - With Lunch or
  - With Dinner or
  - With Other

- Time (24h)

**Correction for hyperglycemia**

- Choose one based on current Total Daily Dose (TDD)

<table>
<thead>
<tr>
<th>Units</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG 4.1-10</td>
<td>+0</td>
</tr>
<tr>
<td>BG 10.1-14</td>
<td>+1</td>
</tr>
<tr>
<td>BG 14.1-18</td>
<td>+2</td>
</tr>
<tr>
<td>BG 18.1-24</td>
<td>+3</td>
</tr>
<tr>
<td>BG 24.1-30</td>
<td>+4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Units</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG 4.1-10</td>
<td>+0</td>
</tr>
<tr>
<td>BG 10.1-12</td>
<td>+2</td>
</tr>
<tr>
<td>BG 12.1-14</td>
<td>+3</td>
</tr>
<tr>
<td>BG 14.1-16</td>
<td>+4</td>
</tr>
<tr>
<td>BG 16.1-18</td>
<td>+5</td>
</tr>
<tr>
<td>BG 18.1-24</td>
<td>+6</td>
</tr>
</tbody>
</table>

**Physician Name**

[Signature]

[Date] [Time]
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 (3/4 cup) 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

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 3.6mmol/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?

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.

<table>
<thead>
<tr>
<th>Before Breakfast (Time)</th>
<th>0740</th>
<th>0745</th>
<th>0735</th>
<th>0737</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG</td>
<td>8.6mmol/L</td>
<td>7.8mmol/L</td>
<td>6.7mmol/L</td>
<td>7.7mmol/L</td>
</tr>
<tr>
<td>Before Lunch (Time)</td>
<td>1145</td>
<td>1130</td>
<td>1139</td>
<td>1142</td>
</tr>
<tr>
<td>BG</td>
<td>11.2mmol/L</td>
<td>3.8mmol/L</td>
<td>5.1mmol/L</td>
<td>6.1mmol/L</td>
</tr>
<tr>
<td>Before Supper (Time)</td>
<td>1724</td>
<td>1730</td>
<td>1730</td>
<td>1728</td>
</tr>
<tr>
<td>BG</td>
<td>10.2mmol/L</td>
<td>9.6mmol/L</td>
<td>13.1mmol/L</td>
<td>9.1mmol/L</td>
</tr>
<tr>
<td>Before Bedtime (Time)</td>
<td>2155</td>
<td>2150</td>
<td>2140</td>
<td>Discharged Home</td>
</tr>
<tr>
<td>BG</td>
<td>8.2mmol/L</td>
<td>7.8mmol/L</td>
<td>7.5mmol/L</td>
<td>x</td>
</tr>
<tr>
<td>Other (Time)</td>
<td></td>
<td></td>
<td>1150</td>
<td></td>
</tr>
<tr>
<td>BG</td>
<td></td>
<td></td>
<td>5.6mmol/L</td>
<td></td>
</tr>
</tbody>
</table>
Case Study 3 - Order Set to Complete the BG and Insulin Administration Record

Basal Bolus Insulin Therapy (BBIT)

**Adult Inpatient Order Set**

1. Discontinue all previous insulin and bedside blood glucose monitoring orders.
2. All adult subcutaneous insulin orders (except STAT orders) must be documented using this order set. Any change in insulin orders requires completion at 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 initialed.

**Blood Glucose (BG) Monitoring**
- [ ] 4 times per day (15 - 30 minutes before meals and at bedtime), as well as PRN for suspected hypoglycemia and:
  - [ ] 0200h x days
  - [ ] 2 hours after meals
  - [ ] Other (specify)
- [ ] If BG less than 4.0 mmol/L Initiate Hypoglycemia Procedure
- [ ] If BG greater than 18 mmol/L, initiate Hypoglycemia Procedure and call MD

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

**Basal Insulin**

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

<table>
<thead>
<tr>
<th>Choose One Basal Insulin</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>glargine (Lantus®)</td>
<td></td>
</tr>
<tr>
<td>detemir (Levemir®)</td>
<td></td>
</tr>
<tr>
<td>Humulin® N</td>
<td></td>
</tr>
</tbody>
</table>

**Bolus and Correction Insulin**

Use the same insulin pene or short acting for bolus and correction.

**Choose One Bolus/Correction Insulin**
- [ ] insulin (regular or rapid acting) with meal
- [ ] Humulin® N 30 min ac 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, KPO or other feeds stopped (continue Basal & Correction insulin). If reduced dietary intake, call MD for reduction in bolus dose.
- [ ] Patient may adjust own dose and report dose to nurse (Order insulin type and specify accountable-dose range)

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

**Correction dose** (required) and Bolus dose to be combined and administered as a single subcutaneous injection with meal or feed only. Bedtime correction dose not routinely recommended.

<table>
<thead>
<tr>
<th>□ TDD 15-30 units</th>
<th>□ TDD 31-50 units</th>
<th>□ TDD 51-80 units</th>
<th>□ TDD 81 units or more</th>
<th>□ Custom</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
<td>BG Units</td>
</tr>
<tr>
<td>4.1-10            +0</td>
<td>4.1-9             +0</td>
<td>4.1-10            +0</td>
<td>4.1-9                  +0</td>
<td></td>
</tr>
<tr>
<td>10.1-14           +1</td>
<td>9.1-12            +1</td>
<td>10.1-12           +2</td>
<td>9.1-11                 +2</td>
<td></td>
</tr>
<tr>
<td>16.1-18           +5</td>
<td>15.1-17           +5</td>
<td>15.1-17           +5</td>
<td>13.1-17                +8</td>
<td></td>
</tr>
<tr>
<td>17.1-18           +10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Physician Name:**

**Signature:**

**Date (yyyy-mm-dd):**

**Time (hh:mm):**

*06559(Revised 4-23-16)*

White - Chart

Canary - Pharmacy
Case Study 4- Mr. Jones

Day 1

Mr. Jones, 74 year old man, is 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. He is on BBIT for his insulin regime, see page 36. 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 7.8mmol/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 Orderset

Basal Bolus Insulin Therapy (BBIT)
Adult Inpatient Order Set

1. Discontinue all previous insulin and bedside blood glucose monitoring orders.
2. All adult subcutaneous 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 meals and at bedtime), as well as PRN for suspected hypoglycemia
☐ 0200h x ☐ days ☐ 2 hours after meals ☐ Other (Specify)
☒ If BG less than 4.3 mmol/L, initiate Hypoglycemia Procedure
☒ If BG greater than 18 mmol/L, initiate Hyperglycemia Procedure and call MD

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

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

Basal Insulin
Home dose or ½ TDD (given initially as much, twice daily doses at transferred into hospital, Glargine may be given once daily)

Choose One Basal Insulin
☒ Glargine (Lantus®)
☐ Detemir (Levemir®)
☒ Humulin® R

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

Choose One Bolus/Correction Insulin
☒ Lyspro (Humalog®) sc with meal
☐ Aspart (Novolog®) sc with meal
☒ Humulin® R sc 30 min ac 3 serial doses

Bolus Insulin (Home dose (consider reduction of 25-50%) for hospital dose), or ½ TDD divided into 3 equal doses
☒ Hold if no calorie intake, NPO or bolus feeds stopped (continue Basal & Correction Insulin) If reduced dietary intake, call MD for reduction in bolus dose
☐ Patient may adjust own dose and report dose to nurse (Order insulin type and specify acceptable dose range)

Correction for hyperglycemia: Choose one based on current Total Daily Dose (TDD)
☒ Correction dose required and bolus dose to be combined and administered as a single sc injection with meal or feed ONLY. Bolus correction dose not routinely recommended.

Physician Name (Hand)
Signature
Date (mm/dd/yyyy)
Time (h:mm)

Example
Answer Guide Case Study 1-4

Case Study 1- Mr. Young Day 1: Answer reference on Page 14, 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 on Page 14, 18, 20, Appendix B

1. What insulin will be administered?
   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 14.1-18.0mmol/L)

4. Patient requires insulin→ as patient able to eat bolus + correction insulin to be administered. Basal insulin ordered at 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, Page 14, Appendix B

1. Patient’s with Type 1 Diabetes are at increased risk for:
   a. Hypoglycemia
   b. Diabetic Ketoacidosis (DKA)
   c. These patient always requires basal insulin

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

3. a) No insulin required- Call MD as patient dietary intake has changed. Holding insulin requires an order
   Basal → not needed until bedtime
   Bolus: 0 units as patient refuses her meal tray
   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 20, 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 15gm of Fast acting carb (1 choice only)
   - Reassess- BG in 15min (8.1mmol/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 4mmol/L
   - Document and discuss with patient for possible causes…
     o Decreased meal intake in the morning
     o Illness
     o Medication

4. Follow protocol and administer glucagon OR D50W IV direct push – site/unit/area specific protocol
   Contact Most Responsible Health Professional immediately without delay of treatment
Case Study 2- Day 3: Ms. Smith- Answer reference Page 20, Appendix F

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

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

3. Follow up with patient for possible causes:
   • Diet
   • Nausea
   • Activity – e.g. Physiotherapy
   • Medications
   Review hypoglycemic episodes with most responsible provider for possible titration of insulin doses (decrease in morning bolus dose possibly)

Case Study 3- See page 48 and 49

Case Study 4- Mr. Jones- Answer reference page 14 and 18

1. Basal Insulin- 20units Humulin N® (unless most responsible prescriber has ordered a different dose pre-procedure)
   Bolus Insulin- 0units on HOLD
   Correction Insulin- 0units

2. 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
<table>
<thead>
<tr>
<th>Time</th>
<th>Glucose (mg/dL)</th>
<th>Treatment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>07:00</td>
<td>110</td>
<td>Breakfast</td>
<td></td>
</tr>
<tr>
<td>12:00</td>
<td>80</td>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>19:00</td>
<td>115</td>
<td>Dinner</td>
<td></td>
</tr>
</tbody>
</table>

**Case Study:**

1. Blood Glucose and Subcutaneous Insulin Record.

2. Case Study 3: Completed BG and Insulin Administration Record.
### Blood Glucose and Subcutaneous Insulin Record

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Breakfast</th>
<th>Lunch</th>
<th>Dinner</th>
<th>Bedtime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Glucose</td>
<td>7.5</td>
<td>8.9</td>
<td>9.3</td>
<td>7.1</td>
</tr>
<tr>
<td>Subcutaneous Insulin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Notes:
- Case Study #3
- Alberta Health Services

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**Diabetes, Obesity and Nutrition SCN™ 2017**

**BBIT and Improved Glycemic Management in Hospital Self-Study Guide**
References


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

8. AHS draft Hypoglycemia Procedure 2016

9. AHS draft Hyperglycemia Procedure 2016
Acknowledgements

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