Factors and Variables that Can Affect Blood Glucose Results

Can you trust a blood glucose (BG) meter?

The Food and Drug Administration (FDA) has set the current standards for blood glucose meters that require 95 percent of all meter test results to be within 20 percent of the actual blood glucose level for results greater than 75 mg/dl and within 15 mg/dl for values below 75 mg/dl. So, a blood glucose that in reality is 100 mg/dl could show on a meter as being between 80 and 120 mg/dl—and still be considered accurate. This FDA requirement is likely moving to 15% soon, which is much closer to a laboratory accuracy (5-7%). Still not 100% perfect.

The FDA doesn't regularly monitor blood glucose meters or strips once they hit themarket (unfortunate but true!). This means some companies may not maintain the same level of quality and accuracy as when the products were initially approved.

What other factors can affect the accuracy of a BG meter?

There are multiple factors that can influence blood glucose meter results and accuracy.When testing blood glucose, simply put, the glucose interacts with an enzyme on the strip, releasing electrons. Another agent on the strip, called the "mediator," turns these electrons into an electrical current. The greater the glucose concentration, the greater the current. That current then speeds through the strip. Finally, an algorithm (formula) in the meter converts the current into a concentration of glucose. Then you get a number... What else could go wrong, right??

Here are some examples of factors and variables that could affect the accuracy of your results:

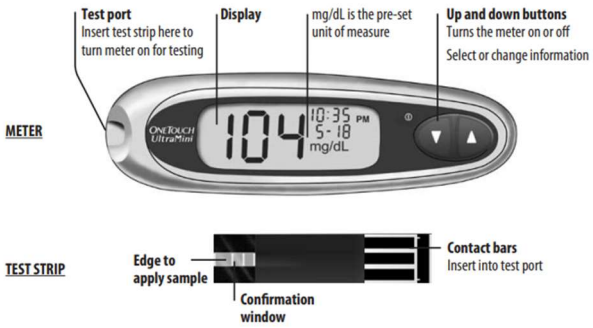
- Testing with fingers that are unwashed and dirty - even a small amount of food, fruit, sugar, dirt, lotion, or glucose tab residue can affect readings drastically - one study found that in a 0.3 microliter blood sample, 1 microgram of glucose (weight of a dust particle) could raise the sugar by 300 mg/dL.
- Testing a site that is still damp from an alcohol wipe or water from recently washed hands will dilute the sample (allow hands to dry thoroughly)
- Extreme altitude, temperature, and humidity can all affect the test strip accuracy
- Not enough blood sample applied to the test strip
- Test strip exposed to air and moisture for more than a few minutes before use (replace cap on strip bottle immediately after taking a strip out)
- Storage of test strips in very hot or freezing conditions, or environments subject to temperature fluctuations, direct sunlight moisture (can damage the enzymes and reagents on the strips)

- Alternate test site location such as forearms (delayed, not as accurate as fingertips)
- Failing to code the meter properly (when required)
- Large doses of Vitamin C from supplements (>1,500mg daily)
- Variability in the volume of red blood cells due to dehydration or anemia
- Expired test strips. Use all test strips in bottle within 30 days of opening that bottle.
- Purchasing test strips from unverified sources (believe it or not, thereare people out there selling look-alike products)
- Squeezing a fingertip vigorously (better to use a gentle milking motion of the entire finger)
- Wrong brand of test strip for your brand of meter
- User error (small child helping, still learning technique)
- There is no consensus on testing with the first drop or second drop (old days), but with appropriate technique the first drop should be more thanaccurate (however, if unable to wash or clean hands, recommend wiping away the first drop and hopefully any impurities, and then using a second drop to test the blood glucose)
- Low battery in a meter may also interfere with accuracy
- If you're getting blood glucose results that are inconsistent, variable or inaccurate, you should contact the manufacturer to report it and ask them to remedy the concern with a new meter or replacement test strips. Doing quality control testing with the supplied control solution for your meter can also help determine if there is a problem (follow your meter's recommendations).

That is a LOT!!! The overall key is clean and dry hands, consistency with proper technique, adequate sample size, and careful storage of test strips.

Ultra Mini by One Touch

Getting to know your system



Turning your meter on

To perform a test, insert a test strip as far as it will go. The display will turn on and the meter will briefly perform system checks. ***Or***, to change the time and date, start with the meter off, then press and hold ▼ for five seconds until the start-up test screen appears. After the start-up test screen, the pre-set time and date will appear on the display. ***Or***, if you want to turn the meter on to review past results, start with the meter off, then press and release ▼.

Start-up Test Screen

Every time you turn your meter on, a start-up test screen will appear for two seconds. All segments of the display should appear briefly on the start-up test screen to tell you that the meter is working properly. To check that all display segments are working, as soon as the start-up test screen appears, press and hold ▲ to keep the start-up test screen display on. Release ▲ to proceed to the next step. If the meter does not power on, try changing the meter battery. See *Replacing the battery* in Section 6.

Turning your meter off

There are several ways to turn your meter off:

- Press and hold ▼ for two seconds, when reviewing past results.
- Your meter will turn off by itself if left alone for two minutes.
- Before or after completing a test, remove the test strip.

⚠ **CAUTION:** If any information is missing from the start-up test screen, there may be a problem with the meter. Call LifeScan Customer Service at 1 800 227-8862 (available 24 hours a day, seven days a week).

Setting the time and date

Your OneTouch® UltraMini® Meter comes with the time, date and unit of measure pre-set. Before using your meter for the first time or if you change the meter battery, you should check and update the time and date. Make sure you complete steps 1 to 7 below to ensure your desired settings are saved.

⚠ WARNING: If your display shows mmol/L rather than mg/dL, contact LifeScan Customer Service at 1 800 227-8862 (available 24 hours a day, seven days a week). You cannot change the unit of measure. Use of the wrong unit of measure may cause you to misinterpret your blood glucose level, and may lead to incorrect treatment.

❶ Turn the meter on
Press and hold ▼ for five seconds until the start-up test screen appears. After the test screen, the pre-set time and date will appear on the display for five seconds. The hour will now start flashing.

NOTE: If a setting does not need to be updated, simply wait five seconds. The meter display will automatically advance to the next setting.

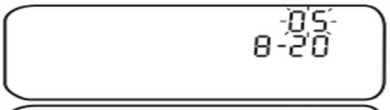
❷ Set the hour
With the hour flashing on the display, press and release ▲ or ▼ to go forward or backward one hour. To move faster, hold the ▲ or ▼ buttons down.

When the correct hour appears on the display, wait five seconds. Your entry will be saved and you will move to the next setting. The minutes will now start flashing.

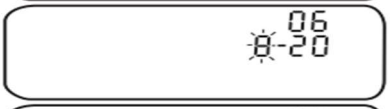
❸ Set the minutes
Press ▲ or ▼ to change the minutes. When you have the correct minutes on the display, wait five seconds to move to the next setting. AM or PM will now start flashing.

❹ Set AM or PM
"AM" or "PM" will be displayed next to the minutes. Press ▲ or ▼ to set AM or PM, then wait five seconds to move to the next setting. The year (last two digits only), month and day appear on the display and the year flashes.

❺ Set the year
Press ▲ or ▼ to change the year. When you have the correct year on the display, wait five seconds to move to the next setting. The month will now start flashing.



❻ Set the month
Press ▲ or ▼ to change the month. When you have the correct month on the display, wait five seconds to move to the next setting. The day will now start flashing.



❼ Set the day
Press ▲ or ▼ to change the day. When you have the correct day on the display, wait five seconds to move to the next screen.

Your time and date settings will be displayed for five seconds. After the five seconds, the settings will be saved and the meter will then turn off. If you want to adjust your settings, press ▲ or ▼ while the time and date are still on the display. You will be returned to the first set-up screen where you can begin with the hour.

Testing Control solution procedure:

❶ Check the code on the test strip vial before inserting the test strip

Code numbers are used to calibrate your meter with the test strips you are using to obtain accurate test results. You must code the meter before using it for the first time and then every time you change to another vial of test strips.

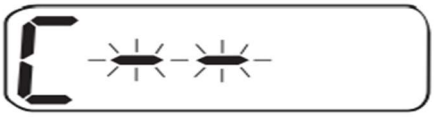
⚠ **CAUTION:** The test strip vial contains drying agents that are harmful if inhaled or swallowed and may cause skin or eye irritation.

❷ Insert a test strip to turn on the meter

Start with the meter off. If you have turned the meter on to change settings or review past results, turn it off. Remove a test strip from its vial. With clean, dry hands, you may touch the test strip anywhere on its surface. **Do Not** bend, cut or modify the test strips in any way. Use each test strip immediately after removing it from the vial.

Hold the meter as shown and insert the test strip into the test port. Make sure the three contact bars are facing you. Push the test strip in as far as it will go. **Do Not** bend the test strip.

After the start-up test screen appears, the meter will display the code from your last test. If a constant C and a flashing "– –" appear instead of a code number, such as when you are first using the meter, follow the instructions in step 3 to change to a numerical code.



❸ Match the code on the meter with the code on the test strip vial

If the code on the meter does not match the code on the test strip vial, press ▲ or ▼ to match the code number on the test strip vial. The new code number will flash on the display for three seconds, and then stay constant for three seconds. The display will advance to the screen with the flashing blood drop icon.

If the codes already match, wait three seconds. The display will advance to the screen with the flashing blood drop icon. The meter is now ready to perform a blood glucose test.

NOTE:

- If the screen with the flashing blood drop icon appears before you are sure the codes match, remove the test strip, wait until the meter turns off, then re-start from step 1 in *Coding your meter*.
- If you press ▲ by mistake so that the control solution test symbol **CtL** appears on the display, press ▲ again to change it back to the screen with the flashing blood drop icon.

⚠ **CAUTION:** Matching the code on the meter and the code on the test strip vial is essential to obtain accurate results. Each time you test, check to make sure the code numbers match.

When to test with control solution

OneTouch® Ultra® Control Solution contains a known amount of glucose and is used to check that the meter and the test strips are working properly.

Do a control solution test:
- to practice the test process instead of using blood,
- once a week,
- whenever you open a new vial of test strips,
- if you suspect the meter or test strips are not working properly,
- if you have had repeated unexpected blood glucose results as described in *Applying blood and reading results* in Section 3, or
- if you drop or damage the meter.

NOTE:
- Use only OneTouch® Ultra® Control Solution with your OneTouch® UltraMini® Meter.
- Control solution tests must be done at room temperature (68–77°F). Make sure your meter, test strips, and control solution are at room temperature before testing.

⚠ **CAUTION: Do Not** swallow control solution; it is not for human consumption. **Do Not** apply control solution to the skin or eyes as it may cause irritation.

How to test with control solution

Start with the meter off. If you have turned the meter on to change settings or review past results, turn it off.

❶ Check the code on the test strip vial before inserting the test strip

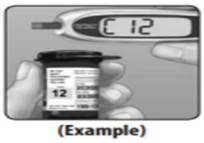
❷ Insert a test strip to turn on the meter

Make sure the three contact bars are facing you. Push the test strip in as far as it will go. **Do Not** bend the test strip.

❸ Match the code on the meter with the code on the test strip vial

If the code on the meter does not match the code on the test strip vial, press ▲ or ▼ to match the code number on the test strip vial. The new code number will flash on the display for three seconds, and then stay constant for three seconds. The display will advance to the screen with the flashing blood drop icon.

If the codes already match, wait three seconds. The display will advance to the screen with the flashing blood drop icon.



(Example)

❹ Mark the test as a control solution test

IMPORTANT:
- Mark all control solution tests with **CtL**. This will stop them from being stored as blood glucose results.
- Control solution results marked with **CtL** are not stored in the meter's memory.

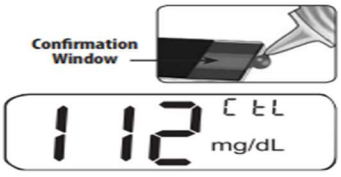
Press ▲ so that the control solution test symbol **CtL** appears in the upper right corner of the display. You must mark the test before you apply control solution. Once you have completed the test, you cannot change the marking. The meter is now ready to perform a control solution test. If you decide not to do a control solution test, press ▲ again to remove **CtL** from the display.

❺ Prepare and apply control solution

Shake the control solution vial before each test. Remove the cap and squeeze the vial to discard the first drop. Then wipe the tip with a clean tissue or cloth. Hold the vial upside down and gently squeeze a hanging drop. Touch and hold the hanging drop of control solution to the narrow channel in the top edge of the test strip. Make sure the confirmation window fills completely. Control solution should not be applied to the flat face of the test strip.

❻ Read your result

When the confirmation window is full, the meter will count down from 5 to 1. Your result will then appear on the display, along with **CtL** and the unit of measure.



❼ Check if the result is in range

Compare the result displayed on the meter to the control solution range printed **on the test strip vial**. Each vial of test strips may have a different control solution range. If the results you get are not within this range, the meter and test strips may not be working properly. Repeat the control solution test.

Out-of-range results may be due to:
- not following the instructions detailed in steps 1–7,
- expired or contaminated control solution,
- expired or damaged test strip,
- use of a test strip or control solution past its discard date, or
- a problem with the meter.

100-135 mg/dL (Example)

⚠ **CAUTION:** The control solution range printed on the test strip vial is for OneTouch® Ultra® Control Solution only. It is not a recommended range for your blood glucose level.

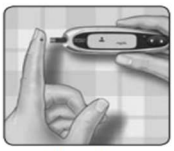
⚠ **CAUTION:** If you continue to get control solution results that fall outside the range printed on the test strip vial, **Do Not** use the meter, the test strips, or the control solution. Call LifeScan Customer Service at 1 800 227-8862 (available 24 hours a day, seven days a week).

Applying blood and reading results

Once you have a blood sample and your meter shows the screen with the flashing blood drop icon, you are ready to obtain a blood glucose result. If your meter does not show the screen with the flashing blood drop icon, remove the unused test strip and re-start the test process. See *Getting a blood sample* in Section 3.

❶ Prepare to apply the sample

Keeping your finger extended and steady, move the meter and test strip toward the blood drop.

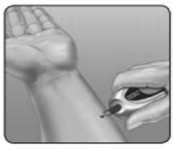


Fingertip

Do Not apply blood on the top of the test strip.

Do Not hold the meter and test strip underneath the blood drop. This may cause blood to run into the test port and damage the meter.

When applying a drop of blood from your forearm or palm, keep your palm or forearm steady and bring the top edge of the test strip to the drop of blood with your other hand.

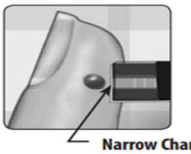


Forearm

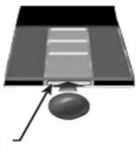
Palm

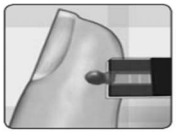
❷ Apply the sample

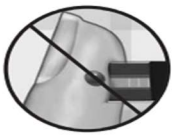
Line up the test strip with the blood drop so that the narrow channel on the edge of the test strip is almost touching the edge of the blood drop.



Narrow Channel







Gently touch the channel to the edge of the blood drop.

Be careful not to push the test strip against your fingertip or the test strip may not fill completely.

NOTE:

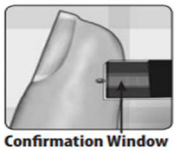
- **Do Not** smear or scrape the drop of blood with the test strip.
- **Do Not** apply more blood to the test strip after you have moved the drop of blood away.
- **Do Not** move the test strip in the meter during a test.

> ⚠ **CAUTION:** You may get an **Er 5** message or an inaccurate result if the blood sample does not fill the confirmation window completely. See *Understanding error and other messages* in Section 7. Discard the test strip and re-start the test process.

❸ Wait for the confirmation window to fill completely

The blood drop will be drawn into the narrow channel and the confirmation window should fill completely.

When the confirmation window is full, this means you have applied enough blood. Now you can move the test strip away from the blood drop and wait for the meter to count down from 5 to 1.



Confirmation Window

Full

Not Full

Hypoglycemia Procedure

Purpose:

Describe the specific procedure for treating mild to severe hypoglycemia and guidelines for bedtime blood glucose management to avoid nighttime hypoglycemia.

Objectives:

- Identify causes and symptoms of hypoglycemia
- Identify which volunteer is responsible for treating hypoglycemia
- Describe the steps for oral treatment of hypoglycemia
- Provide guidelines to avoid nocturnal hypoglycemia, and bedtime snack procedure
- Identify when and how Glucagon is to be used for treatment of severe hypoglycemia

Personnel:

- Med Team have the primary responsibility for treating campers/volunteers for hypoglycemia.
- Counselors and programs volunteers are responsible for helping a camper treat hypoglycemia according to guidelines when there is no medical support immediately available.
- Counselors are responsible for obtaining hypoglycemic treatment supplies and/or Medical team before engaging in activities away from the camp's health services area.
- Counselors are responsible for blood glucose testing and appropriate treatment for campers with hypoglycemia during the night.
- Counselors who have assisted or supervised blood glucose monitoring or treatment for hypoglycemia will provide the medical personnel with the camper's blood glucose result, treatment for hypoglycemia, and follow-up blood glucose result before the next scheduled testing time.

Equipment and Supplies:

- Blood glucose testing supplies (meter, test strips, finger-stick device)
- Fast-acting (quickly absorbed) carbohydrate source
- Slower-acting complex carbohydrate source and protein
- Glucagon Kit
- Camper health record

Causes of Hypoglycemia:

- Late or missed snacks/meals
- Extra exercise, spontaneous activity
- Over-estimation of insulin need/dose
- Delayed peak of long-acting insulin
- Injection into muscle
- Mistake in drawing up insulin
- Intentional overdose

Symptoms of Mild to Moderate Hypoglycemia:

- May be No symptoms
- Hunger
- Shakiness
- Sweatiness
- Pale color
- Headache
- Confusion
- Drowsiness
- Behavioral changes
- Double vision

Nighttime Lows:

- Inability to sleep
- Waking up sweating
- Waking up w/headache
- Sleep Walking
- Waking up foggy- headed,memory loss
- Unusually high morning BG

Procedure for Treating Hypoglycemia (low blood glucose):

Step 1: Test the blood glucose if possible. Treat IF the blood glucose is less than 70, OR there are definite symptoms of hypoglycemia present. If testing supplies are not available or camper is significantly symptomatic, go to Step 2.

Step 2: Give 10-15 grams of a fast-acting carbohydrate source (e.g. juice, glucose tabs, Smarties, etc.). Blood glucose will usually rise approximately 4-5 points for every gram of carbohydrate given. For blood glucose less than 50, start with 20-30 grams of fast-acting carbohydrate.

Step 3. Check IOB (insulin on board). This may be checked on the camper's pump, or calculated with the following formula. IOB = Insulin given X (4 minus hours since dose) ÷ 4. Consider this information and camper's carb: insulin ratio in decision-making about carb intake plan.

Step 4: Wait 15 minutes and retest blood glucose. If blood glucose is still below 70, eat/drink another 15 grams of fast-acting carbohydrate and retest in 15 minutes. Repeat until blood glucose is above 80, and the camper's hypoglycemic symptoms have resolved.

Step 5: Document the blood glucose results and specific treatments used, in the camper's health record. Provide copies of this information to each camper's team before the next pre-meal check.

Various Carbohydrate Sources to Use for Treating Hypoglycemia:

Food (measured in grams of carb)	
Glucose tabs (4g each)	4-5
Instant glucose gel (1 tube = 31g)	½ to 2/3 tube
Apple juice can (20g)	½ to 2/3 cup
Juicy Juice box (15g)	1-2 boxes
Honey (1tsp = 5g)	3-4 tsp
Regular soda pop (1oz = 3g)	5-6oz
Milk (1c = 12g)	1 ½ cup
Lifesavers® (2.5g each)	6-8
Raisins (1Tbsp = 7 ½g)	2 ½ T

An important note about insulin on board (IOB) or Active Insulin. When calculating the IOB as noted above in Step 3, recall that the gut can absorb carbohydrates and starches differently, and the insulin on board will likely compensate for this food ingestion. It is tempting to see several units of IOB and to give carbohydrates to counter these units, but this often results in rebound hyperglycemia. It is reasonable to allow SOME of the IOB to go uncovered, while taking the IOB, previous activity level, previous history of hypoglycemia, and symptoms all into account when deciding on how many carbohydrates will be adequate.

Bedtime Snack Guidelines

- Snacks are different for the different BG result categories. Campers with results over 200 may eat non-carb snacks, and are given an extra 4-8 oz of water with the snack.
- Ketones are checked for those over 300 if Medical Lead suggests

Night Time Guidelines

- Follow Camp MYDA hyper/hypoglycemia protocols. Do not dose unless Medical Lead approves
- Medical Lead to be contacted for campers with persistent lows.
- Campers with persistent BG>300 with ketones are to be reviewed by a Medical Lead for further management.
- Please consider treating younger campers less aggressively when treating hypoglycemia,as they tend to rebound with hyperglycemia, given the larger night snacks.

Indications for 0200 Rounds testing are as follows:

- If any camper/counselor has been treated during the day for low BG more than twice, as this puts them at risk of nocturnal hypoglycemia.
- Any camper/counselor who has been treated for highs or lows at Night Snack may need checked at midnight if advised by Medical Lead
- If any camper/counselor has had a severe hypoglycemic reaction at any time, they should be routinely tested during the night.
- 0200 Rounds routine testing is also done at the request of the parent, camper or counselor if they feel they need additional monitoring at night.

Treatment for Severe Hypoglycemia:

Medical personnel will administer **GLUCAGON** as a first line of treatment when a camper has **severe** hypoglycemia. **Severe** low blood glucose is evidenced by impaired swallowing and/or level of consciousness, or seizure (similar to epileptic-type seizure).

Glucagon is a hormone that stimulates the liver to release stored glucose (glycogen). It works very rapidly to raise blood glucose. In most situations, the blood glucose will begin to rise within 5-10 minutes of the injection.

Up to 100 lbs./45kgs – give half of Glucagon dose (0.5mg) IM or subcutaneously

More than 100 lbs./45kgs – give full dose of Glucagon (1.0mg) IM or subcutaneously

1. Because Glucagon can cause nausea and vomiting from the rapid rise in blood glucose,turn the camper or volunteer onto their side to avoid aspirating.
2. As soon as the camper is awake and can swallow safely, a Med Leader should decide if more carb intake will be needed (it is often a good idea).
3. Check Insulin on Board (IOB) to predict the magnitude of the current situation.
4. If the camper does not fully awaken within 10 minutes, follow a Med Provider's (MD, NP or PA) direction or procedure for intravenous glucose -- IV Dextrose 50% 1-2cc/kg.
5. Following severe low blood glucose, the camper will be transported to med cabin, where the blood glucose can be monitored closely every 30-60 minutes for the next 4 hours, followed by routine nocturnal blood glucose testing as well. The glycemic effect of the Glucagon may only last 30-60 minutes. If there is recurrent hypoglycemia, there may be a need for repeated glucagon, IV dextrose, transport, etc.
6. Notify the medical director immediately of any required rescue dose Glucagon for severe hypoglycemia.
7. Document the time, specific symptoms, treatment, and response to treatment on the camper's health record.
8. Adjustments to the insulin dosing may be indicated for the next 24-48 hours to avoid recurrence of severe low blood glucose.
9. Medical Director will notify the parents of any severe hypoglycemia event requiring glucagon or intravenous D50 treatment.

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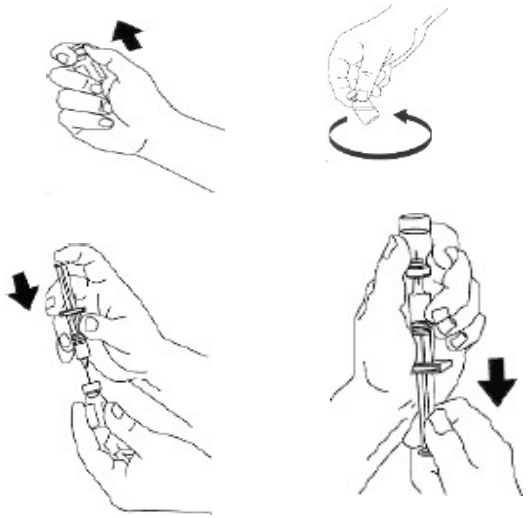
Glucagon Education:

During camper checkout, provide parents who do not have a Glucagon kit at home with a Glucagon Emergency Kit prescription from a Camp MYDA health care provider. Encourage parents to fill the prescription when they get home, and to review the process with their diabetes team before they need to use it.

HOW TO MIX GLUCAGON

- **Locate the bottle of powder and the syringe filled with fluid.**



- **Pop the cap off the bottle of powder**
- **Remove the cap from the syringe of fluid.**
- **Insert the need of the syringe into the bottle of powder.**
- **Inject all the fluid into the powder.**
- **Remove the needle from the bottle.**
- **Swirl the bottle gently several times, until all the powder disappears (liquid should be clear).**

HOW TO DRAW UP GLUCAGON

- **Locate the syringe inside the kit and note the approximate age of the child (THERE IS NO DANGER OF OVERDOSE):**
- **Up to 100 pounds = one-half of the syringe (0.5 mg mark on syringe)**
- **Over 100 pounds = full amount in the syringe (1 mg mark on syringe)**
- **After locating the correct Glucagon amount to give, insert the syringe into the bottle of already-mixed Glucagon.**
- **Make sure the syringe needle is poked through the center of the rubber seal onthe bottle. (Think of the bull's eye of a target.)**
- **Invert the bottle so the medication is at the neck of the vial.**
- **Only draw out the amount of Glucagon into the syringe that is needed for the recommended amount based on the child's age.**

HOW TO GIVE GLUCAGON

- **Select a site to inject the glucagon, (arm, thigh, abdomen or buttocks.)** Note: glucagon is equally effective when given in the muscle or fat. **May need someone to hold patient.**
- **Insert the needle into the selected area, no need to cleanse the site with alcohol.**
- **Inject all the fluid from the syringe, and then apply light pressure over the injection site.**

FOLLOW UP CARE AFTER GIVING GLUCAGON

- **Be certain that camp health care provider has been called, transport to central Med Cabin.**
- **Continue to check blood sugars every 15-30 minutes for the first hour, then hourly.**
- **May cause nausea, vomiting or abdominal cramping, keep child/volunteer on their side.**
- **When the child is alert and awake, start clear liquids with sugar about every 15 minutes.**
- **Give solid food as tolerated, blood sugars should be at least 80.**

Low-Dose Glucagon:

The use of glucagon in smaller doses is approved for a few situations. Because it is expensive and not in a large supply, other treatments are preferred for first-line treatment of hypoglycemia. The use of low-dose glucagon is approved for recurrent hypoglycemia < 50, or if the camper is nauseated or vomiting and is unable to keep any food or fluids down. The glucagon is mixed fully, and then a dose of 1 unit per year of age (up to 15 units max) can be given. The dose can be repeated if the blood glucose is not coming up within 30 minutes.

Because it is given in small doses, it rarely causes any of the side effects of the larger doses. Be sure to document and notify the medical director if this treatment is used. See policy on following page.

Low-Dose Glucagon Protocol

IF the Blood Glucose (BG) is < 50 WITHOUT significant symptoms, follow the usual treatment protocol using oral glucose (juice, glucose tabs).

Low-Dose Glucagon (LDG) is approved for recurrent hypoglycemia with BG < 50, or if the camper/volunteer are showing signs and symptoms of moderate to severe hypoglycemia. Oral glucose treatment (juice, glucose tabs) should be used *in addition* to low-dose glucagon.

Remember to assess the amount of insulin on board (IOB) when evaluating any hypoglycemia. If the camper or counselor chooses not to use the low-dose glucagon, please respect their wishes and monitor closely.

Once an appropriate use of low-dose glucagon has been identified, mix up a 1 mg vial of glucagon with 1cc/mL of supplied diluent. A fully mixed vial of glucagon contains 100 units per 1cc/mL (using U-100 insulin syringe). Check the refrigerator for any previously filled 15 unit syringes, ("Glucagon 15 units").

1. Draw up **1 unit per year of age (up to a max of 15 units)** and administer subcutaneously. Be sure to draw up medication, not just air. Go slow and use your medication administration procedure. At discretion of trained volunteer, a lesser amount of glucagon may be used.
2. Retest BG in 15 minutes to verify effectiveness:

- If BG still less than (<) 70, repeat oral glucose treatment with additional 15g of fast-acting carbs.
- If BG is greater than (>) 70, symptoms are improving, assess whether additional carbs are needed (beyond what has already been provided); they may just need an additional protein option to hold them until the next meal or snack time.
- If BG is not correcting as expected, camper/volunteer should be transported to Med Lead for additional monitoring and observation.

Any use of low dose glucagon should be documented carefully in the medical record and the team leader should be notified as soon as available. If you are uncomfortable with this procedure, please review with, or defer to a senior medical lead for direction.

If low dose glucagon is used on a camper/volunteer, please educate them that this was not an emergency rescue dose situation; also, be sure to review with the parent how and why thiswas used. Low dose Glucagon should not cause any significant symptoms of nausea or vomiting, and can be used very safely in many scenarios, both at camp and at home, with appropriate monitoring and education

Hyperglycemia Procedure

Purpose:

Describe the specific procedure for treating hyperglycemia to avoid potential Diabetic Ketoacidosis (DKA), a condition that may require hospitalization.

Objectives:

- Identify which volunteer is responsible for treating hyperglycemia
- Describe the steps for insulin correction of hyperglycemia
- Provide guidelines to avoid prolonged hyperglycemia or DKA
- Identify when hospital transport is required

Personnel:

- The Medical Lead has the primary responsibility for treating campers and other volunteers for hyperglycemia.
- Counselors are responsible for making sure campers with hyperglycemia are monitored more closely, ensuring follow-up as directed by their medical team.
- A Medical Lead or Medial Support should be notified of any illness, persistently elevated BG,increasing ketones, or any significant change in symptoms (i.e. fever, vomiting, abdominal pain, respiratory distress, etc.).

Equipment and Supplies:

- Blood glucose testing supplies (meter, test strips, finger-stick lancet device)
- Precision X-tra meter for testing blood β-Ketones
- Camper's insulin and health care record
- Extra calorie-free fluids

Description of Hyperglycemia:

Hyperglycemia or high blood glucose may be defined as blood glucose of > 180 mg/dL.

Possible causes include:

- Incorrect carbohydrate calculation
- Eating more food than usual
- Sneaking of extra food/snacks
- Loss of insulin potency
- Infection or illness
- Dehydration
- Insulin resistance of puberty
- Inadequate/ incorrect insulin dose
- Intentional omission of insulin
- Poorly absorbing pump site
- Blockage or bubbles in pump tubing
- Disconnected or broken pump tubing
- Stress – physical or emotional
- Sedentary activity
- Hypertrophy of injection sites,
- caused by inadequate site rotation
- Insulin effect not lasting through thenight, resulting in AM highs

Symptoms of Hyperglycemia: thirst, hunger, mood changes, blurred vision, fatigue, frequent urination, sweet breath, dry mouth, nausea, stomach cramps, vomiting, progression to deep, labored breathing

Sick Day Guidelines

1. Monitor blood glucose (BG) every 1-2 hours and PRN, usually to be done by a Medical personnel.

2. Test blood for ketones if BG is persistently > 300, using the blood ketone meter and teststrips. (Refer to the procedure for this product). (Higher level of suspicion with pumps)

3. Trouble shoot insulin pump infusion site, pump reservoir, last insulin given, etc. Refer to insulin pump protocol. If ketones present, corrective insulin should be given as an injection (as long as ketones present), and the insulin pump site changed right away.

4. If ketones are present, activity should be restricted to prevent worsening of condition.

5. When ill or having hyperglycemia, additional rapid-acting insulin is required to help clearany ketones (which are a sign of inadequate insulin). This is *in addition* to the insulin required for the blood glucose correction.

6.In addition to the BG correction dose, give Humalog, Novolog, Apidra or Fiasp every 2-4 hours for ketones as a percentage of the total daily dose (TDD) of insulin (TDD includes both long-acting insulin/basal rate PLUS rapid-acting insulin/boluses).
See table below:

Notify team leader immediately, if ketones greater than 1.0 (moderate or large).

Blood ketones (range 0.0 to 6.0 mmol/L)	**β-Ketone Correction Dose* (in addition to BG correction)**	**Example**
> 3.0 (Very Large	Correction dose X 2	Lantus 25 units each eveningHumalog 8-9 units per meal TDD = about 50 units Using Correction 1:50 > 150 BG 300…3 units Lg Ketone…..(Multiply x2) Total given…..... 6.0 units
1.6 to 3.0 (Large)	Correction dose X 2	
1.0 to 1.5 (Moderate)	Correction dose X 1.5	
0.6 to 1.0 (Small or Trace)	Correction dose, hydrate	
< 0.6 (Negative)	No action necessary	

*Use as a starting dose, may require increased insulin to resolve ketones; verify with healthcare provider or team leader prior to increasing.

7. Continue to check ketones every 2-4 hours and repeat above procedure, until the ketones are cleared it is very important to PUSH fluids to provide hydration and wash out the ketones. Ingeneral,

- If BG is > 150, give calorie-free beverages and water. If camper feels well enough to eat, suggest lower carb meal choices to avoid further hyperglycemia.
- If BG is < 150 and camper is not eating, give sugar-containing beverages (10-15 grams every 15-30 minutes) as tolerated, covering these extra carbohydrates withextra insulin.

8. If hyperglycemia and ketosis persist > 4-6 hours, or if vomiting occurs, notify medical director discuss use of ondansetron (for vomiting), IV fluids and/or transport to emergency room and

possible hospitalization for Diabetic Ketoacidosis (DKA)

Diabetic Ketoacidosis (DKA)

What is DKA:

Diabetic ketoacidosis is what happens in the body when not enough insulin is high blood glucose (BG) levels and development of ketones. Moderate or large ketones can accumulate until the body develops acidosis, a potentially life-threatening emergency. If hyperglycemia and ketosis cannot be corrected within several hours, or if the camper/volunteer has ongoing vomiting, IV fluids and even hospitalization may be required. The main causes of DKA are illness/infection, traumatic stresses to the body, forgetting to take insulin, or faulty insulin or insulin delivery.

Assessment Findings of DKA:

- Blood glucose > 250, usually persistent
- Moderate to large ketones, by blood testing
- Increased thirst and urination
- May have fruity breath (ketone odor)
- Dehydration with dry lips and oral mucosa, concentrated urine
- May have nausea, vomiting, and/or abdominal pain
- Increased heart rate, normal blood pressure, may have rapid respiratory rate
- May have altered level of consciousness with lethargy, fatigue, weakness, or somnolence

Management of DKA:

1. Notify medical director immediately and transport to a Medical Lead
2. Monitor vital signs every 2-4 hours
3. Follow Sick Day Rules and Guidelines.

Monitoring Blood β-Ketones using the Precision Xtra Blood Ketone Meter

Purpose:

As outlined in the rules and guidelines for hyperglycemia, diabetic ketoacidosis (DKA), and sick day protocol, blood ketones are to be tested as directed for hyperglycemia or illness. The Precision Xtra Ketone meter is used to quantify the ketones in fresh capillary whole blood. Results are then interpreted and acted upon accordingly, per the previously mentioned protocols.

Ketones appear in the blood when there is not enough insulin in the body to change sugar into energy. When the body cannot use sugar, it uses fat and muscle stores for energy. The breakdown of the fat and muscle produces ketones. Ketones are an acid waste product that build up in the blood. This can happen when there is too little insulin in the body due to not taking enough insulin or illness. It can also happen when there is not enough food due to weight loss or skipping meals. Because ketones are an acid, they can upset the way the body functions. This can lead to a serious condition called diabetic ketoacidosis (DKA).

Storage and Use:

- Blood ketone test strips should be stored in a cool dry place between 59-86 degrees.
- Do not store near heat or moisture.
- Store the test strips in their original foil packaging only. Remove only when ready to use.
- Do not use test strips beyond the expiration date printed on the package.
- Requires a very small blood volume: 0.8uL (ketone); do not reapply blood to test strip.

<u>Blood Ketones Scale</u>

Negative < 0.6

Small/Trace 0.6 to 1.0

Moderate 1.1 to 1.5

Large 1.6 to 3.0 Very Large > 3.0

Precision Xtra Blood Ketone Meter Manufactures Instructions:

Important information about monitoring your Blood B-Ketone

- For more detailed information about your blood B-Ketone test strip, please refer to its instructions for use before monitoring.
- **Do not** use out-of-date test strips. Check the expiration date printed on the test strip box and on each test strip foil packet.
- **Do not** put urine on the blood B-Ketone test strip
- Use the test strip immediately when you take it out of its foil packet.
- **Do not** use a wet, bent, scratched, or damaged test strip
- **Do not** use the test strip if its foil packet has a puncture or tear in it.
- Use each test strip only once.
- Before you monitor your blood glucose or blood B-Ketone, allow your monitor and test strip to reach the recommended operating range of the test strip. The test strip operating range is in the "Limitations of Procedure" section of your blood B-Ketone test strip instructions for use.
- Read the lancing device instructions for use.
- The blood B-Ketone test strip foil packet contains a desiccant tablet (Zeolite-Sodium Calcium Aluminosilicate). Although this material is not considered dangerous, the following safety advice should be observed:

1. Keep away from children.
2. Do not expose to water as product gets hot and could cause burns.
3. Do not eat, and avoid contact with eyes and skin. May cause burns to the mouth and throat.
4. If swallowed, drink two glasses of water. Seek medical help.

How to Monitor Your Blood B-Ketone

Getting Started

1. Prepare your lancing device.
2. Wash your hands using warm soapy water and dry them completely.
3. Remove the strip from its foil packet.
4. Insert the tree black lines at the end of the test strip into the strip port.
5. Push the test strip in until it stops.

The monitor turns on automatically.

These items show on the display window, one after the other:

- Display Check – remember to make sure that all items in the picture here show on the display window. (See chapter 1 for more information about the Display Check.)
- Time, month, and day (if set) If date and time are not set, dashes will show instead of numbers.
- Calibration CODE for the box of blood B-Ketone test strips you are using
- **KETONE** and Apply Blood message, which tell you that the monitor is ready for you to apply blood to the blood B-Ketone test strip.

Obtaining A Blood Drop

Use your lancing device to obtain a blood drop.

***Important:** Blood B-Ketone test strips have not been evaluated for alternative site monitoring. **Use only fingertip blood samples for blood B-Ketone monitoring.**

Recommendations for Obtaining a Blood Drop

- Before you obtain a blood sample from the fingertip, make sure the sample site is clean, dry, and warm. To warm the sample site, wash it in warm water or rub the skin vigorously for a few seconds.
- Hang your arm down before pricking your fingertip to help blood flow.
- Avoid squeezing the fingertip
- Apply the blood sample to the test strip immediately.

Lancets and Lancing Device

- Lancets are for one-time use only. Use a new lancet each time you monitor.
- Discard your used lancet properly. Put it in an empty puncture-resistant container, such as a plastic milk carton or detergent bottle.
- Never share your lancing device or lancet with another person.

Applying the Blood Drop to the Test Strip

1. Touch the blood drop to the purple area on the top of the test strip. The blood is drawn into the test strip.

   Note: If the monitor shuts off before you apply blood to the test strip, remove the test strip from the monitor and try again.

2. Continue to touch the blood drop to the purple area on the top of the test strip until the monitor begins the test. The monitor begins the test when:
   - ✓ You hear the beeper, if the beeper is ON.
   - ✓ The display window shows the status bar.
   - ✓ Then the display window shows the countdown.

   Note: Do not remove the test strip from the monitor or disturb it during the countdown.

   Important: If the countdown does not start:

   What it means:

   You might not have applied enough blood to the test strip.

   What to Do:

   - Apply a second drop of blood to the test strip. Refer to your test strip instructions for use for the number of seconds you have to apply a second drop.

- If the countdown still does not start, or if the number of seconds you have to apply a second drop have passed, discard the test strip, turn off your monitor, and try again with a new strip.

3. At the end of the countdown:
   - If the beeper is ON, listen for the beeper.
   - The blood B-Ketone result shows on the display window with the word **KETONE.**
   - The result is stored in your monitor's memory as a blood B-Ketone result. You may also write the result in your logbook.

Shutting Off Your Monitor

1. Removing the test strip from the strip port turns off the monitor. You can use the opened foil packet to remove and discard your used test strip.
2. Discard the test strip properly.

Note: You may also turn the monitor off by Pressing  and Holding the button. If you do not turn your monitor off or pull the test strip out, the monitor shuts off automatically after 60 seconds.

Understanding Your Result

Blood B-Ketone is expected to be lower than 0.6mmol/L. Blood B-Ketone may be higher when a person is ill, is fasting, exercises vigorously, or if blood glucose levels are not controlled.

When:

- Blood B-Ketone result is between 0.6 and 1.5 mmol/L and blood glucose result is 300 mg/dL (16.7 mmol/L) or higher:

What it Means:

A problem requiring medical assistance may be occurring.

What to Do:

Contact your healthcare professional. Follow his or her instructions for sick day management.

When:

- Blood B-Ketone result remains high or becomes higher than 1.5 mmol/L:

What It Means:

You may be at risk of developing diabetic ketoacidosis (DKA).

What to Do:

Contact your healthcare professional **immediately.**

"HI" Result

What It Means:

- Your monitor has determined that your blood B-Ketone result is higher than 6.0 mmol/L, or there may be a problem with the test strip.

What to Do:

- Monitor your blood B-Ketone again with a new test strip. If **HI** shows on the display window again, contact your healthcare professional **immediately.**

"E-4" Result

What It Means:

- There may be a problem with the test strip.

What to Do:

- Monitor your blood B-Ketone again with a new test strip. If **E-4** shows on the display window again, contact your healthcare professional **immediately.**

Important: It is recommended that you repeat the blood B-Ketone test with a new test strip when:

- **HI** appears in the display window.
- Your result is unusually high.
- You question your result.
- You obtain a 0.0 mmol/L blood B-Ketone result BUT your blood glucose is higher than 300mg/dL (16.7 mmol/L).

Important: A result that is incorrect may have a serious medical outcome. Consult your healthcare professional before changing your diabetes medication program.