



## Diabetes

Victory Junction Medical Staff and Volunteer Training



## Objectives – What's the target?

- Review normal metabolism and role of insulin
- Review pathophysiology of diabetes mellitus in children and adolescents
- Discuss diabetes complications and emergencies
- Discuss management of diabetes in children and adolescents
- Discuss diabetes in the Victory Junction camp setting



The target is camper safety! Better understanding of the diseases our campers have means better care!

# Metabolism

how the food we eat becomes useable energy...

The brain consumes up to 40-90% of all the body's glucose

One molecule of **glucose** yields up to **38 ATP** (energy). This process involves glycolysis, the citric acid cycle, and oxidative phosphorylation.



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**Insulin**, an endocrine hormone, is required to “unlock” the cell membrane and allow glucose in to cells.

Exceptions: Neurons & Muscle cells during contraction (exercise) are permeable to glucose



# Metabolism and the role of insulin

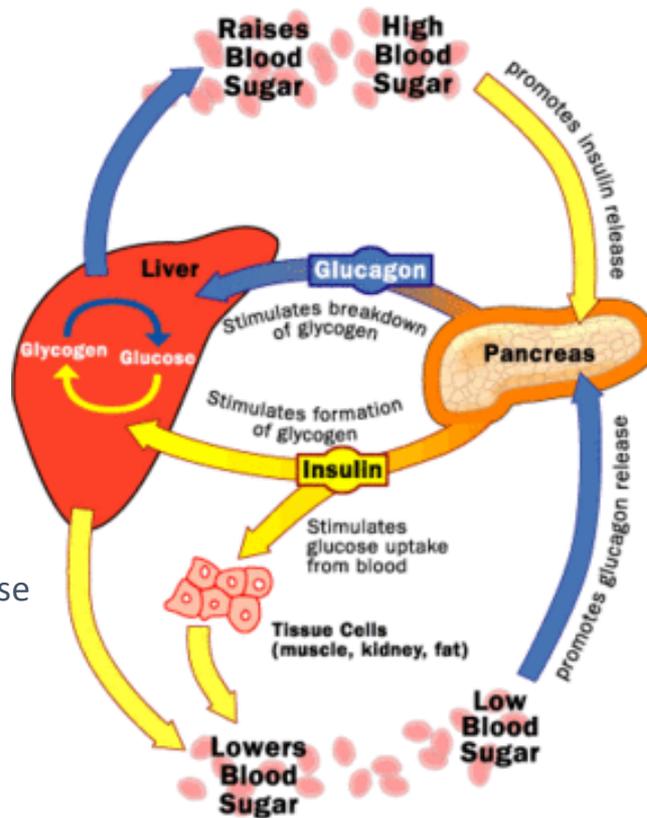
Blood sugar, or blood glucose, is the amount of glucose circulating in the blood stream, outside of cells.

Blood glucose levels are maintained by a complex feedback system.

Within **3-5 minutes** of changes in blood glucose, insulin secretion changes in response.

**Insulin** is required for glucose to enter tissue cells.

Insulin binds to the cell and assists in the uptake of circulating glucose into the cell to be used as fuel.



**Insulin** is a hormone made and released by the islets of Langerhans in the **beta cells** of the pancreas.

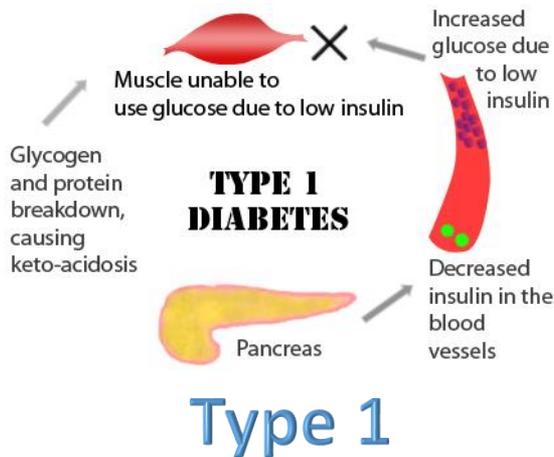
**Glucagon** is a hormone made and released by the **alpha cells** of the pancreas.

Glucagon is potent, a small amount can increase the circulating blood sugar rapidly.

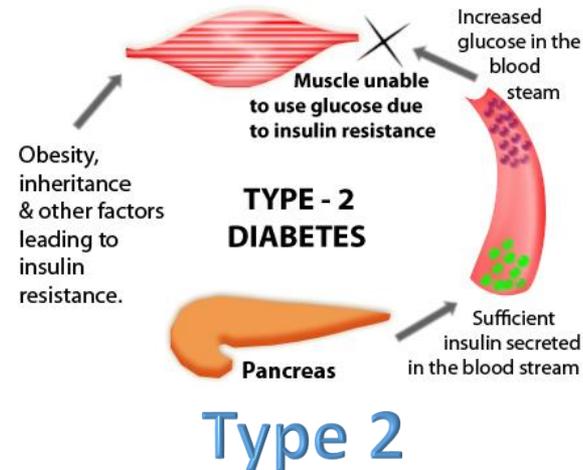


# Diabetes Mellitus

Diabetes is one of the most common diseases among children. About **208,000** children and adolescents < 20 years old were living with diabetes in the U.S. in 2012.

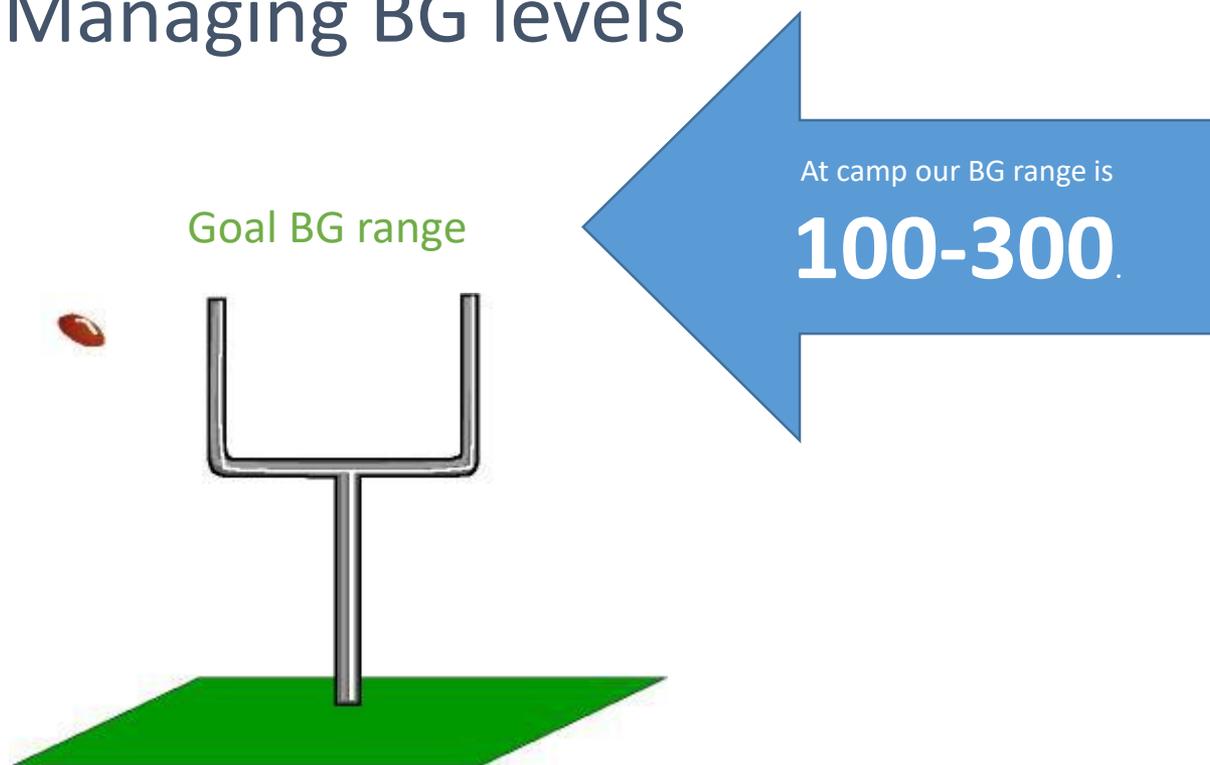


- Also called insulin-dependent diabetes mellitus (IDDM), previously “juvenile diabetes”
- 5% of all diabetes diagnoses, and nearly all diabetes diagnoses for children < 10 years old
- Acute onset, no known prevention, increased risk for related autoimmune diseases
- Autoimmune origin, beta cells of pancreas injured
- Minimal to no insulin produced



- Previously called “adult onset” diabetes
- Typically diagnosis occurs > 40 years old, although prevalence is rapidly increasing in children > 10 years old
- Slow onset, diagnosis preceded by insulin resistance, associated with obesity and “metabolic syndrome”
- Pancreas releases increasing amounts of insulin to compensate for decreasing sensitivity of cells
- Cells are not receptive to the action of insulin in uptake of glucose

# Diabetes – Managing BG levels



Managing BG levels is challenging, especially in children and adolescents.

It requires a balance of food, insulin, activity, hydration, and stress...  
and **A LOT** of communication between counselors and the **medical team**.



# Diabetes – When to check BG levels

- before every meal
- before bedtime (approximately 2100 to 2200)
- Before high-energy activities like swimming, the Adventure Tower, the SuperDome
- if they feel “low” (especially after high-energy activities like swimming!)
- in the middle of the night for some campers – (this is a case by case basis)
- 15 minutes after treating a low blood glucose level with a snack (see details below)
- any other time you are question a camper’s blood glucose
  - Don’t be afraid to check a blood glucose if concerned!!!

The overnight check for those campers needing it, will happen at 2 AM.

Campers **MUST** show a counselor or a member of the medical team their BG!



# Diabetes – Giving insulin

- Should be given immediately after meals are eaten, or to cover HIGH blood sugars (>300)
- Campers will check their BG BEFORE eating
- Counselors will count the carbs that they eat
- Campers will get ONE dose of insulin after they eat to cover high Blood sugars (their correction), and to cover the amount of carbs that they ate.

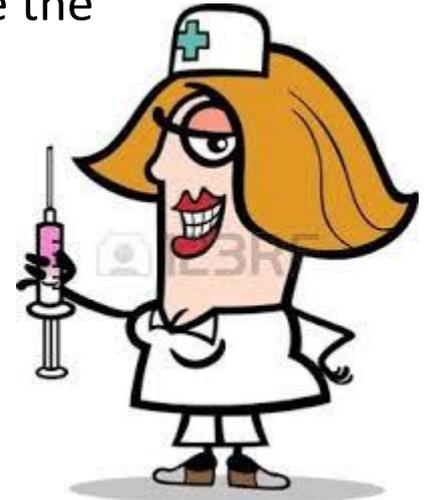
**Counselors are responsible for documenting the campers Blood Sugar readings and camper MUST show counselor their blood sugar reading.**



# Diabetes- Giving Insulin



- Counselor responsibilities:
  - Recording Blood Sugar levels
  - Recording Carbs!
  - Recording the amount of insulin to be given if the camper's pump already calculated it for them
    - The camper **MUST** wait until a medical team member verifies the carbs and insulin dose!!!
- The medical team is responsible for:
  - Ensuring the number of carbs that is recorded makes sense
  - Calculating and/or verifying the insulin dose
    - Most campers will have pumps that will calculate the insulin dose for them
  - Administering the insulin for the campers if needed
    - Campers can administer their own insulin only **AFTER** you have verified the dose



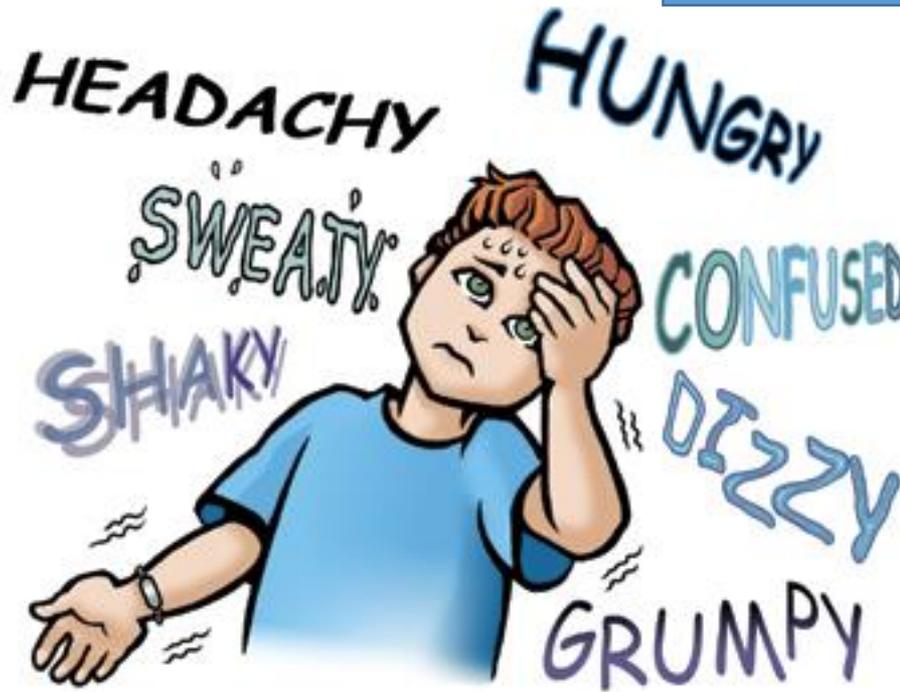
# Diabetes – Complications - Hypoglycemia

## Causes of low BG:

- Too much insulin
- Too much exercise
- Too little food/fuel

At medical check-in, ask the camper what his/her “low” symptoms are, and note this on the medical Camper Care form

All campers will check BG before heavy exercise (Waterpark, Adventure, possibly SuperDome) to help prevent lows



## When to give snacks:

- Scheduled snack of 1630
- Any time your camper's BG is low and they need a snack to get within the 100-300 safe range



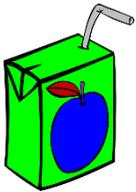
# Diabetes – Complications - Hypoglycemia

Counselors will notify the medical for a **BG < 100**. If **BG < 100**

Give **15 grams** of quick acting carbohydrates

AND a protein snack., Recheck in **15 minutes**

Snacks are always available in the Fuel Stop, in the cabins, and in a backpack that the counselors will carry (“low bag”)



- ❖ Prevention is the key! Counselors will be trained to notify the medical team for any signs or symptoms of hypoglycemia.
- ❖ If a camper is consistently low and you are giving lots of snacks all the time, let the APP know.

An Advanced Practice Provider will need to be notified for a BG < 70.



# Diabetes - Emergencies

## Severe hypoglycemia = BG < 50

If BG drops to an extremely low level, cells are starving!

As a result, this can cause **seizures, loss of consciousness, or coma**



Glucagon (the hormone that quickly increases blood glucose) may be prescribed to be given IM in this type of emergency. Glucagon will be given if a camper is unconscious or unable to take oral glucose.

IV dextrose may also be given to increase blood glucose.



# Diabetes – Complications - Hyperglycemia

Causes of high BG:

Too little insulin  
Too much food/sugar



The camper may also:

- Urinate frequently (may have ketones in urine)
- Have fruity smelling breath
- Eventually have decreased LOC or coma

If a camper is consistently high (>300-400) and they are on a pump, they may need to change their "pump site." Or they may not really be giving themselves their insulin!



# Diabetes – Complications - Hyperglycemia

Treating hyperglycemia:



## Insulin

Dosed according to the camper's home correction factor, or the on call provider's orders

- Counselors will call **medical team** for
- BG > 300
  - An Advanced Practice Provider needs to be notified of BG > 350

## Hydration

Have the camper rest and hydrate until BG returns to normal

If BG is sustained > 300, urine will be checked for ketones and the provider on-call must be notified



# Diabetes - Emergencies

Severe hyperglycemia = **BG > 350**

When BG is very high:



- Glucose is circulating instead of inside the cells
  - Cells are **starving!**
- Osmotic diuresis pulls fluid out of the cells to dilute the glucose
  - Cells are **dehydrated!**

Stress, illness, and hormones can contribute to high BG, especially in teens

## Diabetic ketoacidosis (DKA)

- Leading cause of morbidity and mortality among children with T1DM
- Cell metabolism converts from using glucose to using fatty acids, creating excess ketones
  - Ketones spill into urine \*if BG > 300, check urine dipstick to assess for ketones
- Ketones => metabolic acidosis (pH <7.3)
  - imbalance in K and other electrolytes, progressive dehydration
- **Signs of DKA:** polyuria, polydipsia, Kussmaul respirations (fruity breath, slow and deep breaths), decreased level of consciousness

At medical check-in, as your camper about any recent episodes of DKA



# Diabetes – Long-term Complications

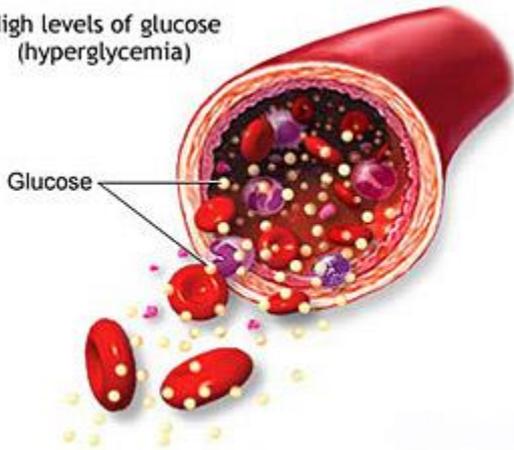
People with diabetes are at risk for a number of long term complications:

- Vascular disease
- Kidney disease
- Stroke
- High blood pressure
- Neuropathy
- Skin problems (delayed healing)
- Eye problems or vision problems

Well managed and controlled BG decreases risk for these complications.

Metabolic control over time is measured by a blood test called HbA1C.

High levels of glucose (hyperglycemia)



Glucose molecules are abrasive, so when BG is high there is damage to vessels.

Over time, this creates problems in circulation to many different organs and systems.



# Diabetes – CGM and Insulin pumps

## CGM = continuous glucose monitoring

- camper wears a device that measures BG about every 5 minutes
- check BG with a finger stick BID and enter into device to correlate

## Insulin pump

- Many different brands, all deliver insulin subcutaneously with continuous and bolus
- Preprogrammed with basal rate (often changes based on time of day)
- Many glucometers are linked to the pump, and the pump will calculate bolus dose
- \*\*\*campers with a pump must show the **medical staff** the entered bolus dose before administering the dose\*\*\*
- Site changes usually every 3 days to prevent tissue damage.



At medical check-in, verify the pump settings, use, and site with each camper and caregiver.

# Diabetes at Victory Junction

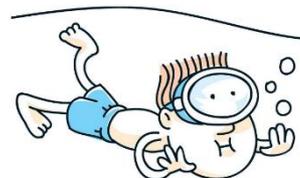
## Every camper's BG is checked:

Anytime that they feel low or "off"

Before meals



Before strenuous activity (i.e. pool, sports, adventure)



Before bed



Overnight (2am) – on a case by case basis

\*BG should also be checked as needed for symptoms of low or high BG. Keep in mind that these times are subject to change.\*

The "floating" or lightheadedness of low BG can be easily disguised while campers are swimming – watch them closely!



# Diabetes at Victory Junction

## Every camper's BG is corrected:

According to his/her correction factor and target BG \*example on next slide\*

To cover carbohydrates according to his/her correction ratio for that meal

To cover carbohydrate snacks if needed

Carb counts are available for all snacks and meals.

The NUT (nutrition) team plans healthy, balanced, safe meals for our campers.

Review the camper's insulin doses and correction factors during medical check-in.



# Diabetes at Victory Junction

## Calculation Method

Insulin units are calculated using the following formula:

$$X = \frac{\text{Pre-Meal Blood Sugar} - \text{Blood Sugar Goal}}{\text{Correction Factor}}$$

$$Y = \frac{\text{Meal Carbohydrates}}{\text{Carbohydrate Factor}}$$

Insulin Units = X + Y

## Rounding Method

The Insulin Units are rounded using the following method based upon hospital recommendations:

.00 to .24 --> Round down

.25 to .74 --> Round to .5 (1/2)

.75 to .99 --> Round up

## Practice

Jimmy's blood sugar before lunch is 185

Jimmy eats 60gm of carbs at lunch

Need to know:

Goal blood sugar = 140

Correction = 30 ( 1 unit insulin: each 30 above goal)

Carb correction ratio for lunch = 1:12

185 (current sugar)-140 (goal sugar)= 45

45 ÷ 30 (correction factor) = 1.5 units

60 carbs ÷ 12 = 5 units

1.5 + 5 = **6.5 units of insulin total**

# Diabetes at Victory Junction

An example check in sheet for a camper with diabetes

## Victory Junction Diabetes Log

Please fill out the front of this sheet at check-in.

Name: Parker Gardner Cabin: Bristol

I use the following type(s) of insulin: Novalog

I give my insulin using a:  vial and syringe  insulin pen  pump

I always check my blood sugar:

- First thing in the morning
- Before meals
- At bedtime
- During the night (at \_\_\_\_\_)
- Before certain activities \_\_\_\_\_

|                                   |  |
|-----------------------------------|--|
| <b>CARB RATIOS for each meal:</b> | <b>CORRECTION FACTOR:</b>                  |
| BREAKFAST: <u>1:10</u>            | 1 unit per 50 over 180                     |
| LUNCH: <u>1:10</u>                | (CF) (target)                              |
| DINNER: <u>1:10</u>               | OR   |
| SNACKS: <u>1:15</u>               | Blood Glucose minus <u>180</u> + <u>50</u> |
|                                   | (target) (CF)                              |

**FOR PUMP USERS ONLY:**

Next site change on Tuesday Fill reservoir with 90 units

Level of assistance needed for site change: Full assistance

If you use a pump, please list your basal rates (only needed in case pump malfunctions):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Managing LOWS: When my blood sugar is below 80 what works best for me is:  
Juice boxes, smarties

Any other notes on diabetes care: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



# Questions



Bring your questions with you, and get set for a great week!!



Thank  
you!



## References

- Centers for Disease Control and Prevention: National diabetes statistics report: estimates of diabetes and its burden in the United States, 2014. Atlanta, GA: U.S. Department of Health and Human Services; 2014.2.
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- Silverstein, J., Klingensmith, G., Copeland, K., Plotnick, L., Kaufman, F., Laffel, L., Deeb, L., Grey, M., Anderson, B., Holzmeister, L., & Clark, N. (2005). Care of children and adolescents with type 1 diabetes, a statement of the American Diabetes Association. *Diabetes Care*, 28(1), p. 186-212. doi: 10.2337/diacare.28.1.186

