Diabetes At School

Rachel Calendo MS, RN, CPNP, CDCES
Martha Cuevas RN, BSN, CPT
Rachel Shubitz RN, BSN, CPT
Wendy Rose RN, CPT

Banner Children's Specialists: Endocrinology

Objectives

At the end of this session, you will be able to answer these questions:

1. What is diabetes?
2. What are the differences between T1D and T2D?
3. What is insulin?
4. What is Time-in-Range (TIR)?
5. How to do insulin dose calculations?
6. What is hyperglycemia?
7. What is hypoglycemia?
8. What is glucagon?
9. When should glucagon be administered?
10. What glucagon options are available?
11. How is glucagon given?
12. What is a continuous glucose monitor (CGM)?
13. What is an insulin pump?
14. What is an automated insulin delivery (AID) device?

1. What is diabetes?

A disease in which the body's ability to produce or respond to the hormone insulin is impaired, resulting in abnormal metabolism of carbohydrates and elevated levels of glucose in the blood and urine.

1 of the 4 criteria must be met:

- A1c ≥6.5%. The test should be performed in a lab using a NGSP certified and standardized to the DCCT assay (normal A1c is <5.6%)

OR

- A fasting plasma glucose (defined as no caloric intake for at least 8 hours) greater ≥126 mg/dl

OR

- Symptoms of diabetes mellitus (polyuria, polydipsia, and unexplained weight loss) **plus** a random (casual) plasma glucose of ≥200 mg/dl

OR

- A two-hour plasma glucose ≥200 mg/dl during an oral glucose tolerance test using a glucose load containing the equivalent of 75g anhydrous glucose dissolved in water (Glucola or equivalent)

2. What are the differences between T1d and T2d?

T1d – No insulin production. An autoimmune disease.
T2d –Insulin production, but might not be enough and/or doesn't work well. Not an autoimmune disease.

There are two common types of diabetes in children

Type 1

Many kids who have diabetes have type 1 diabetes. It is an autoimmune disease that causes your body not to make insulin. Insulin is a hormone that helps your cells use the energy from the food you eat. No one knows exactly why people get type 1 diabetes, but if you have family members with type 1 diabetes, you may be more likely to develop type 1 diabetes.

Type 2

Some kids have type 2 diabetes. With type 2 diabetes, your body makes some insulin, but the insulin doesn't work well. If you have family members with type 2 diabetes, you may be more likely to develop type 2 diabetes.

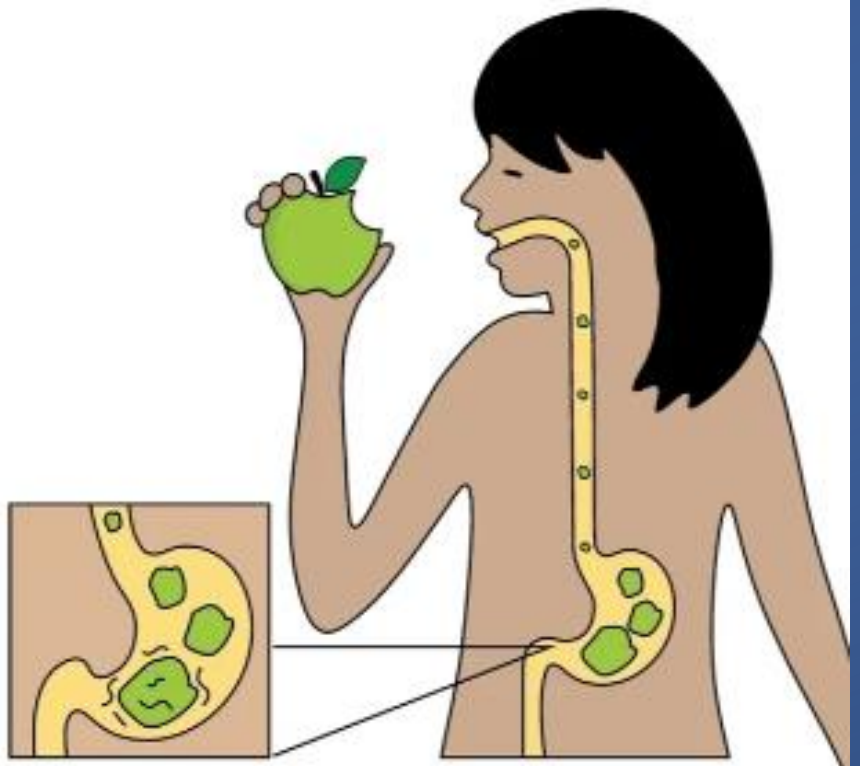
****Both adults and children can develop either T1d or T2d****

TYPE 1	VS.	TYPE 2
Body no longer makes insulin. Beta cells in pancreas that make insulin are destroyed		Body still makes insulin, but maybe not enough or doesn't use it well (insulin resistance)
RISK FACTORS		
• Family history • Genetics • Environmental factors • Other autoimmune conditions		• Family history • Genetics • Ethnicity • Lack of activity • May be overweight or obese
TREATMENT		
• Always needs insulin • Glucose checks • Healthy eating • Physical activity		• May need insulin or other injectable medications • May need oral medications • Glucose checks • Healthy eating • Physical activity

Digestion turns food into fuel

How the body normally gets energy

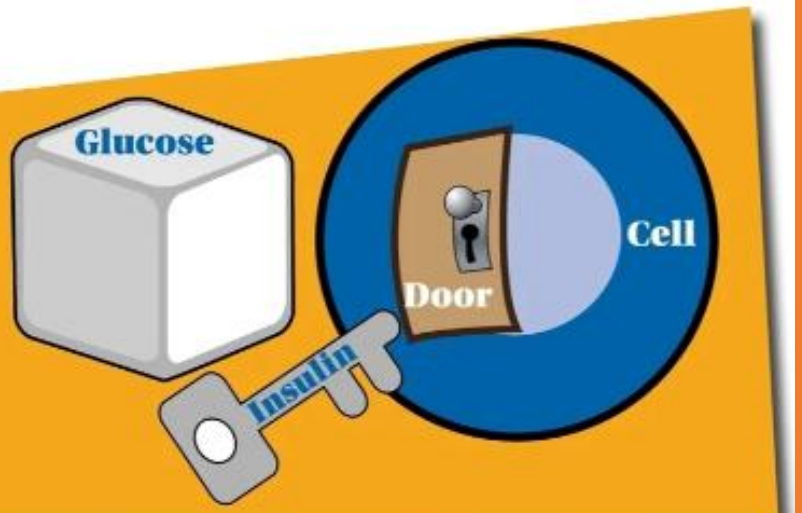
When you eat, the digestive system turns the carbs in food into glucose. The glucose in the stomach enters the bloodstream so it can reach your cells to make energy. More glucose in the bloodstream raises glucose levels.



Glucose needs to get into cells

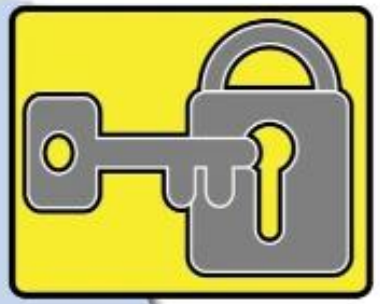
Locked doors

Glucose can't get into cells on its own. Cells are like locked doors, and glucose needs a key to get into the cell.



Insulin is the key

It's a hormone called **insulin**. The insulin (key) is made in the pancreas. When you eat, the body sends insulin through your bloodstream.



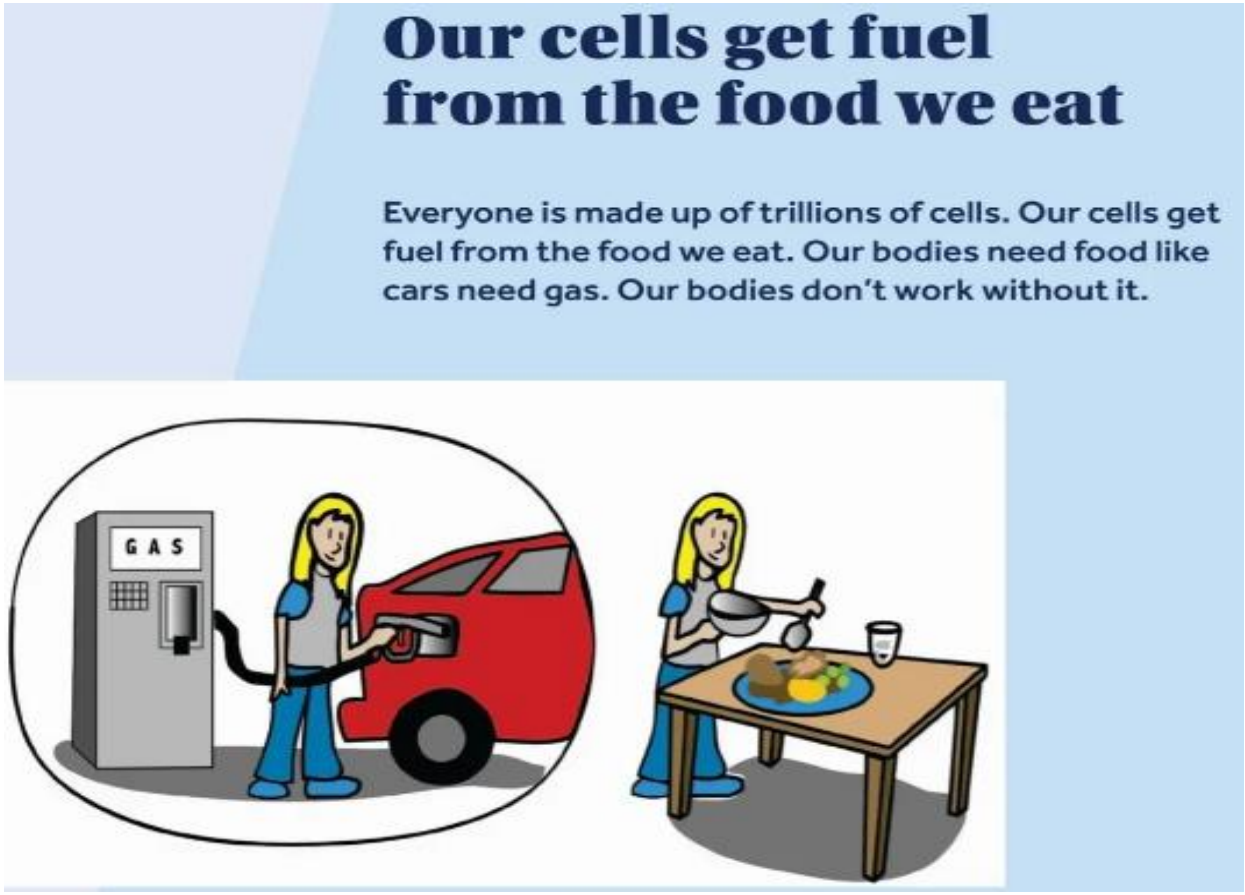
Energy

When insulin gets to the cells and unlocks the doors, it allows glucose to enter. Once inside, glucose can be used as energy or stored to make energy later. As a result, your cells can do all the things you need them to do.

3. What is insulin?

Insulin is a hormone produced in the pancreas by the islets of Langerhans which regulates the amount of glucose in the blood.

In order to understand what insulin is, we need to talk about how the body makes energy!



Natural insulin

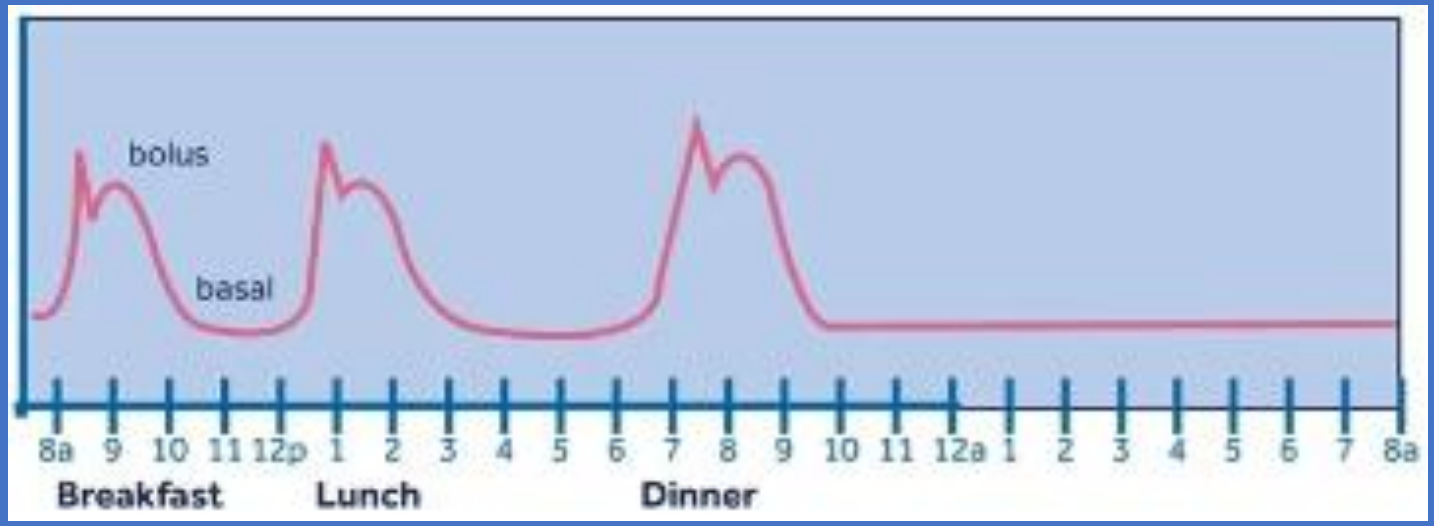
The body makes insulin in two ways:

- A **small** amount all day and night. This lets your body make energy all day and night.

= BASAL

- A **large** amount when you eat. This lets the carbs you eat enter your cells to make energy.

= BOLUS

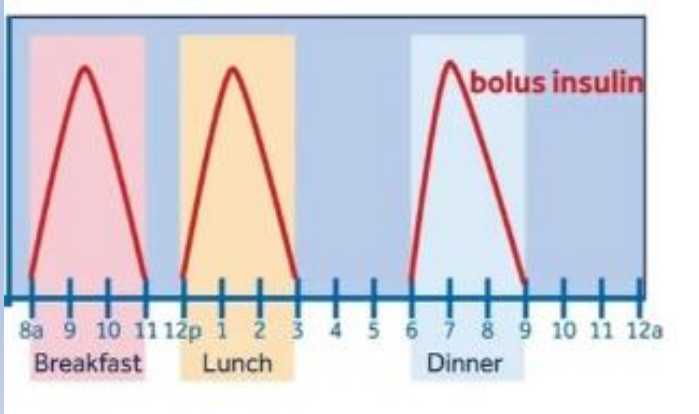


Banner Children's

What are the two types of insulin?

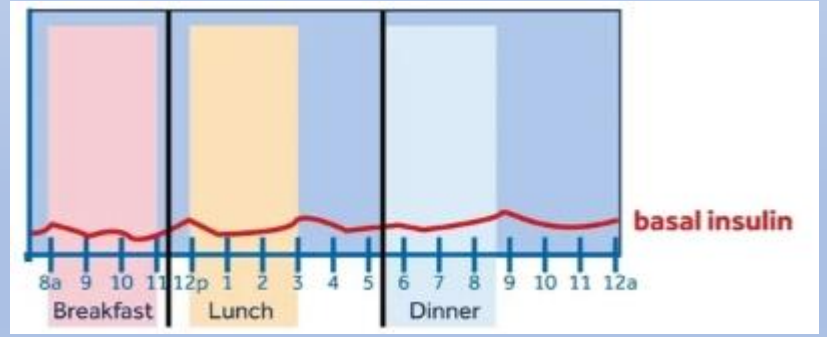
Rapid-acting insulins (bolus insulin):

1. Give for all meals/snacks/drinks containing carbs and to correct high glucose levels
   **Do not give for fast-acting carbs used to treat low glucose levels
2. Most start working 10-20 minutes
3. Last for about 3 hours in the body
4. Names may be: Humalog, Novolog, lispro, Admelog, Lyumjev



Long-acting insulins (basal insulin):

1. Usually given at home once a day
2. Starts working in about an hour
3. Lasts about 24 hours in the body
4. Names may be: Lantus, Tresiba, Levemir, basaglar

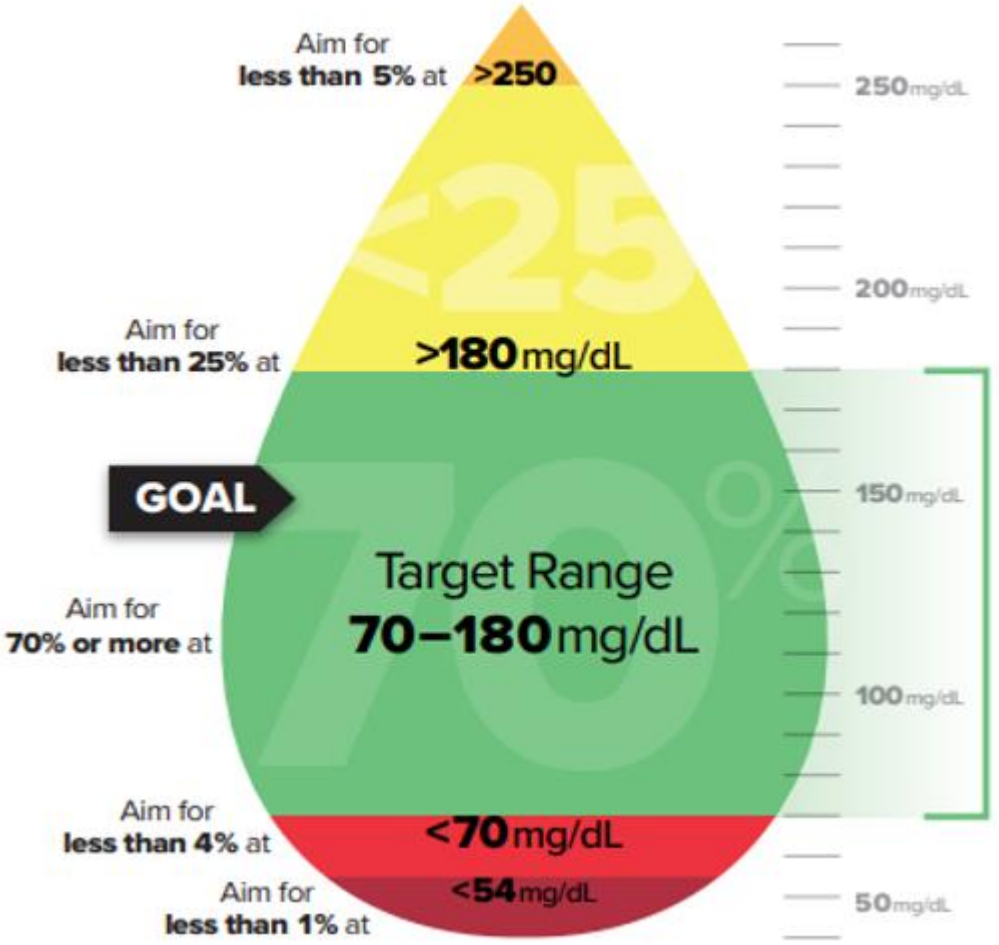


4. What is Time-in-Range (TIR)?

For most people, "range" is defined as glucose levels between 70mg/dL-180mg/dL

Time-in-Range	HgbA1c	Time-in-Range	HgbA1c
0%	12.1%	60%	7.5%
10%	11.4%	70%	6.7%
20%	10.6%	80%	5.9%
30%	9.8%	90%	5.1%
40%	9.0%	100%	4.3%
50%	8.3%		

Vigersky RA et al. The Relationship of Hemoglobin A1C to Time-in-Range in Patients with Diabetes. Diabetes Technol Ther. 2019 Feb;21(2):81-85.



Diabetes School Care Plans/Orders

- These must be followed for the care/treatment of all students with diabetes; most often will come from diabetes provider's office
- New orders needed for every school year
- **Do not need** new orders from the diabetes provider when insulin doses change (ex: carb ratios, correction factor, targets, etc) – parents can relay these changes to the school nurse on their own

Example:

** **APPLICABLE TO ALL SECTIONS OF THIS PLAN** **:

Parent/guardian may adjust insulin or other plan specifics, independent of diabetes team, and will notify the health office. **Provider is not required to provide updated orders for dose or plan changes.**

5. How to do insulin dose calculations?

Insulin:Carb Ratio

- Carb ratio is based on child's weight, changes with growth/age & is adjusted depending on the child's insulin sensitivity
- School orders will have carb ratio(s):
  - This is the number of carbohydrates that one unit of rapid-acting insulin will cover
  - 1 unit of rapid-acting insulin to X grams of carbohydrates consumed (ex: 1:10)
  - given for **all** meals/snacks containing carbs, based on the total carb count = **meal/carb dosing.**
    - **Pay attention to serving sizes on food labels**

Meal Dosing/Carb Dose: *When to give it?*

- Ideally, given **BEFORE** the meal
  - Student needs to commit to what they are going to eat
  - Dose is then calculated and given
  - If student eats less than what was dosed for, they need to make it up with other carbs (do **not** replace with fast-acting carbs like juice)

Post-meal Dosing

- **When to use it**
  - In young or developmentally delayed students
- **When not to use it**
  - In anyone old enough to tell you how much food they are going to eat
- **How to use it**
  - Dose given within minutes of finishing meal (so if student is done in 15 mins, dose is given right then)
  - **NO MORE THAN 30 minutes to eat/count carbs, & give insulin**

Two types of insulin pens: disposable or reusable:

Disposable

Reusable: penfill cartridges are changed out at least every 30 days, sooner when empty

Insulin pens

The pen already has insulin stored inside it.
Many find it easier to use.

To use an insulin pen:

1. Wipe off rubber stopper on tip of pen with alcohol.
2. Get a new pen needle and attach to tip of pen.
3. Dial 1 to 2 units and push injection button with thumb to squirt out some insulin. This makes sure there is no air in the needle. Repeat as needed until you see a drop of insulin appear at the end of the needle.
4. Dial your dose by looking at the numbers on the other end of the pen.
5. Make sure the site where you will inject is clean.
6. Pinch a fold of skin if needed. Place needle against skin at 90-degree angle and push in needle.
7. Push injection button down with thumb. Keep pen in place for about 10 seconds after injecting to make sure the full dose has been delivered. Let go of the skin, and remove the needle from the skin.
8. Remove the needle from the pen. If you leave it attached, air can enter the cartridge or medication can leak out. Never reuse a needle.
9. Dispose of pen needle in sharps container.

Storage of Insulin:

Storage of insulin

Keep these tips in mind:

- Never let it get above 86°F (30°C) or freeze.
- Insulin is good for about 1 month after it is opened. Some insulin can last longer. Check with your diabetes team.
- If **unopened** and kept in the refrigerator, insulin is good until the expiration date on the box.
- Insulin pens should be kept at room temperature once they are used the first time.
- Insulin vials can be stored at room temperature or in the refrigerator once they are used the first time.
- Never leave insulin in direct heat or light (i.e., in the car).
- Always keep a backup insulin supply in the refrigerator.

6. What is Hyperglycemia (High Glucose)?

Hyperglycemia is when glucose is greater than correction target (see school orders)

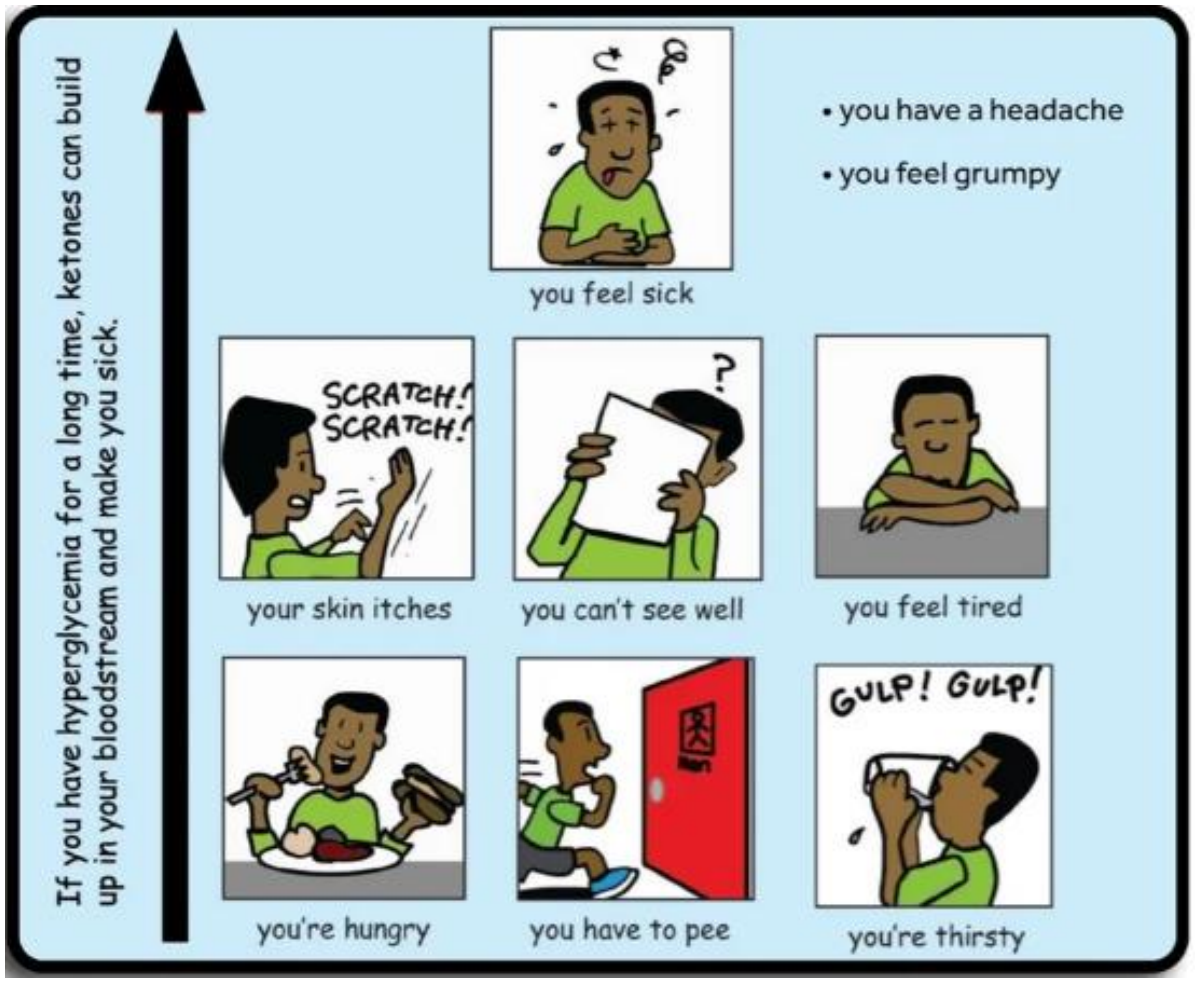
- Not immediate danger unless there are moderate or large ketones.
- Correction can be used at mealtime to bring this back down to target. Can also be used if not eating at mealtime and glucose is high.
- Correction usually happen no sooner than every 3 hours (see school orders), unless there are moderate or large ketones

Signs/symptoms of hyperglycemia:

- Increased thirst
- Increased urination
- Tired
- Feel sick

Signs/symptoms of DKA:

- Difficulty breathing
- Vomiting
- Lethargic



What are ketones?

When do we check for ketones?

Ketones are made when the body burns fat for energy instead of carbs due to a lack of insulin OR during times of illness

- Not immediate danger unless there are moderate or large ketones.

Check ketones if:

- Glucose is higher than 250mg/dL for an UNEXPLAINED reason
- Illness (especially vomiting, diarrhea, or fever)
  - Can have ketones with normal or low glucose levels with illness

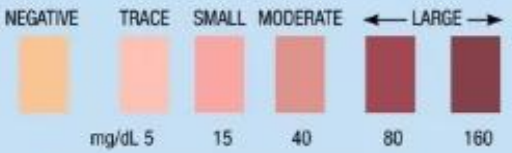
When to check for ketones:

- Glucose is >250 mg/dL for an unexplained reason (eating an hour ago is explained)
- Illness (fever, stomachache, flu symptoms like throwing up or diarrhea, etc.), even if glucose is low or in range

How to check for ketones:

- Clean your hands
- Dip end of ketone test strip in fresh urine or place strip directly into urine stream and then remove the strip from the urine
- Wait 15 seconds
- Compare the square with the colored chart on the bottle

KETONE COLOR CHART - Read at exactly 15 seconds.



*Ketone strips typically expire 2 to 6 months after opening the bottle; check bottle for specific time frame.

Photo courtesy of Ascensia Diabetes Care

Correction Target: a number used **ONLY** for the math in correction dosing

AGE	DAY	NIGHT or before bed
0-4 years	180	200
5-11 years	150	180
12 years and older	120	150

- Goal is to keep glucose in target **RANGE of 70-180 >70% of the time**, NOT at ONE target number.
- Glucose levels in 80s, 90s and low 100s are **GREAT**
- **High glucose levels happen! But no need to panic - high glucose levels with moderate or large KETONES are the problem (unless symptoms of DKA)! Student does NOT have to go home if feeling OK as long as corrections are happening on schedule.**

Correction Dosing:
Correction Factor (CF)
OR
Insulin Sensitivity Factor (ISF)

- This is the number of points 1 unit of rapid-acting insulin will lower the glucose level
  - ex: CF=30: glucose will be lowered by about 30 points if 1 unit insulin is given
- At **mealtimes**, add correction dose to carb dose; round to the nearest 0.5 unit (usually)

Half Unit Rounding Guidelines

Numbers	Rounding		Numbers	Rounding
0.1	Round down to full unit		0.6 - 0.7	Round down to 0.5
0.2	Round down to full unit		0.8	Round up to full unit
0.3 - 0.4	Round up to 0.5		0.9	Round up to full unit
0.5	Give half unit		1	Give full unit

- At **testing times**, if glucose levels are higher than correction target, & it has been at least 3 hours (usually) since the last dose of rapid-acting insulin, you will give a correction dose
- If it has been >3 hours (usually) during the daytime, & glucose level is higher than daytime correction target, give correction dose

Insulin Calculations

1. Calculate Carbohydrate Dose (dosing for meals, snacks, drinks with carbs)

Carbs to Eat	÷	Carb Ratio	=	Insulin for Carbs
60	÷	10	=	6

2. Calculate Correction Dose (ONLY when glucose is above correction target)

Glucose Level	-	Correction Target	=	Amount to Correct	÷	Correction Factor	=	Correction Dose
346	-	Day: 120 / Night: 150	=	226	÷	30	=	7.5

3. Calculate Total Insulin Dose

Insulin for Carbs	+	Correction Dose	=	Total Insulin Dose	If applicable: X	Ketone Dose (see chart to right)	=	Total Insulin Dose
6	+	7.5	=	13.5	X		=	

Half Unit Rounding Guidelines

Numbers	Rounding		Numbers	Rounding
0.1	Round down to full unit		0.6 - 0.7	Round down to 0.5
0.2	Round down to full unit		0.8	Round up to full unit
0.3 - 0.4	Round up to 0.5		0.9	Round up to full unit
0.5	Give half unit		1	Give full unit

Whole Unit Rounding Guidelines

Numbers	Rounding
0.1 - 0.4	Round down to full unit
0.5 - 0.9	Round up to next full unit

Numbers

- Correction Target (**Day**) 120 mg/dL
- Correction Target (**Night**) 150 mg/dL
- Insulin to Carb Ratio 10 (1 unit for every 10 grams)
- Correction Factor 30 (1 unit lowers glucose 30 mg/dL)

Rules for Insulin Dosing

1. **Carb dosing:** give insulin for all carbs eaten
2. **Correction dosing:** correct when glucose is above correction target. Do not correct if:
   - it has been less than 2 hours since the last dose of rapid-acting insulin.
   - you have had a low glucose in the last 1-2 hours or it has been less than one hour since vigorous activity.

Correction Chart

Ketone Level (check when BG >250 mg/dL or sick)	Extra Insulin Calculation	How Often to Correct Glucose Level
negative, trace, or small (or blood ketones ≤ 0.9 mmol/L):	Use *usual* high glucose correction	**Circle one:** Every 2 hours / Every 3 hours
moderate (or blood ketones 1.0-1.5 mmol/L):	Multiply total insulin dose (correction + carb) by **1.1** (10% increase)	Every 2 hours
large (or blood ketones 1.6 mmol/L or higher):	Multiply total insulin dose (correction + carb) by **1.2** (20% increase)	Every 2 hours

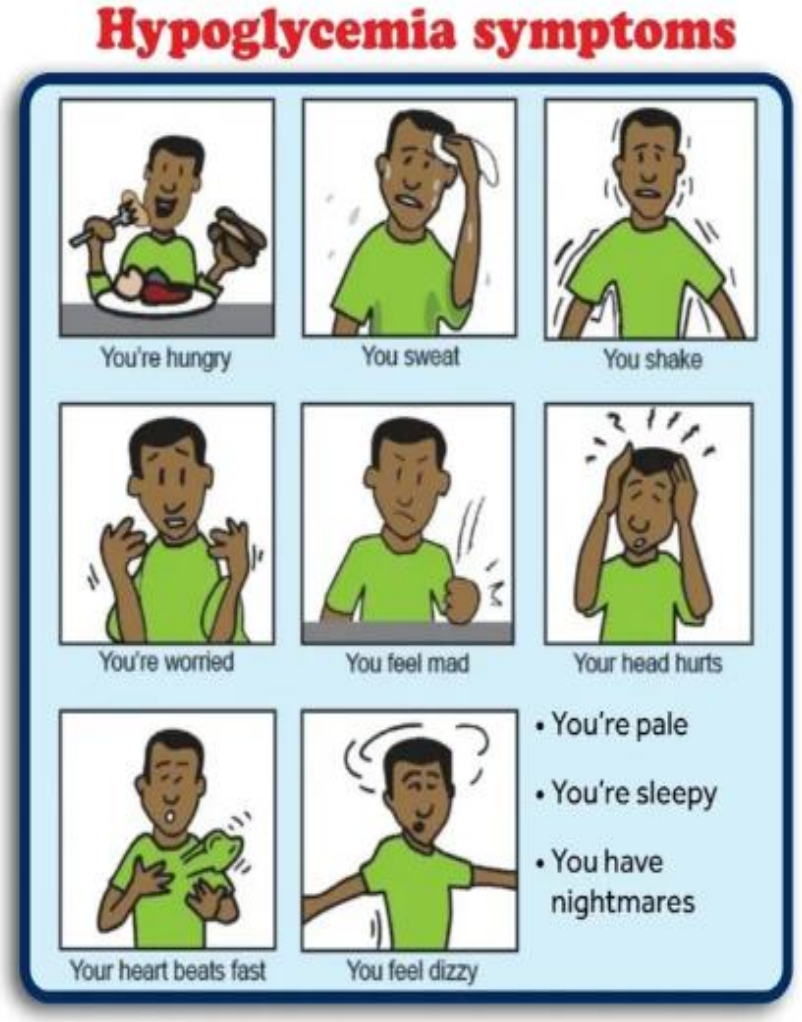
7. What is Hypoglycemia (low glucose)?

Low glucose is defined as glucose <70 mg/dL

In some children, we may use <80 (very young, nonverbal, or if they have symptoms between 70-80)

What makes glucose go too low?

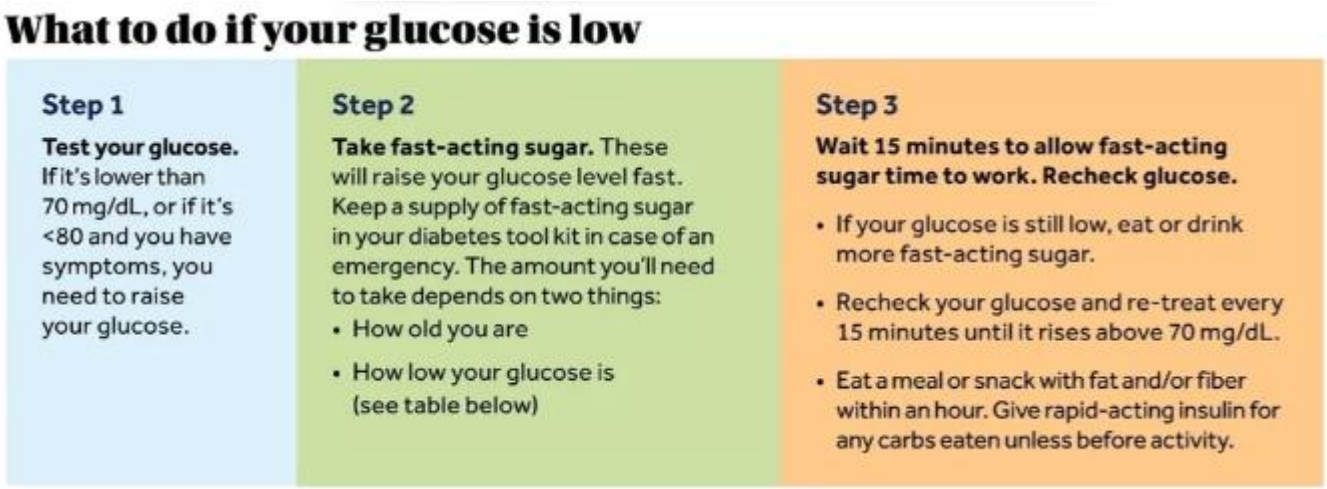
- Too much insulin
- Not enough food
- Miscounting carbs
- Physical activity



Hypoglycemia Symptoms

- Pale face/lips
- Sleepy or quieter (whininess in a toddler)
- Hungry
- Sweaty
- Shaky
- Worried
- Mad
- Head hurts
- Heart beating fast
- Dizzy
- Nightmares

Low Glucose Treatment: Always Follow the Diabetes Care Plan



**IMPORTANT: DO NOT mix fast-acting carbs and complex carbs when treating a low glucose. Adding anything else to a fast-acting carb makes it a slow carb and glucose levels can continue to drop

ALERT AND ABLE TO SWALLOW:

- **If glucose is: between 50-69 mg/dL**
- Birth through 4 years old = 5g fast-acting sugar
- 5 through 11 years old = 10g fast-acting sugar
- 12 years and older = 15g fast-acting sugar

- **If glucose is: less than 50 mg/dL**
- Birth through 4 years = 10g fast-acting sugar
- 5 through 11 years = 20g fast-acting sugar
- 12 years and older = 30g fast-acting sugar
- ***Continue to recheck glucose every 15 mins and repeat appropriate treatment until glucose is >70mg/dL***

Fast-Acting Sugar: Sources & Amounts

	5 Grams	10 Grams	15 Grams
100% fruit juice or regular soda	1 oz.	⅓ cup or 2.5 oz.	4oz./1 small juice box
Smarties® (6g each roll)	1 roll	2 roll	2-3 rolls
Glucose tabs (4-5g each)	1 tab	2 - 2½ tabs	3 - 3½ tabs
Sugar (6g/packet)	1 packet	2 packets	3 packets
Raisins (4g each)	12 raisins	25 raisins	37 raisins
Glucose gel (15g tube)	1/3 tube	2/3 tube	1 tube
Honey (5g/1tsp.) Do not use under age 1	1 tsp.	2 tsp.	3 tsp.
Gummy bears	2-3 bears	4-5 bears	7-8 bears

No chocolate when you are low

When you have low glucose, you need fast-acting sugar (or carbs) to give you quick energy. Don't use chocolate, or anything else containing fat or lots of fiber, such as peanut butter, cookies, cake, ice cream, milk (except skim milk), chips, granola bars, cereal, bread, sandwiches, etc. The fat and/or fiber contained in these foods make sugar slower-acting. These foods can't give you the quick energy you need in an emergency! Anything with fat and/or lots of fiber is a slow-acting sugar.

Hypoglycemia Treatment Tips

- Treat low quickly, & **don’t overtreat**
- After low is treated, student should eat a meal or snack with complex carbs within in the next hour **WITH INSULIN (except before activity)** to prevent another low
- Parents/caregivers need to teach young child signs/symptoms of lows
- Child is never to ignore signs/symptoms of lows
- **Parents** should provide both low treatment options and snacks

Severe Hypoglycemia

- **Student IS AWAKE BUT NOT ABLE TO SWALLOW**
  - Glucose gel/cake decorating gel (need scissors to cut tip)
  - Place in cheek pocket
  - Rub cheek, and encourage student to swallow
  - Once more alert, recheck glucose and proceed with treatment protocol
- If the child is UNCONSCIOUS or CAN'T SWALLOW, glucagon is needed & call 911
  - ***see next slide***

8. What is glucagon?

Glucagon is a hormone produced in the pancreas that stimulates the liver to release stored glucose into the bloodstream when the blood glucose levels are too low.

9. When should glucagon be given?

Glucagon should be used when a student is unconscious, having a seizure, or if symptoms are rapidly worsening (such as a change in mental status and/or combativeness).

10. What glucagon options are available?

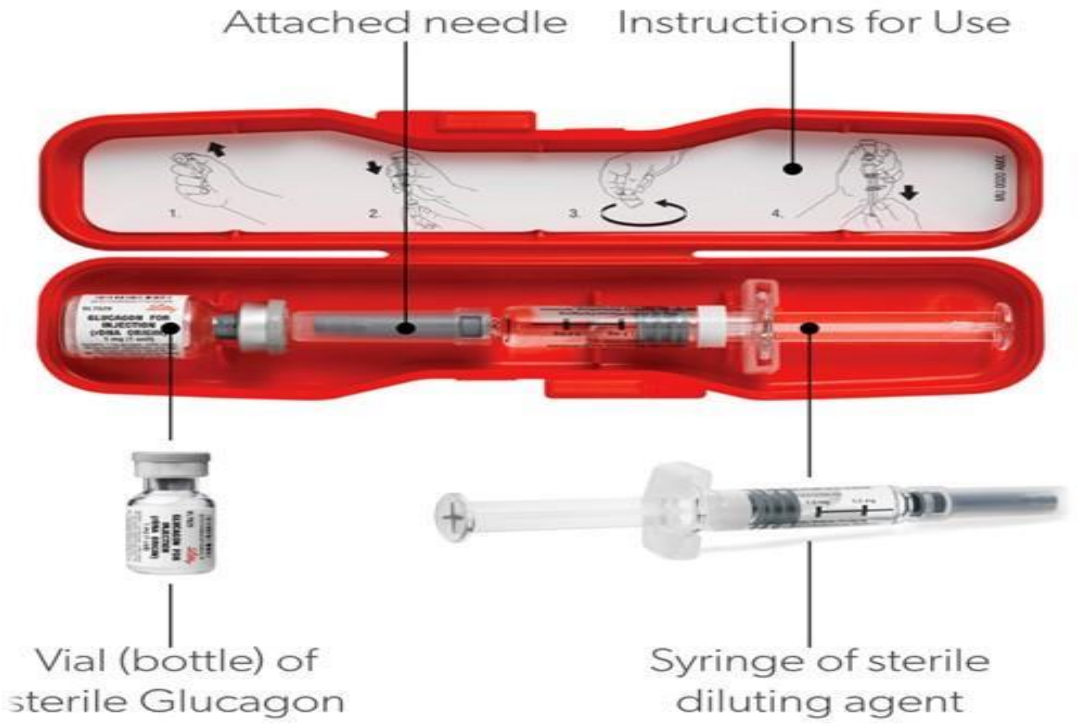
Glucagon is available in several forms: Nasal Powder, Subcutaneous Injection, and Intramuscular Injection.

11. How is glucagon administered?

this kit discontinued recently

- Mix full 1 mL of diluent into bottle with glucagon tablet
- Swirl to dissolve tablet
- Draw out dose, and give IM in the top thigh muscle

- *Dosing Guidelines*
  - Up to 11yrs:0.5ml/0.5mg
  - 12yrs. & older: 1ml/1mg



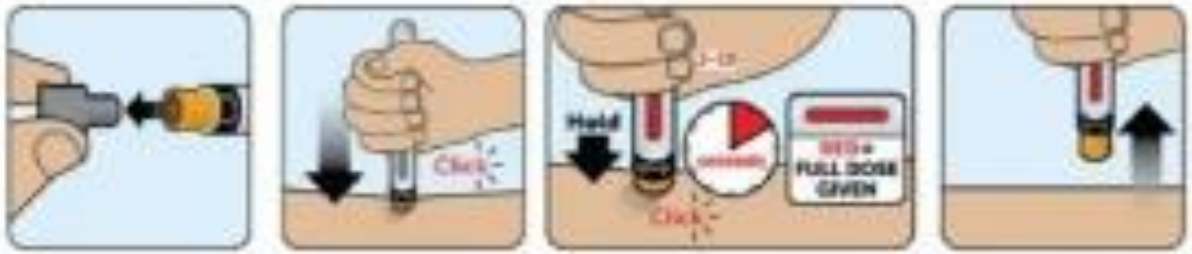
Nasal powder spray glucagon: Baqsimi

Nasal powder spray glucagon:
The glucagon is removed from the container, placed into the nostril, and then the plunger is pushed at the bottom of the device to release the powder spray into the nose.

https://www.baqsimi.com/how-to-use-baqsimi?utm_source=shared%20link&utm_medium=video&utm_campaign=shared%20content

Auto-inject glucagon: Gvoke or Zegalogue

Auto-inject glucagon: Remove the cap (red or gray colored) from the top of the pen and push the pen down onto the skin (stomach, legs, or arms). Hold the pen in place for 5 to 10 seconds (you will hear a click when the dose is complete) before pulling the pen away.



Overview of Gvoke HypoPen® - Short Version - YouTube

After Glucagon

- Roll the patient on their side, they will likely vomit
- Start sips of juice once awake
- Monitor and treat low glucose per protocol
- Within 1 hour after low glucose, student needs to eat a meal or snack with fat and/or fiber of 15-20g carbs; do not dose with insulin

12. What is a continuous glucose monitor (CGM)?

A CGM continuously measures the glucose levels in interstitial fluid (fluid that floats around between cells).

Glucose values will rarely come out the same between a glucose meter and a CGM. There is up to 20% variability allowed by the FDA.

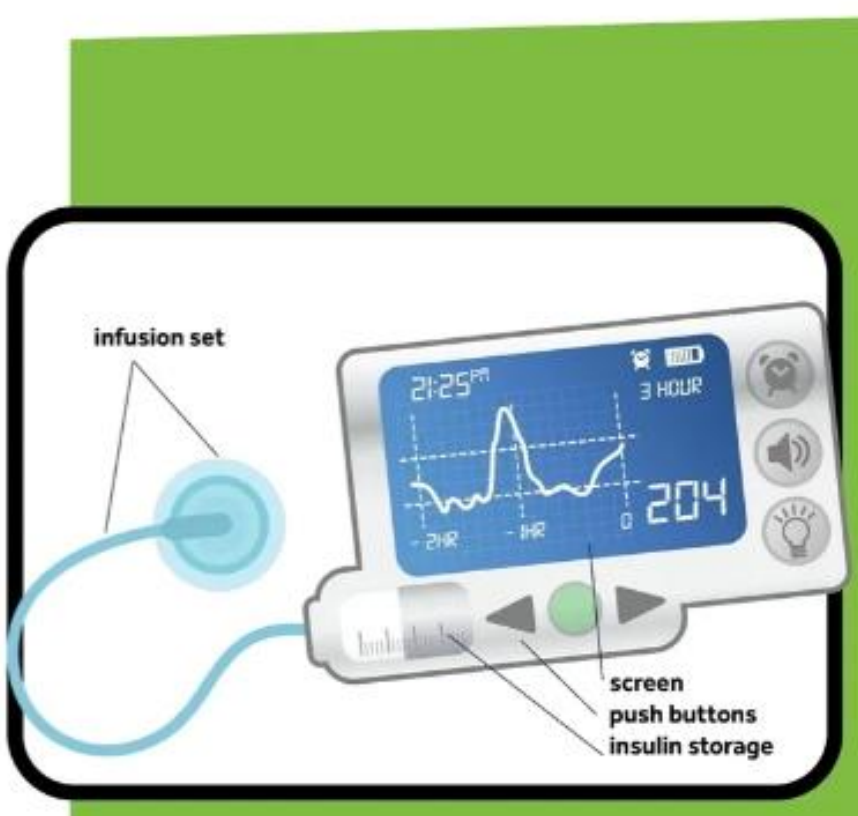
	Freestyle Libre 2	Freestyle Libre 3	Dexcom G6	Dexcom G7	Medtronic Guardian
					
Length of wear	14 days	14 days	10 days	10 days	7 days
Warm up period	1 hour	1 hour	2 hours	30 minutes	~ 2 hours
Calibration with finger sticks	Not required	Not required	Not required	Not required	Required
Trend arrows	Yes	Yes	Yes	Yes	Yes
Alarm for high or low BG	No	Yes	Yes	Yes	Yes

When to double check a CGM value with a fingerstick:

1. If student's symptoms do not match the number
2. If CGM is reading HI (this is >400mg/dL)
3. If CGM is reading low and student is very young or nonverbal

13. What is an insulin pump?

An insulin pump provides a continuous infusion of **rapid-acting insulin** 24 hours a day. Pumps are programmed for both basal and bolus delivery.



Pumps

An insulin pump delivers a little bit of insulin all day and night. At mealtimes, you can use the pump to give yourself a bolus of insulin for your carbs instead of using a syringe or insulin pen.

A tiny tube, called a cannula, carries the insulin into your body. You can wear it in the same place for 2 or 3 days before you need to move it.

You, your caregivers/ guardians, and your diabetes team will decide when using a pump might be right for you.

14. What is an automated insulin delivery (AID) device?

An AID device is an insulin pump that communicates with a CGM and makes automatic insulin adjustments in the background to help manage highs and lows. Frequent user interaction, carb counting, and generalized monitoring is **still required**.

Have student keep **extra** infusion sets and insulin at school.

Thank you.

Banner Children's Specialists: Endocrinology