

# Managing Diabetes, Hypoglycemia, and Insulin Pumps at School

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# Agenda

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**Quick overview of diabetes** — why it occurs and how it is treated

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**Hypoglycemia, hyperglycemia, and DKA**

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**Insulin** — basal and bolus use, and how different providers dose

4

**CGM and insulin pump use**

5

**Automated Insulin Delivery (AID) pumps**



# Key terms and acronyms

- **BG** = blood glucose
  - **AID** = automated insulin delivery
  - **Fast- or rapid-acting carbs or sugar** = regular juice, regular soda, candy (except chocolate), and glucose (often dextrose) gummies, gels, liquids, tablets, powders, and melts are the most common ones.
  - **Snack before activity and/or after a low when using injections or a non-AID pump** = a snack with about 15–20 grams of carbs, protein, and some fat (crackers with peanut butter, crackers with cheese)
  - **Basal** = insulin given to stabilize glucose. Either long acting with injections or small background doses of insulin on pumps.
  - **Bolus** = larger amount of insulin given at one time to get glucose back to target when eating carbs or if high for any reason
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# Diabetes Mellitus quick facts

Type 1 is autoimmune; Type 2 is not.

Both have genetic and environmental risk factors.

Diet and exercise don't cause diabetes, but they help every child manage glucose.

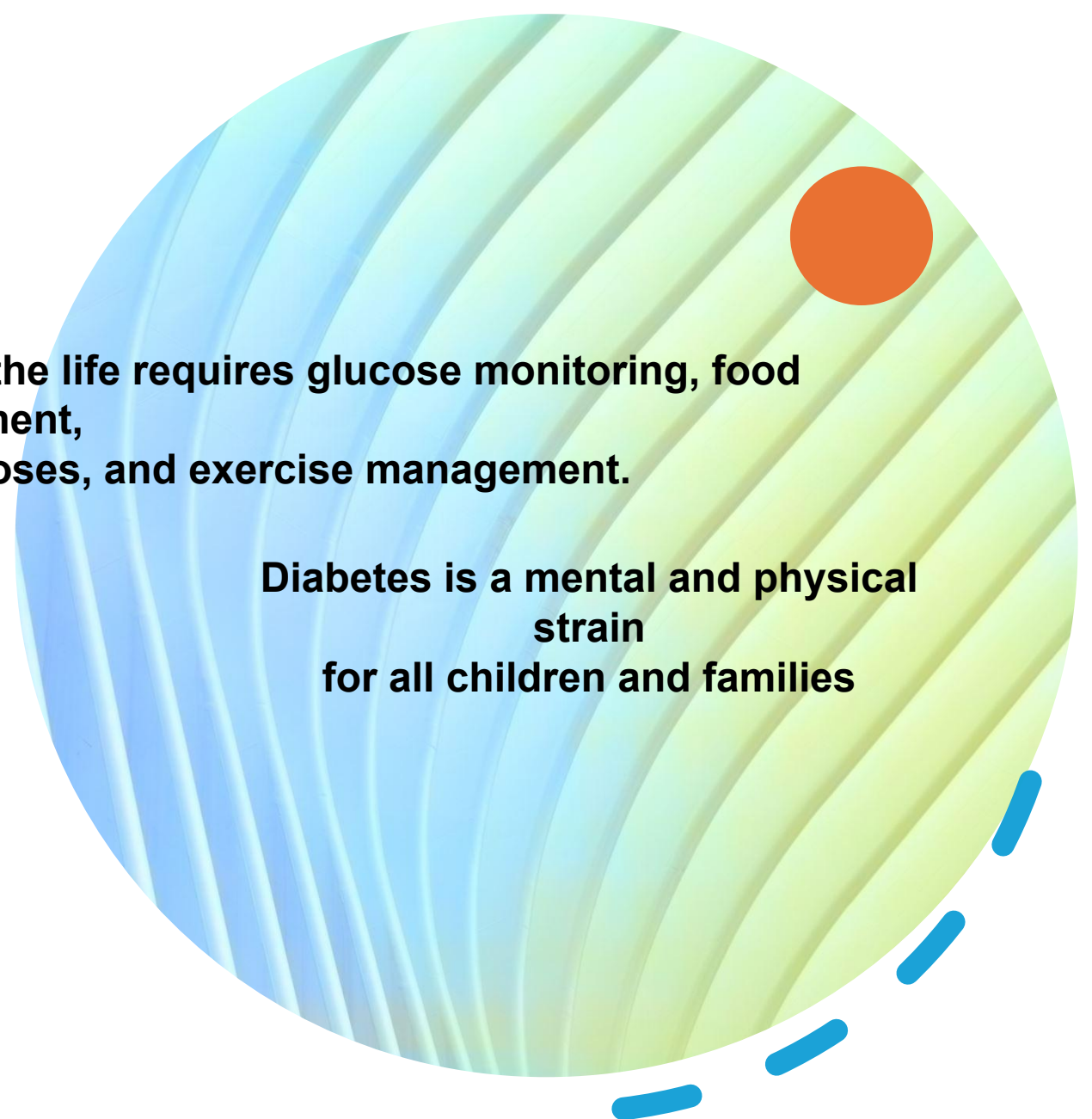
Type 1 has 3 stages. Stage 3 needs lifelong insulin; stages 1–2 may not need treatment.

Treatment varies with each child and family's needs.

No one can prevent all highs and lows—focus on minimizing risk.

**A day in the life requires glucose monitoring, food management, insulin doses, and exercise management.**

**Diabetes is a mental and physical strain for all children and families**



# Hypoglycemia: Recognition & Management

**Glucose thresholds (ISPAD):** Level 1 alert  $\leq 70$  mg/dL (3.9 mmol/L) • Level 2 clinical  $< 55$  mg/dL (3.0 mmol/L) • Level 3 severe — needs external assistance

## SYMPTOMS

### Autonomic / adrenergic — early warning signs

- Tremor or shaking, sweating, pallor
- Palpitations or rapid heartbeat
- Hunger, anxiety, or nervousness

### Neuroglycopenic — brain glucose deprivation

- Difficulty concentrating or confusion
- Blurred or double vision, dizziness
- Slurred speech or poor coordination
- Irritability or uncharacteristic behavior
- **Drowsiness, seizures, or loss of consciousness Emergency services needed**

## COMMON CAUSES

- Excess or mistimed insulin dose (for example, insulin given after eating)
- Missed or delayed meals, or too few carbohydrates
- Extra or unplanned physical activity
- Alcohol consumption (delayed effect)
- Increased insulin sensitivity while recovering from illness

# Hypoglycemia: Treatment

**Glucose thresholds (ISPAD):** Level 1 alert  $\leq 70$  mg/dL (3.9 mmol/L) • Level 2 clinical  $< 55$  mg/dL (3.0 mmol/L) • Level 3 severe — needs external assistance

## TREATMENT

Always confirm a low with a meter check.

- **Rule of 15** — give 15 g of fast-acting carbohydrate (glucose tabs or juice), recheck in 15 minutes, and repeat until glucose is above 70 mg/dL, then follow with a snack (protein, fat, and carbs) or meal. Use for insulin injections or pumps in manual mode.
- *Young children often need less than 15 g — individualize per the care plan. Children under 6 usually need about 10 g; children under 5 may need only 7–8 g or less.*
- *Automated pumps lower and/or stop basal insulin before a low, so less fast-acting sugar is needed — try 5–10 g and recheck in 15 minutes. On an automated system, an uncovered snack is not needed. The goal is to get glucose above 70 without going so high that A1D increases insulin and causes another low later.*
- **Unable to take anything by mouth or feeding tube** — give glucagon (subcutaneous, IM, or intranasal), give nothing by mouth, position the child safely on his/her side, and call for emergency help.

GVOKE, BAQSIMI, Glucagon, or GlucaGen emergency kits.

# Hyperglycemia: Recognition & Management

**Glucose thresholds:** Above target — commonly > 180 mg/dL (10.0 mmol/L) • Check ketones if > 250 mg/dL (13.3 mmol/L) or high for 3+ hrs • DKA risk — high glucose + moderate/large ketones

## SYMPTOMS

### Early / classic — often gradual onset

- Excess thirst · frequent urination (incl. bedwetting)
- Fatigue, drowsiness, irritability
- Blurred vision, headache
- Hunger despite eating; unexplained weight loss

### DKA — emergency red flags Emergency services needed

- Nausea, vomiting, abdominal pain
- Fruity-smelling breath
- Rapid or deep, labored breathing
- **Confusion, drowsiness → loss of consciousness**

## COMMON CAUSES

- Missed or too little insulin; pump site issue or delivery failure
- Too many carbohydrates for the insulin given
- Illness, infection, or stress
- Less physical activity than usual
- Steroid medicines, growth hormones, or strong emotions

# Hyperglycemia: Treatment

**Glucose thresholds:** Above target — commonly > 180 mg/dL (10.0 mmol/L) • Check ketones if > 250 mg/dL (13.3 mmol/L) or high for 3+ hrs • DKA risk — high glucose + moderate/large ketones

## TREATMENT

- **Confirm & correct** — check blood glucose, then give correction insulin per the care plan. Encourage sugar-free fluids (water) to stay hydrated, 4–8 oz every 30 minutes.
- **Check ketones** — if glucose > 250 mg/dL or the child feels ill. Never exercise when ketones are present.
- **DKA warning** — vomiting, fruity breath, labored breathing, or moderate/large ketones. Call parents and provider and seek emergency care right away.

# DKA Prevention & Ketone Treatment

## KETONES IN URINE — WHY

- Dehydration
- Malnourishment
- Lack of insulin

## KETONES IN BLOOD — WHY

- Lack of insulin

**Insulin pump risk:** Ketones and DKA can occur more quickly with insulin pumps — the child is not getting long-acting insulin to stabilize glucose, only rapid-acting insulin, so not getting enough insulin makes glucose rise more quickly.

## MANAGEMENT

- **Trace and small ketones** can be managed with extra fluids — water or a sugar-free beverage. The goal is to keep the child hydrated and flush out ketones. Drink 4–8 oz every 30 minutes.
- **Moderate or large ketones** require extra insulin to flush out ketones.
- If a plan is not included in the physician orders, **call the physician for a management plan for ketones.**

# BASAL Insulin 101

**Basal insulin** = background insulin that stabilizes glucose during the day and night.

## INJECTIONS — LONG-ACTING

- Long-acting or ultra-long-acting insulin when using injections. **No peak** for these insulins. Effects on glucose last 15–36 hours.
- When doses are given varies by prescriber. Some prescribers have the dose given at so the child consistently gets the basal insulin injection. lunch
- **Examples:** Tresiba U100 & U200, Lantus, YFGN/Semglee, Toujeo U300, Basaglar, Rezvoglar.

## PUMP — BASAL RATE

- When using an insulin pump: **tiny doses of rapid-acting insulin every few minutes**, based on an algorithm for AID or a programmed basal rate in manual mode. Used to stabilize BG.
- Mimics the human body by delivering a faster-acting insulin in small, frequent doses.
- **Rapid-acting insulin does have a peak** and a much shorter duration. Peak is 1.5-2 hrs after being given and duration of action is about 3 hours.

*More detail in the technology section*

# Rapid-Acting Insulin: Peak & Duration

## PEAK & DURATION BY TYPE

| Insulin type                                                       | Examples                                                            | Peak          | Duration     |
|--------------------------------------------------------------------|---------------------------------------------------------------------|---------------|--------------|
| Rapid-acting                                                       | Novolog (insulin aspart), Humalog (insulin lispro), Apidra, Admelog | 1–2 hours     | ~3–4 hours   |
| Ultra-rapid                                                        | Fiasp, Lyumjev                                                      | 25–40 minutes | ~2–2.5 hours |
| Afrezza (inhaled), low dose<br>Now approved for age 6 years and up | 4 mg, 8 mg or 12 mg doses (48 units daily is MAX)                   | 12–15 minutes | ~1.5 hours   |
| Afrezza (inhaled), larger dose                                     | —                                                                   | 30–45 minutes | ~2–3 hours   |

# BOLUS Insulin 101

**Bolus** = rapid or ultra-rapid insulin given to offset the glucose rise from carbs and/or to correct high glucose.

## HOW THE DOSE IS CALCULATED

- Use **Carb Ratios (ICR)**, **BG Targets**, and **Correction / Sensitivity Factors (ISF)** to calculate the dose needed, or the dose may be fixed (a specific number of units).
- Bolus insulin for carbs should be given before eating, 10–15 minutes ahead if possible.
- If the child eats before getting insulin, a very high glucose will be seen. A bolus for carbs can be given up to 20 minutes after eating starts.
- If it is not given within the first 20 minutes of eating, DO NOT BOLUS for carbs at all. A CORRECTION can be given later.

# Insulin Injection Dosing: What each scale or setting means

**Why scales differ:** Many practices use scales or carb and correction calculations based on the needs of the patient and family and the level of understanding of the family/patient.

## HOW A SCALE WORKS

- This scale covers **both carbs and high-BG correction** combined in one insulin amount. Dose listed for < 80 is given to cover carbs and rise in glucose due to eating carbs.
- This type of scale should list **how many carbs must be eaten** to use the scale and the doses.
- Allow **3–4 hours or more between doses** — otherwise the insulin dose cannot be given; call the provider.

## SAMPLE SLIDING SCALE • 45–60 g CARBS

| Blood glucose (mg/dL) | Insulin dose |
|-----------------------|--------------|
| < 80                  | 1 unit       |
| 80–150                | 1.5 units    |
| 151–250               | 2.0 units    |
| 251–350               | 2.5 units    |
| 351–450               | 3.0 units    |
| > 450                 | 3.5 units    |

# Injection Dosing: Separate Correction & Carb Scales

**Two scales:** Some providers use two different scales — one for carbs and one for high-BG correction.

## CORRECTION SCALE (BG mg/dL)

| Blood glucose (mg/dL) | Insulin dose |
|-----------------------|--------------|
|-----------------------|--------------|

|       |         |
|-------|---------|
| < 150 | 0 units |
|-------|---------|

|         |        |
|---------|--------|
| 150–200 | 1 unit |
|---------|--------|

|         |         |
|---------|---------|
| 201–251 | 2 units |
|---------|---------|

|         |         |
|---------|---------|
| 252–302 | 3 units |
|---------|---------|

## CARB COVERAGE (1 UNIT / 15 G)

| Carbs eaten | Insulin dose |
|-------------|--------------|
|-------------|--------------|

|        |         |
|--------|---------|
| < 15 g | 0 units |
|--------|---------|

|         |        |
|---------|--------|
| 15–30 g | 1 unit |
|---------|--------|

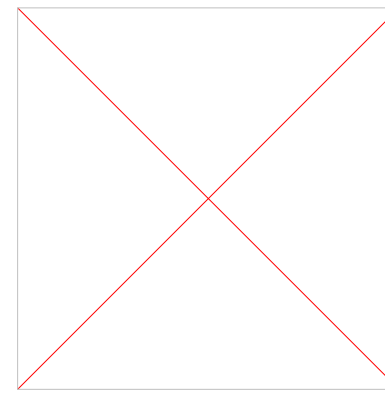
|         |         |
|---------|---------|
| 31–46 g | 2 units |
|---------|---------|

|         |         |
|---------|---------|
| 47–62 g | 3 units |
|---------|---------|

## TIMING — AVOID STACKING

- If using a separate correction scale, the provider should list how long to wait before another correction dose can be given.
- This wait time reduces the risk of stacking insulin and causing a low. Rapid-acting insulin has a ~3-hour duration (action on BG).

# Flexible Dosing: Advanced Dose Calculations



**More precise:** High-BG correction bolus and food bolus calculations are a more precise way to calculate the insulin dose for food and/or high BG — but this does involve math.

## A. HIGH-BG CORRECTION

**Current BG – BG Target** (set by provider) = amount over target BG

**Amount over target BG ÷ Correction Factor (ISF)** = units of insulin for correction

## B. FOOD BOLUS

**Total carbs in food ÷ Carb Ratio (ICR)** = units of insulin to cover carbs.

**A + B = Total insulin needed**

- Because insulin lowers BG for ~3 hours, use the correction calculation only if it has been 3 hours or more since the last dose of rapid-acting insulin.
- Insulin for carbs can be given anytime carbs are eaten.

# Continuous Glucose Monitors (CGMs)

**What it is:** Sensors under the skin measure glucose in body fluid to estimate the glucose level in the bloodstream.

## ACCURACY & LIMITS

- **Not intended to be an exact measurement.**
- **Remember:** a fingerstick meter check only shows the BG at the exact moment in time the sample is taken.
- Normally a **±20% variance** is accepted between the meter reading and the CGM reading.
- When below 60, the variance can be **±20 mg/dL**.

## USE IN CARE

- **FDA approved** for use in insulin dose calculations.
- Use a **fingerstick meter check** if the CGM reading is high or low, or if signs or symptoms do not match the reading.
- Libre 3 plus, Libre 2 plus, Dexcom G7 10-day, Dexcom G7 15-day, Instinct, Simpleria Sync, Guardian 4
- Eversense is the only implanted sensor and is approved only for ages 18 and up.

**dexcom G7** 15 DAY

**dexcom G7**



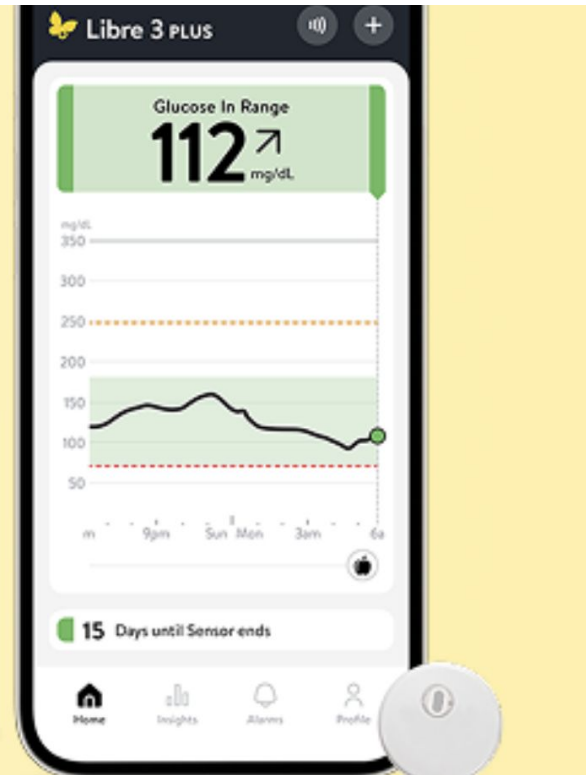
**Dexcom G7 10 day**  
**Dexcom G7 15 day**  
**Minimed Sensors**



Made by  
**Abbott**

**Instinct Sensor**

**Libre 3 Plus**

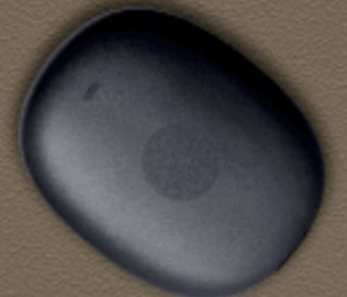


**Simplera Sync™ sensor**



**Guardian™ 4 Sensor**

**EVERSENSE**  
**365**



# Insulin Pumps & Automated Insulin Delivery (AID)

**AID** = Automated Insulin Delivery. A closed-loop / hybrid closed-loop system connects the pump and CGM so basal insulin rates are calculated and delivered automatically based on glucose.

## HOW CLOSED-LOOP WORKS

- The pump and CGM are connected; **basal rates change automatically** based on the readings. **CGM signals do not go through the body so sensor and pump must be in line of site and body not between the 2 devices.**
- Changes to basal amounts and bolus recommendations are based on CGM readings, patterns and trends, and the pump's predictions of future BG.

## WHAT TODAY'S SYSTEMS STILL NEED

- All current systems require **meal announcement / bolus**; many also allow manual correction boluses by the user (this is why they are called "hybrid closed loop"). High BG is reduced with basal increases and auto-corrections given with all pumps except Omnipod (only raises basal).
- **iLet (Beta Bionics)** is the only system that does not allow separate correction boluses — all corrections are delivered automatically by the pump.

**Not yet available:** a complete closed loop — where boluses for carbs and corrections are not required and lows are controlled with an agent like glucagon — is not available at this time.

**ADA 2026 Standards of Care:** AID is the preferred way to take insulin for type 1, type 2 on insulin, and other insulin-deficient diabetes.

# All this amazing automated technology — so why do kids come to the nurse with glucose > 300?

## BIGGEST REASONS FOR HIGHS ON AN AID PUMP

- Cannula bending or kinking. Blood, skin cells, or fluid in cannula.
- Bad sites / poor site absorption/overuse of site/s
- Missed boluses for carbs

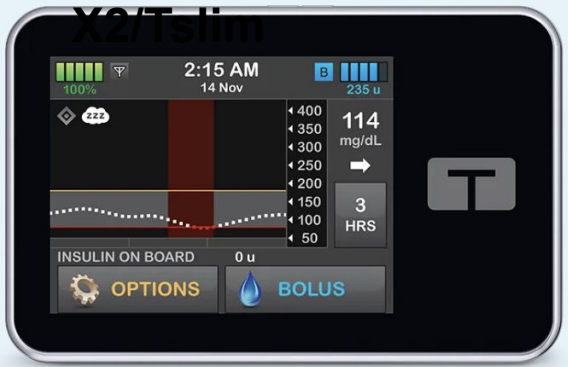
## WHAT TO DO

- **Setting adjustments may be needed.** Let the parent/guardian know about highs and lows so they can contact the provider for adjustments to settings.

**When in doubt, change it out.**

# Tandem

## X2/Tslim



Tandem MOBI

# Minimed FLEX



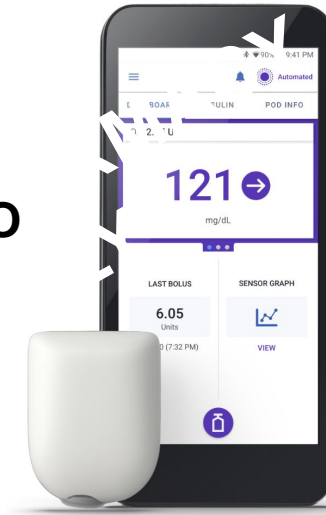
## INFUSION SET/SITE



Minimed  
780G

# Omnipod 5

PO  
D



Pod shown without necessary adhesive.

# TWIIST Sequel Med Tech



# iLet Beta Bionics



## Key Takeaways for School Nurses

- **Have confidence in what you know.** Management comes back to the basics: **highs are treated with insulin and lows with fast-acting sugar or carbs**, and issues resolve in a short time (15 minutes – 2 hours).
- **Concentrate on handling issue NOW.** Concern for future will delay care or lead to possible inappropriate care. Whatever happens in future will be handled after the immediate concern is resolved.
- **AID systems make life easier** for the person with diabetes and everyone around them — **including school nurses.**
- **Make sure every order includes a contact number,** and call if you are unsure about any instructions.
- **Set a plan with each family** for device issues and how to handle them.
- **Pump makers often have training staff** who can show you how the device works if needed. Ask provider, parent or guardian with how to contact a trainer if needed for additional education.



**Advocate for the child to connect to school Wi-Fi so CGM and/or pump data to be shared with providers, families, and you.**



**QUESTIONS?**

