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Hybrid Closed- Loop Systems in Schools

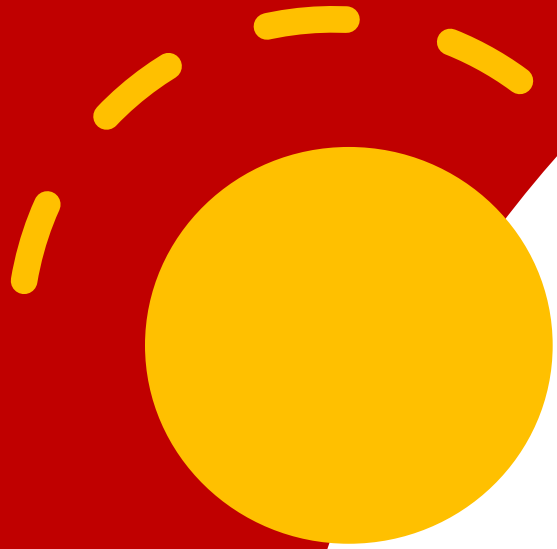


Objectives

- Name the 3 components of Hybrid Closed Loop system
- Compare and contrast traditional pump therapy and hybrid closed loop systems
- Identify 2 essential responsibilities of the school RN in diabetes management with a hybrid closed loop system

Insulin Pump Basics

- Insulin pumps are small computers that are filled with rapid-acting insulin
- No injected basal insulin (Lantus/Levemir/Tresiba/Basaglar) is used
- Rapid-acting insulin is infused in 2 modes – basal “drip” and bolus carb/correction doses
- Pumps allow us to give very exact insulin doses
- Programmed with individualized basal rates, carb ratios, correction ratios, target glucose, and insulin action times.
- Can be used as stand-alone device or in combination with Continuous Glucose Monitor



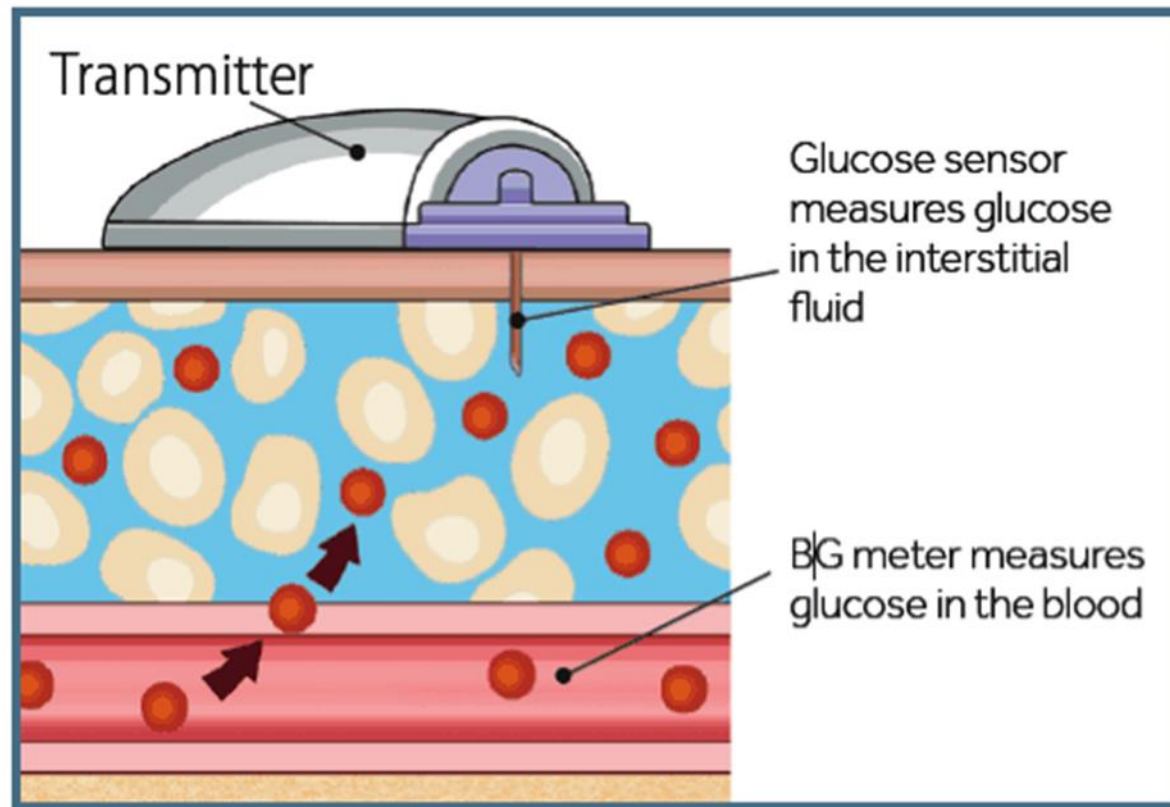
Continuous Glucose Monitors


(Also called CGMs or Sensors)

Continuous Glucose Monitor Basics

- Small subcutaneous catheter (*sensor*) that continuously measures glucose in interstitial fluid
- Glucose values stored in a *transmitter* that relays glucose data to a *receiver*
- Provides Real-Time glucose values
- Have individualized glucose targets (generally 80-180 mg/dL)
- Have alerts and alarms to notify the user of rapidly changing glucose and values outside the glucose target range

Continuous Glucose Monitor





Hybrid Closed Loop Systems

Pumps and CGMs that use software to adjust insulin based
on CGM readings

Automated Insulin Delivery

To automate insulin delivery the system requires:

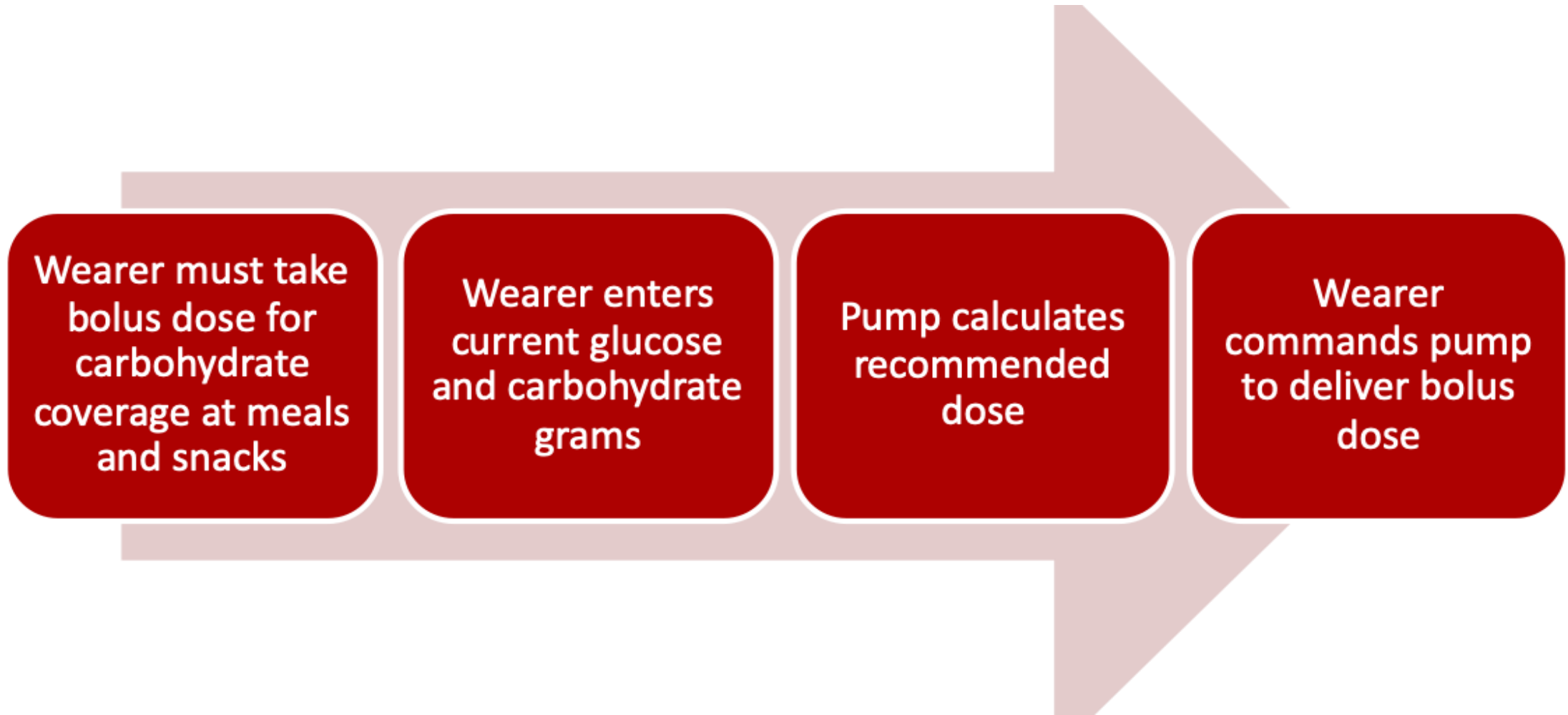
- an insulin **pump**
- a **continuous glucose monitor/sensor**
- an **algorithm** to determine insulin delivery.

American Diabetes Association Recommendation

7.24 Automated insulin delivery systems may be considered in youth and adults with type 1 diabetes to improve glycemic control.

Automated Insulin Delivery

1. Continuous Glucose Monitor relays glucose data to Pump every 5 minutes
2. Algorithm determines change in insulin delivery
 - Slows or stops basal insulin delivery in response to low or falling glucose
 - Increases insulin delivery in response to elevated or rising glucose



Hybrid Closed-Loop System Still Requires Human Intervention

Hybrid Closed-Loop Systems

- Medtronic 670G/770G – FDA approved 2016
- Tandem Control IQ – FDA approved 2019
- Omnipod Horizon – expected release 2021

Hybrid Closed-Loop Medtronic 670G/770G

- Closed-Loop = AutoMode
- Target glucose of 120 mg/dL
- Basal delivery (micro-bolusing) is automated based on current blood sugar and rate of change
- Correction dosing is delivered within the micro-bolus and traditional bolus doses
- Doses are recalculated every night at MN based on last 6 days of blood sugars and response to insulin doses



Image: Medtronic.com

Hybrid Closed Loop Tandem Control IQ

- Tandem T-Slim pump and Dexcom G6 CGM
- Target blood sugar 120mg/dL with adjustments for exercise and sleep
- Uses programmed pump settings
- Increases and decreases programmed basal rate in response to Dexcom glucose
- Automatically gives 60% correction boluses for high blood sugars (not more than once per hour)



Image: Tandemdiabetes.com

Omnipod Horizon (Insulet Corporation)



- **Omnipod Horizon System anticipated commercial release in second half of 2021**
- **Omnipod pump with algorithm embedded in pod that communicates directly with Dexcom Continuous Glucose Monitor**
- **A handheld device will transmit commands for:**
 - ✓ insulin meal boluses
 - ✓ algorithm parameter adjustments such as change in target glucose and bolus delivery options (normal, extended, combo)
 - ✓ connection to a secure cloud server for data management

Buckingham, B., Forlenza, G., et.al. Safety and performance of the Omnipod Hybrid Closed Loop System in Young Children Aged 2-6 years with T1D. 79th Congress Scientific Sessions . American Diabetes Association Conference 2019

Role of the School RN

- Trust the system
- Respond to alerts/alarms and follow directions provided by the pump
- Treat lows with fewer carbs (generally 5-10 grams) as pump already taking action to minimize lows
- Bolus for carbs and/or correction doses as recommended by the pump.

Role of the School RN

- Whenever possible, bolus 5-15 minutes before meal/snack
- Assure that accurate data is entered into the pump for most precise bolus doses
- Utilize the exercise option - temp target (Medtronic) or exercise mode (Tandem) – to prevent hypoglycemia with activity
- Troubleshoot for malfunction when blood sugars are in the extreme or if unresponsive to intervention

What are some problems that might require troubleshooting?



Cannula has come out of the skin or is kinked



Tubing is broken or kinked



The pump itself is having a mechanical problem



Problem with insulin absorption – is the site red or inflamed?



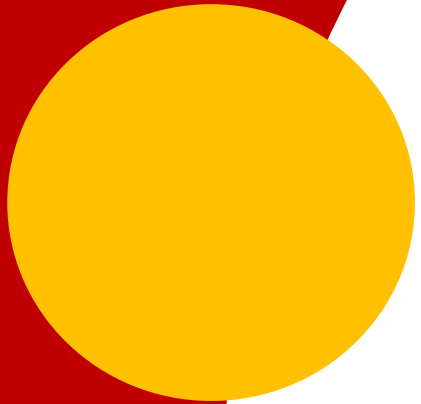
Low or no power (batteries running low or pump needs to be charged)



The pump is out of insulin



No sensor data available to automate delivery



Questions

Or

Comments?