Insulin Pump Management and Continuous Glucose Monitoring Systems (CGMS)

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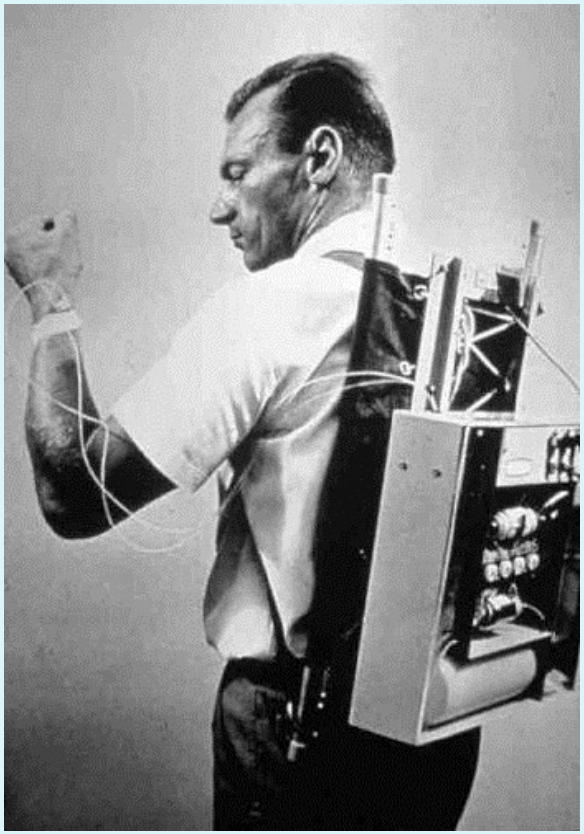
Why Pump Therapy?

- Mimics normal insulin secretion
- Provides a continuous baseline level versus long acting insulin that slowly weans out
- No peaks or valleys
- Insulin is given every time you eat or have a high blood sugar
- Improved Quality of Life

Insulin Pumps

Before



Now

What is the Insulin Pump?

- Beeper-sized machine
- Many communicate with glucometer
- Delivers rapid-acting insulin ONLY
  - Novolog
  - Humalog
  - Apidra

FDA Approved Insulin Pumps

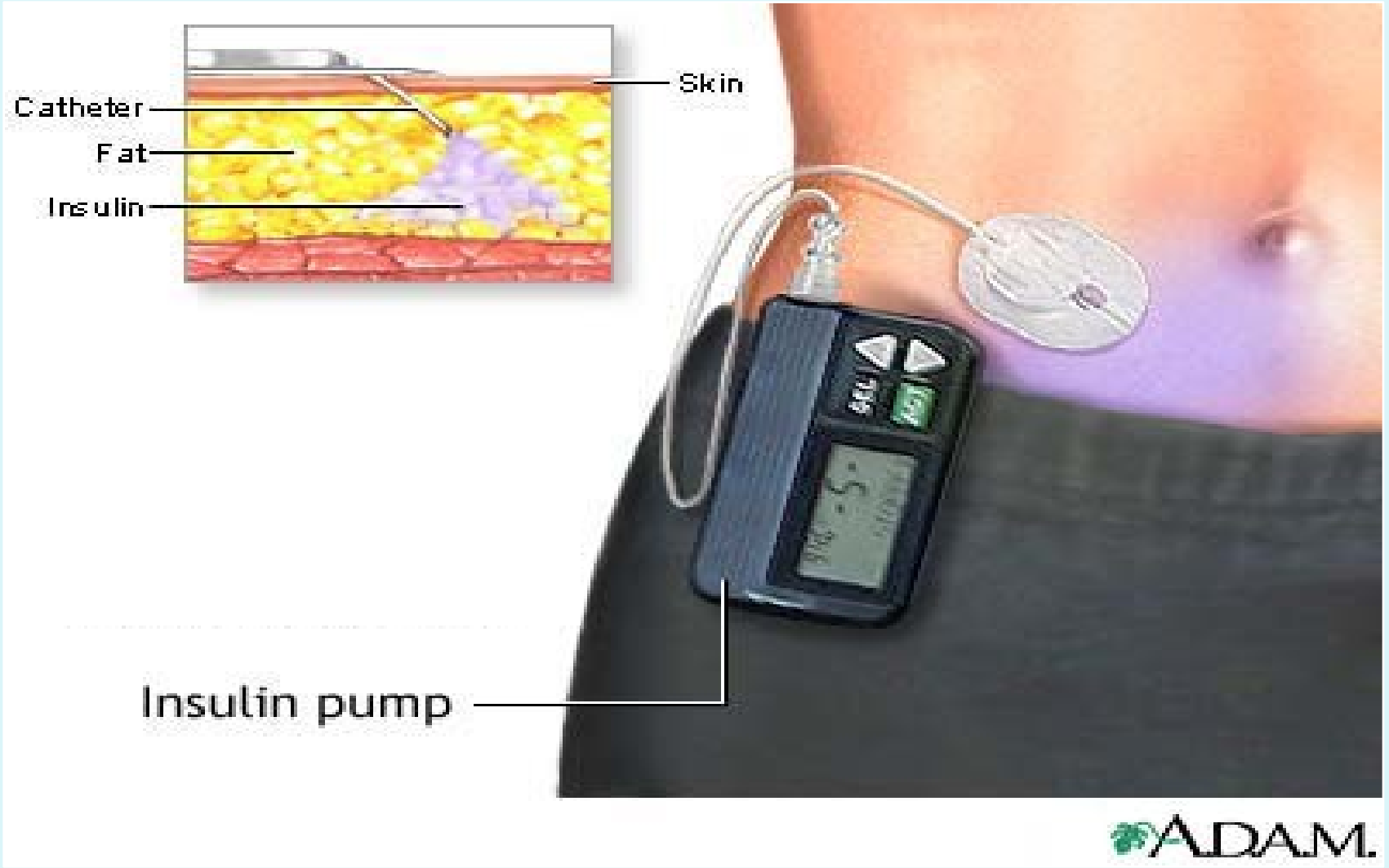
- Medtronic Revel

- Insulet-Omnipod

- Animas Ping

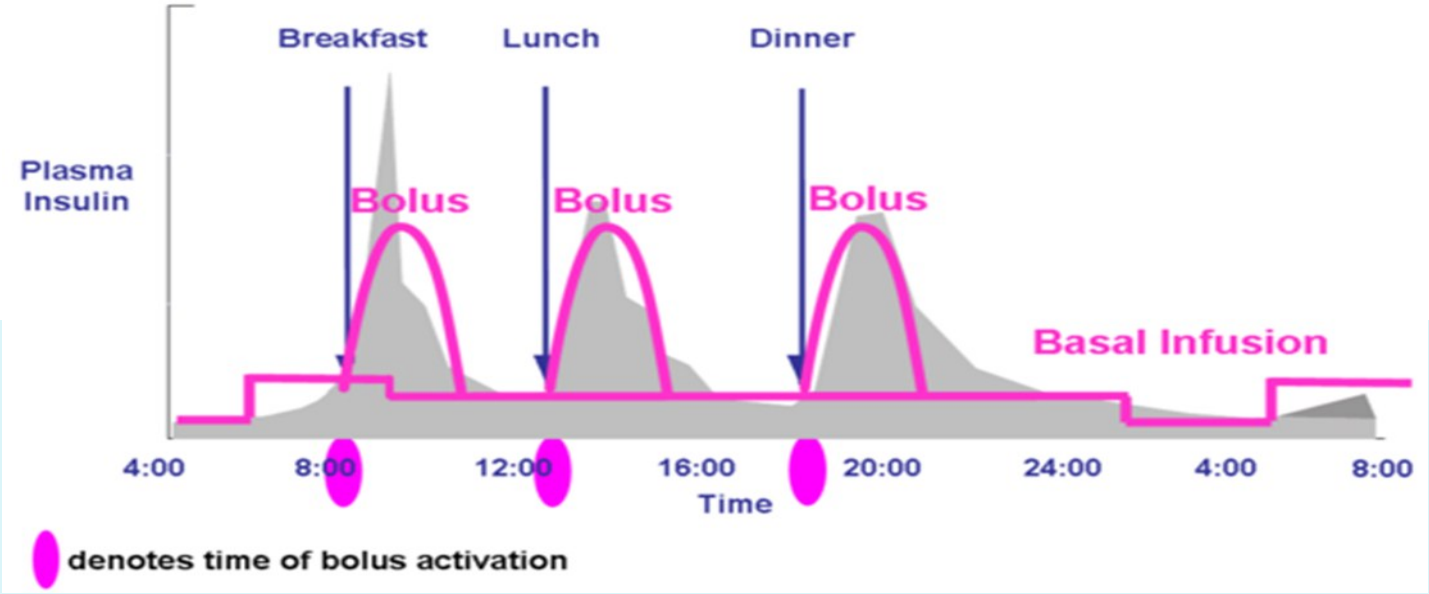
- Tandem T:Slim

How Pump Therapy Works



Pump Gives Insulin in Two Ways

- **Basal rate:** **Covers basic metabolic needs.** An hourly rate of insulin delivered to replace the basal insulin you were once taking such as NPH, Lantus or Levemir.
- **Bolus rate:** **Covers food and high blood sugars.** A dose is given EVERY TIME you eat any carbs AND/OR have a high blood sugar that requires insulin. Delivered just as if you were taking a shot of Humalog, Novolog or Apidra.



What are some potential **advantages** of the pump?

- Fewer injections
- Flexibility
- Precision
- Individualization
- Better A1C
- Prevention of complications

- Less hypoglycemia
- Being like other kids
- Trigger foods
- School days
- Control during illness
- Picky eating
- Information storage

What are some potential **disadvantages** of the pump?

- Cost
- Attachment
  - cannot disconnect for more than 1 hour without checking BG levels.
- Testing basal rates
- Risk of DKA
- Risk of infection
- Fear of insertion
- Skin irritation
- Frequent blood sugar testing

Insulin Pump System

- **Insulin reservoir**

  A large syringe filled with rapid-acting insulin that delivers insulin from the pump through a thin plastic tubing into the infusion set.

How does the pump deliver a bolus?

- The pump is programmed with:
  - Insulin to Carbohydrate Ratio
  - Correction Factor/Sensitivity Factor
- Bolus by entering carbs and blood sugar into the pump.
- The pump will calculate how much insulin to bolus.
- Each pump can be set to alert you if there is still insulin working from a previous bolus. This is called “insulin on board” or “active insulin”.

Animas Ping insulin pump using EZCarb feature.

Pump Mechanics

+

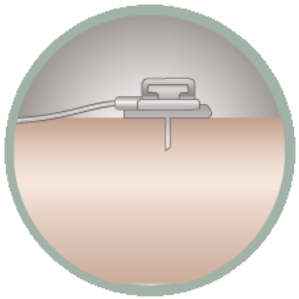
+

= Pump Therapy

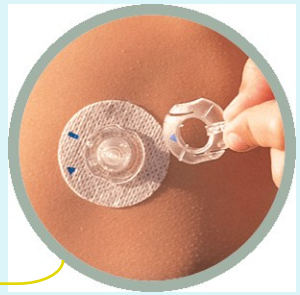
Patients change reservoirs and infusion sets every 2-to-3 days

a.

b.



c.

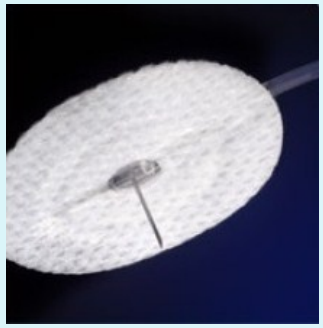


a. Patients use a Serter™ device to place the infusion set.
b. The set's cannula sits just beneath the skin.
c. The user can disconnect at any time

Pump Mechanics: Catheter/Cannula

- **Infusion set**
  - Delivers insulin from pump to you
  - Some can be injected with an inserter device
  - Needs to be changed every 2-3 days
  - 3 Types:
    - Angled (30° entry) with flexible cannula
    - Straight (90° entry) with flexible cannula
    - Metal needle



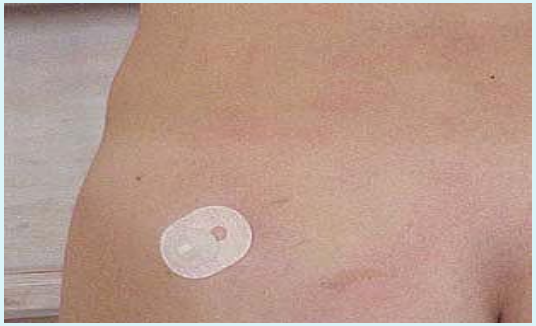
Examples of Infusion Sites

Abdomen

Anterior thigh

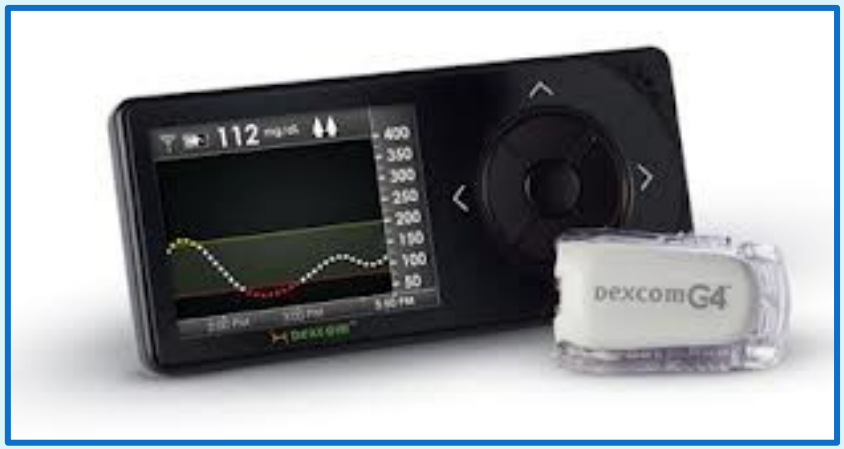
Upper arm

Upper hip



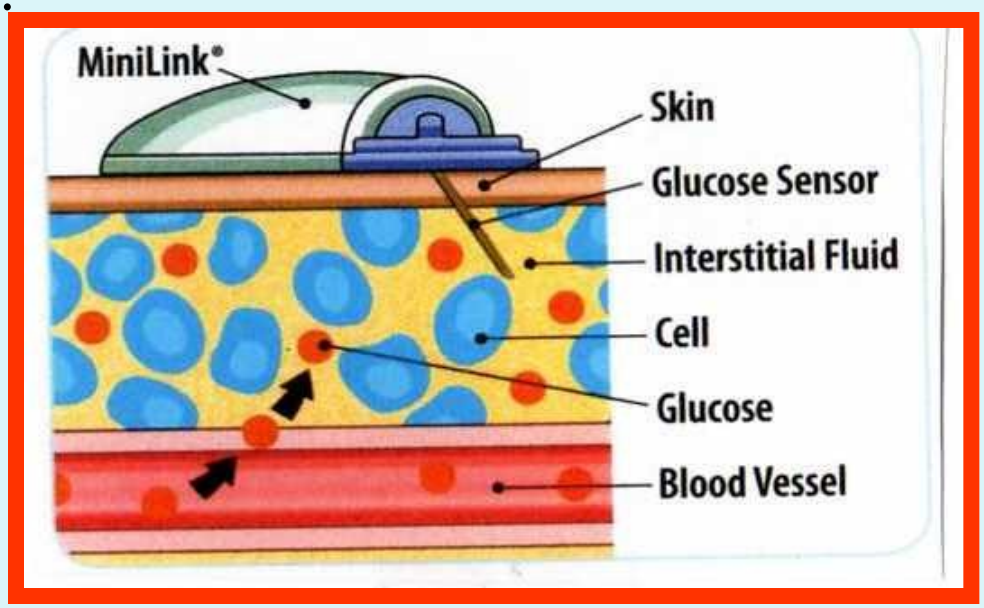
Medial thigh

Continuous Glucose Monitors (CGM)

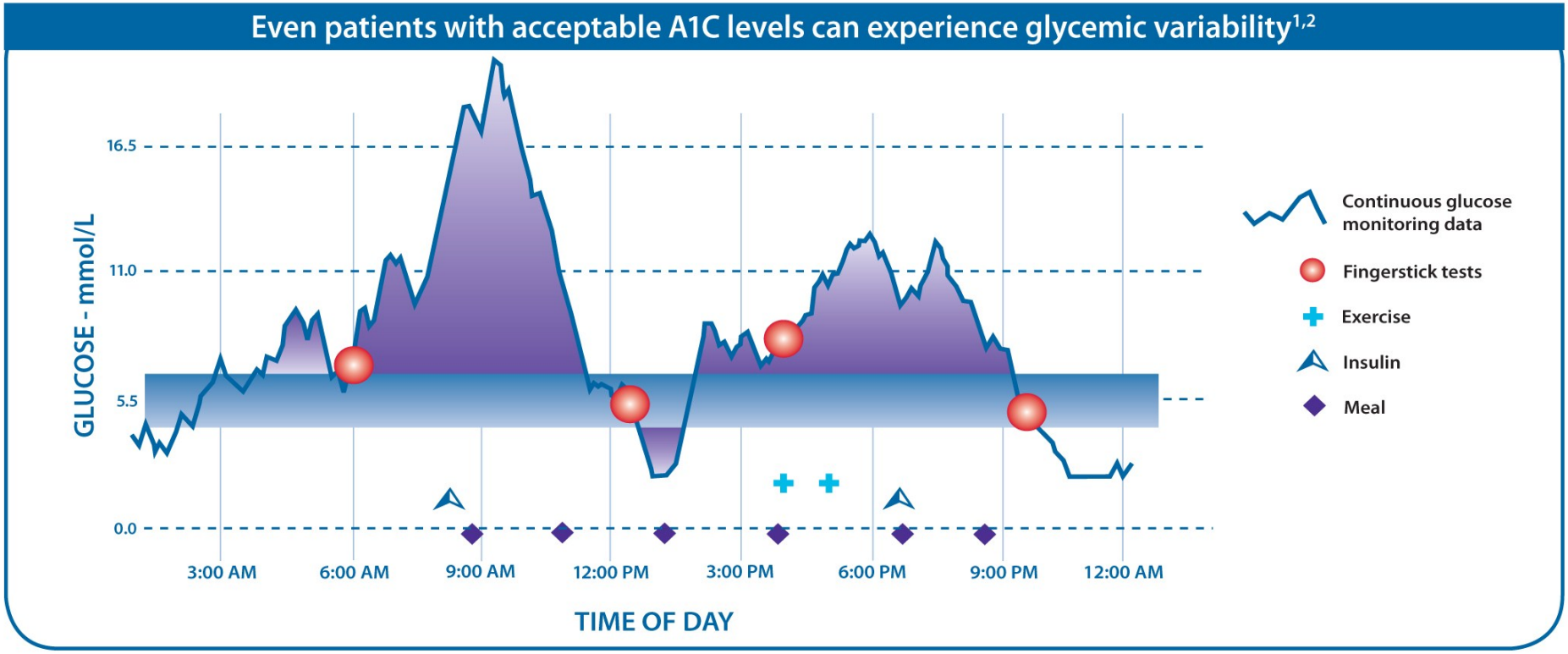


Understanding CGM & Glucose Readings

- The **Blood Glucose Meter** measures glucose in the **blood.**
- The **Sensor** measures glucose in the fluid surrounding the cell in the tissue, which is called **interstitial fluid.**
- Glucose travels throughout the interstitial fluid. Sensor may read different levels of glucose.
- Meter and sensor readings will be close.
- Advised to do a fingerstick before reacting to the sensor reading



Point in time blood sugar checking vs. CGM



Why Use Continuous Glucose Monitoring?

- Low blood glucose alarms set by user.
- High blood glucose alarms set by user.
- Alerts to possible need to check for ketones.
- Alerts to wide blood glucose fluctuations.
- Assists user in behavior modification.
- Improves diabetes management.

Why Use Continuous Monitoring

Examples:

- Detects if the blood sugar is already decreasing before exercise or activity
- Indicates if you are responding to low blood sugar treatment.
- Shows the stability or instability of blood sugars at school before walking home or getting on the bus.

How many CGM's are there?

2 types

- Clinic only device
  - Ipro
- Patient home use device
  - Dexcom G4
  - Medtronic Guardian
  - Medtronic Real-Time
  - Medtronic 530G

Medtronic

Dexcom

CGM: Home Use Options

- If you want a CGM that displays data on a separate device:
  - Dexcom G4
  - Medtronic Guardian
- If you want a CGM that displays data on a pump:
  - Medtronic Real-Time
  - Medtronic 530G
- If you want a CGM that displays data on a pump and shuts off insulin when glucose goes low:
  - Medtronic 530G

CGM Systems

Medtronic

- Communicates to Medtronic insulin pump
- Frequency of real time every 5 minutes
- 3 or 6 day wear
- Receiver (Pump) & Transmitter communicate within 6 feet

www.minimed.com

Dexcom

- Frequency of real time every 5 minutes
- 7 day wear
- Receiver & Transmitter communicate within 20 feet
- www.dexcom.com

Sensors

Medtronic

Dexcom

Transmitters

DexCom

Medtronic

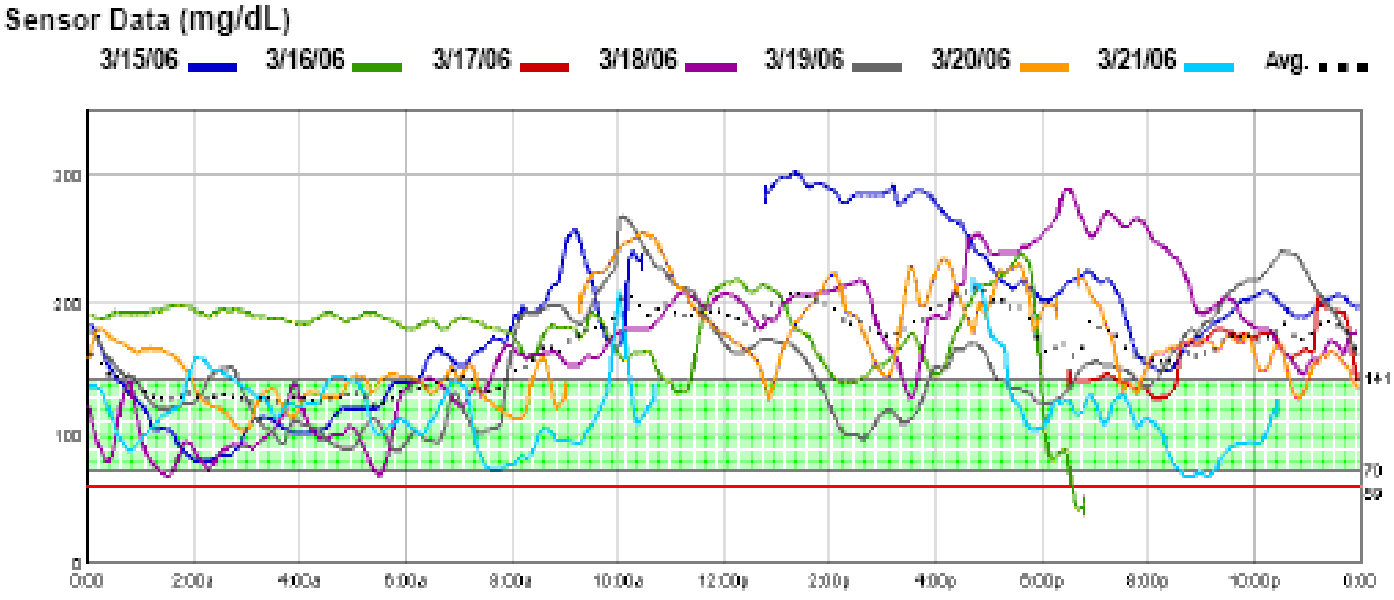
Receiver or Monitor

DexCom

Medtronic

Software Component for families

Generates reports, graphs, and charts



	Wed Mar 16	Thu Mar 16	Fri Mar 17	Sat Mar 18	Sun Mar 19	Mon Mar 20	Tue Mar 21	Average / Total
# Sensor Values	261	226	66	288	288	282	199	1,610
High SG (mg/dL)	302	240	204	290	268	254	216	302
Low SG (mg/dL)	78	40	126	66	86	102	66	40
Average SG (mg/dL)	187	178	161	170	154	168	116	164
Standard Dev.	62	32	21	56	44	37	28	50
MAD %	9.9	7.7	36.9	17.9	14.2	15.0	N/A	17.4
# Valid Calibrations	3	2	3	4	2	4	1	23

Some Smiling Pumpers