EPIC DIABETES CONFERENCE
MARCH 4, 2017 | DENVER MARRIOTT CITY CENTER
EMPOWERING PATIENTS FOR INDIVIDUALIZED CARE

Barbara Davis Center for Diabetes · Children's Diabetes Foundation

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Diabetes Technology
Where have we been and where are we going?

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Self Monitoring Blood Glucose (SMBG)

1980

TODAY

2020???

- Results took up to 1-2 min
- 30 µL sample size
- Often used color to determine glucose levels

- 5 second results
- 0.3 -0.6 µL sample size
- Refill capability
- Can be uploaded to software or in some cases to the cloud or phone

No More Finger pokes?

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REMOTE MONITORING SOFTWARE

Some software is specific to products (e.g., CareLink for Medtronic products and Clarity for Dexcom).

Some programs allow device downloads and data viewing in a single system:

- Glooko: compatible with >50 glucose meters, multiple insulin pumps, CGMs, and fitness trackers; costs ~$60/year

- Tidepool (Blip): compatible with multiple glucose meters, insulin pumps, and CGMs; HIPAA-compliant cloud; free

Insulin Pumps (Continuous Subcutaneous Insulin Infusion)

First Pump 60's   **1980s -1990s**   **Current Pumps**

<u>Basal Insulin or Basal Rate:</u> A programmable continuous delivery of short-acting insulin to cover liver glucose production. Replaces long acting insulin

<u>Meal Bolus:</u> A spurt of insulin given at meal time. The amount given is usually calculated based on your insulin to carb ratio.

<u>Correction Bolus:</u> A spurt of insulin given to bring a high blood sugar back into range. It can be given with the meal bolus or between meals.

Other SMART features

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Continuous Glucose Monitoring (CGM)

FDA approval 2001

Today
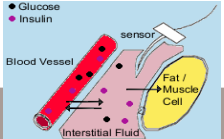
Today's CGM have similar accuracy as blood glucose meters

Accurate about 60% of the time compared to glucose meter

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Continuous Glucose Monitoring (CGM)

<u>Pros</u>

- "Real time" update of glucoses every 5 min.

- Arrows indicating direction and rate of change.

- Alarms can be set when high or low thresholds are reached.

- Can see what is happening with glucose levels at times when we don't typically check BG (e.g., overnight and after meals).

<u>Cons</u>

- Not covered by some insurance policies (Medicare and Medicaid).

- "Lag time" between BG meter results and sensor glucose (SG) readings.

- Possible tendency to over-react and over treat highs and lows.

- More devices to wear and rotate.

- Glucose
- Insulin

sensor

Blood Vessel

Fat / Muscle Cell

Interstitial Fluid

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Sensor Augmented Pump

A sensor-augmented insulin pump (SAP) combines the technology of an insulin pump with a continuous glucose monitoring sensor that transmits glucose readings to the pump.

<u>Sensor Data is displayed on insulin pump:</u>
Animas Ping: Animas Pump + Dexcom G4
T:Slim G4: Tslim pump + Dexcom G4

<u>Pump responds to sensor data:</u>
Medtronic 530G and 630G + Guardian sensor
Pump suspends insulin for up to 2 hours if Low Threshold alarm is ignored.

ARTIFICIAL PANCREAS (HYBRID CLOSED LOOP)

What is it?
- An Insulin Pump and CGM system that works together to control blood sugars.
- The system continuously adjusts the amount of insulin delivered (micro-boluses) based on the sensor glucose value and rate of change.
- The system learns over time.
- The patient must still give a bolus for meals (hybrid closed loop).
- Medtronic 670G approved by FDA in Fall of 2016 and will be available in 2017.

NOT THIS!

THIS!

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184 mg/dL	68 mg/dL		2.0
Average glucose (CGM)	Standard deviation (CGM)	Hypoglycemia risk	Average daily CGM calibrations

This metric is temporarily unavailable.

HIGH
MODERATE
LOW
MINIMAL

55.2% HIGH
45.2% IN RANGE
1.6% LOW

Time in range

Top Patterns

1. Lvnelle had a pattern of nighttime highs
   pattern of significant highs between 10:25 PM and 4:40 AM.

2. had a pattern of daytime highs
   pattern of significant highs between 5:15 PM and 5:40 PM.

3. best glucose day
   data was in the target range about 63% of the day.

This graph shows your data averaged over 17 days

ABOVE HIGH THRESHOLD
75TH PERCENTILE
AVERAGE
18TH PERCENTILE
BELOW LOW THRESHOLD

12am 3 6 9 12pm 3 6 9 12am

2/15/2017 - 2/28/2017

Data Sources: MiniMed 630G, MMT-1715 (NG1182353H)

Sensor, Insulin, & Settings

Breakfast Lunch Dinner

4 AM 6 AM 8 AM 10 AM 12 PM 2 PM 4 PM 6 PM 8 PM 10 PM 12 AM

0.750 1.00 0.900 0.800 1.10 0.800

Bolus Insulin

45 10 40 12 45 15

Breakfast: 6:00 AM - 10:00 AM (13)
Pre-meal SG Avg: 180 ± 80mg/dL
Post-meal SG Avg: 200 ± 45mg/dL
Avg Carbs: 76 ± 23g
Avg Food Bolus: 7.6 ± 2.3U

Lunch: 11:00 AM - 3:00 PM (14)
Pre-meal SG Avg: 127 ± 42mg/dL
Post-meal SG Avg: 108 ± 31mg/dL
Avg Carbs: 97 ± 27g
Avg Food Bolus: 8.1 ± 2.2U

Dinner: 4:00 PM - 10:00 PM (21)
Pre-meal SG Avg: 143 ± 55mg/dL
Post-meal SG Avg: 144 ± 38mg/dL
Avg Carbs: 76 ± 32g
Avg Food Bolus: 6.2 ± 2.7U

Statistics	
Avg BG	167 ± 76mg/dL
BG Readings	4.6 per day
Carbs Entered	359 ± 83g per day

Hypoglycemic Patterns (3)	
	12:16 PM-3:31 P
Time Period	5:32 PM-9:51 PM
	1:55 AM-3:40 AM

Hyperglycemic Patterns (3)	
	7:15 AM-11:40 A
Time Period	11:55 PM-4:55 A
	9:45 PM-10:30 P

Pump Use	Per Day
Insulin TDD	54.1 ± 3.1U
Basal/Bolus Ratio	38 / 62
Manual Boluses	0.0U (0.0 boluses
Bolus Wizard	33.3U (5.4 bolus
Food	31.4U (5.1 bolus
Correction	5.9U (3.5 boluse
Override (+)	0.0U (0.0 boluse
Override (-)	-3.1U (0.4 bolus

| Total Suspends | 35m (1.0 events |
| Suspend On Low | 17m (0.1 events |

Sensor Use	
Avg SG	157 ± 61 mg/dL
Wear Duration	6d 08h per week
Low SG Alarms	0.6 per day
High SG Alarms	2.9 per day