

Use of Technology for Diabetes Care in 2025

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Disclosure of Potential Conflicts of Interest

Consulting

- Medscape
- Vertex

Research

- Insulet
- Abbott
- Zucara

Stock Options

- Omada Health

Objectives

- Discuss outcomes beyond A1C
- Consider how technology can help improve these outcomes
- Review diabetes devices and develop a clinical strategy for their clinical use

Focus on Africa




Focus on Africa

ACCEDE Project: Access to CGM for Equity in Diabetes Management

Funded by the Helmsley Charitable Trust along with the IDF.

The project aims to improve affordability and ensure training on the use of CGMs in Kenya and South Africa.

Focus on Africa

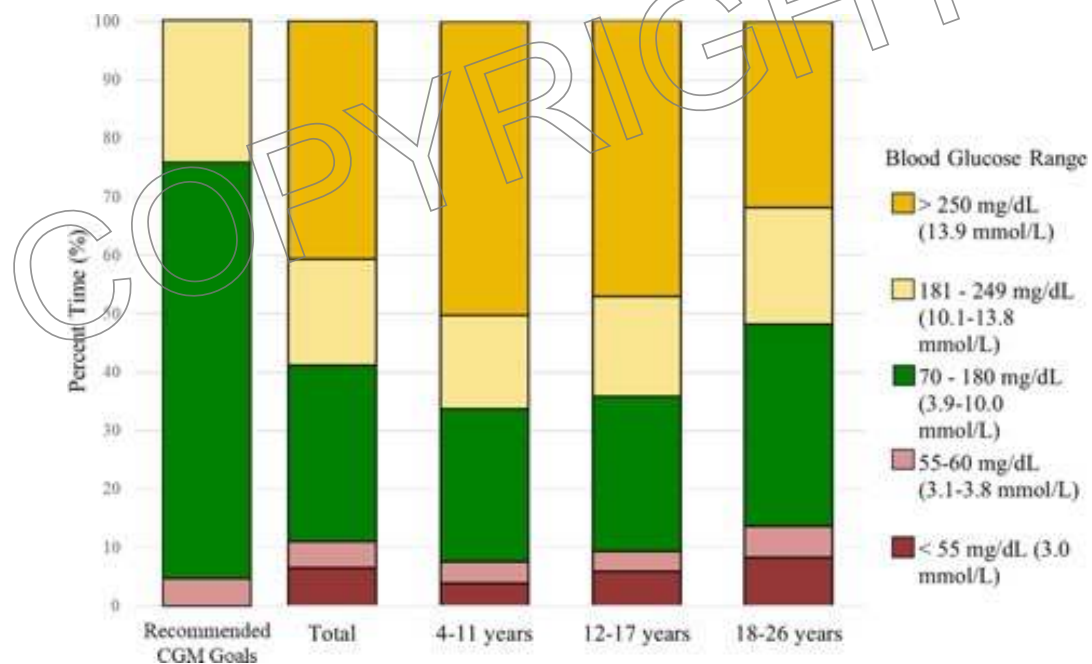
▶ J Diabetes Sci Technol. 2016 May 5;10(6):1294–1302. doi: [10.1177/1932296816648165](https://doi.org/10.1177/1932296816648165) 

First Clinical Experience with Retrospective Flash Glucose Monitoring (FGM) Analysis in South Africa

Characterizing Glycemic Control with Ambulatory Glucose Profile


[Larry A Distiller](#)^{1,*}, [Iain Cranston](#)², [Roger Mazze](#)²

CGM Assessment of Metabolic Control in East African Children and YA with T1D: A Pilot and Feasibility Study



Endocrino Diabet & Metabol, Volume: 3, Issue: 3, First published: 08 June 2020, DOI: (10.1002/edm2.135)

BMJ Open Appropriateness and acceptability of continuous glucose monitoring in people with type 1 diabetes at rural first-level hospitals in Malawi: a qualitative study

Ada Thapa,¹ Stellar Chibvunde,² Leah Schwartz,³ Celina Trujillo,^{1,4} Gina Ferrari,^{1,4} Laura Drown,¹ Apoorva Gomber ,¹ Paul H Park,¹ Beatrice Matanje,² Amos Msekandiana,⁵ Chiyembekezo Kachimanga,² Gene Bukhman,^{1,4,6} Todd Ruderman,² Alma J Adler ^{1,6}

Main Themes:

1. Provider/patient relationship
2. Stigma and psychological support
3. Device use
4. Clinical management

Types of Devices

- Blood glucose monitors (BGM)
- Continuous glucose monitors (CGM)
- Continuous Subcutaneous Insulin Infusion (CSII) or insulin pumps
- Automated Insulin Delivery (AID) or Hybrid Closed Loop (HCL) Systems
- Connected Insulin Pens (CIP) or “Smart” Pens

All should be used in conjunction with diabetes education!

Is A1c Enough To Help Us Manage Patients?

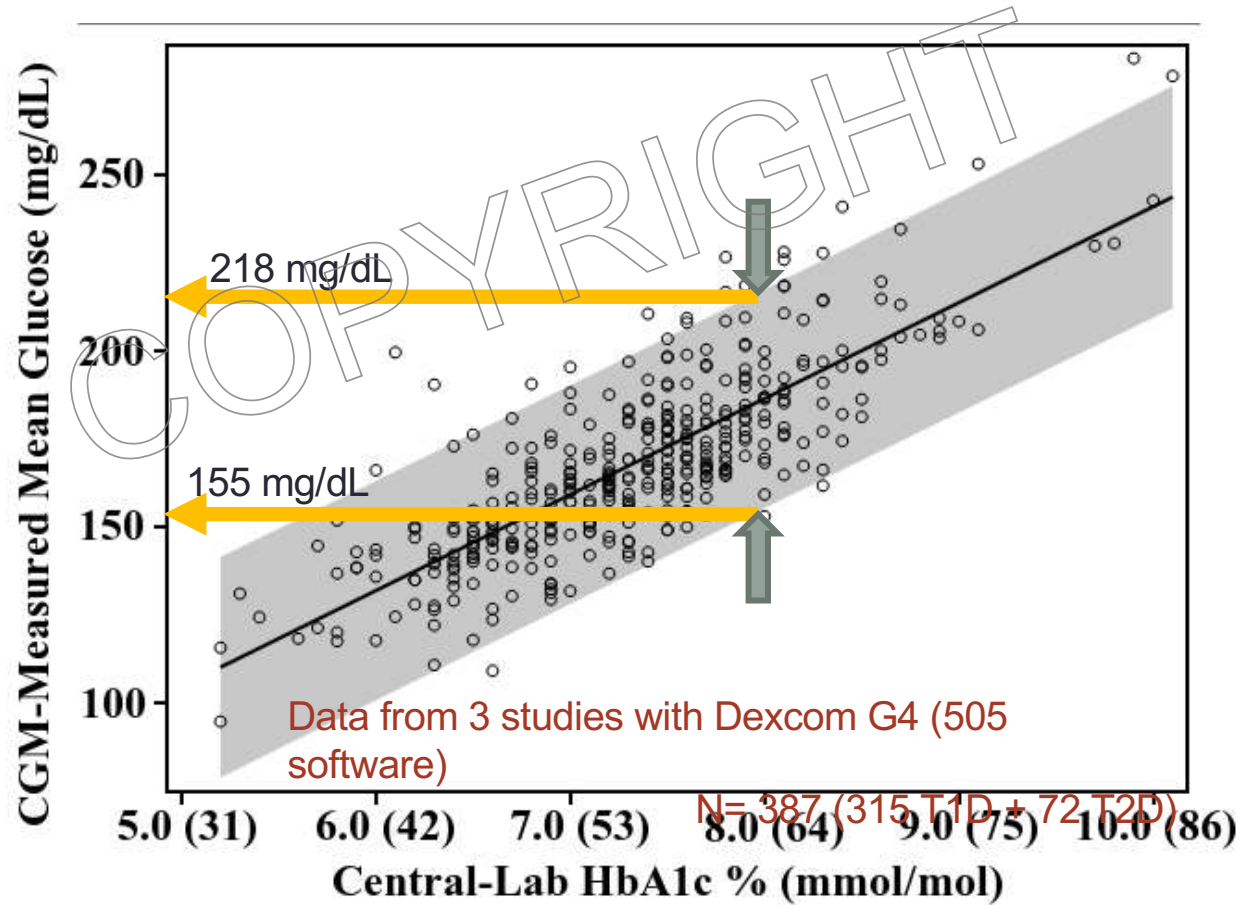
- **Strengths of A1c**

- Reflects blood glucose concentrations over ~3 months
- Only metric of glycemic control that has been prospectively associated with chronic complications
- Useful for assessing trends in a population over time

- **Limitations of A1c**

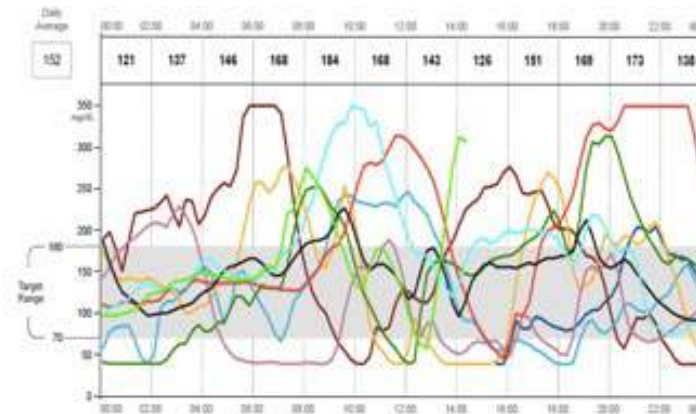
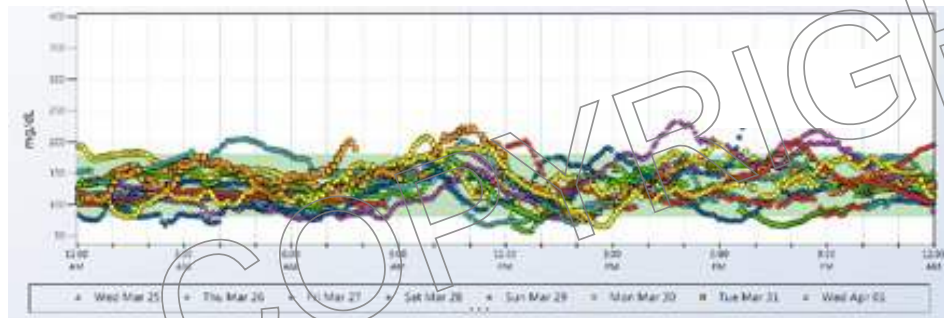
- Affected by other conditions that affect red blood cell lifespan or interfere with glucose binding to hemoglobin
- A wide range of mean glucose concentrations exist for a given HbA1c level
- Provides no information about hypoglycemia frequency or severity
- May under-represent the burden of hyperglycemia in African-Americans

CGM-measured Mean Glucose Versus Lab-Measured HbA1c



Slide thanks to Roy Beck (Beck RW, et al. Diabetes Care. 2017;40:994-999.)

The Same A1C, Very Different Glucose Control

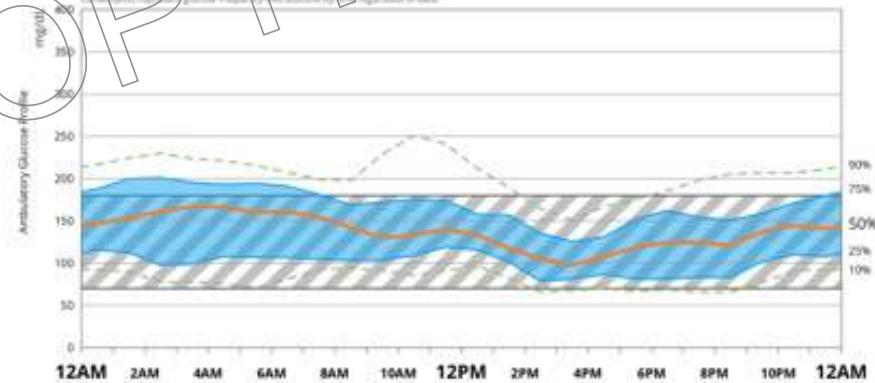


Ambulatory Glucose Profile

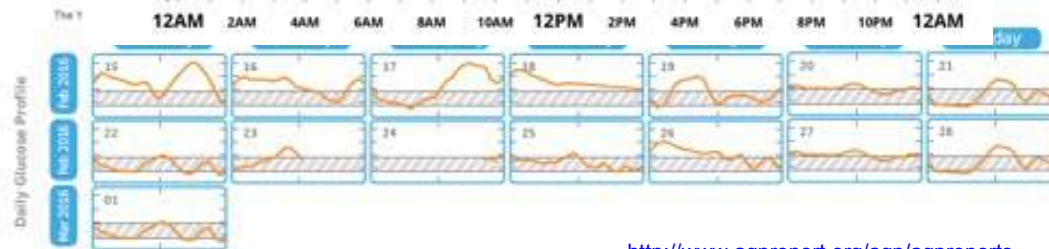
Glucose Metrics



24 hr Glucose Profile/Pattern



Daily View
(Calendar)



<http://www.agpreport.org/agp/agpreports>

Bergental RM, et al. Diabetes Technol Ther. 2013;15:198-211.

Easy to Assess for Hypoglycemia

AGP Report

March 5, 2025 - March 18, 2025 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

TIME IN RANGES

March 5, 2025 - March 18, 2025

14 Days

Time CGM Active:

96%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (8h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose 158 mg/dL

Glucose Management Indicator (GMI) 7.1%

Glucose Variability 44.1%

Defined as percent coefficient of variation (%CV); target 53%



What Types of CGM Are There?

- All forms of CGM continuously monitor interstitial glucose levels but vary in certain characteristics
- CGM that has to be “swiped” to obtain data and CGM that continuously transmits data
- Professional CGM vs real-time CGM
- CGM that requires calibration and CGM that doesn't
- OTC vs prescribed

Use of Smart Phones

- Most CGM's can be used with a reader OR a compatible cell phone
- Some automated insulin deliver systems only work with a smart phone
- Data can only be sent seamlessly through the cloud via a smart phone



RT-CGM: Dexcom G6 and G7 *(have readers)*



- Factory calibrated but can be calibrated
- Has best RCT data supporting its use
- 10 days of sensor use
- Has alarms for hypoglycemia and hyperglycemia thresholds and alerts for trending high or low
- Can display glucose levels on a receiver or phone
- Can 'share' glucose readings with someone else (e.g., parent, spouse)
- Reads glucose q5 minutes
- G7 integrated into Tandem, Ominpod and DIY systems

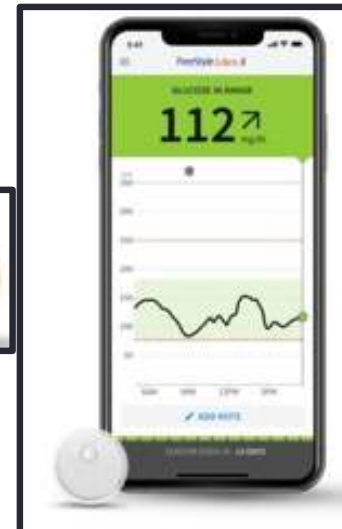
Libre 14-day and Libre 2 (have readers)



- Lasts for 14 days
- Libre 14 day (no alarms) and Libre 2 (alarms) work with require swiping
- Factory calibrated
- Data displayed on reader/smart phone

Libre 3/Libre 3 Plus

- Much smaller, no swiping, has alarms
- Measured glucose every minute



Medtronic: Simplera Sync *(needs compatible smart phone)*



DiaTech Podcast <https://www.youtube.com/watch?app=desktop&v=9rI10rWrHnc>

RT-CGM: Eversense *(needs compatible smart phone)*



- Implanted every 365 days
- Need fingerstick calibration
- Daily charging required
- Transmits to smart phone
- Predictive alerts and alarms
- iCGM approval



OTC: Stelo CGM (Dexcom G7)



OTC: Lingo CGM (Abbott Libre 2)



Big claims:



Weight management

As glucose rises, so does insulin.^[4] And when insulin is chronically elevated, it can impair the body's ability to burn fat for energy.^[5,6] That's why having steady glucose levels can help with losing and maintaining weight.^[7]



Re-training hunger cues

Glucose crashes can trick you into thinking you need more food ASAP.^[8,9] Seeing your real-time glucose data can help you understand the difference between true hunger and just a passing craving.^[9]



Feeling more rested

Studies have shown that adopting habits known to support steady glucose may lead to better sleep. In turn, better sleep can also help you make better food choices to keep your glucose steady.^[10,12]



And more...

Glucose management is associated with improved memory, mental clarity, and mood.^[13,14] One study found that people who ate a high-glycemic diet had a 55% higher report of poor mood as compared to people who ate a low-glycemic diet.

OTC CGM *(needs compatible smart phone)*

Parameter	Stelo (Dexcom)	Lingo (Abbott)
Indication	People not taking insulin	Lifestyle (people not on insulin)
Model	G7	Libre 2 without swiping
Duration of Wear	15 days	14 days
Warm up	30 minutes	1 hour
Alarms for high/low glucose levels?	None	None
Range	70 – 250 mg/dl	55 – 200 mg/dl
Cost (single purchase)	\$99/2 sensors	\$49/1 sensor
Compatible with	iPhone	iPhone

OTC System Available in Some Parts of the World

AiDEX X Continuous Glucose Monitoring

The Smallest 15 Days CGM



6 AiDEX X CGM Sensors (3 Months)

Experience 90 days of continuous glucose monitoring with AiDEX X CGM using 6 sensors (15 days each) and receive real-time updates every minute.

- Compact size 21mm x 2mm, wearable on upper arm or abdomen
- Easy one-step installation for convenience and ease of use
- Real-time data sharing to healthcare providers or caregivers
- 6 customizable alerts for personalized glucose tracking
- Best savings with free shipping compared to all other plans.

Plus, enjoy the security of our hassle-free reimbursement policy with every purchase.

\$332.00 ~~\$396.00~~ **16% OFF**

Mean Absolute Relative Difference (MARD) of Three CGM Devices

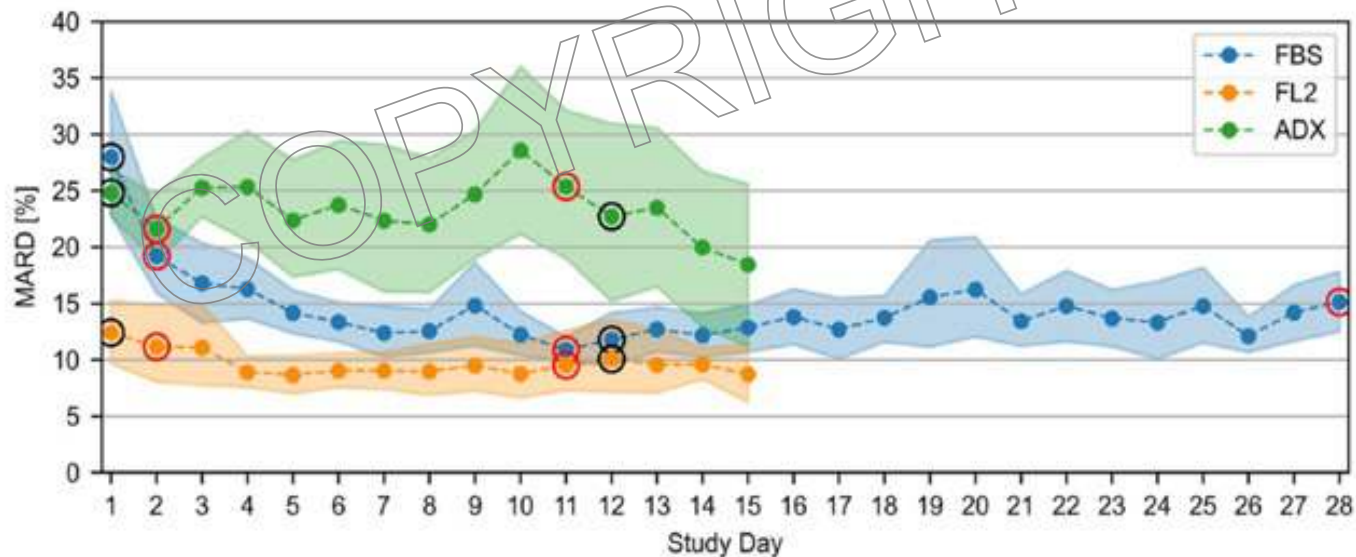


Figure 3. Sensor stability as characterized through mean absolute differences (MARD) on every study day including only sensors inserted on study day 1. The shaded areas indicate the 95% confidence intervals. The circled points indicate days that were at least partially spent at the study site; red circles indicate days with frequent sampling periods. Abbreviations: FBS, FiberSense CGM system; FL2, FreeStyle Libre 2 CGM system; ADX, GlucoRx AIDEX CGM system.

Starting CGM

- Download App
- Sign into account

Libre 3



Dexcom G7



Dexcom Clarity
Medical

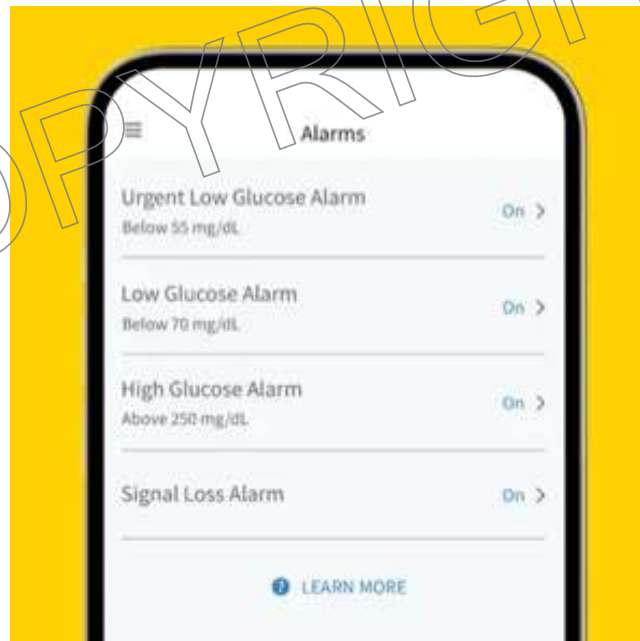


Dexcom G7
Continuous Glucose Monitoring



Dexcom Follow
CGM Remote Monitoring

Libre 3 Alarms



Dexcom Alarms

Example: Dexcom RT-CGM

Alert Settings for Device

General

Low	<input checked="" type="checkbox"/>	70 mg/dL
Low Repeat	<input checked="" type="checkbox"/>	15 min
High	<input type="checkbox"/>	200 mg/dL
High Repeat	<input type="checkbox"/>	30 min
Fall Rate	<input checked="" type="checkbox"/>	3 mg/dL/min
Rise Rate	<input checked="" type="checkbox"/>	3 mg/dL/min
Urgent Low	<input checked="" type="checkbox"/>	55 mg/dL
Urgent Low Repeat	<input checked="" type="checkbox"/>	30 min
Urgent Low Soon	<input checked="" type="checkbox"/>	55 mg/dL
Urgent Low Soon Repeat	<input checked="" type="checkbox"/>	30 min
Signal Loss	<input type="checkbox"/>	20 min

Scheduled - Bedtime

Status: On
Sun, Mon, Tue, Wed, Thu, Fri, Sat
10:30 PM - 7:00 AM

Low	<input checked="" type="checkbox"/>	70 mg/dL
Low Repeat	<input checked="" type="checkbox"/>	15 min
High	<input checked="" type="checkbox"/>	250 mg/dL
High Repeat	<input checked="" type="checkbox"/>	60 min
Fall Rate	<input checked="" type="checkbox"/>	3 mg/dL/min
Rise Rate	<input checked="" type="checkbox"/>	3 mg/dL/min
Urgent Low	<input checked="" type="checkbox"/>	55 mg/dL
Urgent Low Repeat	<input checked="" type="checkbox"/>	30 min
Urgent Low Soon	<input checked="" type="checkbox"/>	55 mg/dL
Urgent Low Soon Repeat	<input checked="" type="checkbox"/>	30 min
Signal Loss	<input type="checkbox"/>	20 min

Who Should Have a CGM?

- Anyone on an insulin pump or multiple daily insulin therapy
 - The strongest data from RT-CGM (devices with alarms and alerts)
 - Covered by Medicare and most insurances
- Patients on basal insulin
 - Data shows reductions in A1C/TIR
 - Covered by Medicare and MediCal
- Potentially all patients when starting/adjusting therapy
 - Generally not covered, although some insurances will pay for it.
 - Libre CGM is often less expensive than others
 - Medicare covers CGM if patient has episodes of hypoglycemia on non-insulin therapy

Diabetes Care. 2021 Jan;44(Suppl 1):S15-S33. doi: 10.2337/dc21-S002

JAMA. 2021;325(22):2262-2272. doi:10.1001/jama.2021.7444

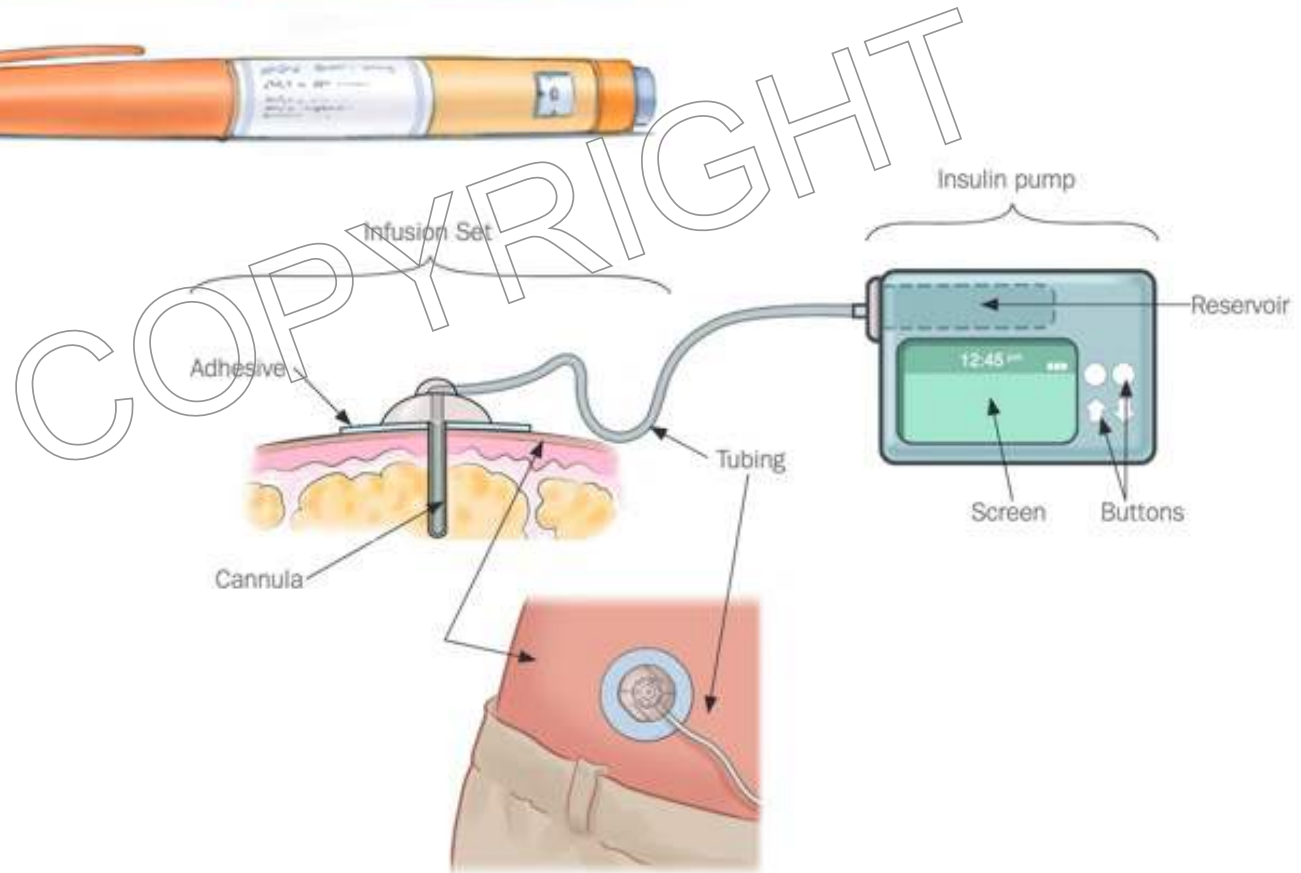
Devices Must Be Downloaded for Interpretation

- However, many offices don't download data; staff needed to do so for each patient
- Need USB cords for people using receivers
- Many pages can print out, need to streamline most useful reports to optimize time in visit
- Many devices now have cloud-based programs with continuous data streams
- Increasing numbers of EHR's are able to capture CGM data
- Work with your local device company reps to set up systems that function
- Diabetes educators often can make this happen

Be Aware of Literacy Level

- Created lower literacy multicultural guides for insulin pen and pump use in English and Spanish.
- Focus groups provided input, nonbranded illustrations were created and text edited by the “Clear Language Group”
- Guides implemented in our clinic with 47 adults with T1D
- Average age = 45 years, half English and half Spanish speakers, all lower income, 89% had some college or less, 78% had some form of governmental insurance

Funded through a generous grant from the Helmsley Charitable Trust



Focus Group Subjects Preferred “Thought Bubbles”



Glucagon helps raise blood sugar levels if you are not able to eat, drink or if you have passed out. It raises sugar levels by signaling the liver to release stored sugar.

I do not know what happened with my blood sugar. When I woke up, I was in the hospital. It was so low I passed out. If I had glucagon at home, I could have avoided a trip to the hospital.



Carb counting!
I am going to have to go to school to learn this stuff.



At first it may be hard. But it gets easier with practice. You do not have to do it alone either.

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Stepp-Up Study: Results—No improvement in A1C's, but other areas better, including rates of DKA

Variable	Baseline	12-Months	P-value
A1C	9.19 +/- 1.97	9.25 +/- 1.92	0.81
CGM Average BG	206 +/- 58	203 +/- 60.7	0.82
TIR	22% +/- 11.1	24% +/- 17.9	0.67
Self-report of health	3.53 +/- 0.97	3.14 +/- 1.04	0.01
Diabetes knowledge	69% +/- 0.17	76% +/- 0.15	0.004
Depression	6.32 +/- 6.36	4.7 +/- 5.02	0.04
Diabetes distress	2.27 +/- 0.96	1.89 +/- 0.95	0.01
Hypo fear	2.11 +/- 0.92	1.85 +/- 0.7	0.02
Rates severe hypo	0.78 +/- 1.51	0.61 +/- 1.55	0.48
Rates DKA	0.66 +/- 1.65	0.10 +/- 0.37	0.01

*Funded through a generous grant from the Helmsley Charitable Trust
Unpublished data*

Social Determinants of Health



Social Determinants of Health and Diabetes: A Scientific Review

<https://doi.org/10.2337/dci20-0053>

*Felicia Hill-Briggs,^{1,2} Nancy E. Adler,³
Seth A. Berkowitz,⁴ Marshall H. Chin,⁵
Tiffany L. Gary-Webb,⁶ Ana Navas-Acien,⁷
Pamela L. Thornton,⁸ and
Debra Haire-Joshu⁹*

Diabetes Care. 2020;44:258–79. doi: 10.2337/dci20-0053.

Common Stressors in East Los Angeles

- Sick family member
- Divorce
- Death
- Eviction/deportation
- Loss of job
- Theft/robbery
- Injury
- Legal issues/prison
- Food insecurity
- Disability

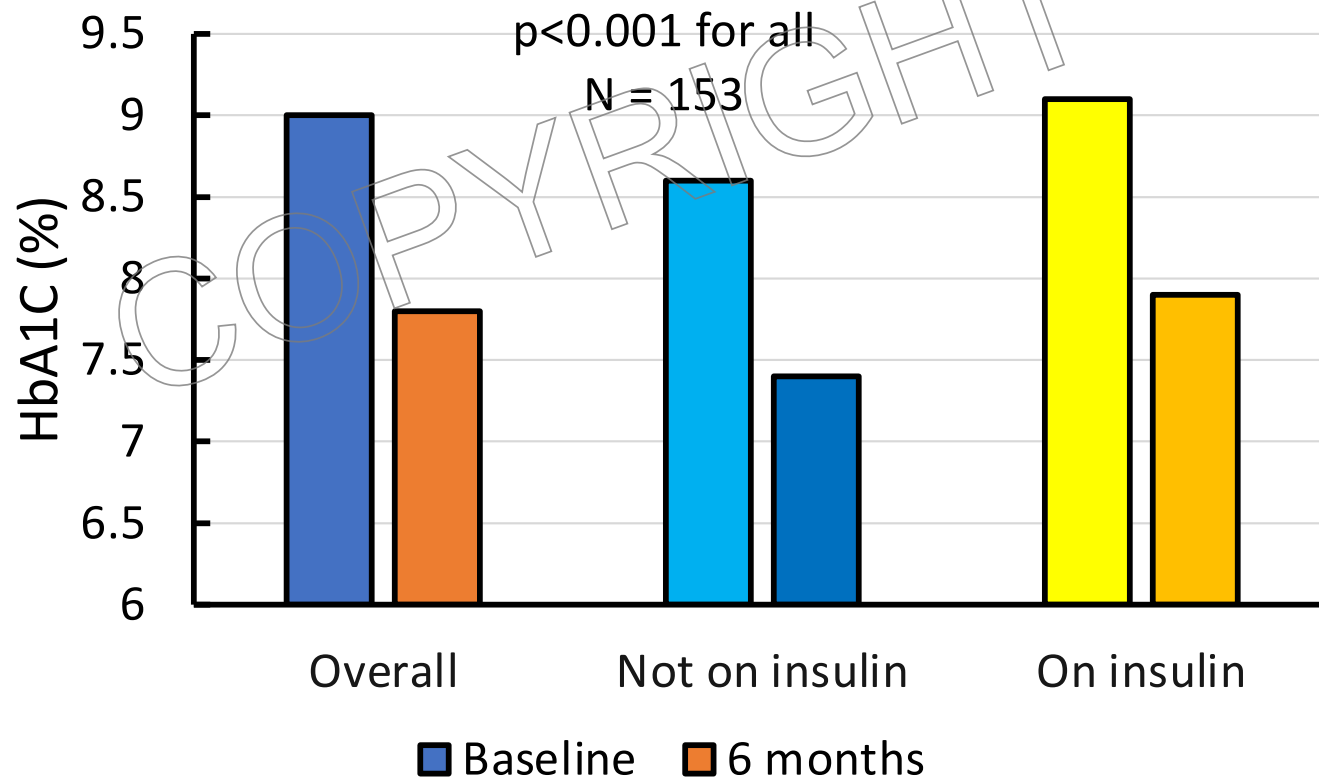
Hankey Project

- A donor from my Westside practice gave us funding to provide CGM's/CGM education and remote monitoring to anyone who wanted it at Roybal, a comprehensive health center
- Our research team is embedded within the center so patients/providers have easy access to our team
- We tracked patients in an observational study to show outcomes

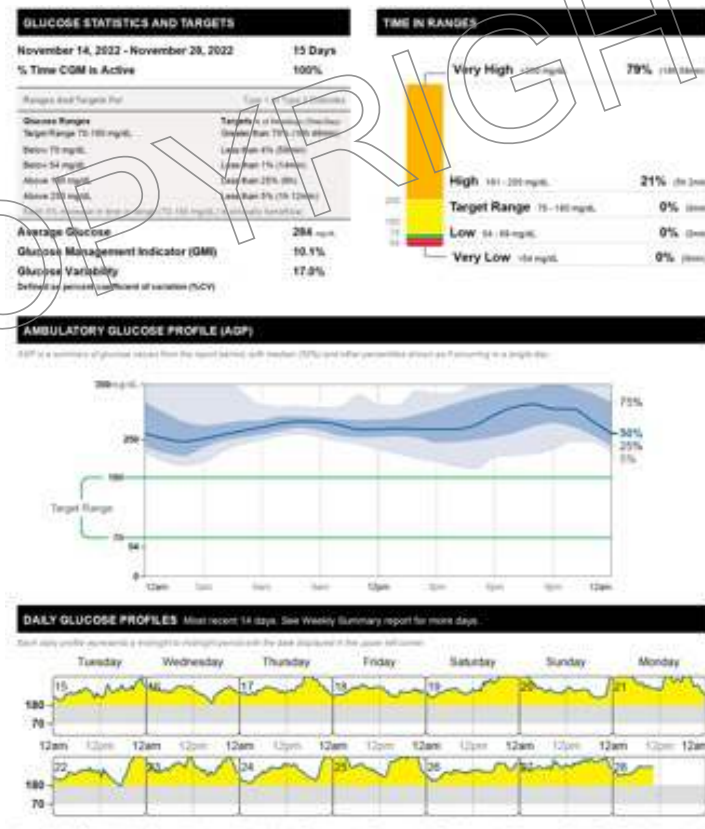
Hankey Project Description -- Methods

- Participants were provided a Libre 2 CGM and followed via LibreView
- Data from a blinded Libre Pro was obtained at baseline, 6 mths and 1 yr.
- CGM based recommendations per study PI were provided to the participants PCP based on the LA County algorithms for diabetes management
- Project staff reviewed LibreView portal data daily
 - Participants were contacted if glucose values were <70 mg/dl or >250 mg/dl more than 5% of the time
 - Diabetes education was provided when events met the criteria above
- AGP reports were sent to PI as clinically indicated (weekly, monthly, q3 months).

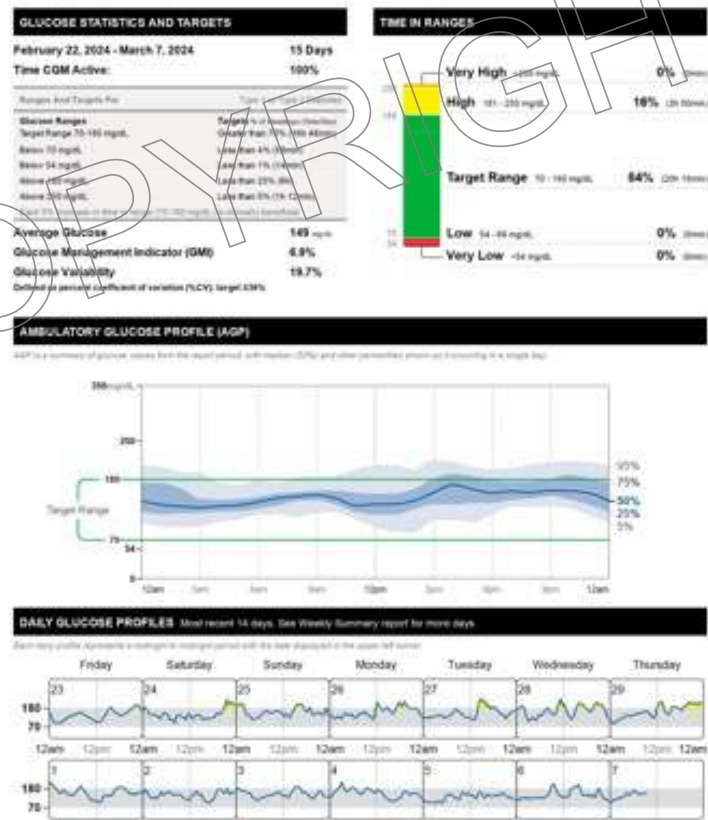
Changes in A1C Levels 6 Months After Starting CGM



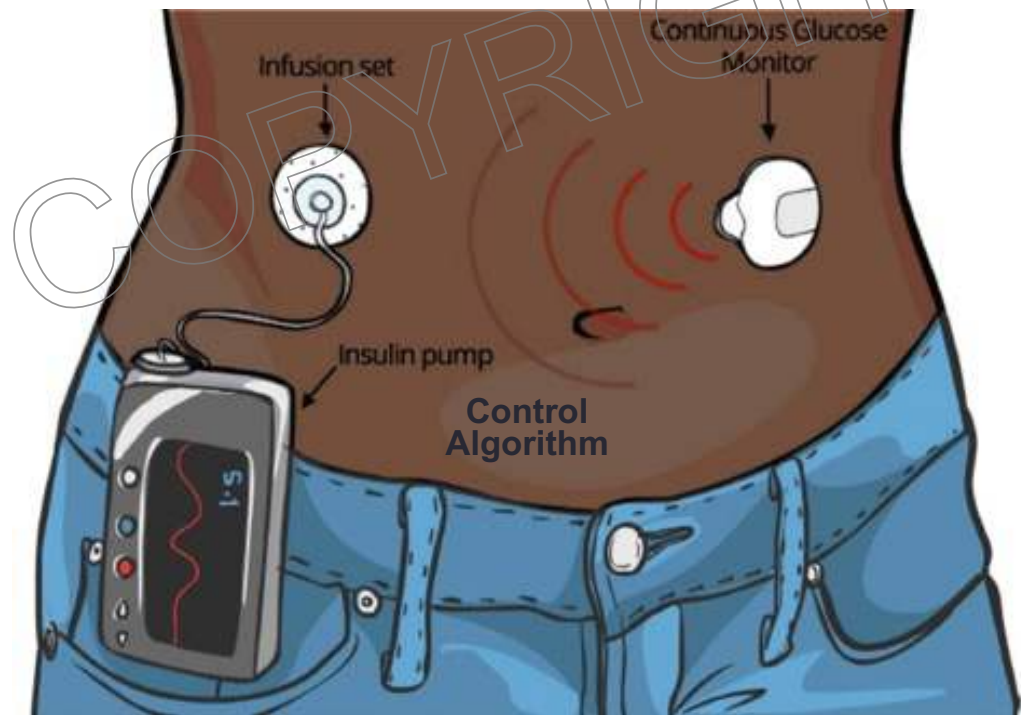
61yo Latina female at baseline: on SA, met, pio, empa and not taking most of it



61yo Latina female at 1yr: on metformin, empa, semaglutide



Automated Insulin Delivery Systems: *Medtronic, Tandem, Omnipod 5, iLet, Twiist, and DIY*



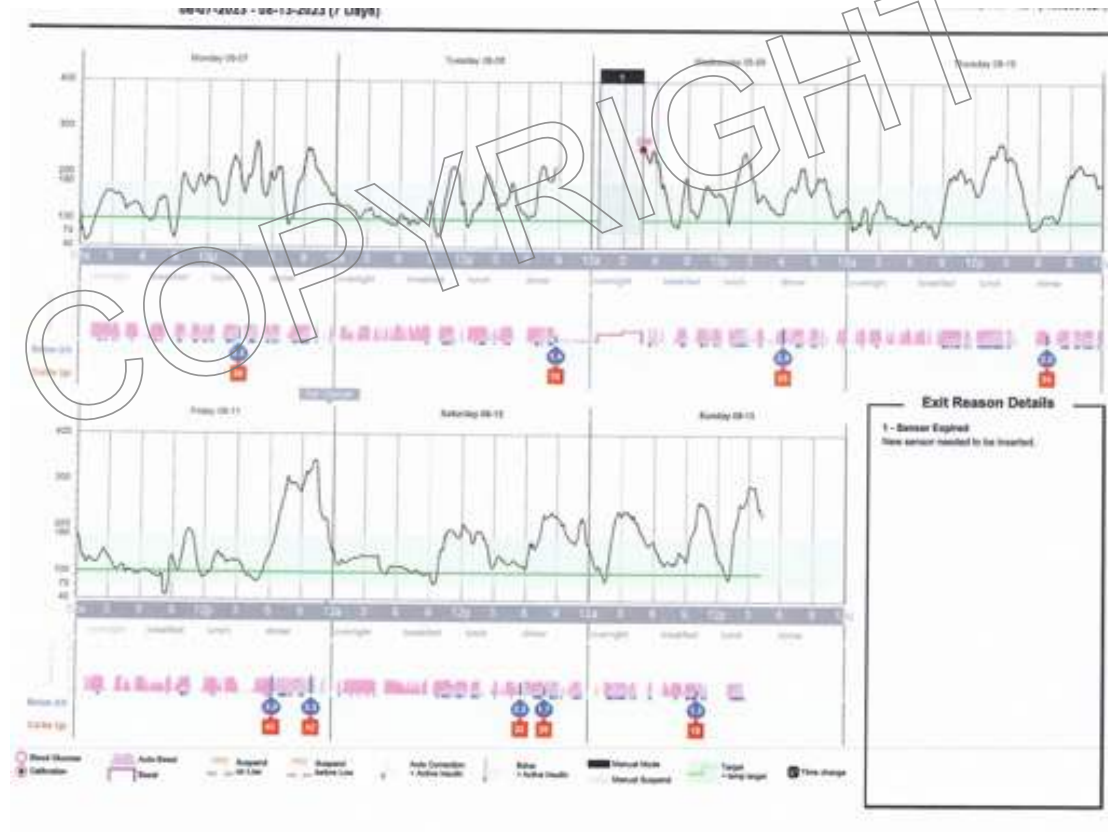
Medtronic 780G

New Features:

1. Guardian 4 sensor which does not require calibration in automode
2. Seven-day infusion set
3. Can set target as low as 100 mg/dl
4. Gives correction bolus doses every 5 minutes



780G Data



T:slim X2 with Control-IQ Technology



- Can set basal rates, correction and carb doses
- Gives autocorrect boluses
- Can give bolus doses from a smart phone

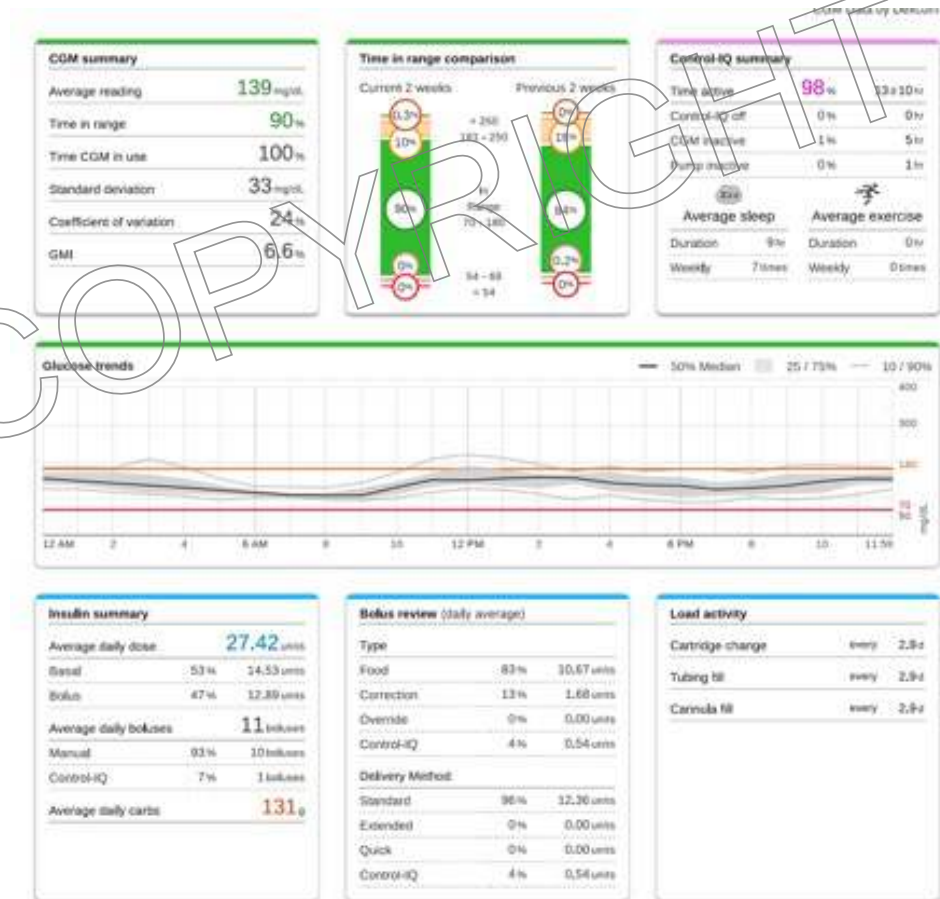
Tandem Mobi Pump *(needs compatible smart phone)*





Data from an AID System

78 yo man who lives in the mountains



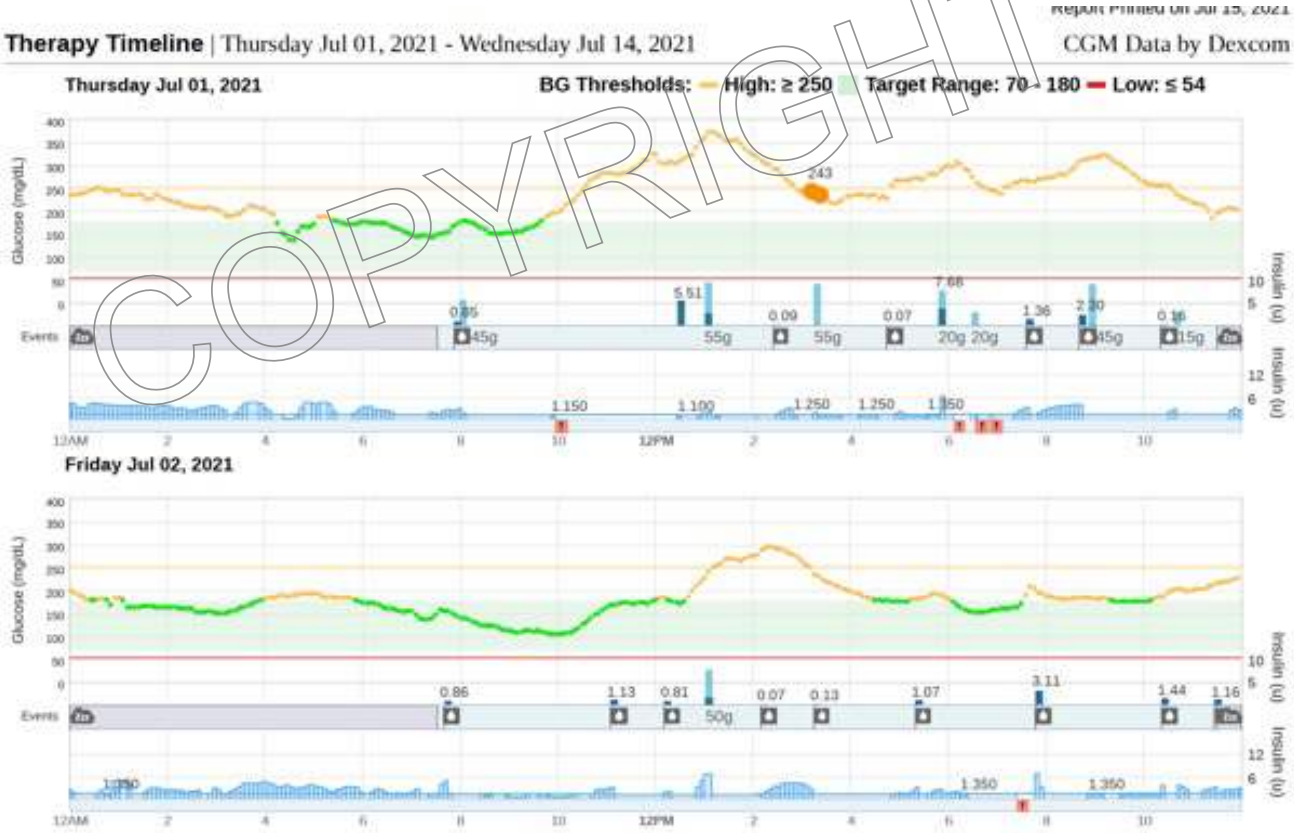
Data from an AID System

78 yo man who lives in the mountains



Data from an AID System

Busy Mom Forgets/Delays PreMeal Bolus Doses



Tubeless AID System: Omnipod 5 *(needs compatible smart phone)*



Brown S et al;. Safety Evaluation of the Omnipod 5 Automated Insulin Delivery System over 3 Months of Use in Adults and Adolescents with Type 1 Diabetes. Presented at Virtual Endocrine Society Annual Meeting; 2021.

iLet Bionic Pancreas

(needs compatible smart phone)

Works with Dexcom G7 and Libre 3 Plus



NEJM 387:13, 2022

Device Comparison Chart

Using the **C|A|R|E|S Framework**, learn how each device: **CALCULATES** insulin delivery; which pump settings the user can **ADJUST**; when it **REVERTS** to open loop; how to best **EDUCATE**; and **SENSOR/SHARE** characteristics.

[LAST UPDATED: JULY 2022]

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MiniMed 670G / 770G



MiniMed 780G



t:slim X2 Control-IQ



Omnipod 5



Conclusions

- Technology can help people with both T1DM and T2DM
- Education and follow-up are vital
- Awareness of stigma
- Data downloading is necessary for interpretation
- Access can be a barrier

Thank you!!!!

Special Thanks to Our Team:

Martha Walker, RD CDCES

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Los Angeles County staff at
the Roybal Comprehensive
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Abbott Diabetes Care for
study sensors and readers

