SB1

Diabetes Technology

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1

Disclosure

- I have type 1 diabetes and I have used many of these devices
- I am not promoting any particular device(s)
- No other disclosures

2

Objectives

- Introduction to common diabetes technology
- Gain understanding of functions of common diabetes technology
- Apply knowledge learned about common diabetes technology to practice

3

Many technologies

- Pumps
- CGM
- Connected “Smart” Pens
- Smart Meters
- Apps
- Personal devices/trainers
- Open source DIY

4

Continuous Glucose Monitoring (CGM)

5

EL [2]1

CONTINUOUS GLUCOSE MONITORING

CGM Professional

- CGM owned by the clinic placed by health professional to assess 7-15 days of blood glucose data
- We often do this for patients with variable blood glucose, difficulty achieving targets, A1C/SMBG mismatches, or those considering a pump +/- CGM

CGM Personal

- CGM owned by person with diabetes
- Track data continuously
- Some integrate with insulin pumps, can also be used freestanding with injection insulin or other medications

6

Slide 1

SB1 Hi Eric - In general - I'm concerned about the number of slides for a 45 minute presentation at the end of the day. Are there things we could cut? I made a few suggestions but would love your input. Also, I realize a few of these you can breeze through...
Sarah Bradley, 5/4/2020

Slide 6

SB4 Do you want to change the language "control problems"?
Sarah Bradley, 5/4/2020

JEL [2]1 yes, thank you
Johnson, Eric L., 3/20/2023

CGM Systems*

Dexcom G7
- Does not require fingerstick blood glucose monitoring (BGM) for calibration
- Can be worn for up to 15 days
- Smartphone app
- Clarity platform
- Can share data with up to 10 people





Stelo by Dexcom (OTC)







Lingo by Abbott OTC

Freestyle Libre 2+ and FreeStyle Libre 3 +
- Do not require fingerstick BGM for calibration
- Can be worn for up to 14 days
- Smartphone app
- LibreLinkUp platform
- Can share data with up to 20 people

*Can be used with insulin injections or pump therapy or other medications

7

Implantable CGM

- Ascensia Eversense e3
- Requires fingerstick BGM for calibration
- Up to 12 months of use
- Has a phone app



8

Devices for Insulin Delivery

9

Devices for Insulin Delivery

- Insulin pens
- Connected or “smart” insulin pens
- Insulin pump (also called continuous subcutaneous insulin infusion or automated insulin delivery)
- Often used with CGM
- Several different brands of each type of insulin delivery device

10

Connected Insulin Pens

Eli Lilly

Minimed

Novo Nordisk

Bigfoot unity

Each connect to various platforms









11

Automated Insulin Delivery Systems

- **Automated insulin delivery (AID) systems connect an insulin pump with a CGM system** with a predictive control algorithm to automate insulin delivery based on real-time glycemic data.
- Commercially available systems are said to have **“hybrid closed-loop”** functionality because they automate insulin delivery in response to real-time glycemic data, but users must manually deliver mealtime bolus doses
- **Fully closed-loop systems** are designed to automate all insulin delivery.

12

Slide 7

LM1 Reviewer 1: As I said earlier, I think it might be better to discuss in this order: smart pens, CGM, SAP pumps, AID systems. If you agree,these CGM slides will momve to earlier in the presentation.

If you rearrange as I'm suggesting, we don't need to include on this slide what AID systems they interface with because that will be covered when we get to the AID slides (in the rearragned order).So I took that info out here.
Logan Moeller, 3/13/2023

LM2 Reviewer 1: Let's try to make the info we provide uniform from one system to the next. For example,you mention no need for fingersticks with Dexcom and Libre, but you don't address fingersticks for Guardian. Also, you mention the Libre smartphone app and Libre LinkUp, but you don't mention an app for the G6 or Dexcom Clarity. For Medtronic, you mention the app but not CareLink. Please review to be sure we're being consistent in the descriptions.
Logan Moeller, 3/13/2023

LM3 Reviewer 1: It looks like Medtronic is discontinuing SugarIQ.
Logan Moeller, 3/13/2023

LM4 Reviewer 1: Don't we need to mention the Eversense implantable sensor system, too?
Logan Moeller, 3/13/2023

JEL [2]2 I have added
Johnson, Eric L., 3/20/2023

JEL [2]3 OK, I believe I have made the suggested changes
Johnson, Eric L., 3/20/2023

EJ1 Eric Johnson, 1/10/2025

Slide 10

LM5 Reviewer 3: For Pens, are you referring to traditional dial up pens like Lantus SoloStar? If not, would remove and just keep "Smart Pens". Did you mean '+/-' instead of '=/-'?
Logan Moeller, 3/17/2023

JEL [2]4 pens refer to traditional dial up pens
Johnson, Eric L., 3/20/2023

Slide 11

LM6 Reviewer 1: I changed to "connected insulin pens" because that's what they're calling them in the SOC these days.
Logan Moeller, 3/13/2023

JEL [2]5 thank you
Johnson, Eric L., 3/20/2023

LM7 Reviewer 1: If we're naming brand names, we have to name them

Slide 11 (Continued)

all the same way. What is the name of the Lilly smart pen? Also, are all of them able to be used with Glooko or just the Echo? And will our audeince know what Glooko is?
Logan Moeller, 3/13/2023

JEL [2]6 see below
Johnson, Eric L., 3/20/2023

LM8 Reviewer 3: For the Novo Nordisk products, I believe the NovoPen 6 and NovoPen Echo Plus are two separate devices. I would make this clear on the slide. I believe the mySugr app can also be used with these pens - would consider including to avoid bias. Please correct Lilley to Lilly. For the InPen, I believe Companion Medical received funding from Lilly to get FDA clearance for the pen and associated application. Medtronic then ended up acquiring Companion Medical. Would consider merging the two outside images into one as they represent the same product.
Logan Moeller, 3/17/2023

JEL [2]7 see below
Johnson, Eric L., 3/20/2023

JEL [2]8 I have been thinking quite a bit about this slide, I have made it more generic. this is a fast changing landscape for these devices. I"m concerned it could become dated quickly if we are too specific. Given our presumed audience, How does this look? it's really just a slide of examples.
Johnson, Eric L., 3/20/2023

Slide 12

LM9 Reviewer 1: I added a slide here to introduce AID systems before you start talking about the specific available brands. Feel free to reword as you wish.

But also, we jumped from smart pens right to AID systems. Do you think we should discuss pens, then CGM systems, then add a slilde or two about SAP pumps that have low-glucose suspend but aren't considered to be AID systems because they don't attempt to reduce both hyperglycemia and hypoglycemia. And THEN discuss AID systems? That seems like the right progression to discuss these products, since you need to know about stand alone CGM and pumps before you talk about AID.
Logan Moeller, 3/13/2023

Basic Pump Function

- Small amounts of insulin continuously **(units per hour)=basal insulin**, variable dependent on blood glucose value
- Bolus insulin- meal announcement
  - **units per gram of carbohydrate** programmed into pump,
  - **corrections (units required to lower blood glucose** X amount-programmed into pump-corrections are often automated)
- Rapid acting insulin only
- Often calculated based on previous injected insulin doses and/or weight
- Rule of 1500-1800 (correction factor), Rule of 500 (insulin per gram of carb)

13

Medtronic MiniMed 780G



- Tethered (tube and cannula)
- Medtronic Instinct, Guardian 4, or Simplera sensor
- Dependent on user to enter carbohydrate intake
- Delivers correction doses
- Holds 300 units
- Phone app, sharable data

14

Minimed Flex



- Tethered (tube and cannula)
- Medtronic Simplera sensor (Instinct soon to follow)
- Dependent on user to enter carbohydrate intake
- Delivers correction doses
- Holds 300 units
- Phone app, sharable data

15

Insulet Omnipod 5



- Wearable tubeless insulin pump (Pod)
- Dexcom G7 CGM sensor, Freestyle Libre 2+, Freestyle Libre 3+
- Dependent on user to enter carbohydrate intake
- Delivers correction doses
- Handheld personal device manager looks more like a smartphone display
- Phone app
- Holds 200 units of insulin
- Sharable data

16

Tandem t:slim X2



- Tandem tethered (tube and cannula)
- Dexcom G7 CGM
- Freestyle libre 2 +, Freestyle Libre 3+ CGM
- Dependent on user to enter carbohydrate intake
- Touch screen
- Holds 300 units of insulin
- Delivers correction boluses
- Phone app/sharable

17

Tandem Mobi



- Tethered (tube and cannulia)
- Phone app controls pump
- Dependent on the user for carbohydrate intake
- Dexcom G7
- Sharable data
- Holds 200 units

18

Beta Bionic iLet



- Tethered (tube and cannula)
- Only needs weight of the patient to start
- Works with Dexcom G7, FreeStyle Libre 2+, Freestyle Libre 3+
- Dependent on user to enter carbohydrate intake, can be usual, less then usual, more than usual (meal announcement)
  Delivers correction doses
- Phone app
- Holds 180 units of insulin

19

Twiist

- Tethered (tube and cannula)
- Tidepool algorithm/Deka pump
- Phone app
- Can be operated with iPhone or Apple SmartWatch
- Delivers correction doses
- CGM Freestyle Libre 3+, Eversense
- Holds 300 units



20

DIY "looping"

- **Open-source AIDs**:**
  OpenAPS™ / AndroidAPS /
  Loop / FreeAPS/Tidepool
  "closed loop"
  Not FDA approved (except Tidepool loop is FDA cleared)

  A variety of devices are used
  https://www.loopandlearn.org/sl-pump-cgm/
  https://androidaps.readthedocs.io/en/latest/
  https://www.tidepool.org/tidepool-loop



21

Interpreting CGM Data for Clinical Decision-Making

22

EL [2]12

CGM Data-Sharing Platforms

- All of the devices have proprietary platforms to upload/download data-Dexcom clarity, Medtronic carelink, Tandem source, Libreview
- All have similar data reports
- I don't have a preference; they are all good LM15
- In the era of telehealth, this ability to share and remotely monitor data is more important than ever
- Non-device specific platforms i.e., Glooko, Tidepool

23

Multisystem Downloading Platforms



24

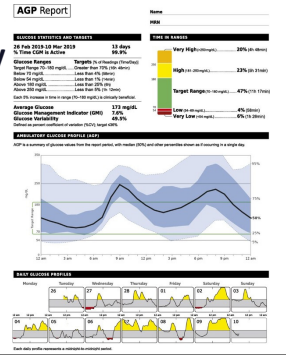
Slide 23

LM14 Reviewer 1: I'm not sure what the final bullet here means. Also, is it worth adding a bullet about the platforms that are not device-specific such as Glooko and Tidepool?
Logan Moeller, 3/13/2023

JEL [2]12 changed and yes
Johnson, Eric L., 3/20/2023

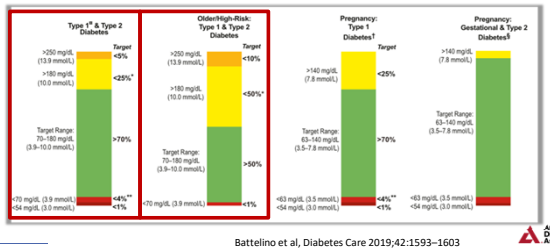
LM15 Reviewer 2: Could also mention Tidepool which supports most devices
Logan Moeller, 3/13/2023

Ambulatory Glucose Profile



25

CGM Time in Target International Consensus Panel Recommendations



Battelino et al, Diabetes Care 2019;42:1593–1603

American Diabetes Association.

26

Getting Started

27

Think About Who Is On Your Team

- The primary diabetes provider
- Nurse
- Certified diabetes care and education specialist(CDCES)
- Dietitian
- Advanced practice nurse or physician assistant
- Others (behavioral health, social worker)

Not every practice will have these team members

28

Get The Necessary Technology For Your Practice

- CGM's and Smart meters often have downloadable data sets
- The responsibility of downloading or compiling the data in-office can fall on a diabetes educator, but more likely in many primary care practices, a nurse or medical assistant can be trained to manage these devices

29

Get The Necessary Technology For Your Practice

- All of the major device manufacturers have software that can be installed on an in-house computer where the **data can be downloaded** to paper or an electronic file (i.e., pdf) that may be uploaded into a medical record or uploaded to a commercial site
- Once you have done a few of these and develop a routine, the flow is usually good
- Doing in advance is best, but if done in office, may do encounter first and review data at end of appointment

30

Slide 25

SB5 Mansur Shomali will show this slide for the algorithm talk but reference your lecture for more info.
Sarah Bradley, 5/4/2020

Slide 28

HF1 does IT need to be a part of the team when dealing with tech issues?
Hope Feldman, 5/15/2020

CGM interpretation can be billed, many third- party payers cover such services

- What is included with CPT® code 95251?
- CPT® code 95251 is the analysis, interpretation and report for CGM for a minimum of 72 hours of data. An appropriate CGM analysis, interpretation and report should include the following elements:
- Patient's name
- Date of birth
- Medical Record #
- Indication for the device placement
- Name/Type of device placed

31

Typical Ambulatory Glucose Profile interpretation template for electronic health record documentation may look something like this:

- Ambulatory Glucose Profile
- Dates of data review: ***
- Average SG: *** mg/dl.
- Coefficient of Variation (goal <36%): *** %
- *** % of time wearing CGM

- Glucose Ranges:
- SG below 54 mg/dl. (goal less than 1%) --*** %
- SG below 70 mg/dl. (goal less than 4 %) --*** %
- SG between 70-180 mg/dl. (goal is greater than 70%) --*** %
- SG above 180 mg/dl. (goal is less than 25%) --*** %
- SG above 250 mg/dl.(goal is less than 5%) --*** %

- Interpretation:
- ***

32

Medicare Coverage Requirements for Personal Therapeutic* CGM

- Have a diagnosis of diabetes, either type 1 or type 2
- Be treated with insulin
- Require frequent adjustments of the insulin treatment regimen, based on therapeutic CGM test results
- Have been seen in office within 6 months, and
- Continue to be seen at least every 6 months in order to continue to receive coverage

33

Patient case: Maria

34

Patient case: Maria

68 year old Hispanic female

- **Type 2 diabetes x 8 years**
- **Hx of HTN, dyslipidemia, albuminuria, transient ischemic attack**
- **GFR 45**
- **BMI 30**
- **A1C 8.5%**
- **Notes "lows", often midday or overnight**
- **Medications**
  - **Atorvastatin 20mg daily**
  - **Lisinopril 10mg daily**
  - **Aspirin 81mg daily**
  - **Metformin 1000mg BID**
  - **Glimiperide 4 mg daily**
  - **Basal insulin 28 units hs**



35

Patient case: Maria

Which of the following glucose metrics is thought to be at least as important as the A1C level?

A. Average glucose
B. Percent of time sensor is worn
C. Glucose variability measured by standard deviation or coefficient of variation
D. Time in Range



36

Patient case: Maria

Answer: E All of the above when combined into a standardized CGM report



37

Patient case: Maria

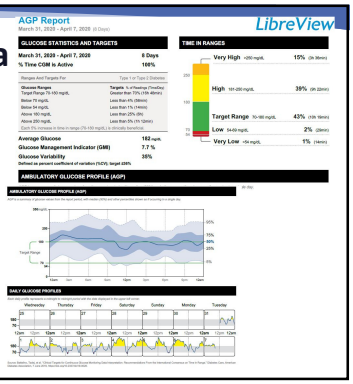
- Individualizing A1C Goal -- factors to consider:
  - Support system
  - Vascular complications
  - Comorbidities
  - Life expectancy
  - Diabetes duration
  - Risks associated with hypoglycemia



38

Patient case: Maria

- Based on this CGMpro data, what are some things we might do next? (note- GMI is better than A1C?)
- Is this patient a good CGM candidate?
- If yes, why?



39

Stop!

- What is going on with her?
- She has an elevated A1C with occasional lows
- What else in her history is concerning?
  - CVD and non-optimal glucose control
  - Microvascular complications
  - Hypoglycemic episodes
- What would be some good next steps? (GLP-1 and/or SGLT-2) (stop glimiperide?)

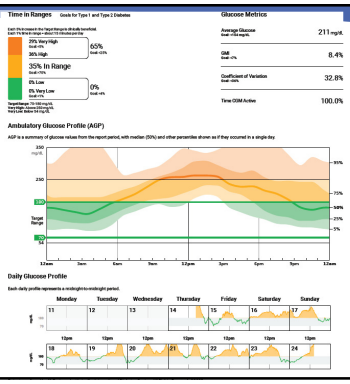
40

CGM cases

41

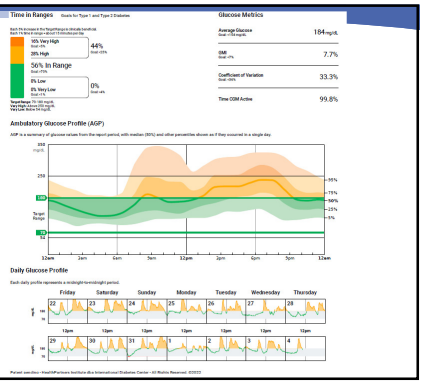
48 year old male type 2 basal insulin and metformin

Good add-ons?



42

64 year old female Type 2 CKD, CVD; MDI insulin, metformin, empagliflozin, intolerant of GLP-1 A1C's 9's; 3 months after starting CGM



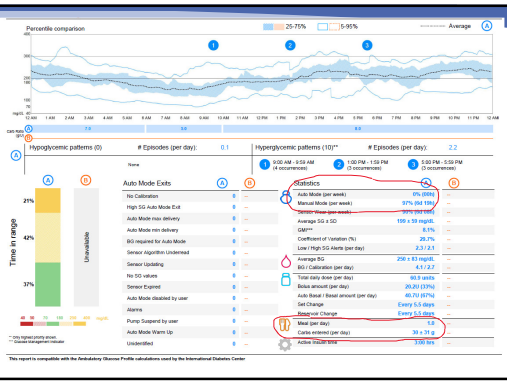
43

63 year old type 2 Metformin + Glipizide added SGLT-2



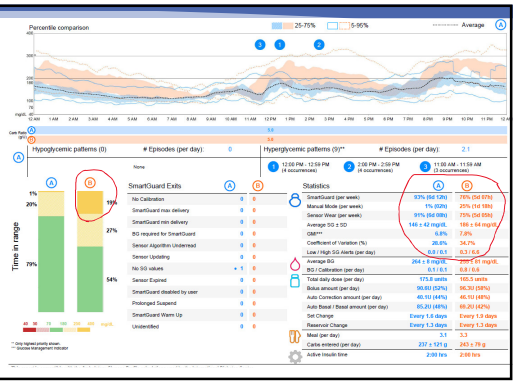
44

77 year old type 1 pump; CVD, CKD



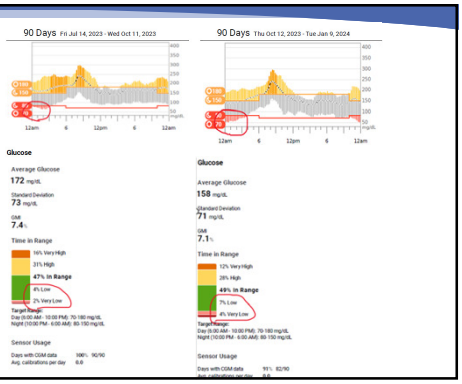
45

37 year old female type 1; encouraged more time in automated mode (smart guard)



46

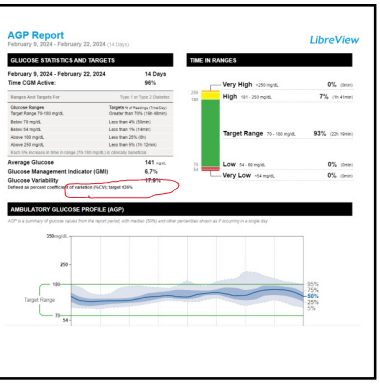
52 year old male type 2 metformin, basal insulin-insulin dose changed-better A1C, but at what cost?



47

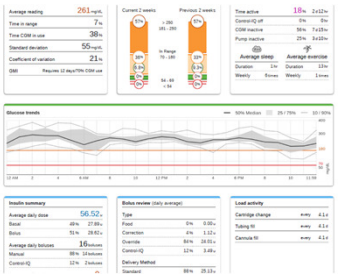
69 year old male type 2, CKD, CVD risk
Was on metformin, glipizide, pioglitazone, "not really testing"
A1C's 9's;
switched to metformin, dulaglutide, empagliflozin-lost 53lbs

This is a CGMpro; not on insulin, considering cash pay



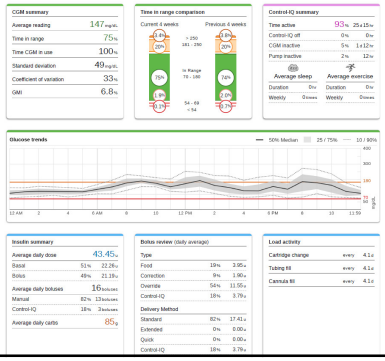
48

33 year old type 1 on pump



49

40 year old female type 1 on pump



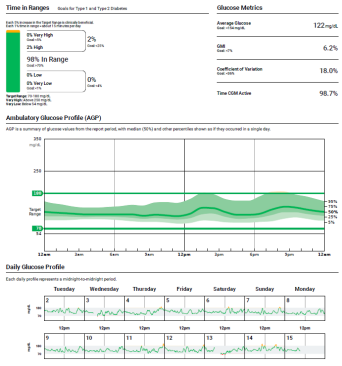
50

60 year old type 1 on pump



51

50 year old female type 2 on pump and tirzepatide can't tolerate metformin or SGLT-2 lost about 50lbs



52

Gaps in Technology Based Diabetes Care

- Availability of health care personnel familiar with devices
  - Pick a device like a CGM or a smart pen and get some experience with it
  - Who does telehealth? Can they link with your clinic?
  - Do you have community health care workers who can be familiar with devices?
  - It doesn't have to be all or none
- Payer variability, but we see a lot of Medicare and Medicaid coverage
- Provider biases
- Other social determinants of health
- Is technology widening the inequity gap?
- Who can make the leap in your practice?

Agarwal S, et al Curr Diab Rep. 2022 Jul;22(7

53

Diabetes Care Is More Than Glycemic Management: Addressing the Needs of the Whole Person

54

Avoiding Bias

- Be aware that coverage exists for diabetes technology, including Medicaid and Medicare-don't assume it won't be covered
- Racial and ethnic minorities and those of lower socioeconomic status have higher rates of diabetes, may have worse outcomes, and are less likely to be offered diabetes technologies
- Geographic disparities

How Can You Help Patients Use New Diabetes Technologies? - Blog - NIDDK (nih.gov) accessed March 2

55

Summary

- CGM use is becoming widespread
- Patients do better on CGM +/- pumps
- You can incorporate this into your practice

56

Contact Info

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57

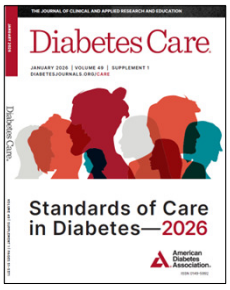
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58

Standards of Care in Diabetes—2026

(Standards of Care)



59