DiabetesEd Training Conference |San Diego *

Day Two | October 10, 2024 (Pacific Time)

Insulin Pattern Management, Physical Assessment & Diabetes Techn

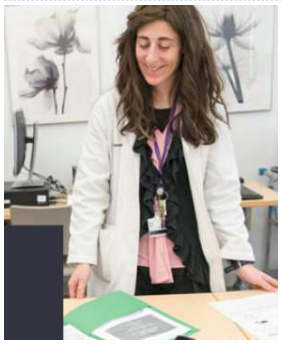
Time	Topic	Speakers
7:30am – 8:00am	**Breakfast & Welcome**	
8:00 – 9:30	**Insulin - the Ultimate Hormone Replacement Therapy**	Diana Isaacs, PharmD, BCPS, BCACP, CDCES, BC-ADM, FADCES, FCCP
9:30 – 9:45	**Break**	
9:45 – 10:45	**Insulin Pattern Management and Dosing Strategies**	and Beverly Dyck Thomassian, RN, BC-ADM, MPH, CDCES
10:45– 12:00	**Diabetes Interview – From Head to Toe** **Microvascular Risk Reduction**	
12:00 – 1:00	**Lunch Break**	
1:00 - 2:15	**Diabetes Technology- Monitors, Pumps and Data Interpretation**	
2:15– 2:30	**Break**	
2:30 – 3:15	**Diabetes Technology- Monitors, Pumps and Data Interpretation**	
3:15 – 4:30	**Integrating Mental Health with Body Health.** **Assessment Tools and Coping**	

Diabetes Education Services Presents:

DiabetesEd Training Conference 2024 – Day 2

Beverly Thomassian, RN, MPH, BC-ADM, CDCES
Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
www.DiabetesEd.net

Insulin – Ultimate Hormone Replacement Therapy



Diana Isaacs, PharmD, BCPS, BCACP, CDCES, BC-ADM, FADCES, FCCP
Endocrine Clinical Pharmacy Specialist
Co-Director Endocrine Disorders in Pregnancy
Cleveland Clinic Diabetes Center

Disclosures for Dr. Isaacs

- Diana Isaacs, PharmD, BCPS, BCACP, CDCES, BC-ADM, FADCES, FCCP declares the following disclosures:
- Speaker: Abbott, Dexcom, Novo Nordisk, Insulet, Medtronic, Lilly, Cequr, Sanofi
- Consultant: Undermyfork, Sequel
- ADCES Board Member

Objectives – Insulin –The Ultimate Hormone Replacement Therapy

Objectives:

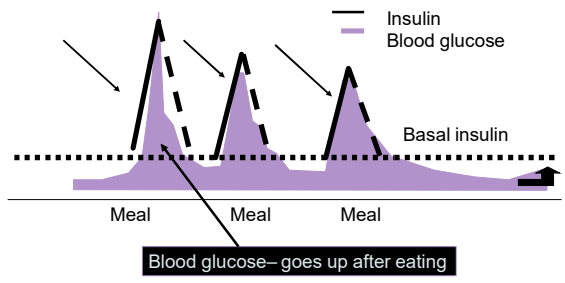
- Discuss the actions of different insulins
- Describe how to use the ADA algorithm for insulin management
- Counsel a person with diabetes on safe and effective insulin use
- Discuss strategies to determine and fine-tune basal and bolus insulin settings based on glucose pattern management
- Describe how insulin settings are used to program insulin pumps and connected insulin pens

History of insulin

- Insulin is produced by beta cells in the pancreas
- Discovered in 1921 by Frederick Banting and his assistant Charles Best from a dog's pancreas
- First used in a dog with diabetes and kept him alive for 70 days until they ran out of extract
- With the help of JB Collip and John Macleod, insulin was derived from the pancreas of cattle and in January 1922, given to a 14-year-old dying from diabetes in a Toronto hospital
- In 1923, Banting and Macleod received the Nobel Price in Medicine which they shared with Best and Collip
- Soon after, Eli Lilly started large-scale production of insulin

ADA. The history of a wonderful thing we call insulin (accessed 2020 Aug 29).

Physiologic Insulin Release:
Individuals without diabetes



Physiologic Insulin at Meals

- **1st phase:** peak 1-2 minutes, duration 10 minutes, suppresses hepatic glucose production
- **2nd phase:** duration 1-2 hours

The perfect insulin would be fast enough to match the absorption of carbohydrates

Freeman JS. J Am Osteopath Assoc. 2009;109:26-36.

Insulin Overview

- None of the commercially available insulins are as fast as true physiologic insulin
- Almost all insulin is injected (SC or IV) with 1 inhaled option
- All people with T1D require basal + bolus insulin or insulin pump therapy
- Many people with T2D require insulin due to the progressive nature of the condition

Basal aka "Background" Insulin

- The liver plays a major role in maintaining glucose levels by regulating the process of gluconeogenesis and glycogenolysis
- Excessive hepatic glucose release leads to hyperglycemia
- In a person without diabetes, there is a low level of insulin to keep glucose homeostasis from glucose produced by the liver (**basal insulin**)
- People with type 1 diabetes lack the ability to produce insulin to counteract the liver's effects
- In people with type 2 diabetes, there may not be enough insulin due to insulin resistance
- Long-acting insulins or intermediate-acting insulins serve as a basal or "background insulin"
- In an insulin pump, a regular or rapid-acting insulin can be given continuously to serve as the basal

Everyone with T1D need basal insulin and many with T2D may need it

Sharabi K et al. Mol Aspects Med. 2015; 46:21-22.

Bolus Insulin

- Glucose rises in response to carbohydrates
- A regular or rapid-acting insulin is given as a bolus to prevent the glucose from rising too much
- A regular or rapid-acting insulin can also be given to "correct" or bring down a high glucose

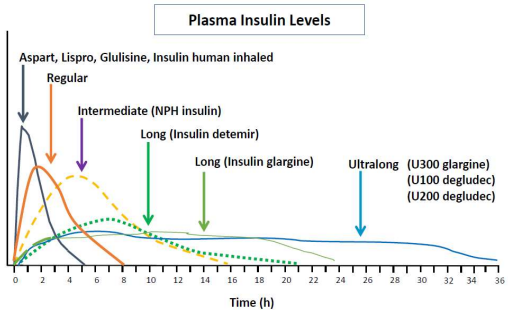
Everyone with T1D needs bolus insulin, some people with T2D may need it to achieve glycemic targets

Insulin PocketCard™

Action		Insulin Name	Onset	Peak	Duration	Considerations
			Effective			
Bolus	Very Rapid Acting Analogs	Aspart (Fiasp)	16 - 20 min	1 - 3 hrs	5 - 7 hrs	Bolus insulin lowers after-meal glucose. Post meal BG reflects efficacy.
		Lispro-aabc (Lyumjev)	15 - 17 min	2 - 3 hrs	5 - 7 hrs	
	Rapid Acting Analogs	Aspart (Novolog)	20 - 30 min	1 - 3 hrs	3 - 7 hrs	Basal insulin controls BG between meals and nighttime. Fasting BG reflects efficacy.
		Lispro (Humalog*/ Admelog)	30 min	2 - 3 hrs	5 - 7 hrs	
		Glulisine (Apidra)	15 - 30 min	1 - 3 hrs	3 - 4 hrs	
	Short Acting	Regular*	30 - 60 min	2 - 4 hrs	5 - 8 hrs	
Basal	Intermediate	NPH	2 - 4 hrs	4 - 10 hrs	10 - 16 hrs	Side effects: hypoglycemia, weight gain. Typical dosing range: 0.5-1.0 units/ kg body wt/day. Discard most open vials after 28 days. For pen storage guidelines, see package insert.
	Long Acting	Glargine (Lantus*/Basaglar/Semglee/Rezvoglar)	2 - 4 hrs	No Peak	20 - 24 hrs	
		Degludec (Tresiba)*	~ 1 hr		< 42 hrs	
Basal + Bolus	Intermediate + short	Combo of NPH + Reg 70/30 = 70% NPH + 30% Reg 50/50 = 50% NPH + 50% Reg	30 - 60 min	Dual peaks	10 - 16 hrs	
	Intermediate + rapid	Novolog® Mix - 70/30 Humalog® Mix - 75/25 or 50/50	5 - 15 min		24 hrs	

Concentrated insulins available - see Concentrated Insulin Card for details. Insulin action times vary; time periods are general guidelines only. All PocketCard content is for educational purposes only. Please consult prescribing information for detailed guidelines. © 2024

Insulin Profiles



Hirsch IB. NEJM 2005;352:174-183.
Lexicomp Online, Lexi-Drugs Online, Hudson, Ohio: UpToDate, Inc; 2020; August 21, 2020.

Insulin Concentration

- Most insulin is U100: 100 units/mL
- There is also concentrated insulin
  - U500 insulin, 500 units/mL, U300, 300 units/mL, and U200, 200 units/mL
- Insulin is available in a vial, pen, or cartridge
- U100 insulin:
  - 1 vial =10mL = 1000 units
  - 1 pen =3 mL = 300 units
  - 1 cartridge = 3 mL = 300 units
  - 1 box of pens = 5 pens = 1500 units
- Inhaled insulin
  - 4, 8, 12 units cartridges

Afrezza, Novolog, Humalog, Lantus, Levmir (package inserts) 2022

Image: :Blausen.com staff (2014). Medical gallery of Blausen Medical 2014. WikiJournal of Medicine 1 (2).

Concentrated and Inhaled Insulin

Concentrated & Inhaled Insulins

Name/Concentration	Insulin/Action	Considerations
Humulin Regular U-500 • 500 units insulin/mL • KwikPen or Vial	Regular Bolus / Basal	Indicated for those taking 200+ units daily. 3 mL pen holds 1,500 units. Max dose 300 units. Once opened, good for 28 days. 20 mL vial holds 10,000 units. Max dose 250 units using U-500 syringe. Once opened, good for 40 days.
Humalog KwikPen U-200 200 units insulin/mL.	Lispro (Humalog) Bolus	3 mL pen holds 600 units. Max dose 60 units. Once opened good for 28 days.
Lyumjev KwikPen U-200 200 units insulin/mL.	Lispro (Lyumjev) Bolus	3 mL pen holds 600 units. Max dose 60 units. Once opened good for 28 days.
Toujeo Solostar U-300 Pen 300 units insulin/mL.	Glargine (Lantus) Basal	1.5 mL pen holds 450 units. Max dose 80 units. 3 mL Max Solostar pen holds 900 units. Max dose 160 units. Once opened good for 56 days.
Tresiba FlexTouch U-200 Pen 200 units insulin/mL.	Degludec (Tresiba) Ultra basal	3 mL pen holds 600 units. Max dose 160 units. Once opened good for 56 days.
All concentrated insulin pens and the U-500 syringe automatically deliver correct dose (in less volume). No conversion, calculation or adjustments required. For example, if order reads 30 units, dial the concentrated pen to 30 units or draw up 30 units on the U-500 syringe. **Important – never withdraw concentrated insulin from the pen using a syringe.**		

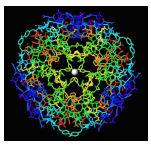
Inhaled Insulins

Action	Insulin Name	Dose Range	Onset	Peak	Duration	Considerations
Bolus – Rapid-acting	Afrezza Inhaled regular human insulin	4, 8, and 12 unit cartridges before meals	~ 12 min	35 - 45 mins	1.5 - 3 hrs	Assess lung function. Avoid in lung disease — bronchospasm risk. Side effects: hypo, cough, throat irritation.

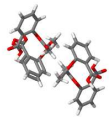
The information listed here are not guidelines. Please consult prescribing information for details. DiabetesEd.net ©2024

Follow-On Insulin

- Follow-on insulin products requires a separate prescription (not directly interchangeable)
  - Examples:
    - Insulin glargine (Lantus), follow-on product (Basaglar)
    - Insulin lispro (Humalog), follow-on product (Ademlog)
- Semglee and Rezvoglar can be interchangeable with Lantus (insulin glargine)



Insulin – Large Molecule



Aspirin – Small Molecule

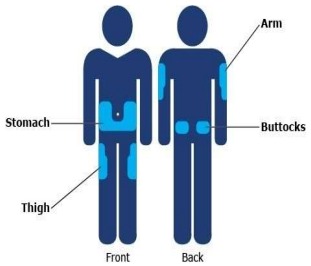
Generic Insulins

- Insulin aspart
- Insulin lispro
- Insulin glargine
- About half the cost of the brand name
- Exact same formulation, produced by same manufacturer, interchangeable at pharmacy

Which Insulin is Interchangeable with Lantus (Insulin glargine U100)?

A. Toujeo (Insulin glargine U300)
B. Basaglar (Insulin glargine U100)
C. Semglee (Insulin glargine U100)
D. Insulin degludec U100
E. All of the above

Insulin Injection Sites



Sites should be rotated

Insulin Key Counseling Points

- Do not shake insulin
- Cloudy insulin (NPH or pre-mixed) should be rolled before use so suspension is uniform
- Skin thickness is usually 2mm regardless of person's size, so shortest needles (4mm) work well for most
- Take outer and inner covering off for pen needles
- Leave the needle/syringe in the body for 5-10 seconds
- Change needle or syringe with each injection
- Dispose of needles/syringes in a sharps container or per local regulations

Dang DK. Taking medication. In: Cornell S et al, eds. The art and science of diabetes self-management education desk reference. 5th ed.

Priming insulin

- Prime pens before every use to get air bubbles out
- Hold vertically with needle at the top
- Turn dial to 2 units
- Push plunger
- Repeat until insulin comes out of the top
- May have to do multiple times for a new pen
- This will ensure all air is out and that pen needle works
- Do this every time an insulin pen injection is given

Storage Options

Insulin Storage and Expiration Cheat Sheet Available

Insulin Storage and Dispensing Info

Product Name/Type	Expiration when opened, stored at room temp up to 86 F	Pens per Box Or Vial	Units per Pen/Vial	Max Dose / Notes
Rapid Acting Insulins				
Aspart (Fiasp) -Vial -Pen -Pump	 28 Days 28 Days 6 Days	 1 Vial 5 Pens per Box	 1000 units 300 units in 3 mL	 80 Units
Aspart (Novolog) -Vial -Cartridge -Flexpen - Pump	 28 Days 28 Days 28 Days 6 Days	 1 Vial 5 cartridges 5 Pens per Box	 1000 units 300 units in 3 mL 300 units in 3 mL	 60 Units
Glulisine (Apidra) -Vial -SoloStar Pen -Pump	 28 Days 28 Days 2 Days	 1 Vial 5 Pens per Box	 1000 units 300 units in 3 mL	 80 Units
Lispro (Humalog/Admelog) -Vial -Cartridge -Pen -Pump	 28 Days 28 Days 28 days Up to 7 Days	 1 Vial 5 cartridges 5 Pens per Box	 1000 units 300 units in 3mL 300 units in 3mL	 80 Units (Admelog) 60 Units (Humalog)
Lispro -aabc (Lyumjev) - Vial -Cartridge -KwikPen	 28 Days 28 Days 28 days	 1 Vial 5 cartridges 5 Pens per box	 1000 units 300 units in 3mL 300 units in 3mL	 60 units

Side Effects of Insulin

Weight Gain

Lipodystrophy/ Lipohypertrophy

Hypoglycemia

Dang DK. Taking medication. In: Cornell S et al, eds. The art and science of diabetes self-management education desk reference. 4th ed.

Sharps Disposal: Product and Info

- Search for household hazardous waste listing for your city or county.
- Call 1-800-CLEANUP (1-800-253-2687)

Polling Question 1

- After how many days should an open vial of insulin degludec be discarded?

A. 28 days
B. 30 days
C. 42 days
D. 56 days

Type 1 Diabetes (T1D)

- Absolute deficiency in endogenous insulin
- Exogenous insulin is required
- The regimen should include:

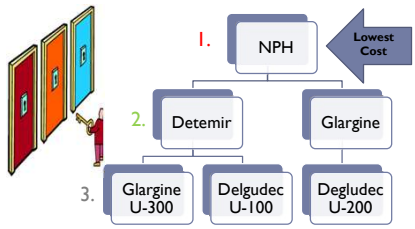
Basal Insulin + Bolus Insulin

How to Dose Insulin? T1D

- Newly diagnosed T1D
  - Total insulin dose: 0.5-1.0 units/kg/day
  - 50% basal
  - 50% bolus
- Bolus can initially start with set doses or calculations can be used to determine initial carbohydrate ratio and correction factor

Pomaglugapatal LG et al. In: Cornell S et al., Pharmacotherapy for Glucose Management. The art and science of diabetes self-management education desk reference. 5th ed.

Choice of Basal Insulin



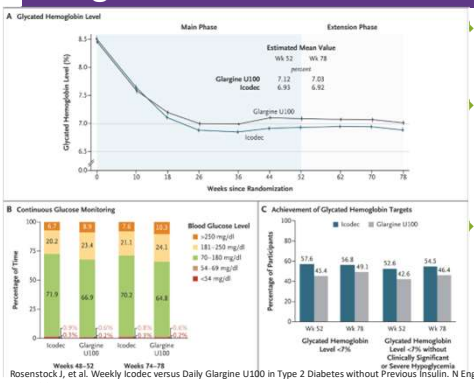
1. Shortest duration, 2. Medium duration, 3. Longest duration

Weekly Insulin

- Awiqli® (once-weekly basal insulin icodec) approved for use in the EU
- Anticipated US approval in the near future
- Half-life: 196 hours ~8 days
- U700 insulin, 3mL pen = 2100 units/pen
- 70 units icodec weekly = 10 units glargine daily
- Efsitora alfa is also a weekly insulin
  - Announced positive topline results in adults with T2D, (QWINT program)

Rosenstock J, et al. Weekly Icodec versus Daily Glargine U100 in Type 2 Diabetes without Previous Insulin. N Engl J Med. 2023 Jul 27;389(4):297-308.
In a first-of-its-kind fixed dose study, once weekly insulin efsitora alfa leads to A1C reduction similar to daily insulin | Eli Lilly and Company

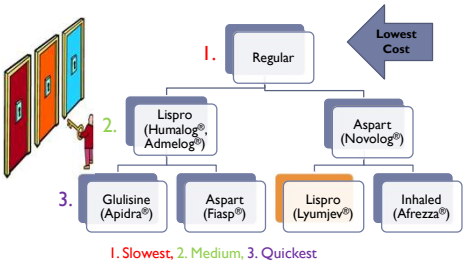
Glargine vs. Icodec in T2D



- 492 pts in each group
- Primary outcome: change in A1C
- Conclusion: glycemic control better with icodec

Rosenstock J, et al. Weekly Icodec versus Daily Glargine U100 in Type 2 Diabetes without Previous Insulin. N Engl J Med. 2023 Jul 27;389(4):297-308.

Choice of Bolus Insulin



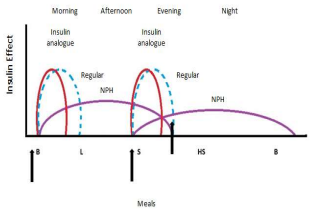
1. Slowest, 2. Medium, 3. Quickest

T1D: Insulin Dosing Regimens

Time of Insulin Administration	Before breakfast	Before lunch	Before dinner	Bedtime
Method 1	Intermediate: Regular (2/3 TDD) 2:1 ratio		Intermediate: Regular (1/3 TDD) 2:1 ratio	
Method 2	Regular/ analog (1/2 TDD ÷ by 3)	Regular/ analog (1/2 TDD ÷ by 3)	Regular/ analog (1/2 TDD ÷ by 3)	Long-acting (1/2 TDD)

***These are starting regimens and are adjusted based on ability to carbohydrate count and glycemic management as determined by A1C, BGM and/or CGM

Intermediate-acting Insulin + Regular Insulin or Insulin Analog

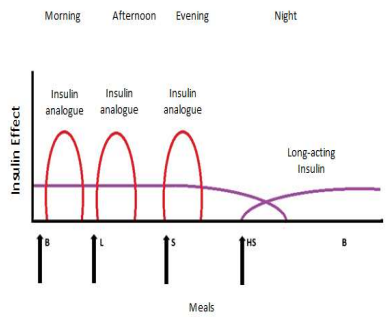


Intermediate insulin serves as basal while regular or insulin analog serves as bolus

Regular insulin: Novolin R, Humulin R
Intermediate insulin: Novolin N, Humulin N
Insulin analogue: aspart, lispro, glulisine

Dipiro JT et al, eds. Pharmacotherapy: a pathophysiologic approach. 11th ed. 2020.

Long-acting Insulin with Insulin analog



Long-acting serves as basal insulin analog serves as bolus

Carbohydrate Ratio

- Insulin to carbohydrate ratio (ICR)
  - 1 unit of insulin is expected to cover X grams of carbohydrates
- Rule of 450 or 500 can be used
  - 500/TDD = estimated carbohydrate ratio

Trujillo J et al. Diabetes mellitus. In: Dipiro JT et al., eds. Pharmacotherapy: a pathophysiologic approach. 11th ed.

Correction Factor

- Insulin correction factor (ICF)
  - Often returned to as insulin sensitivity
  - 1 unit of insulin is expected to lower glucose by Y points
- Rule of 1700 or 1800 can be used
  - 1700/TDD = estimated ICF
- For regular insulin, the rule of 1500 is typically used

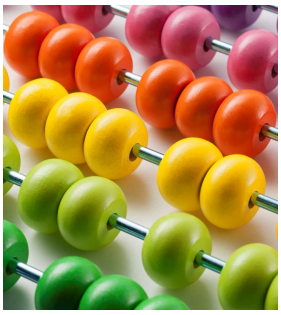
Trujillo J et al. Diabetes mellitus. In: Dipiro JT et al., eds. Pharmacotherapy: a pathophysiologic approach. 11th ed.

An Example: Meet Austin

- Austin is a 12-year-old newly diagnosed with T1D, he weighs 40kg
- He is started on 0.5 units/kg/day of total insulin
  - 40*0.5=20 units
  - 50% basal=10 units
  - 50% bolus=10 units
- Austin is prescribed 10 units of long-acting insulin and 3 units of rapid-acting insulin at meals
- The insulin doses will be adjusted based on glucose data

Austin Calculation cont'd

- Austin is ready for carbohydrate counting
- Based on the rule of 500 and rule of 1700, what should his ICR and ICF be?



Poll Question 2

- Based on the rule of 500 and rule of 1700, what should Austin's ICR and ICF be? (TDD=20 units/day)

A. ICR=25, ISF=85
B. ICR=20, ISF=60
C. ICR=15, ISF=50
D. ICR=30, ISF=75
E. I am not sure

Answer and Explanation

- ICR=500/20=25
  - This means that 1 unit of insulin covers 25 grams of carbohydrate
  - If Austin eats 50 grams of carbohydrate, he should inject 2 units
- ISF=1700/20=85
  - This means that 1 unit of insulin is expected to lower glucose by 85 mg/dL
  - Austin's glucose target is 100
  - If his current glucose is 185, he should take 1 extra unit of insulin

Correction Scale 1

Rapid/Fast Acting Insulin (1 unit:50 mg/dl>150)

Less than 70	Subtract 1 unit
70-150 mg/dl	0 units
151-200 mg/dl	1 unit
201-250 mg/dl	2 units
251-300 mg/dl	3 units
301-350 mg/dl	4 units
351-400 mg/dl	5 units

Correction Scale 2

Rapid/Fast Acting Insulin (2 units:50 mg/dl>150)

Less than 70	Subtract 1 unit
70-150 mg/dl	0 units
151-200 mg/dl	2 unit
201-250 mg/dl	4 units
251-300 mg/dl	6 units
301-350 mg/dl	8 units
351-400 mg/dl	10 units

Poll Question 3

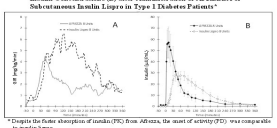
- How much insulin does a person with type 1 diabetes need a day?
  a. 1 to 2 units/kg per day
  b. No more than 0.5 units/kg per day
  c. 5 to 10 units/kg per day
  d. 0.5 to 1 units/kg per day

Inhaled Insulin

Injected Meal Time Dose	Inhaled Insulin Dose
Up to 4 units	4 units
5-8 units	8 units
9-12 units	12 units
12-16 units	16 units
17-20 units	20 units
21-24 units	24 units

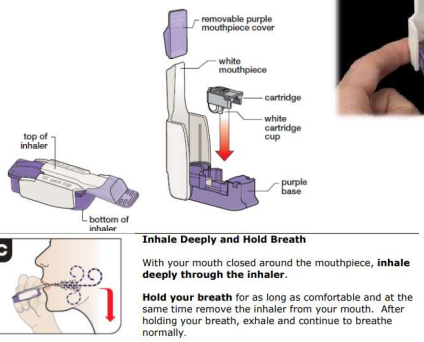
- **FDA approved for adults over 18yo**
- **Not indicated for pregnancy, while breastfeeding**

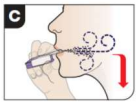
Figure 3. Baseline-Corrected Glucose Infusion Rate (A) and Baseline-Corrected Serum Insulin Concentrations (B) after Administration of AFREZZA or Subcutaneous Insulin Lispro in Type 1 Diabetes Patients*



* Despite the faster absorption of insulin (PK) from Afrezza, the onset of activity (PD) was comparable to insulin lispro.

Inhaled Insulin





Inhale Deeply and Hold Breath

With your mouth closed around the mouthpiece, **inhale deeply through the inhaler**.

Hold your breath for as long as comfortable and at the same time remove the inhaler from your mouth. After holding your breath, exhale and continue to breathe normally.

Inhaled Insulin Storage

- Opened inhaler: use in 15 days
- Sealed foil packages: refrigerate until expiration date on package
- Sealed blister card strips: room temp-use within 10 days, fridge-30 days
- Opened strips: room temperature, use within 3 days
- Before using, inhaler and strips should be at room temperature for at least 10 minutes

https://afrezza.com/wp-content/uploads/2020/01/Afrezza-Storage-and-Handling-Guide.pdf

Inhaled Insulin Dosing and Counseling

- Bolus insulin – inhaled before meals
- Dosing: 4, 8 and 12 unit cartridges
- Lung function test before start (FEV1)
  - Not for pts w/ chronic lung issues
    - Asthma, COPD, history of lung cancer, smoking within past 6 months
    - Can cause acute bronchospasm – Black box warning
- Side effects:
  - Sore throat, cough
  - Less hypoglycemia than injected insulin

Bolus Insulin Timing

- How is the effectiveness of bolus insulin determined?
  - 1-2 hours post meal
  - Before next meal blood glucose
- Glucose goals may be modified by HCP/pt
  - 1-2 hours peak post meal <180 (ADA)
  - 2 hour post meal <140 (AACE)
  - Before next meal 80 - 130

Poll Question 5

- Mary takes 4 units of insulin lispro (Humalog) before breakfast. Which BG result reflects that the dose was the right dose?

1. Before breakfast BG of 97
2. 1 hour post lunch BG of 160
3. Before lunch BG of 87
4. 2 hour post breakfast BG of 185

More than 200 units a day?

DRUG NAME	AVAILABILITY	PEN UNITS	EXPIRATION	ONSET	PEAK EFFECT	DURATION OF ACTION	CLINICAL PEARLS
INSULIN HUMAN REGULAR (HUMULIN R U500)	Pen, Vial	5 unit	Vial: 40 days Pen: 28 days	0.25-0.5 hours	4-8 hr	13-24 hr	This insulin is 5 time as concentrated. If using a vial, use the special U500 syringe.

DailyMed: https://dailymed.nlm.nih.gov/dailymed/index.cfm
Stahnke AM et al. ADCES in Practice. March, 2020. https://doi.org/10.1177/2633559X20896414

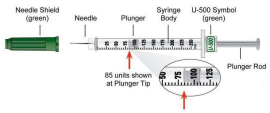
Switching to u500 insulin

- Typically reserved for people requiring insulin >200 units/day
- U500 acts like an intermediate acting insulin but replaces both the basal and bolus doses
  - If A1C< 8%, recommend to reduce TDD by 10-20%
  - If A1C≥ 8%, consider 1:1 conversion
- Typically dosed 2-3 times daily
- It should be taken 30 minutes prior to meals
- Often initiated as a 60/40 or 40/30/30 split

Reid TS, et al. Postgrad Med. 2017;129(5):554-562.

U500 example

- A woman with obesity, T2D, and insulin resistance takes insulin glargine 120 units BID and insulin aspart 60 units TID a.c. Her most recent A1C=9%. How would she switch to U500?
  - 1:1 conversion since A1C ≥ 8%
  - TDD=180+240=420 units split as 40/30/30
- New Dose:
  - U500 165 units QAM, 125 units at lunch, 125 units at dinner
  - Must round to nearest 5 unit increment
  - Inject 30 minutes before each meal
  - Use U500 syringe or U500 pen
  - Do not use U100 syringes!



Reid TS, et al. Postgrad Med. 2017;129(5):554-562.

Poll Question 6

- AJ tells you she doesn't want to start on insulin. What is your best response?

a. The needles are so small, you won't even feel it.

b. Lots of people are afraid of insulin.

c. It sounds like you are refusing to take insulin?

d. I'm sorry, but there is a doctors' order to start insulin.

e. What concerns do you have about taking insulin?

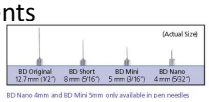
Psychological Insulin Resistance (PIR)

- 50% of providers in study threatened pts "with the needle".
- Less than 50% of providers realized insulins' positive effect on type 2 DM
- Most pts don't believe that insulin would "better help them manage their diabetes".
- Solutions: Find the root of PIR and address it

Diabetes Attitudes, Wishes, Needs Study - Rubin

Needle Size often a Barrier: Size Matters

- Use shortest needles – 4 mm
- Effective for almost ALL patients
- Keeps it subq
- If thin, inject at angle
- To avoid leakage, count to 10 before withdrawing needle
- For needle phobias, consider insulin pumps, patches, iport, and inhaled insulin



BD Nano 4mm and BD Mini 5mm only available in pen needles

How To's of Adding Insulin in Type 2 DM

Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
Director, Education & Training in Diabetes Technology

Injectable Therapy for Type 2 Diabetes

- Use GLP-1 RA as first injectable when possible
- Start basal insulin 10 units or 0.1 to 0.2 units/kg day
- Titrate up 2 units every 3-4 days, until FBG at goal
- If hypo, decrease insulin 20% or 4 units
- If basal insulin is >0.5 unit/kg day, add bolus insulin (avoid overbasalization)
- Adding bolus
  - Start with 4 units bolus at largest meal or
  - Start 1-2 injections with 10% of basal or
  - Switch to 70/30 twice or three times daily.

Intensifying Injectable Footnotes 9.2

- Consider insulin as the first injectable if evidence of ongoing catabolism A1C levels (>10%) or BG levels ≥300mg/dL or a diagnosis of type 1 diabetes is a possibility.
- For those on GLP-1RA and basal insulin combination, consider using a fixed-ratio combination product (iDegLira or iGlarLixi).
- Consider switching from evening NPH to a basal analog if there is hypoglycemia and/or the individual frequently forgets to administer NPH in the evening. In this case, an AM dose of a long-acting basal insulin could be a better choice.
- If adding prandial insulin to NPH, consider initiation of a self-mixed or premixed insulin regimen to decrease number of injections.

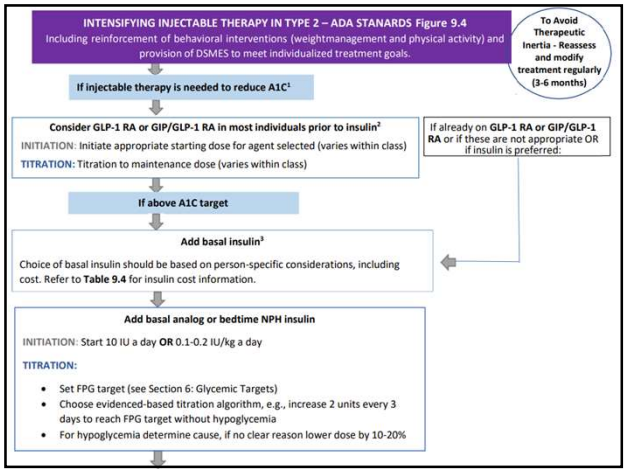
Insulin/Injectable Combos

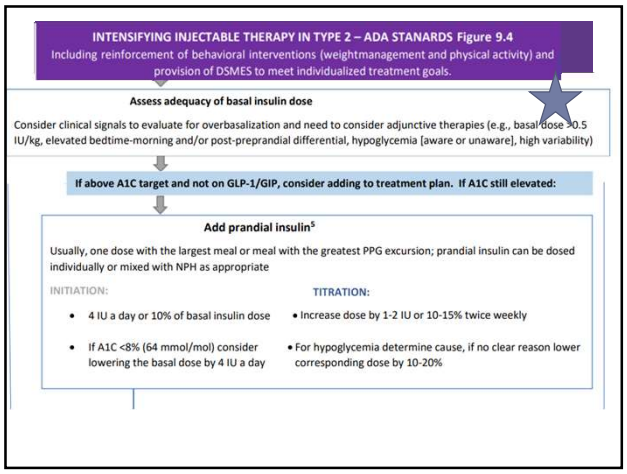
PocketCards are updated twice yearly. Scan QR code to download or order the latest version.

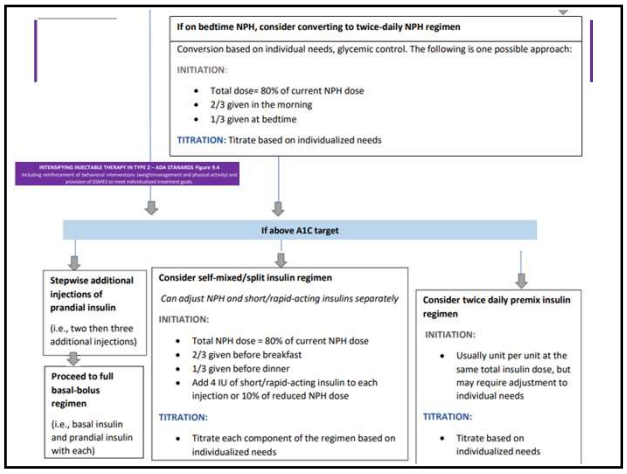
Name	Combines	Considerations
IDegLira* Xultophy 100/3.6	Insulin degludec (IDeg or Tresiba) Ultra long insulin + Liraglutide (Victoza) GLP-1 Receptor Agonist (GLP-1 RA)	**Xultophy 100/3.6 pre-filled pen** = 100 units IDeg / 3.6 mg liraglutide per mL Once daily injection – Dose range 10 to 50 = 10 – 50 units IDeg + 0.36 -1.8 mg liraglutide **Recommended starting dose:** • 16 IDegLira (= 16 units IDeg + 0.58 mg liraglutide) Titrate dose up or down by 2 units every 3-4 days to reach target. Supplied in package of five single-use 3mL pens. Once opened, good for 21 days.
iGlarLixi* Soliqua 100/33	Insulin glargine (Lantus) Basal Insulin + Lixisenatide (Adlyxin) GLP-1 Receptor Agonist	**Soliqua 100/33 Solostar Pen** = 100 units glargine / 33 µg lixisenatide per mL Once daily injection an hour prior to first meal of day. Dose range 15 – 60 = 15-60 units glargine + 5 – 20µg lixisenatide **Recommended starting dose:** • 15 units if not meeting glucose target on 30 units basal insulin or GLP-1 RA • 30 units if not meeting glucose target on 30-60 units basal insulin or GLP-1 RA Titrate dose up or down by 2-4 units every week to reach target. Supplied in package of five single-use 3mL pens. Once opened, good for 14 days.

***Discontinue basal insulin /GLP-1 RA therapy before starting. If dose missed, resume with next usual scheduled dose.**

Observe precautions of each component drug. DiabetesEd.net ©2024







Case Study: Jenny

Jenny is a 50-year-old woman that takes insulin glargine 100 units daily, glipizide 10mg BID, metformin 1000mg BID, and linagliptin 5mg daily. A1C is 9.3%. She weighs 110kg. She checks glucose in the AM only and reports it's 90-130mg/dL. Her eGFR is 70. She previously had UTI's with empagliflozin.

What is the best recommendation to adjust this regimen?

Thinking about the choices

- Continue glargine?
- Continue glipizide?
- Continue linagliptin?
- Add GLP-1 agonist?
- Switch to combination GLP1 receptor agonist /insulin injectable?
- Add prandial insulin?
- Add SGLT-2 inhibitor?

Piecing it Together

- New Regimen:
  - Insulin glargine 80 units once daily (20% reduction)
- Semaglutide 0.25mg weekly, titrated up to 2mg weekly
- Stop linagliptin
- Continue glipizide (for now)
- Next step could be to retry SGLT2i with counseling on how to avoid UTIs
- Or replacing glipizide with prandial insulin with largest meal
- CGM!

How to Switch Basal Insulin

- When going from twice daily basal insulin to once daily, reduce dose by 20%
  - Examples:
    - Insulin NPH BID to insulin glargine daily
    - Insulin detemir BID to insulin degludec daily
- When switching between once daily, a unit per unit conversion is okay
- Long-acting to glargine U300 often requires higher doses (10 to 18%) but start with a unit to unit conversion
- When switching from glargine U300 to another long-acting insulin, reduce dose by 20%
- Need to use clinical judgement
  - For example, if A1C, FBG, and pre-meal BG are all above target, then may not be necessary to reduce basal insulin dose

Clinical Resource. Pharmacist's Letter/Prescriber's Letter. August 2019.

Poll 7 - Making the switch: Meet Joan

Joan is taking insulin glargine 30 units twice daily. Her insurance formulary wants her to switch to insulin degludec. Her current A1C is 6.9%. What is the best dose recommendation?

A. Insulin degludec 30 units twice daily
B. Insulin degludec 60 units once daily
C. Do not switch since her A1C is well-controlled and get a prior authorization to continue with insulin glargine
D. Insulin degludec 48 units once daily

Switching Meal time Insulin

- This is a 1:1 conversion when switching between regular insulin, aspart, lispro, and glulisine including Fiasp® and Lyumjev™.
- The exception is when switching to Afrezza

Injected Meal Time Dose	Inhaled Insulin Dose
Up to 4 units	4 units
5-8 units	8 units
9-12 units	12 units
12-16 units	16 units
17-20 units	20 units
21-24 units	24 units

Clinical Resource. Pharmacist's Letter/Prescriber's Letter. August 2019.
Afrezza (package insert) 2019.

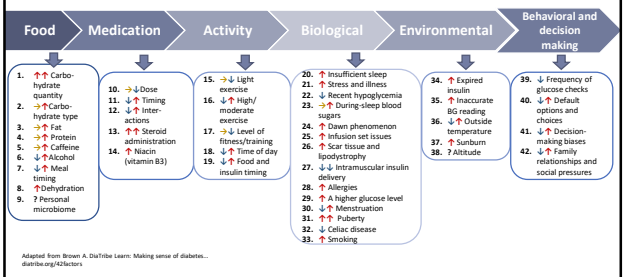
Poll 8. Patient Case: Lumy

- Lumy's insurance formulary changed from insulin lispro to insulin aspart.
- She was following an insulin to carbohydrate ratio of 1:12 and a correction factor of 1:50.
- How should she dose insulin aspart when she switches?
  A. Reduce all doses by 10%
  B. Increase all doses by 10%
  C. Same dosing
  D. Submit prior authorization so she doesn't change insulin

Insulin Pattern Management

Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
Director, Education & Training in Diabetes Technology

At Least 42 Factors Affect Glucose!



Poll Question 9

- When looking at glucose patterns, which problem do you fix first?
  - a. Hyperglycemia
  - b. Hypoglycemia
  - c. Non-compliance
  - d. Legible writing

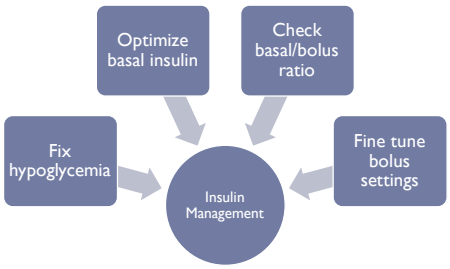
Pattern Management

- Safety 1st!! - Evaluate 3 day patterns
- **Hypo:** eval 1st and fix:
  - If possible, decrease medication dose
  - Timing of meals, exercise, medications

- **Hyperglycemia:** evaluate 2nd
  - Identify patterns
  - Before increase insulin, make sure not missing something (carbs, exercise, omission)

General Rules with Basal Bolus

- Optimize basal dose
  - Stay within 30mg/dL when not eating
  - Stay within 50mg/dL after a meal

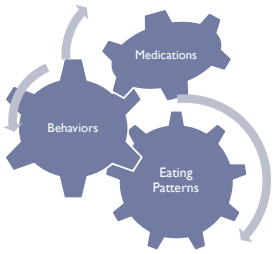


Adjusting Insulin doses in a Basal/Bolus regimen (T1DM & T2DM)

Out of Range Glucose	Insulin to Adjust
Fasting	Long acting insulin or evening NPH
Post-breakfast/pre-lunch	Pre-breakfast rapid/regular insulin
Post lunch/pre-dinner	Pre-lunch rapid/regular insulin or morning NPH
Post-dinner/before bedtime	Pre-dinner rapid/regular insulin

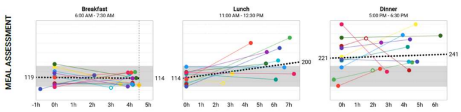
Tips for Data Interpretation

- Start by asking the person what they've experienced and noticed with their glucose patterns
- Avoid judgment
- Learn from 1 time episodes, but make changes based on patterns
- Fix lows first but some amount is expected (<1-4%) and if you remove all lows, you may end up with too many highs
- If it's not making sense, dig deeper (ex. missed doses, rationing, injection technique, food insecurity, etc)



Meal Time Data Review

- Glucose data before and after breakfast, lunch and dinner
- Ideally, 2 hour post-meal should not rise above 180mg/dL or 50mg/dL from the pre-meal start
- By 4-5 hours, glucose should return to pre-meal level



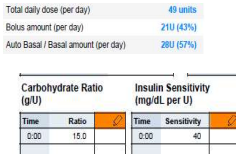
Bolus Pattern Management

- Does glucose go low after a correction dose?
  - May need a higher sensitivity
  - Ex. 1:60 instead of 1:50
- Does glucose remain high after a correction dose?
  - May need a lower sensitivity
  - Ex. 1:40 instead of 1:50
- Often people are more sensitive overnight (less insulin needed)
- Does the person spike high after eating?
  - Is the person bolusing BEFORE the meal
  - Counting carbs correctly?
  - May need a more intensive carb ratio
  - Ex. 1:6 instead of 1:8
- Does the person go low after eating?
  - Counting carbs correctly?
  - May need a less intensive carb ratio
  - Ex. 1:10 instead of 1:8

Adjustments typically made 10-20% at a time

Checking the Sensitivity

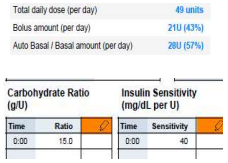
- TDD=49 units
- Rule of 1700
  - 1700/49=35
- Current sensitivity is 40



The calculation is slightly different from the current sensitivity. Look at the glucose data to determine if the sensitivity should be decreased.

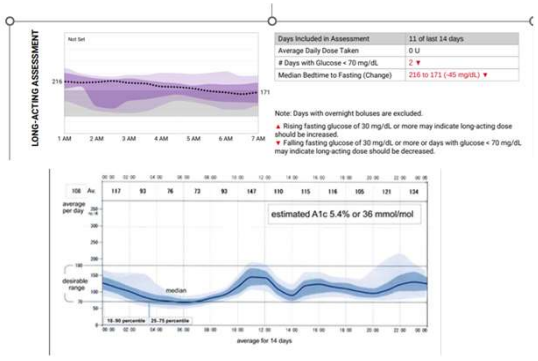
Checking the Carb Ratio

- TDD=49 units
- Rule of 450
  - 450/49=12.9
- Current carb ratio is 15



The calculation is different from the current carb ratio. Look at the glucose data to determine if the carb ratio should be decreased.

Basal Insulin Review



Case Study: Larry Poll Question 12

Larry takes metformin 1000mg BID, insulin glargine 50 units once daily, empagliflozin 10mg daily. His A1C is 7.8%. He weighs 90kg. FBG averages 100mg/dL. 2 hr PP breakfast=190mg/dL, 2 hr PP lunch=210mg/dL, and 2 hr PP dinner is 240mg/dL. What is the best recommendation for an agent to add to the regimen to achieve A1C target?

A. Initiate insulin aspart 5 units at dinner, decrease insulin glargine to 45 units daily
B. Initiate insulin aspart 5 units with all meals, decrease insulin glargine to 35 units daily
C. Initiate insulin aspart 5 units at dinner, continue insulin glargine 50 units daily
D. Initiate tirzepatide 2.5mg weekly, decrease insulin glargine to 45 units daily

Summary

- Many different types of insulin
- Basal + bolus needed for T1DM
- Weight based dosing and rules of 1700/1800 and 500/450 can be used to calculate correction factor and carb ratio
- GLP1 agonist preferred 1st injectable in T2DM
- Avoid overbasalization, if taking more than 0.5unit/kg/day, think about GLP1 agonist +/- prandial insulin
- Counsel patients on injection site technique, administration and storage
- Fine tune insulin settings based on BGM and CGM data

During interviews, outline strategies to identify previously undiscovered diabetes co-conditions, identify clinical inertia and move to best health.

Diabetes Interview – From Head to Toe & Microvascular Risk

Beverly Thomassian, RN, MPH, BC-ADM, CDCES
President, Diabetes Education Services

Objectives

1. Identify common yet often under diagnosed co-conditions associated with type 1 and type 2 diabetes.
2. Describe the interrelationship between glucose, inflammation and diabetes complications.
3. List the elements of a head-to-toe assessment including lower extremity assessment.
4. Discuss barriers to sexual health and communication strategies.

4. Comprehensive Medical Evaluation and Assessment of Comorbidities

- Person centered communication, strength-based language, active listening, literacy, quality of life
- It is necessary to take into account all aspects of a person's life circumstance
- It is important to integrate medical eval, engagement and lifestyle changes.
- Interdisciplinary teams provide best care

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes—2024

EV Arrives and Requests Help

- 58 yr old complains of 4 lb wt gain for past month. BMI 31, wt 90 kg. B/P 142/96. A1C 8.3%
- Meds include:
  - Sitagliptin, Metformin
  - Actos 15mg ac breakfast
  - Basaglar 58 units
  - Semaglutide 0.5mg weekly
  - Levothyroxine (ran out)
  - Lisinopril 10mg
  - Gabapentin 100 mg TID

What story do these meds tell?
Any med(s) missing?
Any med needs to be stopped?

EV Arrives and Requests Help

- 58 yr old complains of 4 lb wt gain for past month. BMI 31, wt 90 kg. B/P 142/96. Checks BG in morning; 150ish. A1C 8.3%
- Meds include:
  - Sitagliptin (DPP-IV), Metformin
  - Basaglar 58 units (Basal)
  - Actos 15mg (TZD)
  - Semaglutide 0.5mg wk (GLP-1)
  - Levothyroxine (ran out)
  - Lisinopril 10mg (ACE)
  - Lovastatin 20mg (Statin)
  - Gabapentin 100 mg TID (leg pain)

What does this tell us about EV?

- Struggling with weight
- B/P & A1C above target
- Overbasalized (max dose 0.5 units/kg a day
- Why not taking thyroid med?
- Lower extremity pain contributing to distress?
- Elevated CV risk?

EV is Gaining Weight and is Tired

- 58 yr old complains of 4 lb wt gain for past month. BMI 31, wt 90 kg. B/P 142/96. Checks BG in morning; 150ish. A1C 8.3%
- Meds include:
  - Sitagliptin, Metformin
  - Actos 15mg ac breakfast
  - Basaglar 58 units
  - Semaglutide 0.5mg weekly
  - Levothyroxine – ran out
  - Lisinopril 10mg
  - Gabapentin 100 mg TID

Labs
A1C – 8.3%
UACR 26 GFR >60
TSH 10.6
LDL 98 mg/dl, Trig 158
ALT 85 IU/L, AST 90 IU/L

Life situation
Takes care of dad with dementia
Gums inflamed
No eye doctor for year
Both feet hurt at night

ABC's of Diabetes

- A1c less than 7% (individualize)
  - Pre-meal BG 80-130
  - Post meal BG <180
  - AGP - Time in Range (70-180) 70% of time
- Blood Pressure < 130/80
- Cholesterol
  - Statin therapy based on age & risk status
  - If 40+ with ASCVD Risk, decrease 50%, LDL <70
  - If 40+ with ASCVD, decrease 50%, LDL <55

Assessment and Treatment Plan

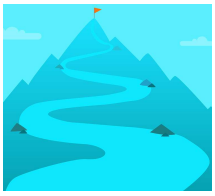
4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

Therapeutic treatment plans

- Lifestyle management
- Pharmacologic therapy: glucose lowering
- Pharmacologic therapy: cardiovascular and kidney disease risk factors
- Weight management with pharmacotherapy or metabolic surgery, as appropriate
- Use of glucose monitoring and insulin delivery devices
- Referral to diabetes education, behavioral health, and medical specialists

Advocating for Best Health for people with Diabetes

- Modifiable
  - Sleep
  - Activity
  - Smoking
  - Dietary Habits
  - Glucose
  - Blood Pressure
  - Lipids
  - Oral Care
  - Immunizations
  - Psychosocial care



- Make small, achievable goals. We are in this for the long run.

Diabetes is a long path

Get at least 7 hours of sleep a night – Check for sleep apnea

Obstructive Sleep Apnea - OSA

- OSA affects ~25% of people with type 2
  - Up to 60% of those with type 2 have disordered sleep
- Associated with increased CVD risk
- Signs include excessive daytime sleepiness, snoring and witnessed apnea
- Treatment:
  - Lifestyle modification
  - Continuous positive oral airway pressure and devices
  - Surgery

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*
American Diabetes Association Professional Practice Committee

Where are we on this continuum?

Only about 50% of us are meeting activity goals

Benefits of Exercise and Diabetes

- Increase muscle glucose uptake 5-fold
- Glucose uptake remains elevated for 24 - 48 hours (depending on exercise duration)
- Increases insulin sensitivity in muscle, fat, liver.
- Reduce CV Risk factors (BP, cholesterol, A1c)
- Maintain wt loss
- Contribute to well being
- Muscle strength
- Better physical mobility

5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes—2024*
American Diabetes Association Professional Practice Committee

Exercise decreases:

- Sleep apnea
- Diabetic kidney disease, retinopathy
- Depression
- Sexual dysfunction
- Urinary incontinence
- Knee pain
- Need for medications
- Health care costs

5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes—2024*
American Diabetes Association Professional Practice Committee

Smoking and Diabetes

Smoking increases risk of diabetes 30%

- **Ask at every visit**
- **Assess**
- **Advise**
- **Assist with stop smoking**
- **Arrange for referrals**
- **Organize your clinic**

Goals of Medical Nutrition Therapy – ADA

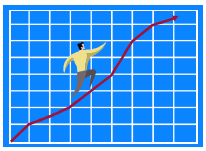
Promote and support *Individualized* healthful eating patterns

1. Support healthful eating patterns
• Emphasize eating a variety of nutrient dense foods in appropriate portions to:
  • Attain individualized BP, glycemic and lipid goals
  • Attain and maintain body wt goals
  • Delay and/or prevent complications
	2. Individualize nutrition care based on:
	• Personal and cultural preferences
	• Health literacy and numeracy
	• Access to healthful foods
	• Willingness and ability to make behavioral changes
	• Barriers to Change

3. Maintain pleasure of eating. Provide positive, nonjudgmental messages about food • Limit food choices only when backed by science	**4. Provide practical tools for day-to-day healthy meal planning**

5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: *Standards of Care in Diabetes—2024*
American Diabetes Association Professional Practice Committee

EV asks why the weight gain?



- Fluid retention - diabetes doubles risk for Congestive Heart Failure (CHF). Check lower extremities.
- Inaccurate nutrition knowledge
- Actos and Avandia, (TZD's) associated with edema
- Blood sugars improving
- Thyroid disease under treated
- Novel Antipsychotics
- Depression / Increased intake

Poll question 13

- Which of the following is a true statement?

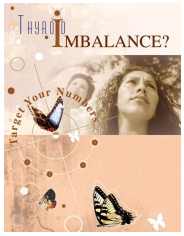
a. Atypical antipsychotics are contraindicated for people with diabetes and thyroid disease.
b. Hypothyroidism is more common than hyperthyroidism.
c. Hyperthyroidism can be associated with weight gain or weight loss.
d. Hypothyroidism causes LDLs to decrease.

Thyroid Disease and Diabetes

- 15 to 30% of people w/ diabetes & their siblings or parents are likely to develop thyroid disease
- Up to 60 percent of those with thyroid disease are unaware of their condition.
- Women are 5-8x's more likely than men to have thyroid problems.
- Check TSH on Type 1 & 2 annually or if indicated.
- Hashimoto's thyroiditis – autoimmune thyroid
  - most common cause of hypothyroidism w/ dm
  - Associated with:
    - Elevated cholesterol levels
    - Increased risk of CV disease
    - Weight gain

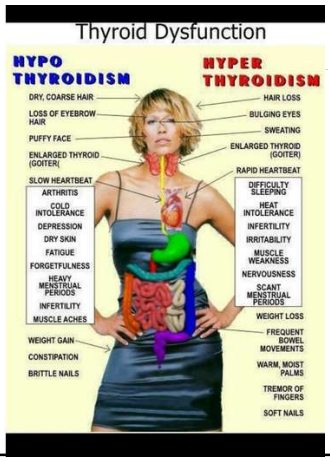
AACE Website

Thyroid & TSH* Levels



AACE Guidelines

- *Thyroid Stimulating Hormone - secreted by pituitary gland
  - controls thyroid hormone thyroxine production
  - first and best test
  - TSH Norm = up to 4.5 mIU/mL
  - Treatment based on TSH plus symptoms.
    - 4.5 – 10 based on risk, s/s
    - 10 or more = treat
  - Lower = hyperthyroidism
  - Higher = hypothyroidism



A TSH above 10 mIU/L, in combination with a subnormal free T4 characterizes overt hypothyroidism.

If TSH in range, but person is symptomatic, Check for thyroid peroxidase atb or TPO antibodies

A low TSH indicates hyperthyroidism (0.1 ish)

Collaborative Action Plan

- Increase semaglutide to 1.0mg
- Decrease basaglar by 10 units
- Stop sitagliptin
- Continue pioglitazone (Actos)
- Walk after lunch during work week
- Restart levothyroxine, Re-Check TSH - Re-evaluate in 4 weeks.
- Eat one serving of veggie a day and decrease meat intake to 4 nights a week.
- Meet with RD/RDN
- Check BG a few times a week before bed (in addition to am)

Labs
A1C – 8.3%
UACR 26 GFR >60
TSH 10.6
LDL 98 mg/dl, Trig 158
ALT 85 IU/L,
AST 90 IU/L

Non-Alcoholic Steatosis Disease

NAFLD is when fat reaches 5% of the liver's weight

Without consumption of significant amounts of alcohol defined as:

- Ingestion of less than 21 standard drinks per week in men and
- Less than 14 standard drinks per week in women

over a 2-year period preceding evaluation) or the presence of other secondary causes of Steatosis disease.

Non-Alcoholic Fatty Liver Disease (NAFLD)
Metabolic dysfunction–associated steatotic liver disease (MAFLD)

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes—2024

Liver Nomenclature Update

Old Terms	New Terms
Fatty Liver Disease	Steatotic Liver Disease
Non-Alcoholic Steatohepatitis (NASH)	Metabolic Dysfunction-Associated Steatohepatitis (MASH)
Non-Alcoholic Fatty Liver Disease (NAFLD)	Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD)

Fatty Liver Disease & Steatohepatitis

Adults with type 2 diabetes.

- NAFLD is prevalent in >70%
  - Of those 50% have NASH*
  - 12-20% have fibrosis

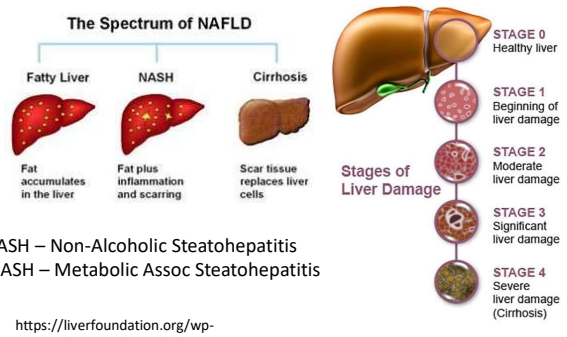
*Non-Alcoholic Steatohepatitis (NASH)

- **Associated with :**
- Increased BMI (30+)
- Cardiometabolic risk factors
- Over 50 yrs
- *ALT & AST 30 units/L +

***ALT & AST**
(Eval if more if 30+ for 6 mo's - ADA)
Gastroenterologist norm
ALT 29-33 men
ALT 19-25 women

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*
American Diabetes Association Professional Practice Committee

Natural History of NAFLD to NASH



NASH – Non-Alcoholic Steatohepatitis
MASH – Metabolic Assoc Steatohepatitis

https://liverfoundation.org/wp-content/uploads/2020/11/StagesFibrosis.jpg

Stages of Liver Failure

- NAFLD – nonalcoholic fatty liver disease
  - NAFL – simple fatty liver, doesn't usually progress to cause liver damage
  - NASH or MASH nonalcoholic / metabolic steatohepatitis
    - Liver inflammation and cell damage.
    - Can cause fibrosis, scarring
    - Leading cause of hepatocellular carcinoma and liver transplants (ADA)
- Cirrhosis – degeneration of cells, inflammation, fibrous thickening
- End-stage liver disease & Liver Cancer

https://liverfoundation.org/for-patients/about-the-liver/the-progression-of-liver-disease/#fibrosis-scarring

Nonalcoholic Fatty Liver Disease and Nonalcoholic Steatohepatitis Screening

- Screen adults with type 2 diabetes or prediabetes
  - particularly those with BMI 30 +
  - cardiometabolic risk factors or established CV disease
  - even if normal liver enzymes.
- Screen and provide risk stratification for clinically significant liver fibrosis using
- Calculated fibrosis-4 index (FIB-4) (derived from age, ALT, AST, and platelets

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

Screening for NASH – FIB-4

Fibrosis-4 (FIB-4) Calculator

The Fibrosis-4 score helps to estimate the amount of scarring in the liver. Enter the required va It will appear in the oval on the far right (highlighted in yellow).

$$\text{FIB-4} = \frac{\text{Age (years)} \; 58 \times \text{AST Level (U/L)} \; 90}{\text{Platelet Count } (10^9/\text{L}) \; 217 \times \sqrt{\text{ALT (U/L)} \; 85}} = 2.61$$

- The American College of Gastroenterology considers Upper limit of normal ALT levels:
- 29–33 units/L for males
- 19–25 units/L for female individuals

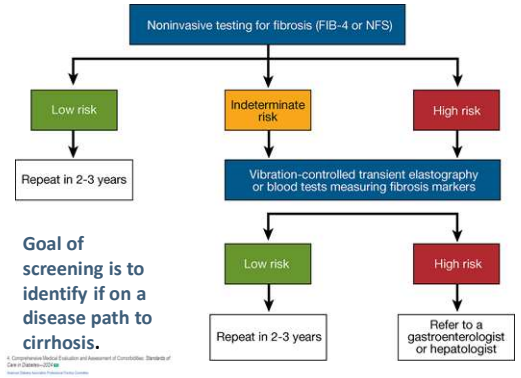
(mdcalc.com/calc/2200/fibrosis-4-fib-4-index-liver-fibrosis).

FIB-4 estimates risk of hepatic cirrhosis (age 35+):

- Calculated by imputing:
  - Age
  - plasma aminotransferases (AST and ALT)
  - and platelet count
- FIB-4 Risk Levels
  - Lower risk is <1.3
  - Intermediate 1.3 to 2.67
  - High risk >2.67
    - considered as having a high probability of advanced fibrosis (F3–F4).

www.DiabetesEd.net

Screening for Fibrosis Risk



Goal of screening is to identify if on a disease path to cirrhosis.

Symptoms of Steatosis

If symptoms do appear, they may include:

- A feeling of fullness in the middle or upper right side of the abdomen
- Abdominal pain, nausea
- Loss of appetite or weight loss
- Weakness
- Jaundice

https://dermcollective.com/palmar-erythema/

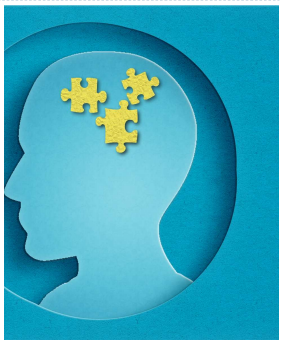
- Swelling of the abdomen and legs
- Mental confusion
- Extreme fatigue or tiredness
- Signs of advanced disease include:
  - Portal hypertension, spider angiomas, reddening of palms, declining platelet counts

Mayo Clinic

Question: What does a Liver Elastography reveal?

The provider is sending JR for a Liver Elastography or FibroScan test since JR has elevated ALT and AST levels along with an elevated Fib-4 score. Which of the following are measured during this liver ultrasound procedure?

A. Liver diameter and density.
B. Liver scarring and ductal health.
C. Hepatocyte density and distribution.
D. Liver stiffness and fat density.



Finding Liver Disease

- Imaging procedures used to diagnose NAFLD include:
- **Abdominal ultrasound,** which is often the initial test when liver disease is suspected.
- **Transient elastography,** an enhanced form of ultrasound that measures the stiffness of liver. Liver stiffness indicates fibrosis or scarring.
- **Magnetic resonance elastography,** works by combining MRI imaging with sound waves to create a visual map (elastogram) showing the stiffness of body tissues
- **Biopsy** by liver specialist confirms definitive diagnosis

Referral to Hepatologist or GI specialist

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

Steatosis Interventions

- Nutrition
  - Weight loss goal of 5-10% or more
  - Mediterranean Diet
  - Avoid alcohol
  - Decrease processed foods, meats and sugary foods.
  - Increase vegetables and other high fiber foods.
- Move more – including aerobic activity and strength training.
- Close follow-up and ongoing monitoring
- Can be associated with worsening renal function

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

Other Treatments for NAFLD and NASH

- Meds that lower glucose, cholesterol and weight
- Bariatric surgery
- Pioglitazone (Actos)
  - Improves lipid and glucose metabolism
  - Reverses steatohepatitis in prediabetes/diabetes
  - Causes 1-2% wt gain at 15 mg
  - 3-5% wt gain at 45 mg
- GLP-1 Receptor Agonists

Support lifestyle changes

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

Actions To Decrease Steatosis

- Increase activity
  - Strength training
  - Yoga or Thai Chi
  - Walking & aerobics
- Thoughtful eating
  - More fiber
  - Less processed foods & less added sugar
  - Avoid alcohol
- Treatment
  - Actos
  - GLP-1
  - Statin
- Prevention
  - Cancer Screenings
  - Decrease inflammation

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

NEW Bone Health Recommendations

- Diabetes associated with increased fractures
- Take preventive action:
  - For high-risk older adults (aged >65 years) and younger individuals with multiple risk factors.
    - Monitor bone mineral density using dual-energy X-ray absorptiometry every 2–3 years.
  - Avoid medications that increase fractures in high risk
  - Problem solve to prevent falls
  - Adequate calcium and vita D intake
  - Consider antiresorptive meds, osteoanabolic agents for those with low bone mineral density score.

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

Risk Factors for Fracture

- General risk factors
  - Prior osteoporosis fracture
  - Age > 65 years
  - Low BMI
  - Sex
  - Malabsorption
  - Recurrent falls
  - Glucocorticoid use
  - Family history
  - Alcohol /tobacco abuse
  - Rheumatoid arthritis
- Diabetes Specific Risk Factors
  - Lumbar spine or hip T-score ≤ -2.0
  - Frequent hypoglycemia
  - Diabetes >10 years
  - Diabetes meds: TZDs or sulfonylureas, insulin
  - A1C > 8%
  - Peripheral autonomic neuropathy
  - Retinopathy and nephropathy

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*

www. DiabetesEd.net

EV Dental, Eye, Kidney and Nerve Care

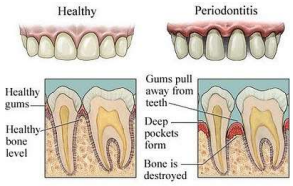
Poll Question 14

- Diabetes is associated with an increased risk of oral disease. Which of the following statements is true?

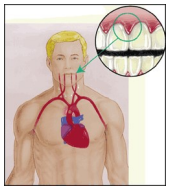
a. Diabetes is associated with decreased saliva production.
b. People with diabetes benefit from vinegar gargles to decrease bacterial load
c. People with diabetes are at greater risk for tongue cancer.
d. Diabetes is associated with increased tonsillitis.

Periodontal Disease

- More severe and prevalent with diabetes and elevated A1c levels.
  - periodontal treatment associated with better glycemic control (A1C 8.3% vs. 7.8%)
  - Benefits lasted for 12 mo's
- People with periodontal disease have higher rates of diabetes.
- Bidirectional



Periodontal disease and Heart Disease



- Heart disease link:
  - oral bacteria enter the blood stream, attach to fatty plaques in coronary arteries increasing clot formation
  - inflammation increases plaque build up, which may contribute to arterial inflammation
  - Hyperglycemia = Gingivitis = Heart Disease

Salivary Dysfunction and Xerostomia (dry mouth) in DM

- Less saliva uptake and excretion = less protection against bacteria
- Hyperglycemia increases glucose levels in saliva, providing medium for bacterial growth- also promotes dry mouth
- Dry mouth increases risk of infection and can alter nutritional intake (due to chewing, swallowing difficulties)

Keeping Oral Healthy

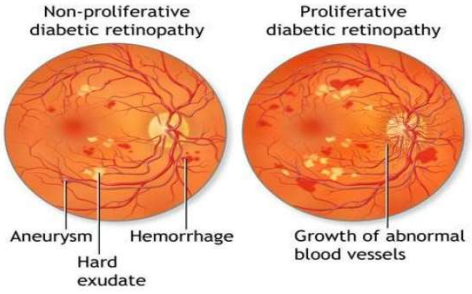
- Oral disease linked with heart disease
- Dental exams (every 6 mo's)
- Metabolic control critical
- Quit smoking
- Brush twice daily and floss daily.
- Help access affordable dental care.
- Treat infections with ATB'x, can lower A1c by 1-2%. Lowering BG shortens infection.

Retinopathy Changes How We See

View of boys by person with normal vision

View of boys by person with diabetic retinopathy.

Non - Proliferative to Proliferative Diabetic Retinopathy



Quick Question 15

- Which of the following is correct regarding eye screening for people with diabetes?

A. All people with diabetes must get a complete eye exam every year

B. All people diagnosed with type 1 and 2 need an immediate eye exam.

C. All people diagnosed with type 2 need an immediate eye exam.

D. People with diabetes over **age** of 60 need an eye exam every 6 months.

12. Microvascular Complications - Eyes

- Optimize BG and B/P Control to protect eyes
- Screen with initial dilated and comprehensive eye exam by ophthalmologist or optometrist:
  - Type 2 at diagnosis, then every year*
  - Type 1 within 5 years of dx, then every year*
  - Type 1 or type 2 diabetes need eye exam before pregnancy and 1st trimester. Monitor every trimester and for 1 year postpartum as indicated by the degree of retinopathy.
  - *If **no** evidence of retinopathy **and** glycemic indicators within goal range, then screening every 1–2 years may be considered.
- Appropriate to use retinal photography with remote reading or U.S. FDA of approved artificial intelligence algorithms to improve access to diabetes retinopathy screening.
- Promptly refer people with macular edema, severe non-proliferative disease to trained specialist.

12. Retinopathy, Neuropathy, and Foot Care: *Standards of Care in Diabetes—2024*

Retinopathy Prevention

- To reduce the risk or slow the progression of retinopathy
  - Optimize glycemia
  - Optimize blood pressure
  - Optimize lipids
    - retinopathy progression may be slowed by the addition of fenofibrate

12. Retinopathy, Neuropathy, and Foot Care: *Standards of Care in Diabetes—2024*

Standard 11 - Chronic Kidney Disease and Risk Management

- **Optimize glucose and B/P Control to protect kidneys**
- Screen Urine Albumin Create ratio (UACR) & GFR
  - Type 2 at dx then yearly
  - Type 1 with diabetes for 5 years, then yearly
  - If urinary albumin ≥300 and GFR 30–60 monitor 1-4 times a year to guide therapy.

Albuminuria Categories	Urinary Albumin Creatine Ratio (UACR)
Normal to mildly increased – A1	< 30 mg/g
Moderately increased – A2	30 – 299 mg/g
Severely increased – A3	300 mg/g +

Kidney Disease Stage	GFR
Stage 1 – Normal	90+
Stage 2 – Mild loss	89 - 60
Stage 3a – Mild to Mod	59 - 45
Stage 3b – Mod to Severe	44 - 30
Stage 4 – Severe loss	29 -15
Stage 5 – Kidney failure	14 - 0

11. Chronic Kidney Disease and Risk Management: *Standards of Care in Diabetes—2024*

Definitions of Abnormalities in Albumin Excretion

- Urine albumin – creatinine ratio (UACR)

Category	UACR mg/g
Normal	<30
Moderately increased urinary albumin	30-299
Severely increased urinary albumin	>300

- 2 of 3 tests w/in 3-6 mo abnormal to confirm*
  - *Exercise within 24 h, infection, fever, congestive heart failure, marked hyperglycemia, menstruation, and marked hypertension may elevate UACR independently of kidney damage.

11. Chronic Kidney Disease and Risk Management: *Standards of Care in Diabetes—2024*

Optimizing Health - Kidney Disease

Optimize glucose and B/P to protect kidneys

- If UACR > 30 mg/g treat hypertension with ACE or ARB, monitor K+
- For people with type 2 diabetes and CKD eGFR ≥20 and urinary albumin ≥200 mg/g.
- For cardiovascular risk reduction:
  - Use SGLT2 inhibitor (if eGFR is ≥20)
  - Use a glucagon-like peptide 1 agonist,
  - or a nonsteroidal mineralocorticoid receptor antagonist (if eGFR is ≥25).
    - Potassium levels should be monitored.
- Refer to nephrologist if GFR <30

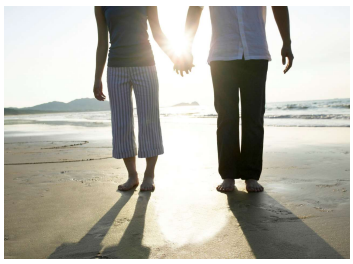
At higher risk of Hypoglycemia

11. Chronic Kidney Disease and Risk Management: *Standards of Care in Diabetes—2024*

Collaborative Action Plan and F/U

- Make appointment with dentist and eye doctor.
- Brush twice daily and floss daily.
- Need some relief from nerve pain.
- Experiencing vaginal dryness.

Moving on to the Lower Half



Diabetes and Amputations

- Rate declined 43% - 2000 – 2009
- Increased 50% from 2009-2015
  - 2.1 per 1000 then up to 4.2 per 1000
  - Driven by a 62% increase in minor amputations
  - Highest rates in young and middle age adults (18- 64 years).
- 50% of amputations can be avoided through self-care skill education and early intervention

Diabetes Care

Resurgence of Diabetes-Related Nontraumatic Lower Extremity Amputation in the Young and Middle-Aged Adult U.S. Population

https://doi.org/10.2337/dc18-1580

Diabetes Care 2018

Poll Question 16

- Which of the following is true about diabetes and lower extremities?

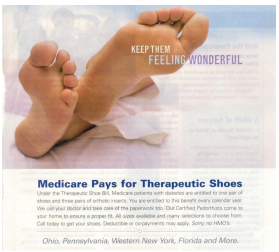
a. Excess hair on the toes indicates compromised circulation.
b. People with diabetes need to inspect lower extremities weekly.
c. People over 65, with high-risk feet, qualify for a pair of custom shoes annually
d. Once a person with diabetes has an amputation, they are not likely to have another.

Lower Extremities

- Lift the Sheets and Look at the Feet

No DeFEET

Feet Deserve Special Care



- Daily inspection
- With order from MD and Loss of Protective Sensation (LOPS), Medicare Covers:
  - Annual custom shoes
  - 3 pairs of orthotic inserts

Medicare and Custom Shoes

- The doctor who treats diabetes must certify need for therapeutic shoes or inserts and be a medicare provider.
- A podiatrist or other qualified doctor must prescribe the shoes or inserts, and ind must get the shoes or inserts from one of these:
  - A podiatrist
  - A pedorthist
  - Another qualified individual
  - A prosthetist
  - An orthotist

Nerve disease Screening

- Screen all people with diabetes for nerve disease using simple tests, such as pinprick, vibration & monofilament sensation.
  - Type 2 at diagnosis, then annually
  - Type 1 diabetes at 5 years, then annually
- Glycemic management is the main strategy to prevent or delay the development and progression of neuropathy.
- Assess and treat to reduce pain and symptoms to improve quality of life.

12. Retinopathy, Neuropathy, and Foot Care: *Standards of Care in Diabetes—2024*

Testing for Small and Large Nerve Fiber Loss

- Test for nerve fiber function and loss of protective sensation:

1. Small-fiber function: pinprick and temperature sensation.
2. Large-fiber function: vibration perception and 10-g monofilament.
3. Protective sensation: 10-g monofilament.

Up to 50% of diabetes peripheral neuropathy may be asymptomatic.

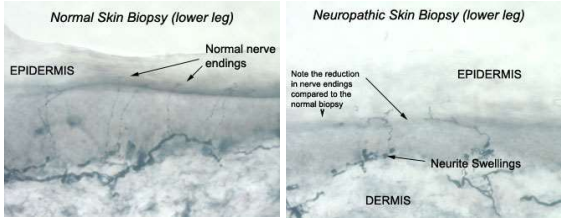
12. Retinopathy, Neuropathy, and Foot Care: *Standards of Care in Diabetes—2024*

Consider Other Causes of Neuropathy

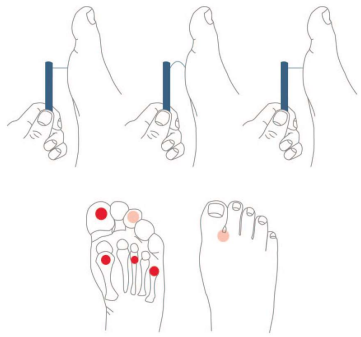
- toxins (e.g., alcohol)
- neurotoxic medications (e.g., chemotherapy)
- vitamin B12 deficiency
- hypothyroidism
- renal disease
- malignancies (e.g., multiple myeloma, bronchogenic carcinoma)
- infections (e.g., HIV)
- chronic inflammatory demyelinating neuropathy
- inherited neuropathies, and vasculitis

12. Retinopathy, Neuropathy, and Foot Care: *Standards of Care in Diabetes—2024*

Skin Biopsy to Assess Neuropathy



5.07 monofilament delivers 10gms linear pressure



Treating Neuropathy

- Improve glycemic control
- Control pain
- Relief from depression from chronic pain
  - Massage, stretching,
  - Pain control clinic,
  - Transcutaneous Electrical Nerve Stimulation (TENS)
  - Avoid alcohol
  - Relaxation exercises....

Neuropathy Treatment for Diabetes

Behavioral Interventions: Improve glucose levels, quit smoking, alcohol reduction, exercise, massage, meditation, pain management clinic, adequate sleep, nutrition therapy, hobbies.

Pathogenetically Oriented Therapy

- Alpha lipoic acid 600 – 1,800 mg a day. Consider B12 replacement therapy.

Prescription Therapy:

1st line – Tricyclic Antidepressants (Amitriptyline, Nortriptyline, Desipramine)

- Calcium Channel Modulators (Gabapentin, Pregabalin)
- Serotonin Norepinephrine Reuptake Inhibitors (SNRI – Venlafaxine, Duloxetine)

2nd Line - Topical Capsaicin Cream for localized pain – Apply 2-4 x daily for up to 8 wks

- Opioids (Tramadol, Oxycodone)

Common Reasons for Treatment Failure

- Dose too low or inadequate trial – requires 2-8 weeks of treatment to observe symptom reduction
- Expecting elimination of symptoms – only reduces symptoms by about 50%
- Incorrect diagnosis: If in doubt, refer to neurologist
- If there is no improvement or person has adverse effects, change medication class
- If some but inadequate relief, raise the dose and consider adding or changing meds.

References: Ziegler, D. Painful diabetic neuropathy. Diabetes Care 2009; 32 (Supp 2): S414-S419

Class	Generic / Trade Name	Usual Daily Dose Range	Comments	Side Effects/ Caution
1st Line Agents **Tricyclic Antidepressants** **TCA** Improves neuropathy and depression	Amitriptyline / Elavil	25 – 100 mg* Avg dose 75mg	Usually 1st choice	Take 1 hour before sleep. Side effects; dry mouth, tiredness, orthostatic hypotension. **Caution**: not for pts w/ unstable angina (<6 mo), MI, heart failure, conduction system disorder.
	Nortriptyline / Pamelor	25 – 150 mg* (for burning mouth)	Less sedating and anticholinergic	
	Desipramine / Norpramine	25 – 150 mg* *Increase by 25mg weekly till pain relieved		
Calcium Channel Modulators	Gabapentin/ Neurontin	100 - 1,200mg TID	Improves insomnia, fewer drug interactions	Sedation, dizziness, peripheral edema, wt gain **Caution**; CHF, suicide risk, seizure disorder.
	Pregabalin / Lyrica *FDA approved for neuropathy treatment	50 - 200mg TID		
Serotonin Norepinephrine Reuptake Inhibitor SNRI	Duloxetine / Cymbalta *FDA approved for neuropathy treatment	60 mg daily	Improves depression, insomnia	Nausea, sedation, HTN, constipation, dizziness, dry mouth, blurred vision. **Caution**: adjust dose for renal insufficiency, do not stop abruptly, taper dose.
	Venlafaxine/ Effexor	75 - 225 mg daily		
2nd Line Agents Opioids	Weak opioids Tramadol / Ultram	50 – 400 mg	Sedation, nausea, constipation (always prescribe stool softener) **Caution**: abuse, suicide risk, short acting	
	Strong opioids	10 – 100 mg		

12. Retinopathy, Neuropathy, and Foot Care: *Standards of Care in Diabetes—2024*

Meds for Neuropathy – Cheat Sheet

Also consider Capsaicin cream 8% patch or Lidocaine 5% patch

Other strategies to help ease the pain

- Music
- Podcasts
- Movies
- Pet's
- Massage
- Touch
- Topical creams
- Lidocaine patches
- Mineral salts baths
- Neurostimulators
- Tylenol / Ibuprofen
- Earthing
- Sleep
- Hobbies
- Aromatherapy
- Time with special people
- Work / volunteering

We Can Make A Difference

- Assess
  - Nail condition, nail care, in between the toes
  - Who trims your nails
  - Have you ever cut your self?
  - Shoes – type and how often
  - Socks
  - Skin/skin care and vascular health
  - Ability to inspect
  - Loss of protective sensation
  - Nerve pain treatment

Lower Extremities

- **"Every time you see your provider, take off your shoes and socks and show your feet!"**
- For those at high risk for foot complications
  - with loss of protective sensation, foot deformities, or a history of foot ulcers
- Everyone else needs a thorough, annual inspection

"DAN" Diabetic Autonomic Neuropathy

- 50% of ind's with peripheral neuropathy also have DAN
- DAN associated with higher M/M Rates
  - hypoglycemia unawareness
  - resting tachycardia, orthostatic hypotension
  - gastroparesis, constipation, diarrhea, fecal incontinence
  - neurogenic bladder
  - sudomotor dysfunction with either increased or decreased sweating
  - erectile dysfunction

Sexual Functions as We Age

20-30 years	trice daily
30-40 years	tri weekly
40-50 years	try weekly
50-60 years	try weakly
60-70 years	try oysters
70-80 years	try anything
80-90 years	try to remember

A touch of humor from AADE-New Perspectives on Erectile Dysfunction, 1999

Asking about sexual health

- " I'm going to ask you a few questions *about your sexual health. Since sexual health is very important to overall health, I ask each person these same questions.*
- Before I begin, *do you have any questions or sexual concerns you'd like to discuss?"*
- Have you noticed any changes in your sex life over the past year?
  - Trouble with erection, lowered libido, decreased sensation, painful intercourse or something else?

Improving Sex Life

People with diabetes get more vaginal and bladder infections

- Difficulty achieving orgasm due to neuropathy
- Painful intercourse due to lack of vaginal lubrication

Treatment

- Lower blood glucose / blood pressure
- Treat vaginal infections and UTI's
- Water based lubricants for vaginal dryness
- Hormone replacement therapy
- Eat to prevent lows during intimacy
- Allow time, touching and romance

Many people with diabetes have issues with sexual desire, arousal, or orgasm. How about you?"

Erectile Dysfunction

- Affects about 50% of men with diabetes
- Loss of erections sufficient for intercourse
- Due to combo of vascular and nerve damage
- Tests: penile tumescence to eval if organic or psychogenic
- Treatment:
  - Sildenafil (Viagra), Vardenafil (Levitra), Tadalfil (Cialis)
    - Use caution if taking nitrate drugs. Check w/ MD first
  - Other meds, vacuum devices, prosthetics
  - HRT- testosterone gel, patches, injections, pills

Low Testosterone

- Hypogonadism: loss of sex drive or activity
- Screening: morning serum levels
- Mean testosterone levels lower in men with diabetes – also associated with elevated BMI
- Testosterone replacement therapy can improve:
  - Sexual function, strength, bone density, mood
  - Repeat am testosterone level after treatment to eval response

EV is feeling Empowered

- Her A1c has dropped, she feels better about herself with healthier eating and increased activity.
- She is back on her thyroid medication and has more energy.
- The pain in her feet is better and she is more hopeful overall!

The ABC's of Diabetes Management

A - A1c less than 7%, TIR 70%
B - Blood pressure < 130/80
C - Cholesterol
LDL< 70, HDL > 40, Triglycerides < 150
D - Drugs- Keep list on phone
E - Exercise and Eyes
F - Food and Feet
G – Glucose checks and goals
H- Healthy Coping - Hoorah for your hard work!
K – Kidneys – Check UACR & GFR

Integrating Technology: CGM Connected Pens and Insulin Pumps

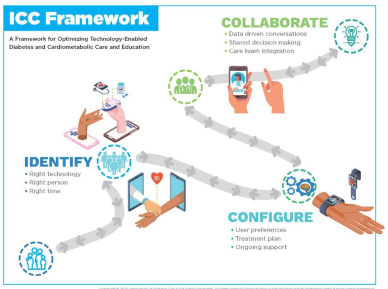
Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
Director, Education & Training in Diabetes Technology

Learning Objectives

- Discuss continuous glucose monitoring (CGM) and the clinical benefits for managing diabetes
- Compare and contract different CGM, insulin pump, and connected pen devices
- Describe critical teaching content for insulin pump, connected pen and CGM use
- Describe appropriate candidates for insulin pump therapy
- List inpatient considerations for insulin pump therapy and CGMs

ICC Framework – Identify-Configure-Collaborate

A framework to overcome barriers to technology use and therapeutic inertia



Greenwood DA, Howell F, Scher L, et al. A Framework for Optimizing Technology-Enabled Diabetes and Cardiometabolic Care and Education: The Role of the Diabetes Care and Education Specialist. The Diabetes Educator. 2020;46(4):315-322. doi:10.1177/0145721720935125

Technology is Here

CONTINUOUS GLUCOSE MONITORS (CGM)

INSULIN PUMPS

CONNECTED PENS AND CAPS

MOBILE APPS

Identify: PWD Identify the "Right" Technology

Helping You Find The Right Diabetes Devices For Your Life.

DEVICE COMBOS

FINDING WHAT'S RIGHT FOR YOU.

Get to know how different devices work together.

Devices

Diabeteswise.org, providers.diabeteswise.org/#/

The Importance of Education & Training

"No device used in diabetes management works optimally without education, training, and follow-up."

ADA. Diabetes Care. 2024.

Guidelines: ADA

- Initiation of CSII and/or AID early, even at diagnosis, in the treatment of diabetes can be beneficial depending on a person's or caregiver's needs and preferences. (C)
- AID systems should be offered for diabetes management to youth and adults with T1D (A) and other forms of insulin deficient diabetes (E) who are capable of using the device safely.
- Connected insulin pens can be helpful for diabetes management and may be used in people with diabetes taking subcutaneous insulin. E
- Systems that combine technology and online coaching can be beneficial in managing prediabetes and diabetes for some individuals. B
- The choice of device should be made based on the individual's circumstances, preferences and needs.

Diabetes Care 2024;47(Suppl. 1):S126–S144

Continuous Glucose Monitors (CGM)

- Measures glucose (sugar) every 1-5 mins and records it every 5-15 mins (up to 288 readings/day)
- Includes 3 components: transmitter, sensor, receiver/reader

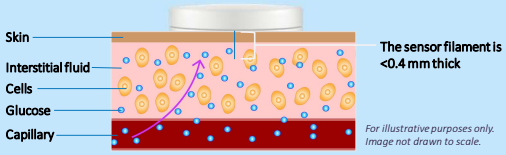


Illustration adapted from: Association of Diabetes Care & Education Specialists. ADCES Practice Paper. Accessed 11/9/21. https://www.diabeteseducator.org/docs/default-source/practice/practice-documents/practice-papers/the-diabetes-educator-role-in-continuous-glucose-monitoring.pdf?sfvrsn=4

CGM: Real-Time Data

Types of CGM

Professional	Personal
Owned by the clinic	Owned by the person with diabetes
Blinded and unblinded (real-time feedback) options	Real-time feedback or scan for feedback (flash device)
Short-term use (3-14 days)	Long-term use
Insurance coverage for most people with type 1 or type 2 diabetes	Insurance coverage more focused on type 1 diabetes or those on intensive insulin regimens
Not compatible with insulin pumps or connected pens	Compatible with smartphones, connected pens and insulin pumps with select devices

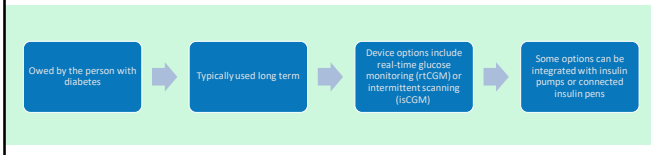
Wright LA, Hirsch IB. *Diabetes Technol Ther.* 2017;19(suppl 2):S16-S26; Kruger DF, et al. *Diab Educ.* 2019;45(suppl 1):S3-S20.

Professional CGM Comparison

	Dexcom G6 Pro	LibrePro
Blinded vs unblinded	Both	Blinded
Maximum wear time of sensor	10 days	14 days
Calibration	None	None
Downloading reports	Clarity	LibreView
Care between transmitter use	Disposable-1 time use, must attached transmitter	Disposable 1-time use, combined sensors/transmitter
Alarms for high/low glucose alerts	Yes	No
Interfering substances	Hydroxyurea	Salicylic acid and high-dose vitamin C

ADCES Practice Paper. The diabetes care and education specialist role in CGM.

Personal CGM Options (Rx)



Freestyle Libre 2 and 2+ | Freestyle Libre 3 and 3+ | Eversense | Guardian 4 | Simplera | Dexcom G6 | Dexcom G7

AS1

Slide 12

AS1 Added Dexcome to G6

Added FreeStyle to Libre 2 and Libre 14 Day

Added Sensor to Guardian 3
Alissa Scott, 11/9/2021

CGM Comparison

	G6	G7	Libre 2	Libre 3	Guardian 4	Simplera	Eversense E3
Integration	T:Slim X2, Omnipod5, InPen, Tempo, iLet	T:Slim X2 Tempo, iLet	Bigfoot Unity, T:Slim X2 (Libre 2+)	No	780G	InPen	No
Type	rtCGM	rtCGM	isCGM	rtCGM	rtCGM	rtCGM	rtCGM
Maximum wear time	10 days	10.5 days	14 days (15 days with Libre2+and 3+)		7 days	7 days	180 days
Warm-up time	2 hours	30 min	1 hour		Up to 2 hours	Up to 2 hours	24 hours
Calibrations required	0	0	0		At least 2/day	0	2/day for 21 days, then 1/day
Water depth	8 feet, 24h	8 feet, 24h	3 feet, 30 min		8 feet, 30 min		3.28 feet, 30 min
Sharing Data	Dexcom Clarity		LibreView		Carelink	Carelink	Eversense Data Management System

CGM Comparison (Continued)

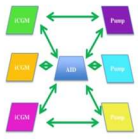
	G6	G7	Libre 2	Libre 3	Guardian 4	Simplera	Eversense
FDA approved sites	Abdomen (ages2+) Upper buttocks (ages 2-17)	Upper arm (ages 7+) Upper buttocks (ages 2-6)	Upper arm		Upper arm, abdomen Upper buttocks (ages 2-13)		Upper arm
Approved in pregnancy	No	Yes	Yes		No	**No**	No
Transmitter	3 months	Disposable	Disposable		Charge weekly	Disposable	Charge daily
FDA approved ages (years)	≥2	≥2	≥4 (2 with Libre2+ and 3+)		≥2		≥18
Drug interactions	Hydroxyurea	Hydroxyurea	Vitamin C (not with Libre 2+ and 3+)		Acetaminophen Hydroxyurea		Tetracycline antibiotics, mannitol

Product user guides: Dexcom G6, Dexcom G7, Libre 2, Libre 3, Medtronic Guardian Connect, Guardian 4, Eversense

Integrated CGM

- Dexcom G6, G7, Libre 2, Libre 2+ Libre 3+, Eversense are integrated CGM (iCGM)
- Integration with digitally connected devices (eg, pumps, pens, automated insulin dosing [AID] systems)

Goal: Greater Interchangeability



- More efficient regulatory pathways
- Faster innovation
- A more vibrant device ecosystem

Poll Question 12

Which of the following sensors is sold over the counter without a prescription?

A. Dexcom G6
B. Dexcom G7
C. Libre 3
D. Dexcom Stelo

Dexcom Stelo

- For people over 18 that don't take insulin
- Glucose range: 70-250mg/dL
- Updates every 15 minutes, 30 minute warm-up
- Stelo app + Dexcom Clarity
- Spike detection, no high/low alerts
- Education in app
- https://www.dexcom.com/stelo

Abbott Lingo

- For people over 18 not on insulin
- Glucose range: 55-200mg/dL
- Updates every minute, 1 hour warm-up
- Lingo app
- No real time alerts
- Education in app, goal to stay under lingo count
- www.hellolingo.com

CGM Counseling Points

- Important to check glucose when indicated
  - Symptoms do not match sensor value
  - During warm-up period
  - When making dosing decisions for select devices
- Sensors are waterproof
  - Showering, bathing, swimming OK
  - Check water depth criteria for individual sensor
- Overlays and skin preps to help it stay on
- Avoid with MRI, CT, diathermy
  - Exception: Eversense implantable, transmitter should be removed
- Not FDA approved
  - Dialysis, critically ill
  - Pregnancy-Guardian,simplera eversense, G6
  - If people choose to use, it is important they know it is off-label

Lag Time

- Refers to a delay in CGM sensor readings compared to finger stick blood glucose readings
  - Estimated CGM sensor reading ~5 minutes behind
- Most apparent when glucose is changing rapidly
- Counsel patients on the train analogy

Causes of Falsely High or Low Readings

- Interfering substances
  - Falsely high
    - Vitamin C (Libre)
    - Acetaminophen (high dose Dexcom, Guardian)
    - Tetracycline antibiotics (Eversense)
  - Falsely low
    - Salicylic acid high dose
- Compression Lows
- Dehydration
- Faulty sensor

When to Check BGM?

- A calibration or blood glucose symbol appears on the device
- Symptoms or expectations do not match CGM readings
- Off-label indications: dialysis
- After correcting a low
- If taking an interfering substance (ex. vitamin C, acetaminophen hydroxyurea)
- Counsel patients about "lag time"

Per ADA, every person using CGM should have access to a meter and test strips

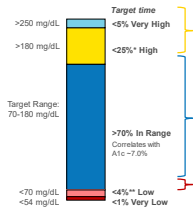
ADCES Practice Paper. The Diabetes Care and Education Specialist's Role in Continuous Glucose Monitoring. Updated March 2021
ADA Standards of Care 2024.

Downloading CGM Data

Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
Director, Education & Training in Diabetes Technology

CGM Key Metrics

Recommended Time in Range for most people with T1D & T2D



Time above range (TAR)
< 1 hr, 12 min, > 250 mg/dL
< 6 hr, > 180 mg/dL

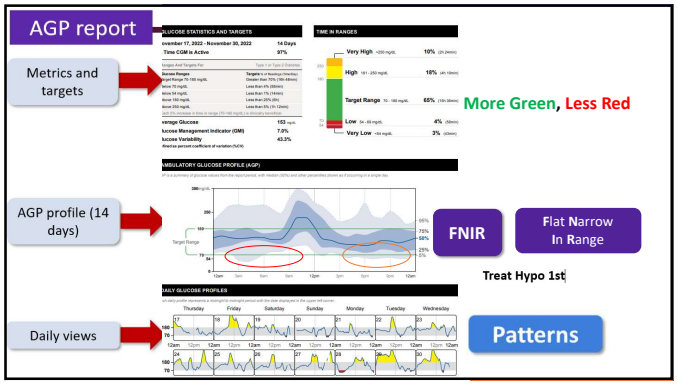
Time in range (TIR)
> 16 hr, 48 min

Time below range (TBR)
< 1hr < 70mg/dL
< 15 min < 54mg/dL

15 minutes = 1% of the day

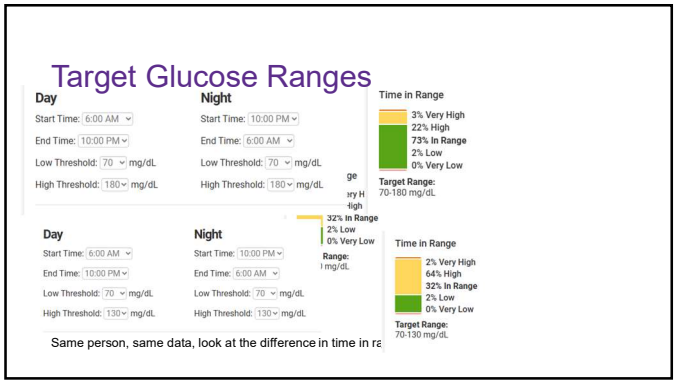
Number of days CGM is worn 14 days is recommended
Percentage of time CGM is active 70% of data from 14 days is recommended
Mean glucose
Glucose management indicator (GMI) Estimated A1C
Coefficient of variation (CV) This is a measure of glycemic variability. A CV >36% is considered unstable.

1. Battelino T et al. *Diabetes Care*. 2019;42(8):1593–1603. ...2. American Diabetes Association. *Diabetes Care* 2021;44(Suppl. 1):S73–S84 | https://doi.org/10.2337/dc21-S006.



Poll 17. What is the goal time in range for most adults with type 1 or 2 diabetes?

A.≥50%
B.≥70%
C.≥80%
D.≥90%



Review of CGM - DATAA

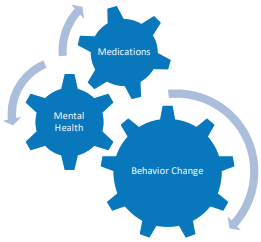
D	Download Data	• Key metrics, AGP, day by day or spaghetti graph • Start with global overview; what AGP, key metrics mean, ask what the person learned/what is going well with self-management
A	Assess Safety	• Hypoglycemia - identify times below range, % time in hypoglycemia, # events • Interactive discussion: possible causes and solutions
T	Time in Range	• Focus on the positive - identify days or times where time in range is highest • Interactive discussion: how to replicate what is working well
A	Areas to Improve	• Hyperglycemia - identify times above range, % time in hyperglycemia, # events • Interactive discussion: possible causes, solutions, and adjustments to self-management
A	Action Plan	• Develop collaboratively with the person with diabetes

At each step, express that this is information, not good or bad

Isaacs D, Cox C, Schwab K, et al. Technology Integration: The Role of the Diabetes Care and Education Specialist in Practice. The Diabetes Educator. 2020;46(4):323-334. doi:10.1177/0145721720935123

Tips for DATA Interpretation

- Start by asking the person what they've experienced and noticed with their glucose patterns
- Avoid judgment
- Learn from 1 time episodes, but make changes based on patterns
- Fix lows first but some amount is expected (<1-4%) and if you remove all lows, you may end up with too many highs
- If it's not making sense, dig deeper (ex. missed doses, rationing, injection technique, food insecurity, etc)



Case 1

Terrance is a 60-year-old man with T2D x 12 years

Current DM2 meds:
- Metformin 1000 mg twice daily
- Glimepiride 8mg daily

Other conditions
- CKD
- Hyperlipidemia
- Hypertension

Checks BGM once daily

Pertinent Labs
- SCr = 1.38 mg/dL, eGFR = 55
- A1C = 8.2%, BMI = 34 kg/m^2

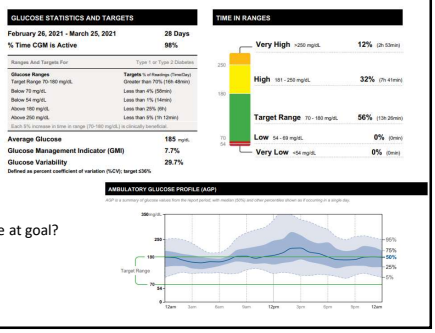
- Works in project management
- Eats 3 meals/day, snacks at night, no regular exercise
- Glucose log

Day	FBG, mg/dL
1	125
2	123
3	110
4	108
5	99
6	81
7	134

Starts CGM

D Download Data

A Assess Safety



- Which CGM key metrics are at goal?
- Which are not?
- Overall patterns?

Poll Question 18

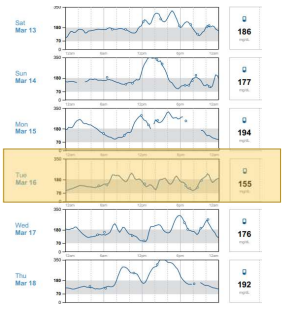
Which CGM key metrics are at goal?

A. Time in range
B. Time above range
C. Time below range
D. Glucose management indicator

Time in Range

T Time in Range

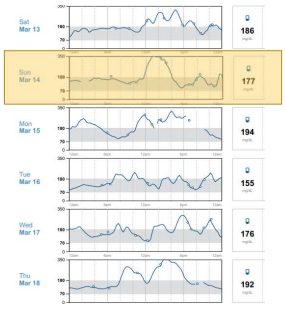
- Focus on the positive: what's worked well on Tue 3/16?
- Time in range is high this day
- Ate a granola bar for breakfast, grilled chicken salad at lunch, steak, greens, potato at dinner
- No missed medication doses
- Good night's sleep, low stress



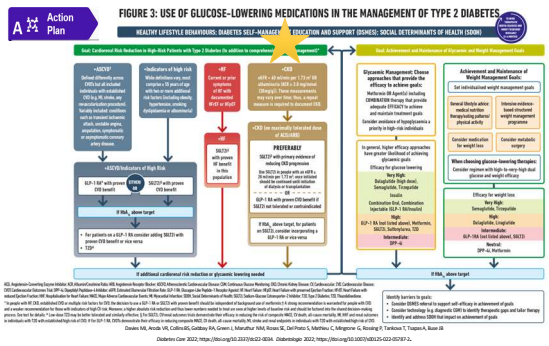
Areas for Improvement

A Areas to Improve

- Sun 3/14 glucose went high 12 pm
- Reports eating rice bowl and coke
- Silver lining
  - Walked around 3 pm (helped to lower glucose)
  - Avoided afternoon snacking
  - Ate low-carb dinner (salmon, salad, small potato)
  - Denies missed doses



A Action Plan



Poll Question 19

What is the most appropriate medication adjustment for Terrance?

A. Add DPP4 inhibitor
B. Add GLP-1 receptor agonist
C. Add SGLT2 inhibitor
D. Lifestyle modifications only

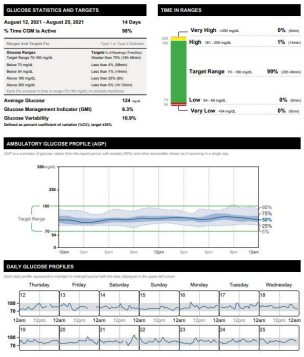
Action Plan

A Action Plan

- In collaboration with Terrance
  - Lifestyle changes
    - Incorporate a brisk walk 3 days per week
    - Reduce high-carbohydrate foods like fries
  - CGM optimization
    - Alerts, high for 280
  - Medication adjustments
    - Add a medication to help his CKD + optimize glucose → SGLT2 inhibitor
  - Follow-up in 3-4 weeks

3 Months Later

DM2 Meds:
Empagliflozin 10mg qday
Metformin 1000mg BID



Case 2

75 yo F with 25 year h/o T2DM. PMH includes HTN, hyperlipidemia, hypothyroid, obesity, ASCVD.

Current DM Meds
-Insulin glargine inject 50 units QAM and 40 at night
-Insulin aspart 8-10-10 units plus correction scale
-Metformin 1000 mg daily
-Semaglutide, 0.25mg weekly (2 doses so far)

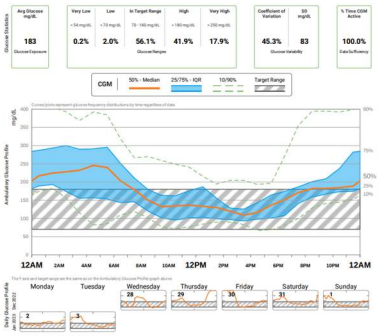
Wears rtCGM

D Download Data

Clarity report obtained from Diana Isaacs

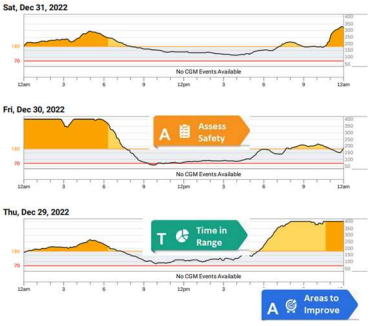
Poll 20. Which of the following CGM key metrics is at target?

A. Time in range
B. Time above range
C. Coefficient of variation
D. Time below range



Clarity report obtained from Diana Isaacs

Using DATAA



A Assess Safety — Less of an appetite since taking semaglutide, often going low during the day

T Time in Range — During the day, glucose often steady, but also having to drink juice to keep from going low

A Areas to Improve — Skipping aspart doses because running low, leading to rebound highs

Clarity report obtained from Diana Isaacs

Action Plan

A Action Plan

- Continue semaglutide 0.25mg weekly x 2 more weeks, then titrate up to 0.5mg weekly
- Decrease insulin glargine to 45 units qam and 35 units qpm
- Continue insulin aspart 8-10-10 + correction scale
- Continue metformin 1000mg daily

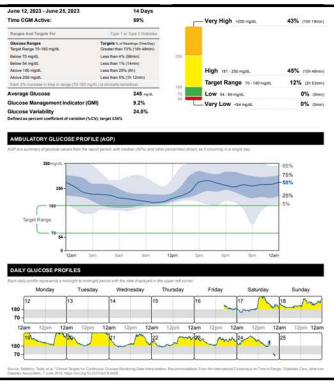
1 month later

- Average glucose improved
- Time in range increased
- Glucose variability improved
- Less hypoglycemia

Clarity report obtained from Diana Isaacs

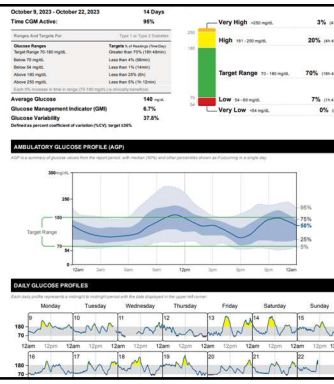
Case 3

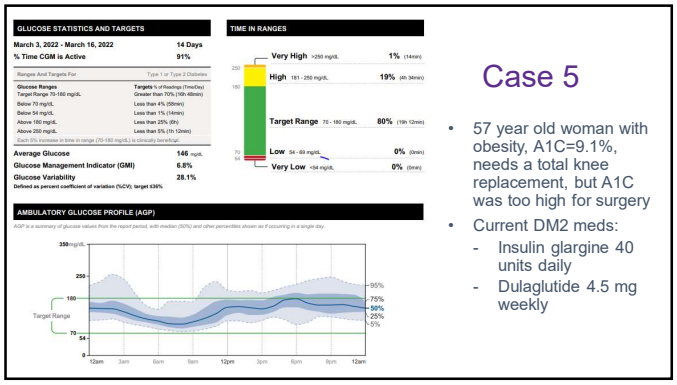
- Person with T2D taking metformin 1000mg twice daily and insulin glargine 20 units daily



Case 4

- Person with T2D
- 56yo, BMI=33, A1C=7%
- Meds:
  - Degludec 40 units daily
  - Dulaglutide 4.5mg weekly
  - Dapagliflozin 10mg daily
  - Metformin 1000mg twice daily

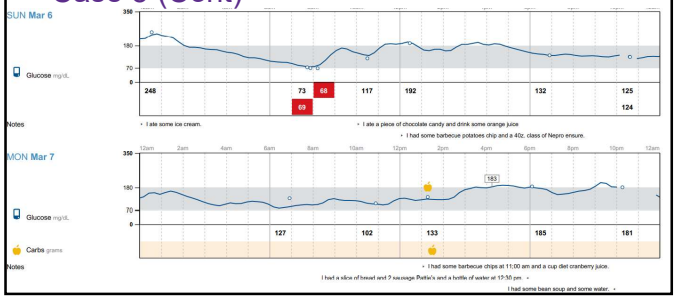




Case 5

- 57 year old woman with obesity, A1C=9.1%, needs a total knee replacement, but A1C was too high for surgery
- Current DM2 meds:
  - Insulin glargine 40 units daily
  - Dulaglutide 4.5 mg weekly

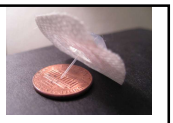
Case 5 (Cont)



Common Insulin Pump Features

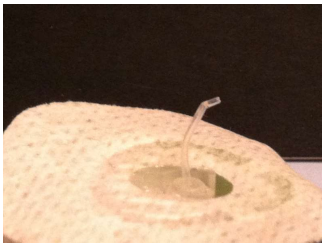
- Bolus calculator
- Temporary basal or temporary target
- Insulin-on-board/active insulin feature to prevent stacking
- Multiple basal patterns
- Small dose increments
- Integration with CGM
- Designed to work with U100 insulin
- Most have a 4-5 year warranty/contract

Infusion Sets



- Infusion sets are usually Teflon
  - Available in different sizes (ex. 9mm vs 6mm)
  - Silhouette (angled) may be better for kids/thinner/very active people
  - Steel infusion sets a good option for people with frequent site occlusions
- Insert at least 1 inch from CGM site
  - Auto-injectors vs. manually injecting
- Site selection/rotation
- Longer tubing options
  - Good if connected on leg, arm or wearing pump further from site
- Caution with kids/babies/pets-pouches available to hide pump
- When changing out infusion set, check glucose or CGM 1-2 hours after
  - Don't change right before bed

What Happens with a Bent Cannula?



A. Hyperglycemia
B. Hypoglycemia
C. No effect

Filling the Pump

- Only fill with how much insulin you expect to use in 3 days + ~30 units
- Pumps hold 200-300 units
- Caution with air bubbles
- Fill cannula amount
  - Steel needle (0 units)
  - 6mm cannula (0.3 units)
  - 9mm cannula (0.5 units)
- If cannula overfilled, can lead to lows
- If cannula under-filled or air bubbles, can lead to highs

Ideal Pump Candidates

- Require meal time insulin
- Wearing CGM or frequently checking BGM
- Carbohydrate counting or good with estimates
- Ability to learn pump programming or have caregivers that can
- Willing to follow up regularly with health care team
- Can afford the pump/supplies
- Following hyperglycemia treatment instructions
- Problem solving skills (ex. high or low glucose)

Patch Pumps

Cequr Simplicity

- Bolus pump patch only
- Approved for adults with T1DM or T2DM
- Holds up to 200 units of rapid acting insulin
- On-demand bolus doses in 2 unit increments
- Doses administered via clicks directly on the device
- Must be changed every 4 days

https://myceqursimplicity.com/

V-Go

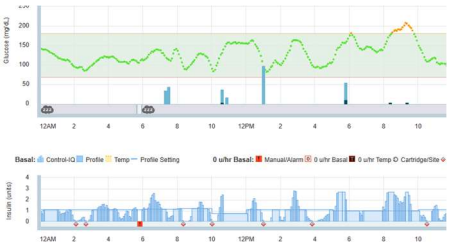
- 24 hr. basal/bolus patch pump
- Approved for adults with T2DM
- Allows 20, 30, 40 unit basal rate options
- On-demand bolus doses in 2 unit increments
  - Up to 36 units/24 hrs
- Doses administered via clicks directly on the device
- Must be changed daily

https://www.go-vgo.com/

Automated Insulin Delivery Systems

- Omnipod 5 (Insulet)
- T:slim X2 (Tandem) Control IQ
- 780G (Medtronic)
- iLet (Beta Bionics)
- Mobi (Tandem) Control IQ
- Tidepool Loop (Sequel)

Hybrid-Closed Loop



- Automated insulin delivery (AID)
- Auto adjust background insulin
- Some systems give auto corrections
- Maximize time 70-180mg/dL

Omnipod® 5

- No tubing
- Holds 200 units
- Uses last 4-5 pods for adjustments, based on TDD
- Control system from a compatible smartphone or controller
- Requires Dexcom G6® use from a compatible smart device
- SmartBolus calculator informed by CGM value and trend
- Glucose targets from 110-150 mg/dL adjustable in 10 mg/dL increments
- HypoProtect mode to reduce risk of lows
- Bluetooth connectivity with glooko, automatic data download
- Requires charging cable

Omnipod® 5 Automated Insulin Delivery System. User Guide.

Medtronic 780G

- Holds 300 units
- Compatible with Guardian Sensor 4
- Meal detection (auto correction + basal)
- Adjustable target (100, 110, 120)
- Bluetooth connectivity, remote software upgrades
- Suspend before/on low options (in manual mode)
- Bluetooth connectivity
- MiniMed and Carelink apps for data sharing/viewing
- 7 day infusion set
- Uses AA battery

Beta Bionics iLet

- Holds 180 units of insulin
- Works with Dexcom G6 and G7
- Uses pre-filled insulin cartridges or fillable cartridge
- Programmed by entering body weight
  - No other insulin pump settings
- Enter in meal estimates (usual, less, more)
- Provides calculated back up settings
- Requires charger

https://www.betabionics.com/

Tandem T:Slim X2 with Control-IQ

- Holds 300 units
- Compatible with Dexcom G6, Dexcom G7, Libre 2+
- Algorithm adjusts insulin delivery from programed “manual” settings
- Automatic correction doses
  - Up to 1 every hour based on projected glucose >180mg/dL
  - Calculated at 60% of programmed correction factor (target of 110)
- T:Connect app to bolus and for remote downloads (changing to Source soon)
- Requires charging cable
- Bolus from T:connect app from phone

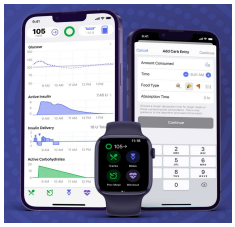
Control IQ Targets

		Control-IQ	Sleep Activity	Exercise Activity
Delivers	Delivers an automatic correction bolus if sensor glucose is predicted to be above ___ mg/dL	180	--	180
Increases	Increases basal insulin delivery if sensor glucose is predicted to be above ___ mg/dL	160	120	160
Maintains	Maintains active Personal Profile settings when sensor glucose is between ___ - ___ mg/dL	112.5 - 160	112.5 - 120	140 - 160
Decreases	Decreases basal insulin delivery if sensor glucose is predicted to be below ___ mg/dL	112.5	112.5	140
Stops	Stops basal insulin delivery if sensor glucose is predicted to be below ___ mg/dL	70	70	80

Tandem Mobi

- FDA approved 6 + years
- Compatible with Dexcom G6, iphone
- 200 unit cartridge
- Controlled with iphone
- Half the size of T:Slim X2
- 5 inches of tubing
- Everything controlled from mobile app (iPhone)
- New syringe-driven pump fill
- Wireless charging
- IP28 water resistant rating (8 feet for 2 hours)

Sequel MedTech Tidepool Loop



- At Launch iPhone
- FDA approved Ages 6 and Up.
  - Download the app from the App Store.
  - Prescription code needed
- Correction Range 87 mg/dL-180 mg/dL.
- Food type for extended boluses: Lollipop, Taco, Pizza Bolus
- Insulin action is fixed with Ultra Rapid, Rapid Acting
- Apple watch compatibility: bolus from watch

Pump Comparison

	Omnipod 5	Control IQ	780G	iLet
Min age	2 years	6 years	7 years	6 years
Min daily insulin	5 units	10 units, 55lbs	8 units	8 units
Max fill	200 units	300 units	300 units	160 units
Basal increment	0.05 units	0.001 units	0.025 units	NA
Bolus increment	0.05 units	0.01 units	0.025 units	NA
Site change frequency	3 days	3 days	7 days (extended infusion set)	3 days
CGM compatibility	G6, G7	G6, G7, Libre 2+	Guardian 4	G6, G7
Calibration	No	No	3-4/day	No
CGM trend in calculator	Increase up to 30% Decrease down to 100%	No	No	NA

Pump Comparison

	Omnipod 5	Control IQ	iLet	780G
Algorithm target	110, 120, 130, 140, 150mg/dL	112.5 – 160 mg/dL	110, 120, 130mg/dL	100, 110, 120mg/dL
Basal automation	Calculated from total daily insulin, updated each pod change, 60 min prediction	Increases or decreases from programmed basal rates, 30 min prediction	Initiated based on user weight and adapts with glucose profile	Calculated based on total daily insulin from past 2-6 days
Automated Corrections	No	Max 1/hour if glucose predicted >180 mg/dL, 60% of calculated dose	No	If glucose > 120 mg/dL and at max "auto basal" delivery, up to every 5min
Extended bolus	No, manual mode only	Yes, up to 2 hours	No	No, manual mode only
Insulin action time (IAT)	2-6 hours	5 hours (automated mode)	NA	2-8 hours
Temporary targets	Activity 150 mg/dL	Exercise 140 -160 mg/dL Sleep 112.5 – 120 mg/dL	NA	150 mg/dL
Bolus adjustments	ISF, IAT, ICR, max bolus, reverse correction	ISF, ICR, max bolus, reverse correction	Usual, more, Less meal announcements	ICR, IAT, max bolus
Ability to override bolus	Yes	Yes	No	No

Sharing Pump Data

System:	Associated Mobile Apps	Website to Access Portal	Data Sources
Glooko	Glooko	Glooko.com	Insulin pumps (Omnipod, Tandem)
Carelink	MiniMed Mobile	https://carelink.medtronic.com/login	Medtronic pumps
Tidepool	Tidepool Mobile	Tidepool.org	Insulin pumps (Medtronic, Tandem)
T:Connect/Source	T:Connect Mobile	https://tconnecthcp.tandemdiabetes.com/hcp_account/#/hcplogin	Tandem pumps
Beta Bionics User Portal	Beta bionics smartphone app	https://report.betabionics.com/	iLet

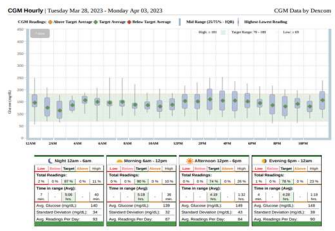
Patient Case

- 47 years old
- T2D x 20+ years
- A1C=8.1%
- BMI=39kg/m^2
- Works as a bank teller
- No diabetes complications
- Meds:
  - Insulin glargine 100 units qpm
  - Insulin aspart 45 units TID a.c.
  - Dapagliflozin 10mg daily
  - Dulaglutide 1.5 mg weekly

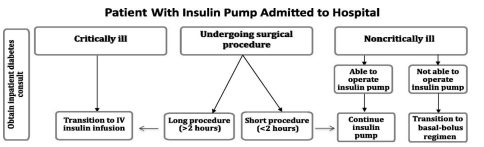
Is this a good candidate for an insulin pump?

Case Study

47yo T2DM, A1C=8.1%, BMI=39kg/m^2



TDD decreased by 30%
Follow-Up A1C=6.7%



Changes to Pump Therapy With Imaging Studies	
X-ray/CT	Pump should be covered by lead apron
MRI	Pump and metal infusion set should be removed
Ultrasound	No need to remove pump but transducer should not be pointed directly at the pump
Cardiac catheterization	Pump should be covered by lead apron
Pacemaker/automatic implantable cardioverter defibrillator (AICD)	Pump should be covered by lead apron
Colonoscopy/EGD	Pump can remain in place
Laser surgery	Pump can remain in place

Umpierrez G et al. Diabetes Care 2018 Aug; 41(8): 1579-1589.

Contraindications to Insulin Pumps in the Hospital

Impaired level of consciousness (except during short-term anesthesia)
Patient's inability to correctly demonstrate appropriate pump settings
Critical illness requiring intensive care
Psychiatric illness that interferes with a patient's ability to self-manage diabetes
Diabetic ketoacidosis and hyperosmolar hyperglycemic state
Refusal or unwillingness to participate in self-care
Lack of pump supplies
Lack of trained health care providers, diabetes educators, or diabetes specialist
Patient at risk for suicide

Umpierrez G et al. Diabetes Care 2018 Aug; 41(8): 1579-1589.

Clinical Evidence

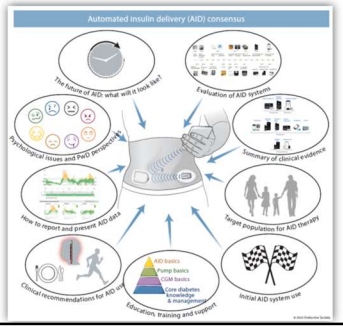
Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
Director, Education & Training in Diabetes Technology

AID Use in Clinical Practice Recommendations

AID therapy should be considered for all populations with T1DM

AID systems still require basic diabetes management skills

All payers (government and private) should reimburse/cover AID systems



HCPs need to be aware of the different AID systems available, their benefits, and their limitations, to advise and support people with diabetes to reach AID benefits

Multifactorial racial and ethnic disparities in prescribing AID system technologies.
Preconceptions and unconscious biases about individual, family, and psychological attributes required to use AID technology effectively **should be recognized and mitigated to ensure fair and equitable access to AID systems**

Phillip M et al. Endocr Rev. 2023 44(2):254-280.

Medtronic 780G Pivotal Trial

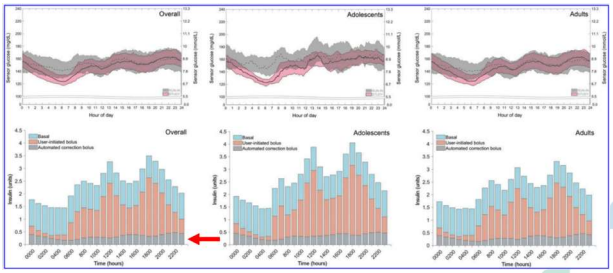
- FDA approved April, 2023

	Overall (n = *157*)	*Adolescents* (n = *39*)	*Adults* (n = *118*)
Age, years	38.3 ± 17.6	16.2 ± 2.1	45.6 ± 14.0
Female, *n* (%)	86 (54.8)	23 (59.0)	63 (53.4)
A1C, %	7.5 ± 0.8	7.6 ± 0.8	7.5 ± 0.9
Diabetes duration, years	22.6 ± 13.3	9.2 ± 3.7	27.0 ± 12.3
Weight, kg	80.1 ± 18.5	68.8 ± 11.9	83.9 ± 18.8
BMI, kg/m^2	27.5 ± 5.7	24.2 ± 4.0	28.6 ± 5.8
Therapy			
HCL	82	25	57
SAP	70	13	57
CSII	5	1	4

	Overall (n = *157*)		
	Run-in[a]	*Study*[b]	P
A1C, %[c]	7.5 ± 0.8	7.0 ± 0.5	<0.001[d]
24-h day			
Time in closed loop, %	—	94.9 ± 5.4	—
TBR <50 mg/dL	0.5 ± 0.7	0.3 ± 0.4	0.003[d]
TBR <54 mg/dL	0.8 ± 1.1	0.5 ± 0.6	0.001[d]
TBR <70 mg/dL	3.3 ± 2.9	2.3 ± 1.7	<0.001[d]
TIR 70–180 mg/dL	68.8 ± 10.5	74.5 ± 6.9	<0.001[d]
TAR >180 mg/dL	27.9 ± 11.0	23.1 ± 7.2	<0.001[d]
TAR >250 mg/dL	6.2 ± 4.7	4.6 ± 3.0	<0.001[d]
TAR >300 mg/dL	1.7 ± 1.9	1.2 ± 1.1	<0.001[d]

Carlson AL, et al. Diabetes Technol Ther. 2022 Mar;24(3):178-189

Medtronic 780G Pivotal Trial



Carlson AL, et al. Diabetes Technol Ther. 2022 Mar;24(3):178-189

Real World 780G Data

	Pediatric		Adult	
	Pivotal CAS (7-17 years) N=109	Real-world (≤15 years) N=10,204	Pivotal CAS (>17 years) N=67	Real-world (>15 years) N=26,099
AHCL use, %	94.4 ± 6.0	91.5 ± 14.0	95.1 ± 7.0	91.3 ± 14.4
CGM use, %	93.7 ± 4.9	92.6 ± 9.4	94.1 ± 6.5	92.0 ± 10.6
Mean SG, mg/dL	153.0 ± 13.0	154.0 ± 17.1	147.6 ± 13.6	152.2 ± 17.6
CV of SG, %	36.2 ± 4.3	37.4 ± 4.9	32.0 ± 4.2	33.1 ± 4.6
GMI, %	7.0 ± 0.3	7.0 ± 0.4	6.8 ± 0.3	7.0 ± 0.4
24-hour day Time at SG ranges, %	6.9 19.4 71.5 1.8 0.4	7.9 19.5 69.9 2.1 0.5	4.2 17.6 76.6 1.3 0.3	5.8 19.4 73.0 1.5 0.3
Nighttime Time at SG ranges, %	3.6 13.4 81.6 1.1 0.3	4.6 14.2 79.2 1.5 0.4	2.9 14.6 81.3 1.0 0.2	4.0 15.6 79.1 1.0 0.3

Data are shown as mean ± SD or mean.
Nighttime was defined as 12:00AM to 05:59 AM.
AHCL, advanced hybrid closed loop; CGM, continuous glucose monitoring;

- Continued Access Study participants Pivotal
  - 780G+G4S for 3 months
  - N = 109, aged 7-17 years
  - N = 67, aged >17 years
- Data of real-world 780G+G4S system users uploaded from 09-2021 to 12- 2022
  - N = 10,204 aged ≤15 years
  - N = 26,099 aged >15 years

Cordero TL, et al. Diabetes Technol Ther. 2023 Sep;25(9):652-658

Bionic Pancreas Pivotal Trial

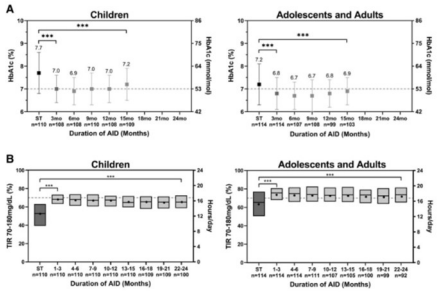
- FDA cleared May 22, 2023
- N=326 T1D ages 6 to 79 yrs randomized 2:1 to bionic pancreas vs. standard of care
- 13 weeks
- A1C decrease of -0.5% (p<0.001)

Table 2. Primary and Secondary Hierarchical Efficacy Outcomes.*

Outcome	Baseline		Follow-up over 13 Wk or at 13 Wk		Adjusted Difference (95% CI)†	P Value
	Bionic Pancreas (N=219)	Standard Care (N=107)	Bionic Pancreas (N=219)	Standard Care (N=107)		
Primary outcome						
Glycated hemoglobin — %	7.9±1.2	7.7±1.1	7.3±0.7	7.7±1.0	−0.5 (−0.6 to −0.3)	<0.001
Key secondary outcome						
Median percentage of time with glucose level <54 mg/dl (IQR) — %	0.2 (0.02 to 0.6)	0.2 (0.0 to 0.4)	0.3 (0.2 to 0.6)	0.2 (0.1 to 0.6)	0.0 (−0.1 to 0.04)	<0.001‡
Other secondary hierarchical outcomes in prespecified order						
Mean glucose level — mg/dl§	187±40	190±42	164±15	181±32	−16 (−20 to −10)	<0.001
Percentage of time with glucose level in range 70–180 mg/dl — %	51±19	51±20	65±9	54±17	11 (9 to 13)	<0.001
Percentage of time with glucose level >180 mg/dl — %	46±20	47±21	33±9	44±18	−10 (−12 to −8)	<0.001
Median percentage of time with glucose level >250 mg/dl (IQR) — %	16.0 (7.0 to 27.3)	17.8 (6.0 to 33.5)	8.5 (5.3 to 13.2)	14.9 (6.3 to 25.3)	−5.0 (−6.6 to −3.6)	<0.001
Glucose SD — mg/dl¶	67±16	68±18	60±11	67±16	−7 (−8 to −5)	<0.001
Median percentage of time with glucose level <70 mg/dl (IQR) — %	1.5 (0.5 to 2.8)	1.4 (0.4 to 2.9)	1.8 (1.1 to 2.9)	1.8 (0.8 to 3.1)	−0.1 (−0.3 to 0.2)	0.51
Median percentage of time with glucose level <54 mg/dl (IQR) — %‖	0.2 (0.02 to 0.6)	0.2 (0.0 to 0.4)	0.3 (0.2 to 0.6)	0.2 (0.1 to 0.6)	0.0 (−0.1 to 0.04)	—
Glucose coefficient of variation — %¶	36±6	36±6	36±5	37±5	−0.8 (−1.6 to 0.0)	—

Russell, S et al. N Engl J Med 2022; 387:1161-1172

Omnipod 5 – 2 Year Data



FDA cleared 1/27/22

N=224 T1D, age 6-70 years

2 wk standard, 12 wk AID,

2 year optional follow-up 224/235 elected to continue

Criego A, et al. Diabetes Technol Ther. 2023 Oct 18. doi: 10.1089/dia.2023.0364.

Real World Data: Control IQ

	Baseline (Basal-IQ)	12-mth control-IQ use	P
All users			
No. of participants	9010	9010	
Mean sensor glucose [mg/dL]	164 (146–185)	152 (140–166)	<0.001
Sensor time <54 mg/dL [%]	0.10 (0.00–0.30)	0.15 (0.06–0.30)	<0.001
Sensor time 54–70 mg/dL [%]	0.8 (0.3–1.8)	0.9 (0.4–1.6)	0.053
Sensor TIR [%]	63.6 (50.0–75.7)	73.6 (64.5–81.8)	<0.001
Sensor time 180–250 mg/dL [%]	25.1 (18.0–31.1)	19.7 (14.2–24.3)	<0.001
Sensor time >250 mg/dL [%]	8.1 (2.9–16.7)	4.6 (1.9–9.5)	<0.001
Coefficient of variation [%]	33.7 (30.0–37.6)	32.9 (29.5–36.3)	<0.001
GMI	7.2 (6.8–7.7)	6.9 (5.6–7.3)	<0.001
T1DM users			
No. of participants	7813	7813	
Mean sensor glucose [mg/dL]	163 (141–190)	151 (134–170)	<0.001
Sensor time <54 mg/dL [%]	0.01 (0.00–0.35)	0.02 (0.00–0.4)	<0.001
Sensor time 54–70 mg/dL [%]	0.9 (0.3–1.9)	0.9 (0.5–1.7)	0.123
Sensor TIR [%]	63.2 (49.8–75.1)	73.5 (64.4–81.6)	<0.001
Sensor time 180–250 mg/dL [%]	25.2 (18.2–31.0)	19.7 (14.3–24.2)	<0.001
Sensor time >250 mg/dL [%]	8.3 (3.1–16.9)	4.7 (2.0–9.6)	<0.001
T2DM users			
No. of participants	378	378	
Mean sensor glucose [mg/dL]	158 (138–184)	150 (136–169)	<0.001
Sensor time <54 mg/dL [%]	0.00 (0.0–0.07)	0.04 (0.01–0.10)	<0.001
Sensor time 54–70 mg/dL [%]	0.2 (0.0–0.6)	0.2 (0.0–0.6)	0.337
Sensor TIR [%]	69.9% (55.1–82.6)	78.0% (66.2–86.1)	<0.001
Sensor time 180–250 mg/dL [%]	23.9 (14.6–32.0)	19.0 (12.4–25.5)	<0.001
Sensor time >250 mg/dL [%]	3.6 (0.7–10.4)	2.3 (0.8–6.7)	<0.001

Data are expressed as median (IQR) unless otherwise specified.
GMI, glucose management indicator; IQR, interquartile range; T1DM, type 1 diabetes; T2DM, type 2 diabetes; TIR, time in range.

T1D: TIR increased from 63% to 73%

T2D: TIR increased from 69% to 78%

Breton MD, et al. Diabetes Technol Ther. 2021 Sep;23(9):601-608

AiDAPT Study (T1D, Pregnancy)

- N=124 T1DM pregnant participants < 14 weeks gestation RCT AID vs standard care
- Primary Outcome=% TIR 63 to 140 mg/dL from week 16 gestation until delivery
- Utilized Dexcom G6 with CamAPS app on smartphone with Dana insulin pump, Glucose targets 81-90 mgL

Table 2. Primary and Secondary Maternal Glucose Outcomes.*

Outcomes	Baseline†		Antenatal Intervention Phase‡		
	Closed Loop (N=59)	Standard Care (N=59)	Closed Loop (N=59)	Standard Care (N=61)	Adjusted Treatment Difference (95% CI)§
Primary outcome					
Percentage of time with glucose level in range 63–140 mg/dl	47.8±16.4	44.5±14.4	68.2±10.5	55.6±12.5	10.5 (7.0 to 14.0)¶
Key secondary outcomes					
Percentage of time with glucose level >140 mg/dl	48.7±18.0	51.8±16.2	29.2±10.6	41.4±13.2	−10.2 (−13.8 to −6.6)
Percentage of overnight time with glucose level in range 63–140 mg/dl (11 p.m. to 7 a.m.)‖	47.4±20.8	44.5±16.6	70.8±11.2	56.7±13.6	12.3 (8.3 to 16.2)
Other secondary outcomes					
Percentage of time with glucose level in range 63–180 mg/dl	71±16	68±15	87±9	80±10	6 (3 to 9)
Percentage of time with glucose level >180 mg/dl	26±17	28±16	11±9	17±11	−5 (−8 to −3)
Glucose area under the curve >120 mg/dl	39.5±23.7	41.3±19.7	19.3±12.2	27.9±12.9	−7.4 (−11.1 to −3.7)
Mean glucose level — mg/dl	149±28	151±24	125±14	136±16	−9.2 (−13.7 to −4.7)
Glycated hemoglobin level — %	7.6±1.1	7.9±1.3	6.0±0.5	6.4±0.5	−0.3 (−0.5 to −0.1)
Glucose SD — mg/dl**	54±14	55±12	42±11	47±10	−4.5 (−7.3 to −1.6)
Glucose coefficient of variation — %	36±5	37±6	33±5	34±5	−1.1 (−2.5 to 0.3)

Lee TTM, et al. N Engl J Med. 2023 Oct 5. doi: 10.1056/NEJMoa2303911.

Technology Use and Glycemic Outcomes during Pregnancy with Type 1 Diabetes

Satish K. Garg, M.D., and Sarit Polsky, M.D., M.P.H.

Table 1. Unknowns about Closed-Loop Use in Pregnancy.

Unanswered Question	Hypotheses	Challenges
When should closed-loop therapy be initiated?	Preconception closed-loop initiation is likely to improve maternal and fetal outcomes.	Nearly 50% of pregnancies are unplanned. This approach may be cost-prohibitive.
Will closed-loop use be beneficial in persons with a glycated hemoglobin level <6.5% at the start of pregnancy?	Closed-loop use in pregnant patients with low glycated hemoglobin levels will still reduce hypoglycemia.	Some patients are unwilling to relinquish glucose control during pregnancy.
Should a closed-loop system have a pregnancy-specific glucose target range or an algorithm?	Both options are likely to be beneficial for maternal and gestational health outcomes.	This may require buy-in from manufactures and regulators.
Can closed-loop use early in pregnancy avoid all adverse maternal and neonatal health outcomes?	Adverse health outcomes would be significantly reduced but not completely eliminated.	Some outcomes are affected by nonglycemic factors (e.g., preeclampsia).
Can closed-loop use help pregnant patients with type 2 diabetes or gestational diabetes?	Anyone requiring intensive insulin treatment will benefit from closed-loop use in pregnancy.	Substantial education or resources are needed with closed-loop initiation, which may be cost-prohibitive.

Garg SK, Polsky S. N Engl J Med. 2023 Oct 5. doi: 10.1056/NEJMe2310798

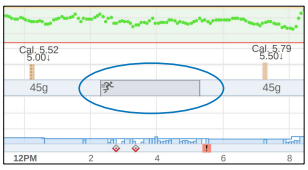
Clinical Scenarios

Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
Director, Education & Training in Diabetes Technology

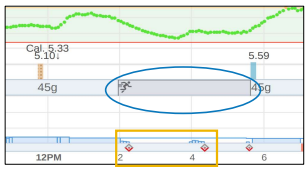
Case 1: Rebound Hyperglycemia

Case 2: Exercise

Case 3: More Optimal Exercise



Glucose steady

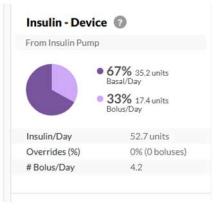


Glucose trending down
Insulin suspended

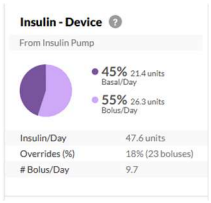
Exercise Activity increases target to 140-160 ★

Case 4: Fake Carbs

Case 5: Overrides



- vs



InPen

- Delivers up to 30 units of insulin per dose
- Delivers in ½-unit increments
- Disposable needles (not included)
- 1 year life span
- Does not require charging
- Comes in blue, gray, and pink
- Integrates with Apple Health and Glooko
- Requires a prescription, uses cartridges
- Compatible with: Humalog, NovoLog, and Fiasp U100 3.0 mL prefilled cartridges
- Multiple pens can be paired to the InPen app.

https://www.companionmedical.com/InPen

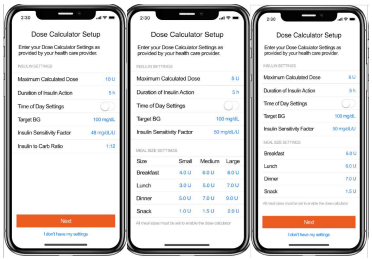
Bigfoot Unity Diabetes Management System

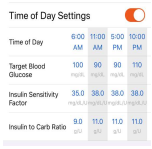
- Cleared by the FDA for ages over 12 years
- Smart insulin pen caps fits onto most commercially available insulin pens
- 2 versions of the pen cap:
  - Black for basal and white for bolus
- Uses glucose data from Freestyle Libre 2 CGM
  - Scan the sensor with the pen cap
- Recommended dose displayed by pen cap
  - 3 options based on small, medium large or carb counts
- Will not recommend insulin within 3 hours of last dose
- Records when a dose was taken (pen cap off for >4 seconds)
- Pen caps are rechargeable

Lilly Tempo Smart Button

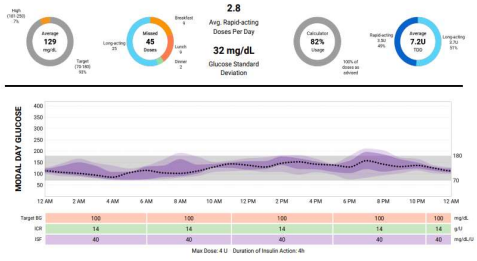
- Tempo pen available with Lyumjev, Basaglar, Humalog
- Button uses Bluetooth to transfer insulin dose to mobile app
- TempoSmart App integrates insulin dosing data with glucose, food, exercise, and sleep data
- Set personalized reminders and alerts
- Basal dose optimization

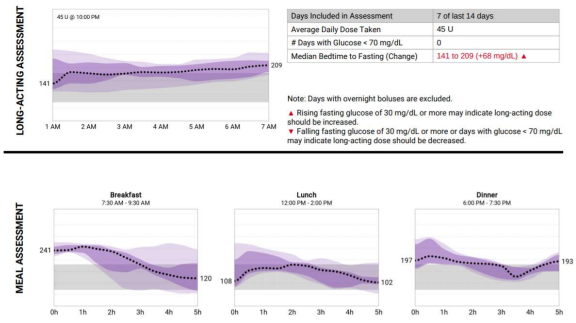
Therapy Settings





Connected Pen + CGM Data





In Summary

- There are several CGM, connected pen and insulin pump options, and the DCES can help PWD select the best device for their individual needs
- New era of hybrid closed loops
- No artificial pancreas yet, but we are getting closer to closing the loop
- Connected data can be used to discussion diabetes self-management with the person with diabetes and help to make meaningful changes-think DATAA

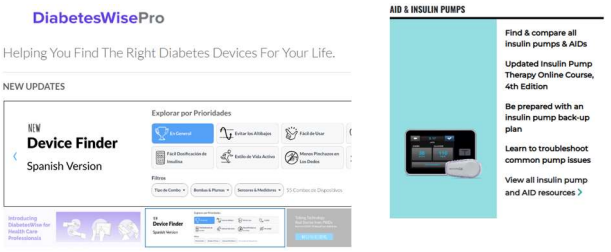
Resources

Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES, FADCES, FCCP
Director, Education & Training in Diabetes Technology

Collaborate: How to Share Data

System:	Associated Mobile Apps	Data Sources
Glooko	Glooko	Insulin pumps (Omnipod, T:slim X2), Dexcom, Eversense, many glucose meters, InPen
Clarity	Dexcom G6, G7, Clarity, Dexcom Follow, Undermyfork, Sugarmate	Dexcom, InPen
LibreView	LibreLink, LibreLinkUp, Libre 14 day, Libre 2, Libre 3	Libre 14 day, Libre 2, Libre 3
Carelink	Guardian Connect, Carelink	770G, Guardian CGM, InPen
Tidepool	Tidepool Mobile	Insulin pumps (770G, T:Slim X2, Tandem, Omnipod), Dexcom, Guardian, Libre, many glucose meters, InPen
T:Connect	T:Connect Mobile	T:Slim X2, G6
Eversense Data Management System	Eversense	Eversense
InPen Insights Report	InPen	InPen, Dexcom, Guardian Connect
Bigfoot Unity	Bigfoot Unity	Bigfoot Unity pen cap, Libre 2
Tempo Platform	TempoSmart	TempoSmart Button, Dexcom

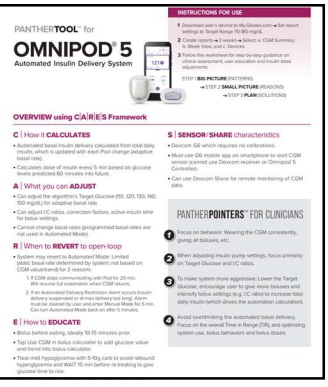
Learn All About the Tech



https://pro.diabeteswise.org/

https://www.diabeteseducator.org/danatech/home)/

Panther Tools



Panther Tools

	iLet Bionic Pancreas	MiniMed™ 780G	t:slim X2™ Control-IQ™	Omnipod® 5
				
CALCULATE	**iLet**	**780G**	**Control-IQ**	**Omnipod 5**
What is automation called?	iLet Bionic Pancreas	SmartGuard™	Control-IQ™	Automated Mode
Basal automation?	Insulin Automation is initialized by entering user's weight. Basal insulin delivery adjusts every 5 minutes based on CGM glucose trends and adapts over time based on the iLet's analysis of the user's daily glucose patterns.	"Auto Basal" calculated from total daily insulin, which is updated each day at midnight. Auto Basal is adjusted every 5 min based on recent CGM glucose trends, aiming for the target glucose value.	Increases or decreases the programmed basal rates based on a 30 min prediction of CGM glucose, aiming for the target glucose range.	"Adaptive Basal" calculated from total daily insulin, which is updated at each Pod change. Adaptive Basal is adjusted every 5 min based on a 60 min prediction of CGM glucose, aiming for the target glucose value.
Bolus automation?	All meal bolus doses and correction bolus doses are automated.	Auto correction boluses (max. every 5 min) if glucose is > 120 mg/dL. Auto corrections can be turned on or off.	Auto correction boluses (max once/hr) if glucose is predicted to be >180 mg/dL in 30 min.	No automated boluses
Algorithm target glucose / target range?	3 target options: "Usual", "Lower", "Higher"	3 target options: 100, 110, 120 mg/dL	Target range: 112.5-160 mg/dL	5 target options: 110, 120, 130, 140, 150 mg/dL
Which insulin does the user give?	User completes a meal "announcement" to prompt the iLet to deliver a meal bolus, which involves indicating the carbohydrate amount for each meal ("Usual for Me"/ "More" than usual/ "Less" than usual).	User gives boluses for meals by entering total grams of carbs in the bolus menu / bolus calculator. User can deliver correction boluses as needed in the bolus menu / bolus calculator.		

Diana Isaacs, PharmD
Instagram/Twitter: @dianamisaacs
Podcast: Diabetes Dialogue available at
https://www.hcplive.com/podcasts/diabetes-dialogue

From Dis-Ease to Well- Being

Beverly Thomassian, RN, MPH, BC-ADM, CDCES
Founder, DiabetesEd Services

From Dis-Ease to Well- Being. Assessment Tools & Coping

- State strategies to assess and address social determinants of health
- Discuss health care delivery systems using a person-centered approach
- List screening tools that can help detect depression, trauma and cognitive decline
- Describe psycho-social and emotional barriers to diabetes self-management
- Provide strategies for healthcare professionals to identify and overcome barriers to self-care.

Psychosocial Care

- Inspired by
- Psychosocial Care for People with Diabetes: A Position Statement of the American Diabetes Association
- New Language for Diabetes

Psychosocial Care for People With Diabetes: A Position Statement of the American Diabetes Association

Deborah Young-Hyman[1], Mary de Groot[2], Felicia Hill-Briggs[3], Jeffrey S. Gonzalez[4], Korey Hood[5] and Mark Peyrot[6]

Author Affiliations

Corresponding author: Deborah Young-Hyman, younghyd@od.nih.gov.

Diabetes Care 2016 Dec; 39(12): 2126-2140.
https://doi.org/10.2337/dc16-2053

Check for updates

Well-Being Key Goal of Care

- Clinical outcomes, health status, and well-being are key goals of diabetes self-management education and support
- Address as part of routine care
- Psychological and social barriers can impair the ability for self-care and lead to poor health outcomes.

Providing Successful Diabetes Care

- Set up delivery systems using chronic care model of pro-active instead of re-active.
- Assess the unique needs of each individual
- Encourage and support diabetes self-management
- All treatment decisions are made in conjunction with the person's preferences, needs & values.
- Person centered care.

Warm-Up Poll Question

- TR is a health care professional getting ready to take their certification exam. They are interested in providing more person-centered care. Which of the following statements verifies they are on the right track?

1. Adherence to the diabetes self-care plan takes time.
2. Motivating individuals to engage in their self-management is the first step.
3. Adult learners do best when provided a step-by-step demonstration.
4. Creating mutual agreement on the plan for next steps.

Diabetes Care and Education Specialist (CDCES) Definition

"A compassionate teacher and expert who, as an integral member of the care team, provides collaborative, comprehensive, and person-centered care and education for people with diabetes"

When I get lost or discouraged, I remember my why.

2022 National Standards for Diabetes Self-Management Education and Support

Diabetes Care 2022;45:484–494 | https://doi.org/10.2337/dci21-2396

How do Diabetes Specialists Help?

How Do Diabetes Educators Help?

- AADE7™ Self-Care Behaviors:

Healthy eating | Being active | Monitoring | Taking medication | Problem-solving | Healthy coping | Reducing risks

From Dis-Ease to Well-Being

FIVE critical times to provide and modify DSMES

1) At diagnosis.
2) When not meeting treatment goals.
3) Annually
4) When complicating factors develop (medical, physical, psychosocial).
5) When transitions in life and care occur.

Powers MA, Bardsley JK, et al. DSMES Consensus Report, The Diabetes Educator, 2020
ADCES. AADE7 Self-Care Behaviors, The Diabetes Educator, 2020

(cdc.gov/diabetes/professional-info/training.html)

Diabetes Self Management Ed Benefits

- Improved knowledge
- Lower weight
- Improved quality of life
- Reduced mortality
- Positive coping
- Reduced cost
- Increased primary care, preventive services
- Less frequent use of acute care
- More likely to follow best practice recommendations

Elevator Pitch: *I help people with diabetes get to their best health through collaboration and education.*

DSMES is for Everyone

- All people with diabetes should participate in diabetes self-management education and support to facilitate the knowledge, decision-making, and skills mastery for diabetes self-care.
- Assess clinical outcomes, health status, well being and support.
- Person centered
- Digital coaching
- Identify barriers
- Eval SDOH
- Consider barriers

DSMES is underutilized

Despite the benefit of DSMES, data from the 2017 and 2018 Behavioral Risk Factor Surveillance System of 61,424 adults with self-reported diabetes indicate that

53% of individuals eligible for DSMES through their health insurance receive it

Social Determinants of Health and Equity

- Recognize the need to provide person-centered services that embrace each individual and acknowledge their SDOH.
- Goal is to increase health equity through access to this critical service while focusing *more* on person-centered care and decreasing administrative complexities.

Poll Question 2

- LS has type 1 diabetes and reports to clinic with unusual hyperglycemia and some weight loss. Tells you they barely have enough money to pay for rent and food. What are you considering?
- A. Disordered eating
- B. Food insecurity
- C. Insulin rationing
- D. Diabetes distress

Tailor Treatment for Social Context

- Consider individualized care and provide resources
- These factors impair ability to self-manage diabetes.
  - 20% of people with food insecurity have diabetes
  - Financial barriers can lead to less healthy food choices and inability to access medications.
  - Lack of housing – 8% of people without homes have diabetes.

1. Improving Care and Promoting Health in Populations: *Standards of Care in Diabetes—2024*

Tailor Treatment for Social Context

- Consider individualized care and provide resources
  - Migrant and seasonal workers at higher risk of diabetes due to stress, food insecurity, lack of med care
  - Health literacy limits ability to navigate HC systems
  - Social capital/ Community Support
    - Health inequities related to Social Determinants of Health
  - Need to make more community connections through Community Health Workers

1. Improving Care and Promoting Health in Populations: *Standards of Care in Diabetes—2024*

Incl

tes

Members of the lesbian, gay, bisexual, transgender and queer (LGBTQ) community have unique health disparities and worse health outcomes than their heterosexual counterparts, which has clinical relevance in the delivery of diabetes care and education.[1] Diabetes care and education specialists are in a pivotal position to help this medically-underserved and vulnerable population get the best possible care.

Definitions[2]

Gender Identity: One's internal sense of being male or female, neither of these, both, or another – female/woman/girl, male/man/boy, other gender(s) (e.g. 58 gender options for Facebook users).

Gender Expression: The physical expression of one's gender identity through clothing, hairstyle, voice, body shape, etc. - feminine, masculine, other.

Sex Assigned at Birth: The assignment and classification of people as male, female, intersex or another sex based on a combination of anatomy, hormones and chromosomes – female, male, other/intersex.

Sexual Orientation: Sexually attracted to men, women, other gender(s).

Romantic/Emotional Orientation: Romantically attracted to men, women, other gender(s)

Transgender: An umbrella term for people whose gender identity and/or gender expression differs from what is typically associated with the sex they were assigned at birth.

Cisgender: A term used to describe people who are not transgender, i.e., who identify with the gender assigned at birth. "Cis-" is a Latin prefix meaning "on the same side as," and is therefore an antonym of "trans-."

Content provided by Theresa Garnero, APRN, BC-ADM, MSN, CDE

Look Beyond – What impacts DSM

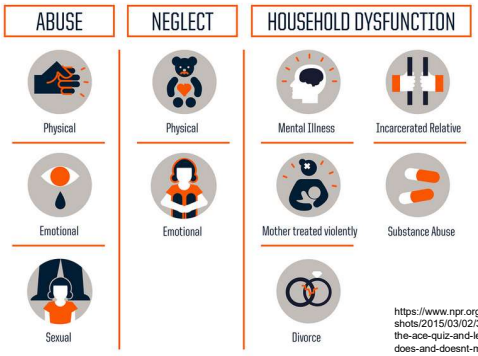
- Improving diabetes treatment outcomes requires looking at multiple factors:
  - Living situation
  - Adequacy of medical management
  - Duration of diabetes
  - Weight gain / weight loss
  - Other health related problems
  - Social structural factors
  - Childhood trauma – Adverse Childhood Experiences

Question - What is ACE?

- ACE =
  - Adverse
  - Childhood
  - Experiences
    - (before 18 yrs)
- What is the relationship between childhood trauma, diabetes and health?

www.AcesAware.org

10 Assessment Areas for ACE – Use 10 Question Screening Tool to Assess

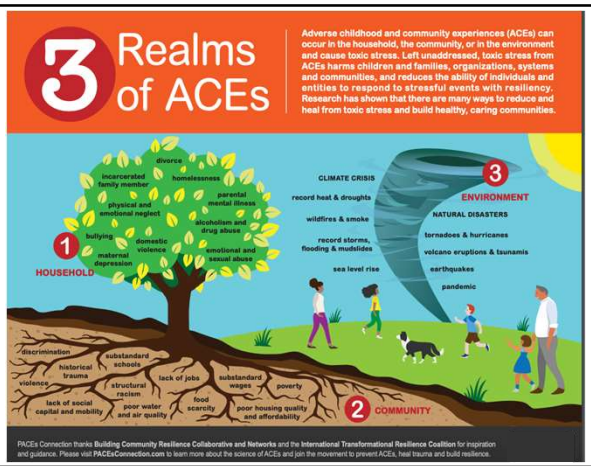


https://www.npr.org/sections/health-shots/2015/03/02/387007941/take-the-ace-quiz-and-learn-what-it-does-and-doesnt-mean

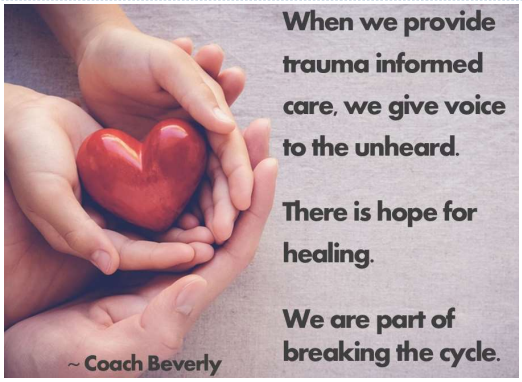
ACE increases risk for 9 out of 10 leading causes of death in US

Leading Cause of Death	Odds Ratio with ≥ 4 ACEs
Heart Disease	2.1
Stroke	2.0
Diabetes	1.4
Kidney Disease	1.7
Cancer	2.3
Alzheimer's	4.2
Suicide(attempts)	37.5

https://www.cdc.gov/vitalsigns/aces/index.html



The Act of Recognition is Healing



Other factors - Assess Literacy

- Numeral
  - 130 could look same as 310, 013
- Health
  - Not sure how to use the health system
  - Prescriptions, appointments, insurance coverage
- Functional
  - Ability to use reading, writing and computation at levels adequate to everyday situations (checkbooks, signs, apps)

Poll question 3

- Which of the following strategies are best used when someone has low literacy skills?
  - A. speak slowly and clearly
  - B. underline key points on educational materials
  - C. direct the teaching to the support person and encourage reinforcement.
  - D. be concrete and focus on problem solving

Teaching Approaches: Low Literacy

- Be Concrete
- Word usage (be sensitive!)
- Identify 1-2 messages
- Be patient, use teaching aids
- Small group- problem solving
- Tech level - video, computer, printed info, "apps"
- Engage support people

Quick Self-Assessment

- LS arrives late for appointment and says they forgot their log book. LS has only been taking their metformin a couple times a week and has gone back to getting fast food each morning for breakfast.
- What feelings would this evoke?
  - LS doesn't care
  - Non-compliant
  - Lazy
  - Better scare them
  - Exasperation

curiosity

Expectancy Theory and Language

- When we label people, we form biases.
- We act out behaviors based on this label.
  - Providers also modify behavior in response to label
- The person labeled may take on attributes of that label.
- Do our language choices lead to clinical inertia?

Limit Advice Giving, Expand Curiosity

- As the person with diabetes is sharing their "story", we might be thinking of a whole range of solutions that will fix the situation.
- The truth is, the person sitting across from us knows what will fix the situation. Our goal is to help them in the process of self-discovery.
- By being curious and asking questions, we can help them explore different strategies and determine the best fit.
- "What would you like to work on today?"

"Our goal is to help in the process of self-discovery"

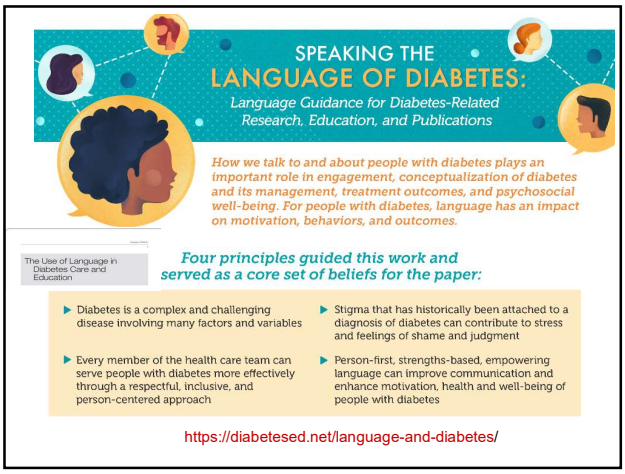
Guiding Language Principles

Strength Based

- Emphasize what people know, what they *can* do.
- Focus on strengths that empower people

Person-first

- Words that indicate awareness
- Sense of dignity
- Positive attitude toward person with diabetes



Take a Strength Based Approach

- Individuals asked to take active role in directing the day-to-day planning, monitoring, evaluation and problem-solving.
- Need to eval perceptions about their own ability and self-efficacy to manage diabetes
- Explore past situations where they have had past success
- Use strength-based language

Highlight What The Person Is Doing Right

- Our belief in people's ability to change is powerful.
- We can transmit our belief in others through body language, affirmation and encouragement.
- When we use a strength-based approach, confidence in success increases – for both parties.
- Use phrases like, "You've overcome this in the past and I believe in your ability to figure out what will work best for you now.

"Mindfulness-based Interventions"

- Avoid compliance model
- Focus on empowerment and acceptance
- Mindfulness
  - "Pay attention-on purpose "
  - Non-judgmental
  - In-the-present
  - Better chance to be present to life and become less reactive to the tides of distraction.
  - Really HEAR your clients!

Poll Question 4

Which phrase represents the principles for communicating with and about people living with diabetes?

A. Your BMI indicates you are in the obese category

B. Your fasting blood sugar is above normal

C. You should try and exercise 150 minutes a week.

D. You are checking your blood sugar daily.

Psychosocial Assessment

- Integrate psychosocial care using a collaborative, person centered approach for all people with diabetes, to optimize health outcomes and health-related quality of life

- Assess for:
  - Anxiety
  - Cognitive capacities
  - Depression
  - Distress
  - Disordered eating
- Use validated tools
- Initial visit & periodically
- If over 65, screen for depression & cognitive impairment

Anxiety – Exaggerated response to normal fears

- Anxiety
- Symptoms - (must have 5 for over 6mo's)
  - restlessness,
  - keyed-up or on-edge
  - easily fatigued
  - difficulty concentrating or mind going blank
  - irritability
  - muscle tension
  - sleep disturbances

Diabetes causes fear –

- Hypoglycemia
- Complications
- Living with chronic condition

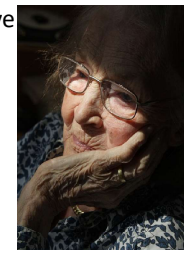
- Impact of Anxiety
  - 1.Counterreg hormones
  - 2. Self-care behavior diminishes

Keeps forgetting insulin

- Cheerful and fun loving
- At diabetes support group, isn't feeling well
- BG 493
- Ran out of insulin "a while ago"

Cognition, Alzheimer's and Dementia

- Diabetes increases risk of cognitive impairment
  - 73% increased risk of dementia,
  - 56% increased risk of Alzheimer's
  - 127% increased risk of vasculature dementia
  - Cognitive impairment influences treatment goals
  - Less intensive, realistic, get support
- People with Alzheimer's and dementia are more likely to get diabetes
  - Rates increase over time



Cognitive Impairment Treatment

- Treatment:
  - Refer to specialist for assessment
  - Achieve optimal BG control
  - Pharmacist to evaluate drug safet and potential drug interactions
  - Keep physically active
  - Nutrition and gut health
  - Community engagement and support

Poll Question 6

- A 47 year old enters your office and says, "the doctor made me come here. I don't know why, I just have borderline diabetes". A1c is 8.7%. What is the most appropriate response?
  - A. Based on your A1c level, it looks like you have diabetes.
  - B. We don't use the term "borderline diabetes anymore
  - C. Let's just start with carb counting.
  - D. It sounds like you aren't sure why you are here.

Adaptation to the Emotional Stress of Chronic Disease

(Kubler-Ross, Rubin RR, WHPolonsky)

Denial	Don't agree, but listen Acknowledge Survival Skills only!
Anger	Indicates: Awareness, Learning Begins Be clear, concise instructs No long WHY answers
Bargaining	ID's w/ others Group classes good Ed: "what" pt. wants to know
Depression & Frustration	Realize permanency of DSC Tx Psycho-social support referral Emphasize + change made
Accept & Adapt	Sense of responsibility for Self-care;

Depression

- Characterized by depressed mood
- Loss of interest in activities usually found pleasurable
- Difficulty concentrating, sleeping, changes in appetite
- Difficulty in following through with self care behaviors
- Person may actually be experiencing diabetes distress.

NAME:_____ DATE:_____

Over the last 2 weeks, how often have you been bothered by any of the following problems?
(use "√" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself – or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite – being so figety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3
add columns		+	+	

PHQ- 9
Quick Depression Assessment

- If there are at least four 3s in the shaded section (including Questions #1 and #2), consider a depressive disorder. Add score to determine severity.
- Consider Major Depressive Disorder - if there are at least five 3s in the shaded section (one of which corresponds to Question #1 or #2)
- Consider Other Depressive Disorder - if there are two to four 3s in the shaded section (one of which corresponds to Question #1 or #2)

My spouse doesn't want to hear

- Living with type 1
- Afraid to exercise due to risk of hypoglycemia
- Afraid to go to sleep for fear of going low even though has CGM and pump
- Spouse does not want them to share about day-to-day diabetes issues.

Diabetes Distress (DD)

DD refers to the *expected* worries, concerns, fears, and threats that are associated with a demanding chronic disease (e.g., management struggles, threats of complications, loss of functioning, access to care).

DD can show itself in many forms

Most common:

- May not show itself outwardly.
- Feelings of frustration, powerlessness, hopelessness.
- Pronounced fear of hypos or complications.
- Avoidance of tough feelings "Who me?" "Everything is fine."
- Burnout because of all of the management tasks, frustrating results, dealing with insurance.
- Anger/frustration with providers: distrust, no-shows.
- Hyper attention to CGM screens and excessive BG checking.

DDS 17: Diabetes Distress Scale

- Yields a total Diabetes Distress Scale score plus 4 sub scores:
  - Emotional burden
  - Physician related Distress
  - Regimen related Distress
  - Interpersonal Distress

Begin a conversation with any item rated 3 or more – See Distress Scale in your resources page

- 44.5% of reported diabetes distress
- Only 24% of providers asked pts how diabetes affected their life (DAWN Study)

Diabetes Distress – Assess Annually


Type 1 Diabetes Distress Scale (T1-DDS)

www.behavioraldiabetes.org

https://professional.diabetes.org/sites/default/files/media/ada_mental_health_toolkit_questionnaires.pdf.

Poll question 7

- You assess that a person with new LADA is struggling with diabetes distress. What is an appropriate intervention?
- A. Encourage them to ask their provider about starting antidepressants.
- B. Set a SMART goal that is very challenging to help move them forward.
- C. Support them in making a realistic goal
- D. Remind them that alcohol is actually a depressant

Mental health – Build a Foundation

- Although the educator might not feel qualified to treat psychological problems, optimizing the individual / educator relationship as a foundation to increase likelihood of acceptance.

- Determine if help is needed
- Have a list of mental health providers
- Resource list of phone helplines
- Help individual problem solve to get access
- If individual cannot act on behalf of themselves, help identify a support person

Psychosocial Assessment

Problem Areas In Diabetes (PAID) Scale

Instructions: Which of the following diabetes issues are **currently** a problem for you? Tick the box that gives the best answer for you. Please provide an answer for each question.

		Not a problem	Minor problem	Moderate problem	Somewhat serious problem	Serious problem
1	Not having clear and concrete goals for your diabetes care?	☐0	☐1	☐2	☐3	☐4
2	Feeling discouraged with your diabetes treatment plan?	☐0	☐1	☐2	☐3	☐4
3	Feeling scared when you think about living with diabetes?	☐0	☐1	☐2	☐3	☐4
4	Uncomfortable social situations related to your diabetes care (e.g. people telling you what to eat)?	☐0	☐1	☐2	☐3	☐4
5	Feelings of deprivation regarding food and meals?	☐0	☐1	☐2	☐3	☐4
6	Feeling depressed when you think about living with diabetes?	☐0	☐1	☐2	☐3	☐4
7	Not knowing if your mood or feelings are related to your diabetes?	☐0	☐1	☐2	☐3	☐4
8	Feeling overwhelmed by your diabetes?	☐0	☐1	☐2	☐3	☐4
9	Worrying about low blood glucose reactions?	☐0	☐1	☐2	☐3	☐4
10	Feeling angry when you think about living with diabetes?	☐0	☐1	☐2	☐3	☐4
11	Feeling constantly concerned about food and eating?	☐0	☐1	☐2	☐3	☐4
12	Worrying about the future and the possibility of serious complications?	☐0	☐1	☐2	☐3	☐4
13	Feelings of guilt or anxiety when you get off track with your diabetes management?	☐0	☐1	☐2	☐3	☐4
14	Not accepting your diabetes?	☐0	☐1	☐2	☐3	☐4
15	Feeling unsatisfied with your diabetes physician?	☐0	☐1	☐2	☐3	☐4
16	Feeling that diabetes is taking up too much of your mental and physical energy every day?	☐0	☐1	☐2	☐3	☐4
17	Feeling alone with your diabetes?	☐0	☐1	☐2	☐3	☐4
18	Feeling that your friends and family are not supportive of your diabetes management efforts?	☐0	☐1	☐2	☐3	☐4

ADA provides screening tools for specific psychosocial topics, such as diabetes distress, fear of hypoglycemia, and other relevant psychological symptoms- See Resource Page https://professional.diabetes.org/sites/default/files/media/ada_mental_health_toolkit_questionnaires.pdf.

Psychosocial Assessment

Informal check in or can utilize more formal assessments

- Adverse Childhood Experiences – ACE – early childhood experience can affect health outcomes for life. Read more about ACE here.
- Psychosocial Care for People with Diabetes: A Position Statement of the American Diabetes Association 2016. (See chart below excerpted from Position Statement)
- Diabetes Distress Scale
- PHQ-9 Depression Screening Scale
- PAID – Problem Areas in Diabetes Survey – Pediatric Version Youth perceived burden of type 1 diabetes.
- General Health Numeracy Test – A 6 question assessment on numeral literacy
- The **Mini–Mental State Examination (MMSE)** or Folstein test is a 30-point questionnaire that is used extensively in clinical and research settings to measure cognitive impairment. It is commonly used in medicine and allied health to screen for dementia.

Consider Referral to Mental Health Provider for Eval and Treatment

- Diabetes distress even after tailored education
- Screens positive for depression, anxiety, FoH*
- Disordered eating or disrupted eating patterns
- Not taking insulin/meds to lose weight
- Serious mental illness is suspected
- Youth with repeated hospitalizations, distress
- Cognitive impairment or impairment of DSME
- Before bariatric/metabolic surgery

*FoH – Fear of Hypoglycemia

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Care in Diabetes—2024*
American Diabetes Association Professional Practice Committee

Empowering and Promoting Health for Individuals and Populations

Our Actions Make a Difference

Move away from term "Non-Compliance"

- People with diabetes are asked to take active role in directing the day-to-day planning, monitoring, evaluation and problem-solving.
- Non-compliance denotes a passive, obedient role or "following doctor's orders" without any input
- Need to eval perceptions about their own ability and self-efficacy to manage diabetes

Empowerment Defined

- "Helping people discover and develop their inherent capacity to be responsible for their own lives and gain mastery over their diabetes".
- Posits:
  - Choices made by individuals (not HCPs) have greatest impact.
  - Individuals are in control of their self-management
  - The consequences of self-management decisions affect the individual most. It is their right and responsibility to be the primary decision makers.

Traditional vs Empowerment Based

Traditional vs Empowerment Based

Table 3.5 *Comparison of Traditional and Empowerment –Based DSME and DSMS*

Traditional DSME and DSMS	***Empowerment-Based DSME and DSMS***
Diabetes is a physical illness.	Diabetes is a biopsychosocial illness.
Professional is viewed as teacher and problem solver, and responsible for outcomes.	Patient is viewed as problem solver and self-manager: professional acts as a resource and shares responsibility for outcomes.
Learning needs are usually identified by professional	Problems and learning needs are identified by patient.
Education is curriculum-driven.	Education is patient-centered and consistent with adult learning principals.
Education is primarily didactic.	Patient experiences are used as learning opportunities for problem solving and serve as the core for the curriculum.
Emotional issues are a separate component of the curriculum.	Emotional issues are integrated with clinical content.
Behavioral strategies are used to increase compliance with recommended treatment.	Behavioral strategies are integrated with clinical content and taught to patients to help them change behaviors of their choosing.
Goal of education is compliance/adherence with recommendations.	Goal is to enable patients to make informed choices.
A lack of goal attainment is viewed as a failure by both the patient and the educator.	A lack of goal attainment is viewed as feedback and used to modify goals and action plans.
Behavior changes are externally motivated.	Behavior changes are internally motivated.
Patients is relatively powerless, professional is powerful.	Patient and professional are equally powerful.

Source: Adapted from MM Funnell, RM Anderson, "Patient empowerment: from revolution to evolution," Treat Strategies Diabetes 3 (2011): 98-105.

This philosophy is important to know for the exam

How to Succeed with Person-Centered Coaching

- A diagnosis of diabetes often carries a significant emotional response. A person with diabetes might report shame, fear, and guilt as they come to terms with their diagnosis and anticipate their future. As diabetes healthcare providers, we can learn to address these feelings while helping people move forward!
- Using a person-centered approach, we can identify the individual's strengths and expertise and then leverage this information to open a door of possibilities.
- Our choice of communication techniques can spark behavior change in people living with diabetes.

Motivational Interviewing

- The primary goal is to evoke intrinsic motivation and commitment to change by creating a collaborative and non-judgmental atmosphere.
- The approach recognizes that individuals often have mixed feelings about changing their behaviors, and it aims to guide them towards resolving this ambivalence in a positive and constructive manner.

Motivational Person-Centered Coaching

- **Express Empathy:**
  - Active listening and empathy
  - Open ended questions
  - Understand the individual's perspective without judgment
  - Individual feels heard and understood.
- **Develop Discrepancy:** recognize discrepancy between their current behavior and their broader goals, values, or aspirations.
- **Roll with Resistance:** Rather than confronting or challenging resistance, "roll with it." Acknowledging and respecting resistance while gently exploring its roots and potential effects.
- **Support Self-Efficacy:** enhance belief capacity to change. Identify and reflect on their past successes, skills, and resources to achieve their goals.
- **Develop a Plan:** If ready to change, help them create a concrete plan for moving forward. This plan is collaboratively developed, with the client taking an active role in defining the steps they're willing to take.
- **Avoid Arguing and Confrontation:** since can lead to resistance and defensiveness. Instead, seek to understand the client's perspective and work from there.

Mindfully Listen to the individuals' problems and fears.

Listening and then reflecting back the struggles of the individual is the first phase of energizing the visit.	"It's hard to eat more vegetables because you are a long-haul truck driver."
Focus on curiosity before exploring possible changes in behavior can provide comfort and open the door to insights.	"As a truck driver, I am curious to learn more about your food choices when driving."
With a person-centered approach, spend more time in the "curiosity" phase before moving to the "action" phase."	
Listen for insights and ideas, "what are your ideas about how you can improve this situation?"	"I could buy a veggie tray before heading out in my truck,"
Ask questions and collaborate	"So, you think you could buy a vegetable tray before heading out?"

FIVE M'S
FOR DIABETES SELF-MANAGEMENT

- Use the 5 M's approach to help the person with diabetes find their expert within.

Based on 5 M Framework Tool by Funnell et al. www.DiabetesEd.net

Informed vs Wise Decisions

- Informed:
- I know that tomatoes are a fruit.

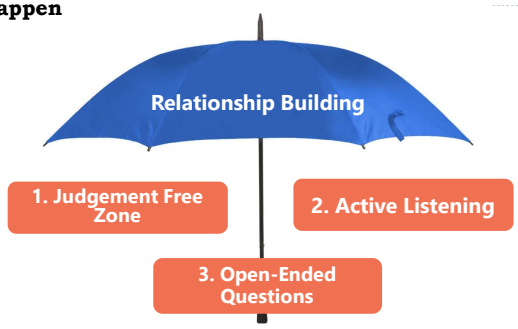
- Wise
- I know not to put tomatoes in my fruit salad.

Avoid and Lean Into

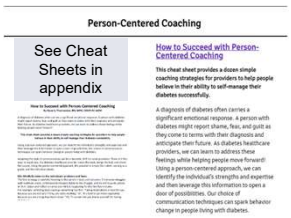
- **AVOID: Pressure, fix, or control.**
- We are careful to avoid forced solutions or controlling language. Our job is to help the person with diabetes find their own answers and solutions.
- **Let's stop "Shoulding" on people**.
- It's time to let go of terms like "You must, you should, you have to, it's better, it's important, do it for me" since they fall under the category of "controlling motivation"—which can be hurtful and lead to the individual becoming defensive or shutting down.
- **Ditch the scare tactics too!**

- Lean into - A person-centered approach energizes individuals to take the lead in managing their condition, in step with their providers and supporters.

Relationship Building | Three Tools To Make It Happen



SMART Goals


Person-Centered Coaching

How to Succeed with Person-Centered Coaching

This cheat sheet provides a dozen simple coaching strategies for providers to help people believe in their ability to self-manage their diabetes successfully.

A diagnosis of diabetes often carries a significant emotional response. A person with diabetes might report shame, fear, and guilt as they come to terms with their diagnosis and anticipate their future. As diabetes healthcare providers, we can learn to address these feelings while helping people move forward! Using a person-centered approach, we can identify the individual's strengths and expertise and then leverage this information to open a door of possibilities. Our choice of communication techniques can spark behavior change in people living with diabetes.

See Cheat Sheets in appendix

Support Self-Confidence

- Support positive expectations for change…
  - emphasize personal responsibility,
  - instill confidence and hope,
  - increase sense of ability to cope.

"From what you've told me about your past successes…it really seems like you can do this!"

Step 8

Take Care of Yourself

- Get enough sleep
- Keep active
- Remind yourself that you are not responsible for the decisions of others. Love and release.
- Connect with friends and family
- Investigate unhealthy behaviors
- Nourish your body
- Consider a hobby

Celebrate and Recognize

In conclusion: Celebrate and Recognize Each Person's Efforts.

- Making behavior changes, like losing weight or adjusting lifelong eating habits, can be extremely difficult.
  - **Find a way to recognize and affirm their efforts even if there is no or little change in clinical measures.**

Our belief in people makes a difference!

Your Turn

- What actions have you initiated to improve diabetes care in your community?
- What barriers did you overcome?
- Any words of wisdom to pass along to your fellow diabetes advocates?

DiaBingo - N

N DPP demonstrated that exercise and diet reduced risk of DM by__%
N Average A1c of 7% = Avg BG of ____
N The goal is to eat 14 gms per 1000 cals of this nutrient a day
N Rebound hyperglycemia
N Scare tactics are effective at motivating behavior change
N Get LDL less than ____for most people with diabetes 40 years+
N Drugs that can cause hyperglycemia
N 2/3 cups of rice equals _____ serving carbohydrate
N 1% A1c = how many points of blood sugar _____
N One % drop in A1c reduces risk of complications by ___ %
N 1 gm of fat equal _____kilo/calories
N Metabolic syndrome = hyperinsulinemia, hyperlipidemia, hypertension
N Average American consumes 15 teaspoons of sugar a day.
N Medication derived from the saliva of the Gila Monster

See you Tomorrow at 0800

Jessica Jones, MS, RDN, CDCES will present on Medical Nutrition Therapy.