Diabetes Education SERVICES

Advancing Your Career in Diabetes Education

DiabetesEd Specialist Virtual Conference

Syllabus – Day 2

October 7, 2021

DiabetesEd Specialist Virtual Course*
Day Two

Time	Topic	Speakers
7:30am – 8:00am	**Login / Welcome**	
8:00 – 9:30	**Insulin - the Ultimate Hormone Replacement Therapy**	Diana Isaacs, PharmD, BCPS, BCACP, BC-ADM, CDCES and Beverly Dyck Thomassian, RN, BC-ADM, MPH, CDCES
9:30 – 9:45	**Break**	
9:45 – 10:45	**Insulin Pattern Management and Dosing Strategies**	
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, Recognizing Trauma and Self-Care Strategies**	

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**Topics and Timing Subject to Change – 8/11/2021*

Diabetes Education SERVICES

CELEBRATING 20 OVER 20 YEARS

Virtual DiabetesEd Specialist Course Part 1 – Day 2

www.DiabetesEd.net

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Welcome to Day 2

- Courses recorded and available for viewing within 1 week.
- Login to Online University for recorded version, take quiz, get CEs
- Bryanna is here to help! Please email questions or to info@diabetesed.net or call 530-893-8635
- Type in questions during course. Will address as time allows during designated Q & A periods

2

Insulin – Ultimate Hormone Replacement Therapy

Diana Isaacs, PharmD, BCPS, BCACP, CDCES, BC-ADM, FADCES, FCCP
Endocrine Clinical Pharmacy Specialist
CGM and Remote Monitoring Program Coordinator
Cleveland Clinic Diabetes Center

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Disclosures

- Diana Isaacs, PharmD, BCPS, BCACP, CDCES, BC-ADM, FADCES, FCCP declares the following disclosures:
- Speaker: Abbott, Dexcom, Novo Nordisk, Insulet, Medtronic
- Consultant: Lilly
- CBDCES Credentialing Committee

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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

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Learning Objectives

- 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 smart insulin pens

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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).

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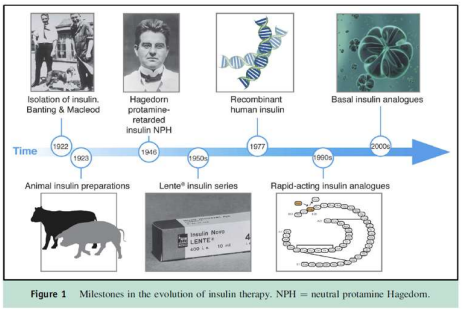

Figure 1 Milestones in the evolution of insulin therapy. NPH = neutral protamine Hagedorn.

Evolution of Insulin: From Human to Analog. Joseph M.Tibaldi, MD American Journal of Medicine, 2014

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Evolution of Insulin

- Earlier insulins derived from bovine and porcine pancreas
- All human insulin now made from recombinant DNA technology
  - Modification of human insulin molecules
  - Overcame problems with human insulin
    - Onset of action
    - Duration of action
    - Absorption

Candido R, et al. Diabetes Ther. 2018; 9(3):927-949.

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Basal aka "Background" Insulin

- The liver plays a major role in maintaining glucose levels by regulating the process of gluconeogenesis and glycogenolysis in the liver
- Excessive hepatic glucose productive 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.

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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" a high glucose

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

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Physiologic Insulin Release

- **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.

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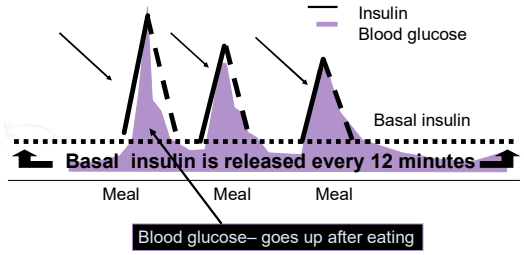
Normal Insulin Release:
Individuals without diabetes

Insulin bolus occurs in the first 10 minutes after eating



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Available Insulins

- None of the commercially available insulins are as fast as true physiologic insulin (as made from a person without diabetes)
- Almost all insulin is injected (SC or IV)
- Oral insulin is not available and degrades too quickly
- One inhaled insulin option (Afrezza®)

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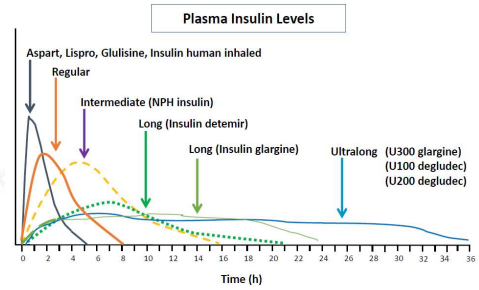
Insulin Profiles



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

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Insulin PocketCard™

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Action		Insulin Name	Onset	Peak	Effective Duration	Considerations
Bolus	Very Rapid Acting Analogs	Aspart (Fiasp)	2.5 min	~60 min	3-5 hours	Bolus insulin lowers after-meal glucose. Post meal BG reflects efficacy. Basal insulin controls BG between meals and nighttime. Fasting BG reflects efficacy. Side effects: hypoglycemia, weight gain. Typical dosing range: 0.5-1.0 units/kg body wt/day. Discard open vials after 28 days. For pen storage guidelines, see package insert.
		Lispro-aabc (Lyumjev)	1 min	~60 min	4-5 hours	
	Rapid Acting Analogs	Aspart (Novolog)	5 - 15 min	30 - 90 min	< 5 hrs	
		Lispro (Humalog*/ Admelog)				
		Glulisine (Apidra)				
	Short Acting	Regular*	30 - 60 min	2 - 3 hrs	5 - 8 hrs	
Basal	Intermediate	NPH	2 - 4 hrs	4 - 10 hrs	10 - 16 hrs	
	Long Acting	Detemir (Levemir)	3 - 8 hrs	No peak	6 - 24 hrs	
		Glargine (Lantus*/ Basaglar/Semglee)	2 - 4 hrs		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. © 2021

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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) 2020.

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

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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 © 2021

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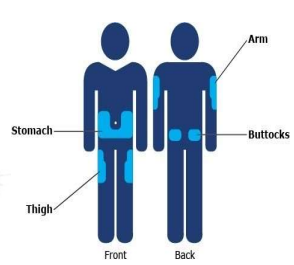
Insulin Injection Sites



Sites should be rotated

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Insulin Key Counseling Points

- Do not shake insulin
- Cloudy insulin (NPH or pre-mixed) should be rolled before use so suspension is uniform
- Pens should be primed before use to get air bubbles out
- 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.

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Priming insulin

- 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 of the air is out
- Do this every time an insulin pen injection is given

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Importance of Insulin Storage

- Insulin is a peptide hormone drug
- It is susceptible to changes in stability when exposed to environmental factors
- These factors accelerate physical and chemical degradation
- Proper storage maintains insulin's potency and enables precise dosing
- Changes in insulin potency contribute to variability in glucose levels
- Precise dosing is essential to achieve glucose targets in diabetes

Heinemann, L et al. J Diabetes Sci Techno. 2020.

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Insulin Storage Before First Use

- All insulin formulations should be stored in a refrigerator at 2℃ to 8℃ (36℉ - 46℉) to keep their quality until the expiration date
- Max temperature 8℃ (46℉)
- Never allow to freeze
- Products are good until expiration date

Heinemann, L et al. J Diabetes Sci Techno. 2020.

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Insulin Storage Once Open

- Insulin can be stored at room temperature up to 25℃ or 30℃ (77℉ or 86℉)
- No need to keep in fridge
- Injecting cold insulin may be uncomfortable
- Do not expose to direct sunlight
- Products are available to help keep cold or room temperature
- Good for 28-56 days once open

Heinemann, L et al. J Diabetes Sci Techno. 2020.

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Insulin & Expiration

Type		Expiration Once Open
Long Acting		
Toujeo	Glargine U-300	56 days
Lantus, Basaglar, Semglee	Glargine U-100	28 days
Tresiba	Degludec U-100, U-200	56 days
Rapid Acting		
Novolog, Fiasp	Aspart	28 days
Humalog, Admelog	Lispro U-100, U-200	28 days
Apidra	Glulisine	28 days
Lyumjev	Lispro-aabc	28 days

Package Inserts

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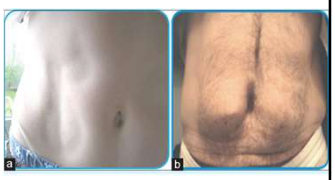
Insulin Teaching Keys

- Rotate
- Stay 1" away from previous site
- Don't re-use syringes/needles
- Look for:
  - Lipodystrophy
  - Lipohypertrophy
- Proper disposal
- Review patient's ability to withdraw and inject.



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Sharps Disposal: Product and Info

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

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Side Effects of Insulin

- Weight Gain
- Lipodystrophy
- Hypoglycemia

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

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How to Dose Insulin

Diabetes Education Services

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Type 1 Diabetes (T1D)

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

Basal Insulin + Bolus Insulin

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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

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

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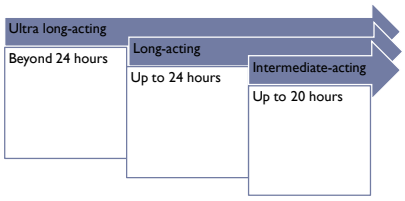
Types of Basal Insulin



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

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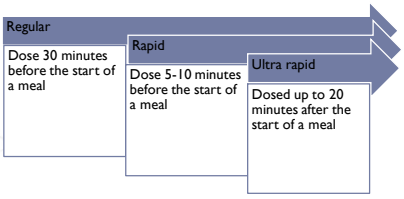
Types of Bolus Insulin



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

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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

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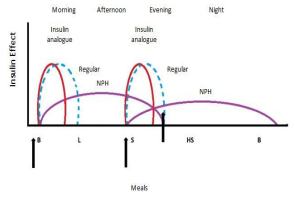
Intermediate-acting Insulin + Regular Insulin or Insulin Analog



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.

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Method 1 Example

- Lacy has T1D and prefers a simple regimen with less insulin injections. She also has difficulty paying for the more expensive insulin analogs. Lacy takes the following regimen:
  - Insulin NPH 27 units QAM and 13 units QPM (intermediate insulin)
  - Insulin regular 13 units QAM and 7 units QPM (regular insulin)
- She has the option of using a 70/30 formulation dosed twice daily or
- She can mix NPH and regular insulin if using vials (not commonly done anymore)

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Patient Education: Mixing Insulin

- NPH can be mixed with regular or rapid-acting insulins when using vials
- Inject air into NPH vial first (# of units for the NPH dose) and pull syringe out without NPH
- Then inject air into regular or rapid-acting insulin vial (# of units for the regular or rapid-acting dose) and this time draw out the exact amount of insulin
- Then put syringe filled with regular or rapid-acting insulin into NPH vial and draw out the full dose of NPH
- This is a way to reduce injections, but isn't commonly done anymore
- Other insulins should not be mixed!

ADCES. Insulin injection resources

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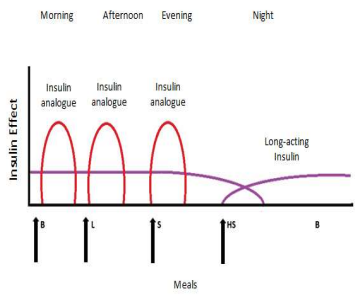
Long-acting Insulin with Insulin analog



Long-acting serves as basal insulin analog serves as bolus

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Method 2 Example

- Genie is 15 years old and newly diagnosed with T1D. She weights 60kg and is started on 0.5 units/kg/day. (30 units total)
- She takes insulin glargine 15 units once daily (long-acting insulin)
- She takes insulin lispro 5 units TID a.c. (rapid-acting insulin)
- Question: Can these types of insulins be mixed?
- **NO**

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Carbohydrate Ratio

- Insulin to carbohydrate ratio (ICR)
  - 1 unit of insulin is expected to cover X grams of carbohydrates
- Rule of 450 (regular insulin) or 500 (rapid acting insulin) 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.

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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.

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An Example: Meet Larry

- Larry 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
- Larry 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

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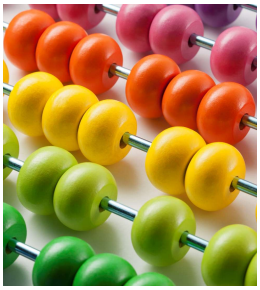
Larry Calculation cont'd

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



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Answer and Explanation

- ICR=500/20=25
  - This means that 1 unit of insulin covers 25 grams of carbohydrate
  - If Larry 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 85mg/dL
  - Larry's glucose target is 100
  - If his current glucose is 185, he should take 1 extra unit of insulin

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Correction Bolus (Common Scale)

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

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Correction Bolus (Common Scale)

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

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Poll Question 1

- How much insulin does a person with type 1 diabetes need a day?
  a. About 1 unit per pound per day
  b. No more than 0.5 units/kg per day
  c. Approximately 5 units/kg per day
  d. About 0.5 to 1.0 units/kg per day

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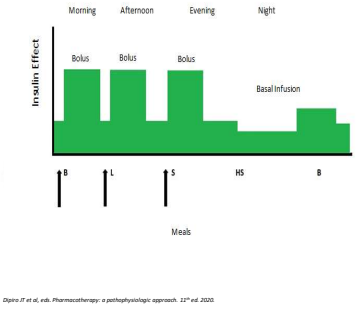
Insulin Pump Therapy



Regular or insulin analogs serve as both the basal and bolus

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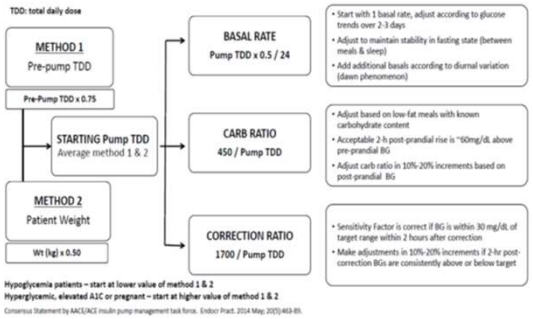
Initial Pump Calculations



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Nick is a 21 year old male about to start insulin therapy

- Weight: 72kg
- Weight based dosing
  - 72*0.5=36 units
- Basal=36/2=18 units
  - If using injections, plan for a basal of 18 units daily
  - If using a pump, start at 18/24=0.75 units/hour

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Nick's Bolus Settings

- Rule of 500 for insulin to carb ratio
  - 500/36=13.88
  - What does this mean?
    - 1 unit of insulin is expected to cover 14 grams of carbohydrate
- Rule of 1800 for sensitivity factor
  - 1800/36=50
  - What does this mean?
    - 1 unit of insulin is expected to lower glucose by 50 points

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In Depth: Types of Insulin

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So Much Insulin…

- Regular insulin
  - Novolin R, Humulin R
- Neutral protamine hagedorn (NPH) insulin
  - Novolin N, Humulin N
- Long-acting insulin
  - Glargine (Lantus®, Semglee® Basaglar®), Detemir (Levemir®), Degludec (Tresiba®)
- Rapid-acting insulin
  - Lispro (Humalog®, Admelog®, Lyumjev®), Aspart (Novolog®, Fiasp®), Glulisine (Apidra®)
- Pre-mixed insulin
- Inhaled insulin
  - Afrezza®
- Concentrated insulin
  - Humulin R U-500
  - Glargine U-300 (Toujeo®)
  - Degludec U-200 (Tresiba®)
  - Lispro U-200 (Humalog®, Lyumjev®)

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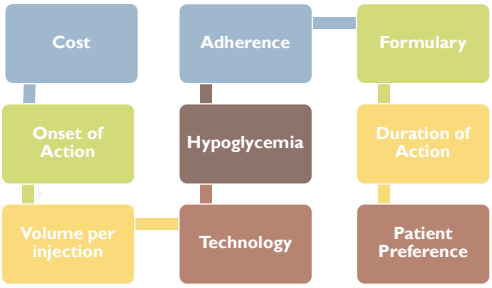
Insulin Selection



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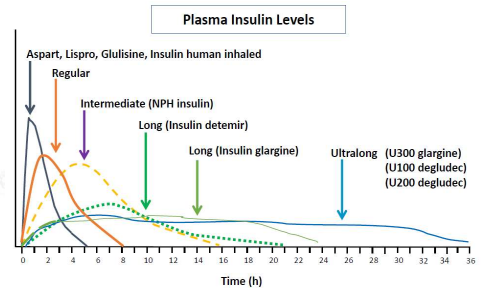
Insulin Profiles



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

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Biosimilar and Follow-On Insulin

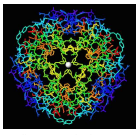
- The expiration of patents for brand name insulin opens up the insulin market worldwide to manufacturers of insulin copies or biosimilars
- Can't use the term generics for *large* molecule biologicals because they are manufactured in living organisms (bacteria and yeast)
- Terminology
  - **Biologic products**: large, complex molecules produced through biotechnology in a live system such a microorganism, plan cell or animal cell
  - **Biosimilar**: a biologic product highly similar and has no clinical meaningful difference from an FDA-approved reference product
  - **Follow-on product**: copies of biologic products approved under the Food, Drug, and Cosmetic Act 505b2 pathway

White J et al. J Pharm Technol. 2019; 35(1):25–35.

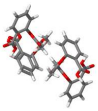
56

Follow-On Insulin

- Follow-on insulin products usually require a separate prescription (not directly interchangeable)
  - Examples:
  - Insulin glargine (Lantus), follow-on products (Semglee, Basaglar),
  - Insulin lispro (Humalog), follow-on product (Ademlog)
- Recently the FDA announced that Semglee that can be interchangeable with Lantus



Insulin – Large Molecule



Aspirin – Small Molecule

57

Poll 2 - 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

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Generic Insulins

- Insulin aspart
- Insulin lispro

- About half the cost of the brand name
- Exact same formulation!

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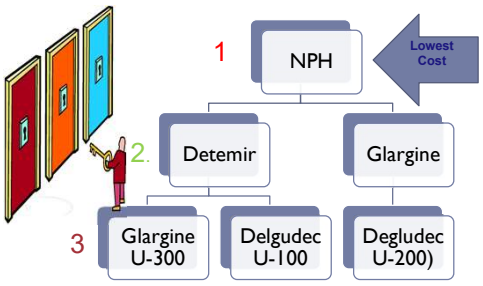
Combo Sub-Q Insulin

Insulin Type	Onset	Peak
Humalog Mix 75/25: 75% NPL, 25% lispro 50/50: 50% NPL, 50% lispro	0.25 - 0.5 hr	0.5-6.5 hrs
NovoLog Mix 70/30: 70% NPA, 30% aspart	0.25 - 0.5 hr	1 – 4 hrs
NPH + Reg Combo 70/30: 70%N /30%R 50/50: 50%N /50%R	0.5 – 1.0 hr	2 - 16 hrs

60

Choice of Basal Insulin



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

61

Basal Insulins

Intermediate Acting	Peak Action	Duration
NPH	4-12 hrs	12-24

Long Acting	Peak Action	Duration
Detemir	No Peak	20 hrs
Glargine U100		24 hrs
Glargine U300		over 24 hrs
Degludec U100, U200		42 hrs

Fasting BG reflects efficacy of basal
Half of TDD in Type 1 Diabetes

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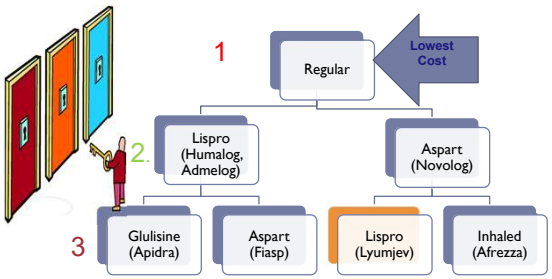
Basal Insulin Summary

- Covers in between meals, through night
- Starts working slow (4 hours)
- Stays in long (12-42 hours)
- Fasting blood glucose and pre-meal glucose levels reflect effectiveness
- Fix fasting first

63

Choice of Bolus Insulin



1. Slowest, 2. Medium, 3. Quickest

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Bolus Insulins
(½ of total daily dose ÷ meals)

Action		Insulin Name	Onset	Peak	Effective Duration
Bolus	Very Rapid Acting Analogs	Aspart (Fiasp)	2.5 min	~60 min	3-5 hours
		Lispro-aabc (Lyumjev)	1 min	~60 min	4-5 hours
	Rapid Acting Analogs	Aspart (Novolog)	5 - 15 min	30 - 90 min	< 5 hrs
		Lispro (Humalog*/ Admelog)			
		Glulisine (Apidra)			
	Short Acting	Regular*	30 - 60 min	2 - 3 hrs	5 - 8 hrs

Inhaled Insulin

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 ©2021

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Bolus Insulin Timing

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

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Poll Question 2A

- Mary takes 4 units 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 breakfast BG of 190
3. Before lunch BG of 69
4. 2 hour post breakfast BG of 154

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Bolus Insulin Summary

- Starts working fast (5-30 mins)
- Gets out fast (3-6 hours)
- Post meal BG reflects effectiveness
- Should comprise about ½ total daily dose in T1D
- Covers food or corrects for hyperglycemia
- In many people: 1 unit
  - Covers ≈ 10 -15 gms of carb
  - Lowers BG ≈ 30 – 50 points
  - Tons of exceptions to this though!

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Introducing the Faster Insulins

69

Aspart (Fiasp)

- Faster aspart formulation, which includes the addition of niacinamide (vitamin B3) to increase absorption speed
- Appears in blood in ~ 2.5 mins
- Faster onset
- Can be taken as long as 20 minutes <u>after</u> starting a meal
- Fiasp available in Flex Touch Pens and 10mL vials, U100
- FDA approved for insulin pumps

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Lispro-aabc (Lyumjev) (LOOM-jehv)

Lyumjev is insulin lispro-aabc injection.

- 2 strengths:
  - U-100 (100 units per mL)
    U-200 (200 units per mL).
- In studies, lispro-aabc appeared in circulation approx 1 minute after injection
- FDA approved for use in insulin pumps
- May dose up to 20 minutes after the start of the meal.

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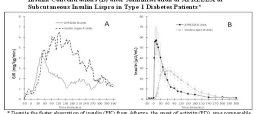
Afrezza – Inhaled Insulin

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.

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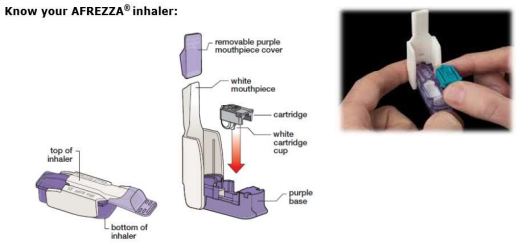
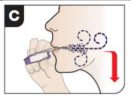
Afrezza Inhaler

Know your AFREZZA® inhaler:





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.

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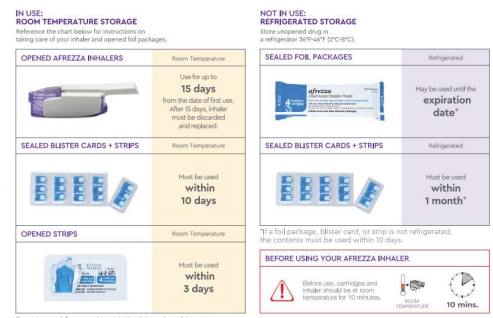
Afrezza Storage



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

74

Afrezza Dosing and Considerations

- Bolus regular 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, smokers
    - Can cause acute bronchospasm – Black box warning
- Side effects:
  - Hypoglycemia, sore throat, cough
  - Less hypoglycemia than injected insulin

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Concentrated Insulin

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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

77

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.

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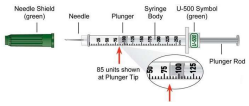
U500 example

- A woman with obesity, T2D, and insulin resistance takes insulin detemir 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.

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Concentrated Insulin

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.**		

- Advantages of Tresiba U200 and Toujeo U300 is that the pens go up to 160 units/injection
- Humalog and Lyumjev U200 have less volume per injection and more units in pen (600 vs. 300)

80

Barriers to Insulin Use

Diabetes Education SERVICES

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Quick Question 3

- 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. Tell me why.

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

82

Psychological Insulin Resistance (PIR)

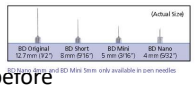
- 50% of providers in study threatened pts "with the needle".
- Less than 50% of providers realized insulins' positive effect on type 2 DM
- Most pts don't believe that insulin would "better help them manage their diabetes".
- Solutions: Find the root of PIR and address it

Diabetes Attitudes, Wishes, Needs Study - Rubin

83

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
- ½ the patients who could benefit from insulin are not using it due to needle phobias
- Also consider insulin pumps, patches, and inhaled insulin



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Intensifying Injectable Therapy in Type 2 DM

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Intensifying Injectable Therapy – Type 2

- Consider GLP-1 RA first
- Start basal insulin 10 units or 0.1 to 0.2 units/kg day
- Titrate up 2 units every 3 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.

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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 the number of injections required.

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Insulin/Injectable Combos

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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 for pts not controlled on 30 units basal insulin or GLP-1 RA • 30 units for pts not controlled 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.

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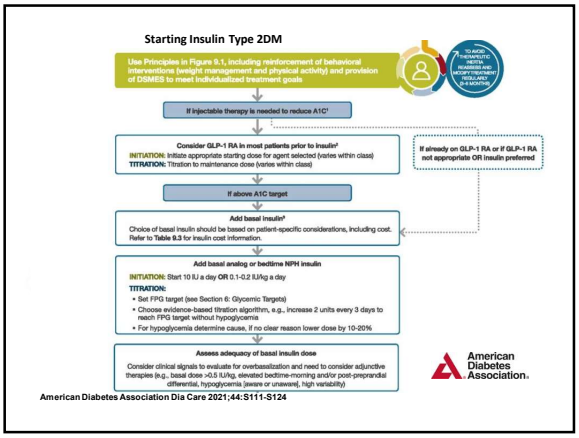

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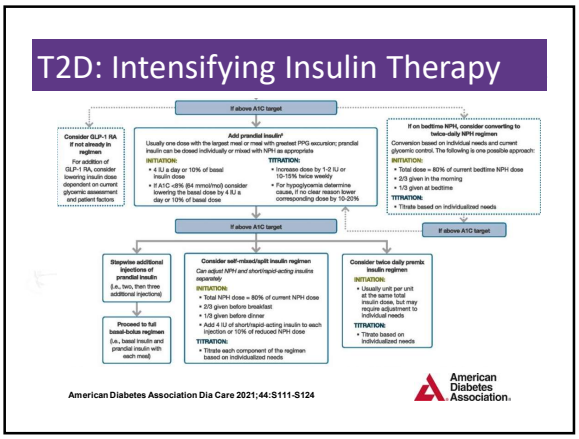

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Case Study: Jenny

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 10%. She weighs 110kg. She rarely monitors glucose. Her eGFR is 70. She previously had UTI's with empagliflozin.

What is the best recommendation to adjust this regimen?

ADA. Diabetes Care. 2020; 43(Suppl 1):S98–S110.

91

Thinking about the choices

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

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Piecing it Together

- New Regimen:
  - Insulin glargine 80 units once daily (20% reduction)
- Semaglutide 0.25mg weekly, titrated up to 1.0mg 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

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Switching Insulin

94

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.

95

Poll 3A | 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

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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 Arrezza

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.

97

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

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Insulin Pattern Management

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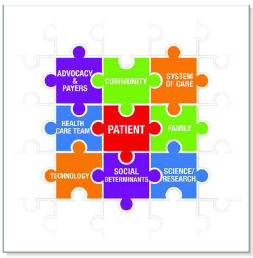
Pattern Management –AKA

How to think like a pancreas

100

What do the numbers mean?

It's like a BIG puzzle!



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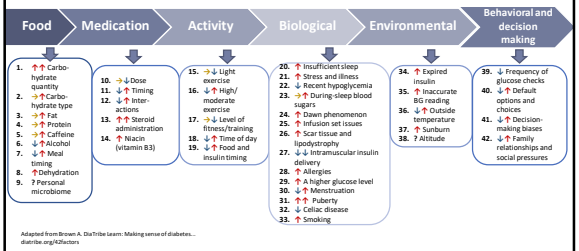
At Least 42 Factors Affect Glucose!



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Poll Question 4

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

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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)

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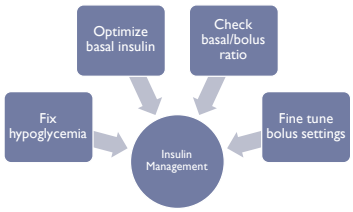
General Rules in T1DM

- Optimize basal dose (stay within 30mg/dL when not eating)



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Adjusting Insulin doses in a Basal/Bolus regimen

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

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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

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Insulin to Carb Ratio Adjustments

- Compare pre-meal BG to 2 hour post-meal BG
- Goal post-meal BG should be 30-60mg/dL higher than pre-meal BG
- If the 2 hour PPG is >60mg/dL above pre-meal
  - Decrease carb ratio by 10-20%
- If the 2 hour PPG is <30mg/dL above pre-meal
  - Increase the carb ratio by 10-20%

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Insulin Sensitivity Adjustments

- When BG is above target and correction dose is taken (without food), does glucose return to target within 3-4 hours?
- If BG is low at 3-4 hours, the ISF is likely too strong
  - Increase by 10-20%
  - Example: 50→55 or 60
- If BG is high after 3-4 hours, the ISF is too weak
  - Decrease by 10-20%
  - Example: 50→45 or 40

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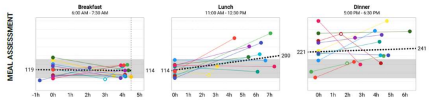
Meal Time Data Review

- Lucose 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 5 hours, glucose should return to pre-meal level



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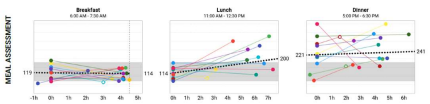
Meal Time Assessment

- Glucose is steady after breakfast
- Glucose is higher after lunch-may need more intensive medication adjustment or decrease carbohydrate intake
- Dinner is variable, often starting dinner high but also times where there is an elevation or a drop, likely needs more consistency with food and/or medications



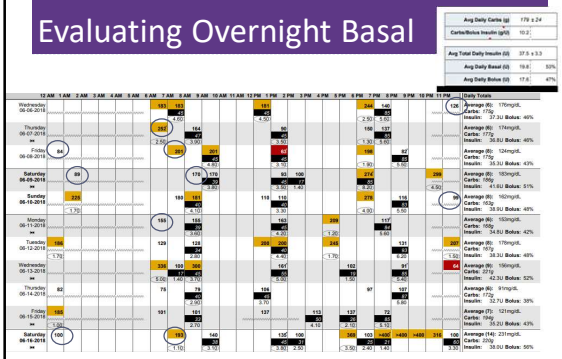
111

Pump Terminology

- Basal rate - a continuous 24-hour delivery of insulin, “background” insulin
- Bolus dose – used for carbohydrate and correction doses
- Insulin-to-carb ratio – how many grams of carbs will be covered by 1 unit of insulin
- Insulin sensitivity factor (aka correction bolus or ISF) – how much 1 unit of insulin is expected to lower glucose
- Target – the goal glucose level
- Insulin-on-board (aka active insulin time or IOB) – a pump feature that keeps track of a previous bolus

112

Evaluating Overnight Basal

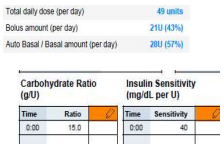


Do you see any problems?

113

Checking the Sensitivity

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

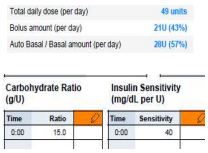


The calculation is slightly different from the current sensitivity. Look at the glucose data to determine if the sensitivity should be decreased.

114

Checking the Carb Ratio

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

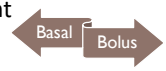


The calculation is different from the current carb ratio. Look at the glucose data to determine if the carb ratio should be decreased.

115

Insulin Pump adjustments

- Use calculations as a starting point



- Fix fasting first
  - Begin with basal rate testing
- Multiple patterns can be set throughout the day
- Alternative basal patterns can be set for sick days, menstruation, etc
- Once basal at goal, focus on bolus settings

116

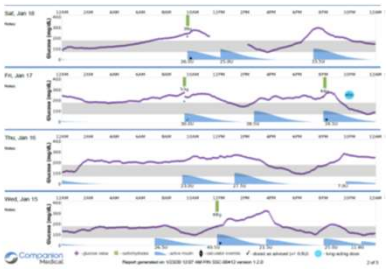
Basal Rate Testing

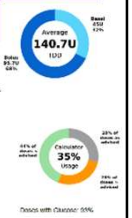
- Start with glucose 80-180mg/dL with last bolus > 4 hours
- Wear CGM or check glucose every 2 hours
- Glucose should not change by more than 30mg/dL if basal is effective
- Avoid physical activity, stress, and high fat meals before test
- Start with overnight, and then work on the rest of the day in smaller segments
- If >30mg/dL rise or fall, make basal rate adjustment, 10-20% increments

117

Connected Pen Data

- Is basal staying steady overnight?
- Are carbs entered for boluses?
- Is glucose under 180, 2 hours after meals and returning to 80-130, 4 hours after meals?





118

2 minute stretch and question break

Insulin Case Studies

Diabetes Education SERVICES

119

Case Study

- 70 yr old, weighs 100kg, eGFR=58
- History of CABG, foot ulcers, smokes
- A1c – 11.3%, BG 400-500mg/dL for weeks
- Insulin – 120 units insulin glargine qpm
- Oral Meds: Metformin 1000mg BID & canagliflozin 100mg daily

120

Case Study

- 70 yr old, weighs 100kg, eGFR 58
- History of CABG, foot ulcer, smokes
- A1c – 11.3%, BG 400-500 for past weeks
- Insulin – 120 units Lantus at hs (solostar).
- Metformin 1000mg BID & canagliflozin
- What is max basal insulin he should be taking without a prandial dose?
- Given his history, what diabetes meds would benefit him?
- Which of his meds may have adverse effects?

121

Case Study

- 70 yr old, weighs 100kg, GFR 58
- History of CABG, foot ulcer, smokes
- A1c – 11.3%, BG 400-500 for weeks
- Insulin glargine 120 units qpm
- Metformin 1000mg BID, canagliflozin 100mg daily
- What is max basal insulin should he be taking?
  - 100kg x 0.5 = 50 units a day
- Given his history, what diabetes meds would benefit him?

122

Case Study

- What can we do next to improve BG?
  - Ask about medication taking behaviors
  - Consider CGM
  - Add GLP-1
    - What about GLP-1/insulin combination?
  - Add bolus insulin:
    - 4 units bolus insulin to largest meal (or 10% of basal = 12 units)
  - Switch to 70/30 insulin ac breakfast and dinner
    - Total previous basal dose – 120 units
    - 70% in am – 84 units am
    - 30% pre dinner – 36 units pm

123

Dosing Will Not Work for This Patient

Insulin/Injectable Combos *PocketCards updated annually. Download FREE CDCES Coach App for latest updates and notifications.*

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 for pts not controlled on 30 units basal insulin or GLP-1 RA • 30 units for pts not controlled 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.

124

Case Study

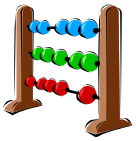
- 70 yr old, weighs 100kg, GFR 58
- History of CABG, foot ulcer, smokes
- A1c – 11.3%, BG 400-500 for weeks
- Insulin glargine 120 units qpm
- Metformin 1000mg BID, canagliflozin 100mg daily
- What will inform you of how to proceed?
  - Insurance coverage
  - His willingness to stick to a complex regimen
  - His ability to self-monitor
  - His social support and connection to his medical team

My Plan:
- Professional CGM
- Add GLP1-RA
- Stop SGLT2i (for now)
- Referral to diabetes care & education specialist
- Build rapport-discussion on medication taking behaviors

125

Quick Calculation

- If a person takes:
- 20 units of Humalog at breakfast, lunch and dinner
- Also has correction factor: 2 units for every 50 over 150 (up to 10 extra units/meal)
- A1c 8.7%
- How many vial(s) of insulin or boxes of pens should be prescribed per month?



126

Quick Calculation

- If a person takes:
- 20 units of Humalog at breakfast, lunch and dinner
- Also has correction factor: 2 units for every 50 over 150 (up to 8 extra units/meal)
- A1c 8.7%

Tip: Always round up!

- How many vial(s) of insulin or boxes of pen would he use a month?
- Vial:
  - Takes up to 100 units/day
  - 1000 units in a vial
  - 1000 / 100 = 10
  - 1 bottle lasts 10 days
  - 3 bottles a month
- Box of pens
  - 1 box of pens=1500 units
  - 1500/100-15
  - 1 box lasts 15 days
  - 2 boxes per month

127

Poll Question 5

- Mary takes 6 units lispro (Humalog) before dinner. Which BG result reflects that it was the right dose?

a. Before breakfast BG of 97
b. 1 hr post dinner BG of 189
c. Before dinner blood glucose of 102
d. 2 hour post dinner BG of 178

128

Adjusting Bolus and Correction Doses Carbohydrate-to-Insulin Ratio

Based on four questions before meals:

1. How much carbohydrate am I going to eat?
2. What is my insulin dose for this amount of carbohydrate?
3. Should I lower the dose because I plan to be very active or have recently been active?
4. Should I lower dose because my blood sugar is low?

129

Poll Question 6

- Erick uses an insulin pump with a carbohydrate ratio of 12 and correction factor of 50
- He plans to eat the following: 1 cup rice, steak, 1 c. skim milk, 1/2 banana, SF ice tea. BG 118. How much insulin should he take?
- How much insulin should he take?

a. 4.8 units
b. 6.0 units
c. 5.2 units
d. 5.0 units

What if he planned to cut the grass right after lunch which usually drops his blood sugar by 75 points?

130

Meet Erin

- Erin is a 62 year old woman with type 2 diabetes x 30 years. She recently underwent a kidney transplant 6 weeks ago. Her current DM2 medications now include: insulin glargine 40 units every morning and insulin lispro 14 units TID a.c. + ss#2 (2 units for every 50 over 150). She also takes prednisone 10 mg every morning. This is her last 7 days of glucose logs.

Day	FBG	Pre-lunch	Pre-dinner	Pre-bedtime
1	123	210	210	278
2	132	194	298	187
3	141	198	210	220
4	98	199	232	218
5	103	210	209	197
6	114	205	207	178
7	109	212	205	301

131

Key Questions to Ask Erin

- Any hypoglycemia?
- Timing and consistency of meals
- Types of meals and snacks and drinks
- Timing of insulin in regards to the meals
- Missed doses
- Changes in other medications (ex. Prednisone)

132

Erin's Plan

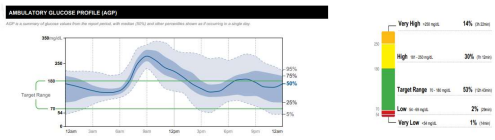
- What is the best plan for Erin?

A. Increase insulin glargine to 44 units daily
B. Increase insulin lispro to 16 units TID a.c.
C. Increase insulin glargine to 48 units daily
D. Increase insulin lispro to 16 units at lunch and dinner, continue 14 units at breakfast

133

Meet Sandra

- Sandra is a 66 year old woman with T2DM. She uses CGM for glucose monitoring. She takes metformin 1000mg twice daily, insulin degludec 70 units daily and insulin lispro 15 units TID a.c. She also has HF and osteoarthritis. eGFR=80. A1C=7.5%, 53% time in range 70-180mg/dL. CV=36.3, 3% glucose <70mg/dL



134

Questions for Sandra

- Medication taking behaviors
- What's for breakfast?
- Does she feel symptoms with hypoglycemia events, has she noticed any patterns leading up to them?

- In the discussion, we learn
  - Sandra goes low often
  - She tries to eat at night to prevent going low (a cookie)
  - She takes her insulin 1 hour after breakfast, out of fear of hypoglycemia

135

Changes to the Regimen

- Insulin degludec is too high, contributing to hypoglycemia
- Counseling on when to take meal time insulin to prevent post-prandial spike after breakfast
- New regimen:
  - Insulin degludec 60 units daily
  - Insulin lispro 15 units TID a.c.
  - Counseling on taking lispro BEFORE the meal
  - Reassess in 2 weeks

136

2 weeks later

- Hypoglycemia is mostly resolved, but there is still post-prandial hyperglycemia especially after breakfast. Which of the following are viable options?

A. Add SGLT2 inhibitor
B. Add GLP 1 agonist
C. Increase prandial insulin dose at breakfast
D. Insulin sulfonylurea

137

Meet Tori

- Tori is a 43 year old woman with T2DM for 4 years. She takes the following medications:
  - metformin 1000mg twice daily
  - glimepiride 4mg daily
  - saxagliptin 5mg daily
  - pioglitazone 15mg daily
- A1C is 10.1%. Weight is 167lbs and height is 61 inches. BMI=31.6.
- She rarely checks glucose and denies hypoglycemia

138

Meet Tori

What is the best recommendation for drug therapy intensification?

A. Increase metformin
B. Increase glimepiride
C. Increase pioglitazone
D. Start basal insulin
E. Start basal + GLP-1 agonist

139

Basal + GLP-1 Agonist

- Remember, GLP-1 agonist should be 1st injectable
- However, with high A1C, Tori is likely going to also need insulin
- A combined product would mean just 1 co-pay and allow her to start both with 1 injection
- Another option would be a weekly GLP-1 agonist and a daily insulin
- Do any of her medications need to be stopped when adding this combination?

140

Tori Worries about Weight Gain

- Tori heard that insulin will cause her to gain weight. She is concerned about weight gain. How could her regimen be adjusted to reduce weight gain?
- Which drugs on her list contribute to weight gain?

141

Case Study: AL, Cont

AL returns home from the hospital and monitors glucose. He denies any low blood glucose events.

- FBG: 160-190mg/dL
- Pre-lunch: 160-180 mg/dL
- Pre-dinner: 200-220mg/dL
- Pre-bedtime: 200-220mg/dL

Should the long-acting or meal time insulin be increased?

142

Fix Fasting First

- Titrate basal insulin to achieve fasting and pre-meal glucose targets
- In the case of AL, all of the pre-meal glucose levels are above target
- Therefore, basal insulin should be increased
- How to titrate?
  - Increase by 2 units every 3 days until fasting or pre-meal is 80-130mg/dL
  - Stop or reduce dose if hypoglycemia develops

143

Back to AL

AL is now taking insulin glargine 16 units daily and he is taking insulin aspart 4 units at meals. He asks to switch to insulin glargine U300 because he feels insulin glargine wears off too early. Current A1C = 7.2%. What is the best recommendation?

A. Insulin glargine U300 12 units daily
B. Insulin glargine U300 16 units daily
C. Insulin glargine U300 18 units daily
D. Insulin glargine U300 20 units daily

144

Case Study: Larry

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. PP breakfast=190mg/dL, PP lunch=210mg/dL, and 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 dulaglutide 0.75mg weekly, decrease insulin glargine to 45 units daily

145

Summary

- Many different types of insulin
- Basal + bolus needed for T1DM
- Weight based dosing and rules of 1800 and 500 can be used to calculate initial insulin dosing in T1DM
- Basal started for T2DM, avoid overbasalization
- Counsel patients on injection site technique, administration and storage
- Keep in mind the type of insulin and duration of action
- Fine tune insulin settings based on glucose data

146

Extra Practice

147

Types of Insulin

Activity: Match the type to the definition

A. Basal insulin
B. Bolus insulin
C. Rapid-acting insulin
D. Regular insulin
E. Intermediate-acting insulin
F. Concentrated insulin
G. Biosimilar insulin

A. Insulin for meals and correction doses (prandial)
B. Background insulin
C. Made with different excipients
D. A faster type of bolus insulin
E. More than 100 units/mL
F. A slower form of bolus insulin
G. A basal insulin that has a peak and is typically dosed twice daily in T1D

148

Types of Insulin

Activity: Match the type to the definition

1. Basal insulin B
2. Bolus insulin A
3. Rapid-acting insulin D
4. Regular insulin F
5. Intermediate-acting insulin G
6. Concentrated insulin E
7. Biosimilar insulin C

A. Insulin for meals and correction doses (prandial)
B. Background insulin
C. Made with different excipients
D. A faster type of bolus insulin
E. More than 100 units/mL
F. A slower form of bolus insulin
G. A basal insulin that has a peak and is typically dosed twice daily in T1D

149

Diabetes Education SERVICES

CELEBRATING 20 OVER 20 YEARS

Diabetes Interview – From Head to Toe & Microvascular Risk

www.DiabetesEd.net
Beverly Thomassian, RN, MPH, BC-ADM, CDCES 2021
President, Diabetes Education Services

Diabetes Education SERVICES

150

Honing Detective Skills

During interviews, outline strategies to identify previously undiscovered diabetes co-conditions

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: *Standards of Medical Care in Diabetes—2021*

American Diabetes Association

Diabetes Care 2021 Jan; 44 (Supplement 1): S40-S52. https://doi.org/10.2337/dc21-S004

+ Add to Selected Citations

151

Objectives

1. Identify common yet often under diagnosed co-conditions associated w/ type 1 and type 2 diabetes.
2. State strategies to identify and treat hypoglycemia
3. Describe the basics of a lower extremity assessment
4. Discuss barriers to sexual health and communication strategies.

152

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

153

ADA – Complete Medical Evaluation

- At initial visit to:
  - Review and confirm diabetes diagnosis
  - Look for diabetes complications
  - Investigate if there are co-conditions
  - Review previous treatment
- Begin engagement in formulation of a care management plan
- Develop a plan for continuing care

154

EV Assessment

Last Name, First Name EV Birthdate 1968 Age 52

Visit Date	Weight (up or down?)	BP/ HR	Glucose Range	Issues?
8/27/21	210↑ 208	130/82/74	40-180	not taking bolus, ↑ variability

Phone _____ Who do you live with? spouse + 12yr old Kid Feel safe? yes

How many years with diabetes? 7 (stopped-was) Family history Aunt w/ DM

How often do you check blood sugars CKing daily Highest ? Lowest BG past few weeks? 90 - 180

Hypoglycemia? Yes ___ No Y What action? Soda Have Med ID? Yes ___ No X

Diabetes Pills Metformin (GX) Empagliflozin 25, Sitagliptin 100 How often take? daily

Diabetes Injections or insulin Tresiba U 15 or Humalog, Basaglar 38 units Site check Y, abd guard

Other meds BP/ lipids/nerves Enalapril 20, Atorvastatin 40 (15 units humalog w/ meals (doesn't take)

155

EV Case Study

How many hours do you sit a day? 12 Daily activity Personal assistant, sedentary

Drinks of alcohol a day? None 1 2 3 4 5+ Tobacco 0 Marijuana/Drug use 0

Do you have chronic pain or neuropathy (Yes) If yes what tx? oxycontin 100 mg TID

Depression or other Mental health issues? Yes, No Sleep hrs 8 hrs Sex Life? Vaginal dryness

Breakfast black coffee

Lunch tortillas (2-3) Chicken, Salad or sandwich

Dinner meat + beans w/ veggies 1-2 tortillas

Snacks cereal or fruit

What beverages? water + 1x Soda a day

Referral to RD? ON _____

Health Checks Last eye exam Oct Last foot exam 1yr plus Last dental visit Sept Brush 2 Floss 1

Hepatitis Vaccine 0 Last flu shot 0 Last pneumonia vaccine 0 COVID Vaccine? yes x2

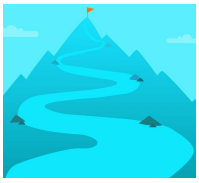
Feet/skin appearance: Some interdigit maceration, no cuts

Date	A1c Result	LDL Result	HDL Result	Trig Result	GFR	UACR	TSH / ALT/ AST
June 21	7.9%	97	41	167	760	25	1.4 OK

156

Reducing Vascular Risk Factors For Type 1 and Type 2

- Modifiable
  - Glucose
  - Smoking
  - Weight
  - Dietary Habits
  - Oral Care
  - Sleep
  - Blood Pressure
  - Lipids

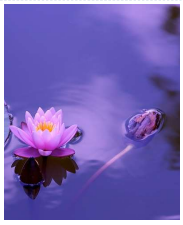


- Make small, achievable goals. We are in this for the long run.

157

Social History and Med Taking

- Eating Patterns & weight history and activity
- Sleep behaviors – goal 7 hrs
- Tobacco, alcohol, substance use
- Social supports and coping skills
- Medication taking behaviors
  - How many times a day/week are you taking this medication?
  - Complimentary meds
  - Evaluate for hyper and hypo glycemia



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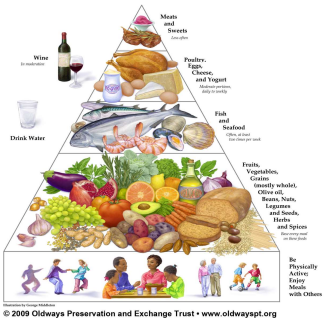
Mediterranean Diet Pyramid



159

DASH Diet – Dietary Approaches to Stop Hypertension

- The DASH diet emphasizes vegetables, fruits and low-fat dairy foods — and moderate amounts of whole grains, fish, poultry, nuts.
- Pt recommendations
  - Eat lots of whole grains, fruits, vegetables and low-fat dairy products.
  - Also includes some fish, poultry and legumes, and encourages a small amount of nuts and seeds a few times a week.
  - Red meat, sweets and fats in small amounts.
  - Focus on low saturated fat, cholesterol, total fat.

160

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

161

Diabetes is a long path

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

162

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
- 4-10 increased risk if BMI 30+ with visceral adiposity
- Treatment:
  - Lifestyle modification
  - Continuous positive oral airway pressure and devices
  - Surgery

163

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**

164

Sensory Impairment

- Hearing impairment 2xs as common in diabetes
  - Due to oxidative stress + hyperglycemia
  - Leads to cochlear microangiopathy and auditory neuropathy
- Risk factors
  - Low HDL cholesterol, coronary heart disease, peripheral neuropathy, and general poor health have been reported as risk factors for hearing impairment

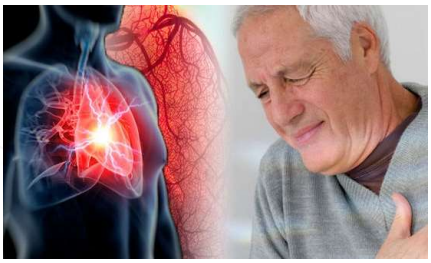
165

ABCs of Diabetes

- A1c less than 7% (avg 3 month BG)
  - Pre-meal BG 80-130
  - Post meal BG <180
- Aspirin if 50+ with CV Risk
- Blood Pressure < 140/90
  - BP target <130/80
    - **If 10 year CVD Risk > 15%**
- Cholesterol
  - Statin therapy indicated if 40+

166

Cardiovascular Disease is the Leading Cause of Death in Diabetes



167

Medication Review

- Is EV on the right medication regimen for CV risk reduction?
- How should we change EV's diabetes regimen?
- What about glucose monitoring. Is it enough?

168

EV Assessment

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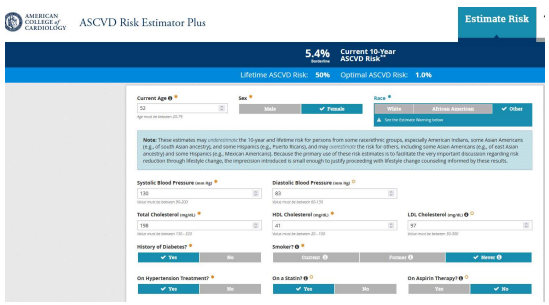
Diabetes Pills Metformin (GR) Empagliflozin 25, sitagliptin 100 How often take? daily

Diabetes Injections or insulin Victoza 0.6 on Sunday, Basaglar 38 units Site check y, abd quad 15 units humalog w/ meals (doesn't take)

Other meds BP/ lipids/nerves Amlodipine 10, Atorvastatin 40

169

CV Risk Calculator Results for



170

Poll Question 1

- Would you recommend starting aspirin therapy on EV?
- A. Yes, absolutely
- B. Probably
- C. No
- D. Would discuss pro and cons with EV

171

ADA Antiplatelet Agents

- **Over age 50 with Diabetes and 1 additional risk factor:**
  - Family history of premature CV disease
  - Hypertension
  - Dyslipidemia
  - Smoking
  - Chronic kidney disease or albuminuria

Who are not at increased risk of bleeding

- Use aspirin therapy (75–162 mg/day)
- Aspirin allergy, use clopidogrel (Plavix) 75 mg/day)

172

Diabetes Toolkit

- Meter
  - Strips that aren't expired?
- Medication supply
- Pump Supplies
- CGM Supplies
- Power back-up

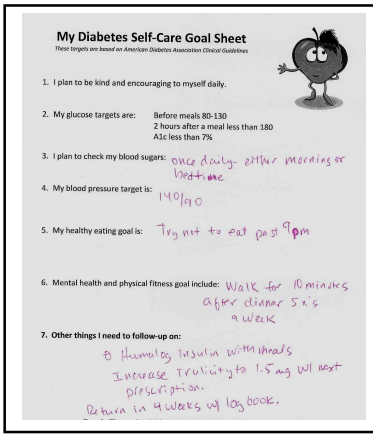
- Diabetes ID
  - Phone, medic alert, person
- Carbohydrate source
  - Granola bar, glucose tabs, GU, gummy bears
- Rescue Meds

173

Plan Changes

- Since EV isn't taking Humalog 3xs a day and A1c is 7.9%, let's stop the Humalog
- Increase Trulicity to 1.5mg
- Let's try to keep as simple as possible
- Re-evaluate in 4 weeks.

174



Goal Sheet

175

EV has the beginning of NASH

176

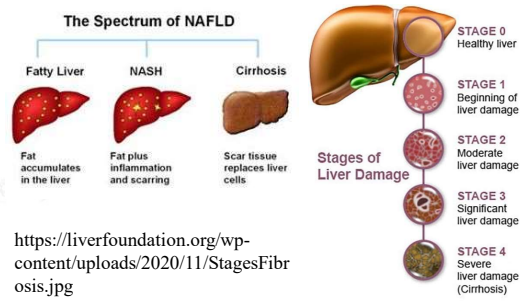
Stages of liver failure

- NAFLD – non alcoholic fatty liver disease
  - NAFL – simple fatty liver, doesn't usually progress to cause liver damage
  - NASH – non alcoholic steatohepatitis
    - Liver inflammation and cell damage.
    - Can cause fibrosis, scarring
- 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

177

Natural History of NAFLD to NASH

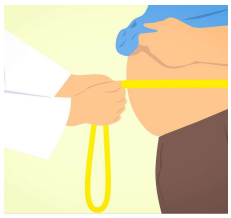


https://liverfoundation.org/wp-content/uploads/2020/11/StagesFibrosis.jpg

NASH – Non-Alcoholic Steatohepatitis

178

Fatty liver disease and diabetes



Signs include elevated alanine transaminase (ALT) and aspartate transaminase (AST).

Results are associated with higher BMI, waist circumference, and triglyceride levels and lower HDL cholesterol levels.

ADA 2021
More common with BMI 30+

179

Symptoms of Fatty Liver

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
- 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

180

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

Mayo Clinic

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Treating NAFLD

Primary Treatments: Weight loss & exercise

Loss of 7-10% linked w/ 50% drop in liver fat
Clinical Endocrinology News 12/12
Treating hyperglycemia and dyslipidemia

For biopsy proven NAFLD – these treatments improve liver histology but need long term studies ADA 2021:

- 2015 - Actos
- 2019 – Vitamin E
- 2020 - liraglutide

182

EV Dental, Eye, Kidney and Nerve Care

183

Poll Question 2

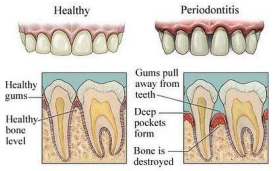
- Diabetes is associated with an increased risk of oral disease. Which of the following statements is true?

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.

184

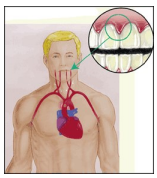
Periodontal Disease

- 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



185

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

186

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)

187

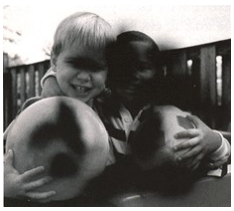
Keeping Oral Healthy

- Oral disease linked with heart disease
- Dental exams (every 6 mo's)
- Metabolic control critical
- Quit smoking
- Pts may not understand importance of dental hygiene.
- Treat infections with ATB'x, can lower A1c by 1-2%. Lowering BG shortens infection.

188

Retinopathy Changes How We See

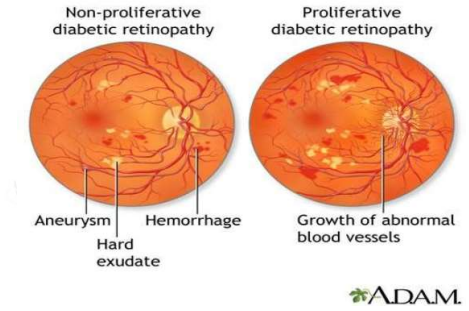
View of boys by person with normal vision



View of boys by person with diabetic retinopathy.

189

Non - Proliferative to Proliferative Diabetic Retinopathy



190

Quick Question 3

- 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 should receive an immediate eye exam.

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

D. People with diabetes over age of 60 should receive an eye exam every 6 months.

191

Eye Screening Recommendations

Screen with initial dilated and comprehensive eye exam by ophthalmologist or optometrist

- **Type 2 at diagnosis, then every one to 2 years**
- **Type 1 within 5 years of dx, then every 1-2 years**

- Programs that use validated retinal photography with remote reading can be used for screening with in-person follow-up as needed.
- Promptly refer those with macular edema, severe non-proliferative disease to trained specialist

192

Keep Eyes and Kidneys Healthy

To reduce the risk or slow the progression of nephropathy

- Optimize glucose control (A)
- Optimize blood pressure control (A)

193

Kidney Screening Guidelines

- Screen Urine Albumin Creatinine Ratio UACR and GFR
  - Type 2 at diagnosis then yearly
  - Type 1 with diabetes for 5 years, then yearly
    - Twice annually if:
      - UACR> 300mg/g or GFR 30-60 mL/min

Optimize glucose and B/P to protect kidneys

- If UACR > 30 mg/g treat hypertension with ACE or ARB
- Monitor serum creat and K+ if on ACE, ARB or diuretics
- If Chronic Kidney Disease (CKD), consider SGLT2 to slow progression and decrease CV Risk
- If CKD consider using GLP-1 to reduce CV Risk

194

Urine Albumin Creatinine Ratio - UACR

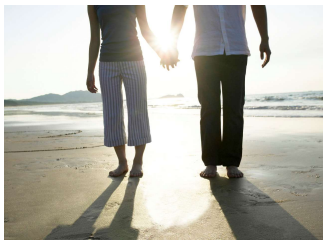
- UACR | Urine albumin – creatinine ratio (spot collection)

Category	mg/g creatinine
normal	<30 mg/g
Moderately increased	30+ mg/g
Severely increased	300 + mg/g

- 2 of 3 tests w/in 3-6 mo abnormal to confirm
- Exercise within 24 h, infection, fever, CHF, marked hyperglycemia, and marked hypertension may elevate urinary excretion over baseline values. ***ADA***

195

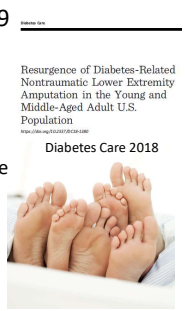
Moving on to the Lower Half



196

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



197

Poll Question 4

- 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.

198

Generalized Symmetrical Polyneuropathy
Chronic Sensorimotor Neuropathy - *Small Nerve Fiber*

- Sensory deficits in distal portions, spreading medially "stocking-glove"
- Small Nerve Fiber Neuropathy
  - C-fiber pain = burning and superficial
  - Allodynia (all stimuli interpreted as painful)
  - Later, loss of pressure and temp sensation
  - Decrease blood flow, sweating
  - Detect w/ Monofilament
  - High risk for ulceration, Charcot, gangrene

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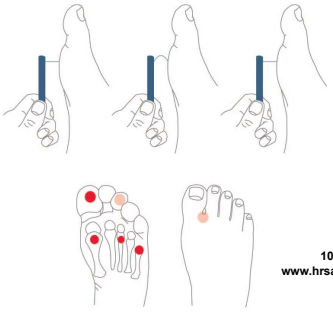
5.07 monofilament delivers 10gms linear pressure



10 Free Monofilaments
www.hrsa.gov/hansensdisease/leap

200

Lower Extremities

- Lift the Sheets and Look at the Feet

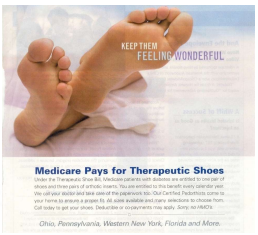
201

Profile of a High-Risk Foot ADA

- Previous amputation
- Previous foot ulcer history
- Peripheral neuropathy
- Foot deformity
- Peripheral vascular disease
- Vision impairment
- Diabetic neuropathy (esp if on dialysis)
- Poor glycemic control
- Cigarette smoking

202

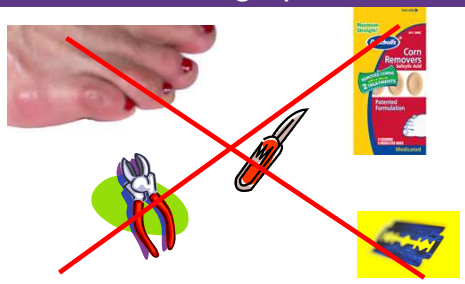
Feet Deserve Special Care



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

203

No Bathroom Surgery



204

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....

205

Pharmacologic Therapy for Neuropathy

Try Alpha lipoic acid: 600 – 1,800mg /day. B12 deficiency?

Prescription Therapy

1st line

- Tricyclic antidepressants (ie amitriptyline, nortriptyline)
- Calcium channel modulators (ie gabapentin, pregabalin)
- Serotonin Norepinephrine Reuptake Inhibitors (SNRI) Cymbalta, Effexor

2nd line

- Topical Capsaicin Cream
- Opioids (tramadol, oxycodone)

Reasons for treatment failure:

- Dose too low, inadequate trial, pt expecting elimination of symptoms, not changing class when no response

Ziegler, D Painful diabetic neuropathy. Diabetes Care, 2009

206

Other strategies to help ease the pain

- Music
- Podcasts
- Movies
- Pet's
- Massage
- Touch
- Topical creams
- Lidocaine patches
- Mineral salts baths

- Tylenol / Ibuprofen
- Earthing
- Sleep
- Hobbies
- Aromatherapy
- Time with special people
- Work / volunteering

207

You 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

208

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
  - All patients with loss of protective sensation, foot deformities, or a history of foot ulcers
- Everyone else needs a thorough, annual inspection

209

Quick Question 5

- Which of the following are at most risk for developing diabetes autonomic neuropathy?

A. Diabetes for 1 year with A1c of 7.6%
B. Person with diabetes for 16 years with A1c never above 6.9%
C. Person with type 1 diabetes for 8 years with retinopathy
D. Person with type 2 for 19 years with A1c less than 7.5%

210

BT1

"DAN" Diabetic Autonomic Neuropathy

- 50% of ind's with peripheral neuropathy also have DAN
- DAN increases M & M rates
  - neurogenic bladder, sexual dysfunction
  - GI related disorders / gastroparesis
  - orthostatic hypotension
  - fixed heart rate, silent MI, sudden death
  - hypoglycemia unawareness
  - sudomotor, pupillary

211

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

212

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?

213

Slide 211

BT1 W

Beverly Thomassian, 8/18/2019

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

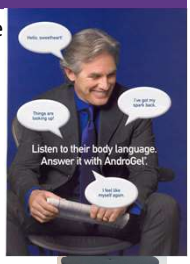
- Lower blood glucose / blood pressure
- Treat vaginal infections and UTI's
- Water based lubricants for vaginal dryness
- Hormone replacement therapy
- Eat to prevent lows during intimacy
- Allow time, touching and romance

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

214

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



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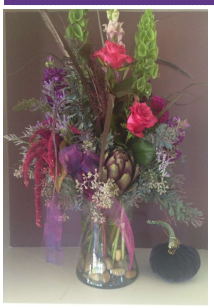
Important Themes

- Keep it person centered
- Careful listening
- Be curious
- Think outside the box
- Review labs for clues
- Encourage preventive screenings
- Collaborate with other members of the health care team

216

Thank You



- Questions?
- Info@diabetesed.net
- 530-893-8635
- www.DiabetesEd.net

Diabetes Education SERVICES

217

Integrating Technology: CGM Connected Pens and Insulin Pumps DiabetesEd Virtual Course – Day 2

Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP CDCES
CGM and Remote Monitoring Program Coordinator
Cleveland Clinic Diabetes Center

1

Disclosures

- Diana Isaacs, PharmD, BCPS, BC-ADM, BCACP, CDCES is a consultant or speaker for the following companies: Lifescan, Medtronic, Dexcom, Xeris Pharmaceuticals, Abbott, Novo Nordisk, Lilly
- Dr. Isaacs also serves as a member of the CBDCE Credentialing committee
- This program is not endorsed by CBDCE

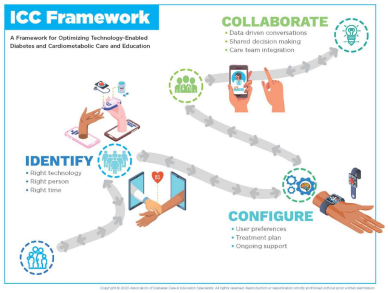
2

Learning Objectives

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

3

ICC Framework – Identify-Configure-Collaborate



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

4

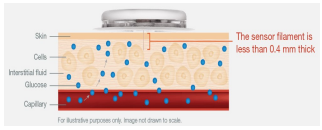
Diabetes Technology

Continuous Glucose Monitors	Insulin Pumps	Connected Insulin Pens/Caps
		

5

How Does Continuous Glucose Monitoring (CGM) Work?

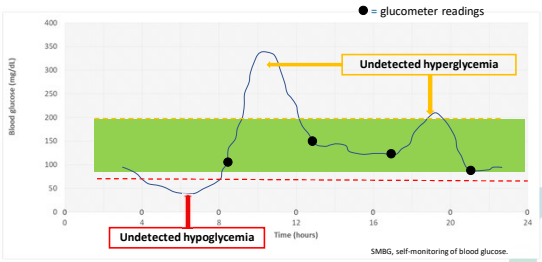
- Measures glucose from interstitial fluid (ISF) every 1-5 minutes and records glucose every 5-15 minutes (up to 288 readings/day)
- Slight delay compared with whole blood glucose (lag time)



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

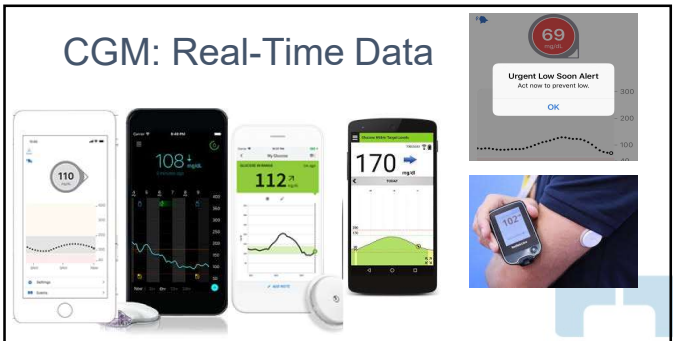
6

BGM vs CGM



7

CGM: Real-Time Data



8

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	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):53-S20.

9

Professional CGM Options

Abbott FreeStyle Libre Pro

Dexcom G6 Pro

10

Professional CGM Comparison

	iPro2	LibrePro
Blinded vs unblinded	Blinded	Blinded
Maximum wear time of sensor	6 days	14 days
Calibration	3-4 per day	None
Downloading reports	CareLink	LibreView
Care between transmitter use	Clean and disinfect transmitter	Disposable 1-time use
Alarms for high/low glucose alerts	No	No
Interfering substances	Acetaminophen	Salicylic acid and high-dose vitamin C

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

11

Which professional CGM allows both blinded and unblinded data?

A. G6 Pro
B. LibrePro
C. Both
D. Neither

12

Personal CGM Options

Libre 2

Guardian Connect or Guardian 3

Libre 14 day

G6

Eversense

13

Dexcom G6

14

- 10 day wear
- 2 hour warm-up
- FDA approved ages 2 and over
- No calibrations required-optional
- 1 press inserter, must attach transmitter
- Reusable transmitter-3 months
- FDA approved for dosing decisions
- Choice of receiver or smart phone
- High, low, predictive low alert
- Hydroxyurea drug interference
- Dexcom G6, Clarity, and Dexcom follow apps (up to 10 followers)
- iCGM Status

https://www.dexcom.com/g6-cgm-system

14

Guardian Connect and Guardian 3

- 7 day wear
- Up to 2 hour warm-up
- Not FDA approved for dosing decisions
- Calibrations required 2-4 times/day
- Acetaminophen and Hydroxyurea interference
- Guardian 3 sensor –compatible with 670G and 770G inulin pumps
- Guardian Connect- compatible with smart phone (no separate receiver)
- Reusable transmitter
  - Charge every 7 days, transmitter lasts for ~1 year
- Guardian Connect, Sugar IQ apps
  - Sugar IQ provides predictive glycemic patterns based on user input
- Ability to have followers through carelink website
- Carelink Connect Mobile app for 770G users

https://www.medtronicdiabetes.com/products/guardian-connect-continuous-glucose-monitoring-system

15

Freestyle Libre

- 14 day wear
- 1 hour warm-up
- FDA approved for insulin dosing except for the first 12 hours after insertion
- Must scan every 8 hours to avoid data gaps
- Salicylic acid and high dose vitamin C interference
- 1 press inserter, disposable transmitter included with sensor
- No real time alerts
- May use phone to scan with LibreLink mobile app
- LibreLinkUp allows up to 20 followers

https://www.freestylelibre.us/index.html

16

Freestyle Libre 2

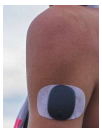
- 14 day wear
- 1 hour warm-up
- FDA approved ages ≥ 4 years
- Real time alerts (hypo, hyper, out of range) - must scan for actual number
- FDA approved for insulin dosing except for the first 12 hours after insertion
- Must scan every 8 hours to avoid data gaps
- Vitamin C interference (>500mg)
- 1 press inserter, disposable transmitter included with sensor
- Libre2 mobile app, required alert when glucose is urgent low (55mg/dL)
- LibreLinkUp allows up to 20 followers
- iCGM status

https://www.freestylelibre.us/safety-information.html

17

Eversense

- Implantable CGM
- Sensor lasts 90 days
- Sensor is MRI safe
- FDA approved for insulin dosing
- 24 hour warm-up, dressing stays on 2 days after insertion
- Requires calibrations every 12 hours
- Rechargeable transmitter taped above sensor
  - Communicates to smart phone (no separate receiver)
  - On-body vibe alerts
- Eversense CGM Mobile app with predictive alerts
- Eversense Now app allows 5 followers



https://www.eversensediabetes.com/

18

Personal CGM Comparison

	G6	Libre 14 Day	Libre 2	Guardian Connect or Guardian 3	Eversense
Insulin pump integration	T:Slim X2	No	No	Medtronic 670G, 630G (Guardian 3)	No
Receiver	iPhone, Android or receiver	iPhone, Android, or reader	Reader	iPhone or Android (Guardian Connect)	iPhone, Android
Maximum wear time	10 days	14 days	14 days	7 days	90 days
Warm-up time	2 hours	1 hour	1 hour	Up to 2 hours	24 hours
Calibrations required/day	0	0	0	At least 2	2
FDA approved sites	Abdomen (ages 2+)Upper buttocks (ages 2-17)	Upper arm	Upper arm	Upper arm, abdomen	Upper arm
FDA Approved for dosing	Yes	Yes	Yes	No	Yes
FDA Approved ages (years)	≥2	≥18	≥4	≥2 Guardian 3 ≥7 Guardian Connect	≥18
Drug interactions	Hydroxyurea	Salicylic acid, vitamin C	Vitamin C	Acetaminophen, Hydroxyurea	Tetracycline antibiotics
MARD	9%	9.4%	9.2%	9.64%	8.5%
Alarms	Yes	No	Yes	Yes	Yes

ADCES Practice Paper. The Diabetes Care and Education Specialist Role in CGM. Available at: https://www.diabeteseducator.org/practice/educator-tools/diabetes-management-tools/self-monitoring-of-blood-glucose. Accessed 4/11/21

19

Question

- Which of the following drugs interact with the Libre 2?

A. Aspirin
B. Vitamin C
C. Hydroxyurea
D. Acetaminophen
E. More than 1 of the above

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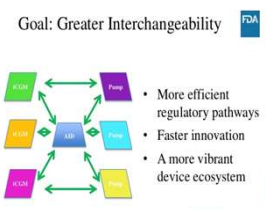
iCGM: The Future of Diabetes Devices

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



21

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
  - Preferable to avoid hot tubs, saunas
- Avoid with MRI, CT, diathermy
  - Exception: Eversense implantable, transmitter should be removed
- Not FDA approved
  - Pregnancy, dialysis, critically ill
  - If people choose to use, it is important they know it is off-label and discuss potential risks

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Troubleshooting Site Adhesiveness

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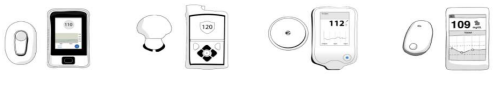
Helping PWD Identify the Right CGM for Them

WHAT ARE CGMs?

Continuous Glucose Monitors (or CGMs) are small devices that have a tiny hair like wire that goes under the skin. Many people with diabetes refer to a CGM as a 'sensor' because it's sensing the glucose in your body. Sensors show your current sugar level and how it's changing - whether it's staying the same, going high, or going low. You can also set alarms if you want. Most CGMs come with automatic inserters that make it easy, and virtually pain-free, to put it in place on your own.



Dexcom G6 | Medtronic Guardian | Abbott Freestyle Libre | Eversense

Compare Sensors

Diabeteswise.org

24

Which of the Following is considered an iCGM?

A. G6 Pro
B. Libre 14 day
C. Guardian 3
D. Eversense

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The Evidence

26

Increased BG Monitoring Leads to Lower A1C in T1DM

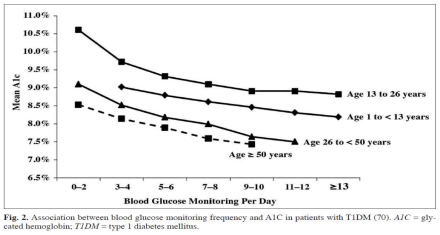

Fig. 2. Association between blood glucose monitoring frequency and A1C in patients with T1DM (70). *A1C* = glycated hemoglobin; *T1DM* = type 1 diabetes mellitus.

Type1 DM
Exchange
N=20,555

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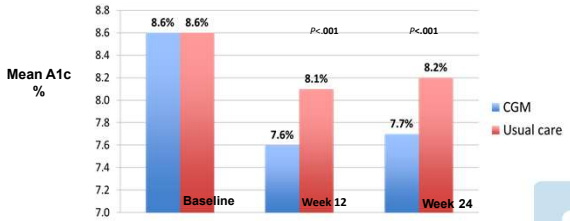
DIAMOND Trial: T1DM MDI
A1C Treatment Group Differences

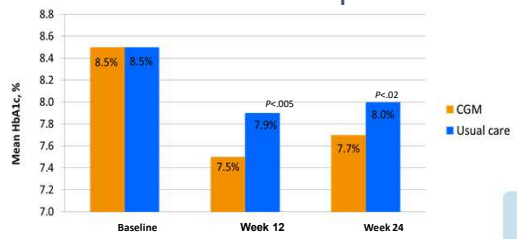


A1C: 0.6% difference at 24 weeks (N=158)

Beck RW et al., *JAMA*. 2017;317(4):371-378.

28

DIAMOND Trial-T2DM MDI
A1c Treatment Group Differences



A1C: 0.3% difference at 24 weeks (N=158)

Beck RW et al. Ann Intern Med. 2017 Sep 19;167(6):365-37

29

DIAMOND Trial-T2DM MDI
Greater Benefit with Higher Baseline A1C

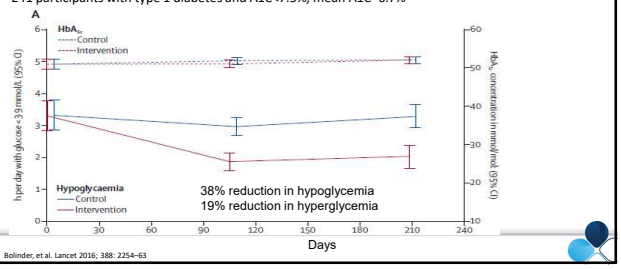
Baseline HbA1c	Change in HbA1c From Baseline		Difference	P value
	CGM Group	Usual Care Group		
≥ 7.5%	-0.9% (n=79)	-0.5% (n=79)	0.4%	0.02
≥ 8.0%	-0.9% (n=63)	-0.6% (n=57)	0.3%	0.05
≥8.5%	-1.1% (n=39)	-0.7% (n=39)	0.4%	0.02
≥ 9.0%	-1.4% (n=17)	-0.7% (n=21)	0.7%	0.04

Beck RW et al. Ann Intern Med. 2017 Sep 19;167(6):365-37

30

Flash CGM in T1DM

- Prospective, randomized controlled trial
- 241 participants with type 1 diabetes and A1C<7.5%, mean A1C=6.7%



Bolinder, et al. Lancet 2016; 388: 2254–63

31

What has the greatest impact on A1C lowering for people with type 1 diabetes?

A. Insulin pump
B. CGM
C. Mobile apps for carb counting

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COMISAIR Study

- Prospective, non-randomized trial with T1D (N=94)
- rtCGM+MDI vs rtCGM+CSII vs SMBG+MDI vs SMBG+CSII
- Primary endpoint: A1C, Baseline=8.2%
- Other endpoints: hypoglycemia, time in range, hyperglycemia
- CGM groups
  - A1C: 6.9% (pump), 7.0% (MDI)
- Non CGM groups
  - A1C: 7.7% (pump), 8.0% (MDI)

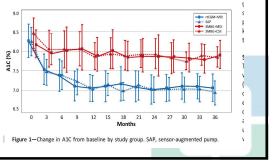
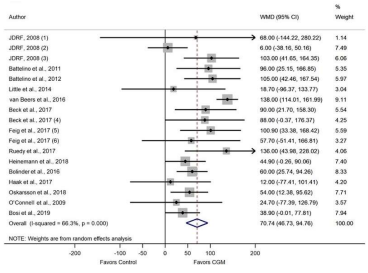


Figure 1—Change in A1C from baseline by study group. SAP, sensor-augmented pump.

Soupal J et al. Diabetes Care 2019 Sep; dc190888.

33

Meta-analysis: Improved Time in Range with CGM



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MOBILE Study

- Effect of CGM on Glycemic Control in Patients with Type 2 Diabetes Treated with Basal Insulin
- Primary outcome: A1C at 8 months
- Randomized 175 individuals 2:1 to CGM vs BGM in primary care practices
- Average age 57, mean A1c=9.1%

	Mean (SD)					
	Baseline		8 mo			
	Continuous glucose monitoring	Blood glucose meter monitoring	Continuous glucose monitoring	Blood glucose meter monitoring	8-mo Risk-adjusted difference, % (95% CI)	*P* value[b]
Primary outcome[a]						
No.	115	58	105	51		
HbA_{1c} level, %	9.1 (1.0)	9.0 (0.9)	8.0 (1.4)	8.4 (1.3)		.02
Change from baseline, %			−1.1 (1.5)	−0.6 (1.2)	−0.4 (−0.8 to −0.1)	
Key secondary outcomes[a]						
No.	114	59	93	53		
% Time in range of 70-180 mg/dL	40 (26)	40 (25)	59 (25)	43 (26)	15 (8 to 23)	<.001
% Time >250 mg/dL[c]	26 (22)	25 (21)	11 (11)	27 (24)	−16 (−21 to −11)	<.001
Mean glucose, mg/dL	209 (48)	206 (45)	179 (43)	206 (53)	−26 (−41 to −12)	<.001

Martens T, Beck RW, Bailey R, et al. Effect of Continuous Glucose Monitoring on Glycemic Control in Patients With Type 2 Diabetes Treated With Basal Insulin: A Randomized Clinical Trial. *JAMA*. 2021;325(22):2262–2272. doi:10.1001/jama.2021.7444

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Downloading CGM Data

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Data Management Tools

System	Website	Associated Mobile Apps	What it Downloads
Glooko	glooko.com	Glooko	Insulin pumps (Omnipod, Tandem), Dexcom, Eversense, many glucose meters
CLARITY	clarity.dexcom.com	Dexcom G6, Clarity, Dexcom Follow	Dexcom CGM
LibreView	libreview.com	LibreLink, LibreLinkUp, Libre 2	FreeStyle Libre 14 day, Libre 2
Carelink	carelink.medtronic.com	Guardian Connect, Carelink, Sugar IQ Diabetes Assistant	Medtronic insulin pump and Medtronic CGM
Tidepool	tidepool.org	Tidepool Mobile	Insulin pumps (Medtronic, Tandem, Omnipod), FreeStyle Libre 14 day, Dexcom, Guardian Connect, many glucose meters
Eversense Data Management System	eversensedms.com	Eversense	Eversense

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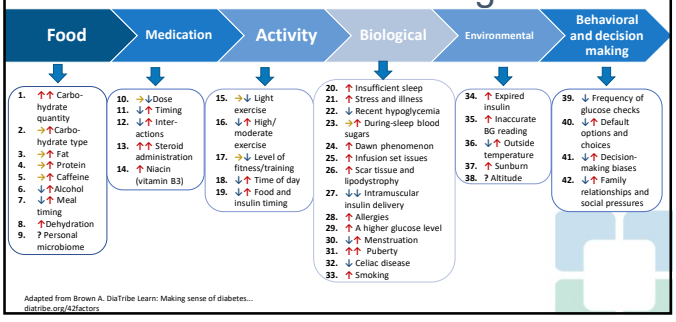
How does exercise affect glucose levels?

A. Increase
B. Decrease
C. No effect
D. I have no idea

38

At least 42 factors affect glucose!

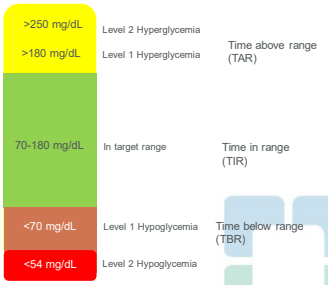


Adapted from Brown A. DiaTribe Learn: Making sense of diabetes... diatribe.org/42factors

39

Standardized CGM Metrics for Clinical Care

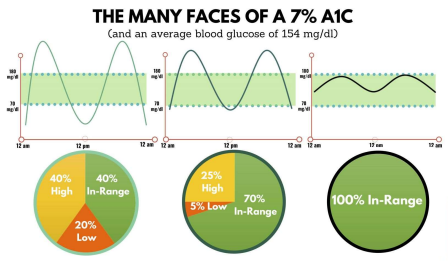
Key Metrics
Number of Days CGM is worn 14+ days recommended
Percentage of Time CGM Is Active >70% of data recommended
Mean Glucose
Glucose Management Indicator (GMI) CGM-derived estimate of current A1C level
Coefficient of Variation (CV) Measure of glycemic variability (st. dev/mean) CV ≤36% is considered acceptable



Battelino T et al. *Diabetes Care*. 2019;42(8):1593-1603.

40

Glycemic variability



https://diatribe.org/time-range. Accessed November 2020

41

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

A.≥50%
B.≥70%
C.≥80%
D.≥90%

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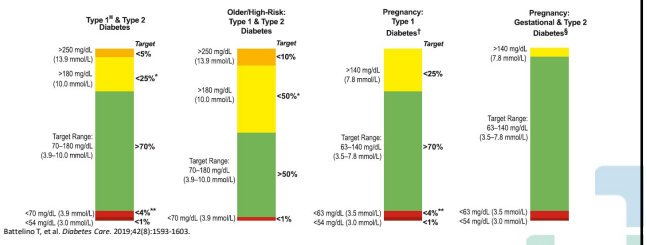
Time in Range (TIR) Goals: International Consensus



Battelino T, et al. *Diabetes Care*. 2019;42(8):1593-1603.

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Time in Range and A1C Correlation

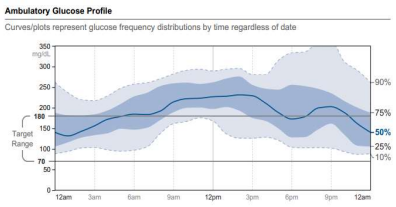
N = 545 participants with type 1 diabetes

Measured TIR	A1C	95% CI
40%	8.4%	7.1%-9.7%
50%	7.9%	6.6%-9.2%
60%	7.4%	6.1%-8.8%
70%	7.0%	5.6%-8.3%
80%	6.5%	5.2%-7.8%

Beck RW, et al. *J Diabetes Sci Technol*. 2019;13(4):614-626.

44

Ambulatory Glucose Profile (AGP)



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Spaghetti Graph

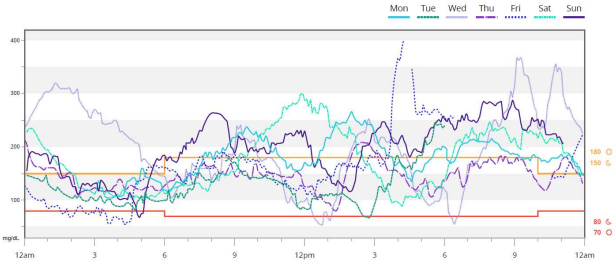

Image obtained from Dexcom CLARITY report.

46

Snapshot to Assess Hypoglycemia

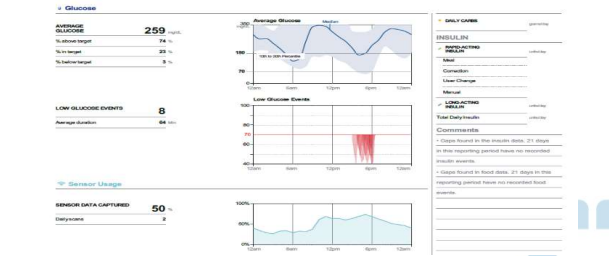

Image obtained from LibreView report.

47

- Day by Day Graphs

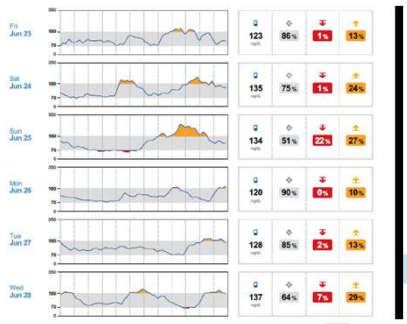

Image obtained from LibreView report.

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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

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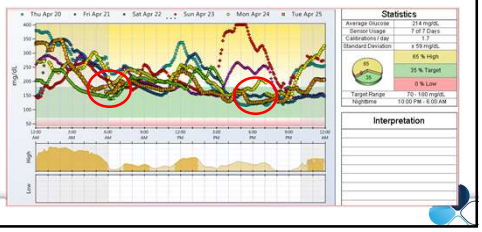
Case Studies & 2 min Stretch

50

Meet Derek

- 48-year-old man, type 2 diabetes x 10 years, maxed out on metformin, GLP-1 agonist, SGLT2 inhibitor, sulfonylurea
- A1C = 9%-9.5% for 12 months, FBG and pre-dinner SMBG ≈150 mg/dL
- He agreed to wear a professional CGM for 7 days

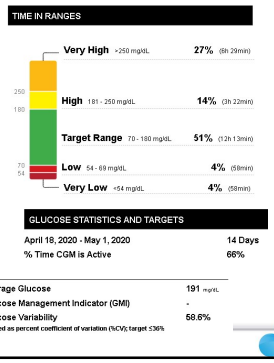
Derek was shocked by what happened between breakfast and dinner; he agreed to start insulin.



51

Meet Adriane

- 47 year old with T1DM
- A1C = 8.1%
- Insulin glargine 16 units BID
- Insulin aspart: 1 unit for10 grams CHO
- Correction factor: 1:25



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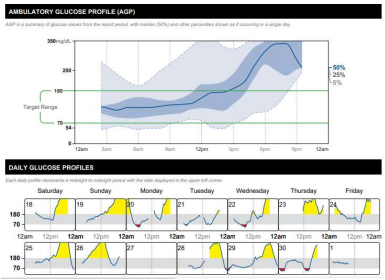
Adriane's AGP

- What do you notice?
- Is Adriane meeting targets?
- What questions to ask?



53

Meet Karen

- 66 year old woman with T2DM, HTN, osteoarthritis, HF
- Medications
  - Dapagliflozin 10mg daily
  - Metformin 1000mg ER twice daily
  - Insulin glargine 60 units qpm
  - Insulin aspart 12 units TID a.c.
- Eats 2 meals/day
- Walks the dog 10 min/day
- Sometimes forgets to take glargine, falls asleep
- A1C=7.1%

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Discussion & Action Plan

- A Assess Safety: "I'm sometimes afraid to give myself insulin because I go low."
- T Time in Range: "I notice overall when I take my meds like I am supposed to, my numbers are more in range. I think I also exercised that day."
- A Areas to Improve: "I fall asleep and forget to take my insulin glargine a few times per week."
- A Action Plan: Switch glargine to QAM, decrease aspart to 10 units BID with 2 main meals, consider future addition of GLP-1 agonist .

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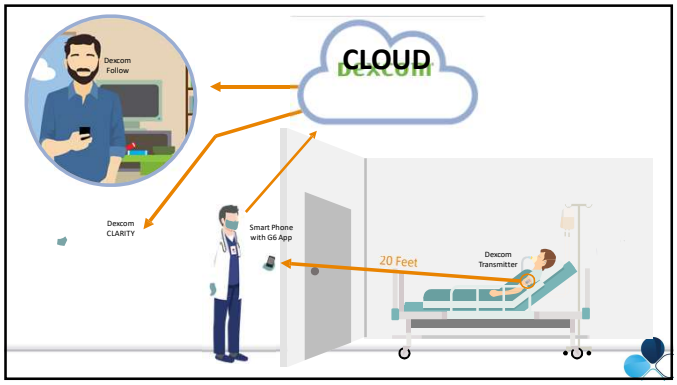
CGM in the Hospital

- Dexcom G6 and Freestyle Libre available for inpatient remote monitoring
  - FDA has temporarily approved due to the public health crisis of COVID-19 and the need to preserve PPE and reduce hospital staff exposure to coronavirus

https://www.dexcom.com/news/dexcom-cgm-hospital-covid19
https://abbott.mediaroom.com/2020-04-08-Abbotts-FreeStyle-R-Libre-14-Day-System-Now-Available-in-U-S-for-Hospitalized-Patients-with-Diabetes-During-COVID-19-Pandemic

57



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CGM Resources

Diabetes Advanced Network Access (DANAtech)	danatech.org
Association of Diabetes Care and Education Specialists (ADCES) glucose monitoring resources	diabeteseducator.org/practice/educator-tools/diabetes-management-tools/self-monitoring-of-blood-glucose
diaTribe	diatribe.org
Senseonics Eversense	eversensediabetes.com
Medtronic Guardian Connect	hcp.medtronic-diabetes.com.au/guardian-connect
Dexcom G6	dexcom.com/g6-cgm-system
Abbott FreeStyle Libre	freestylelibre.us

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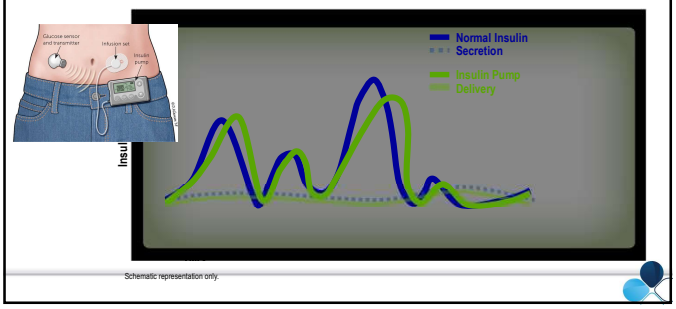
Insulin Pumps

60

How a Pump Delivers Insulin



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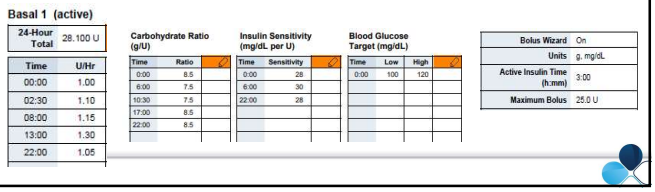
Traditional Pump Therapy

- Pumps use rapid-acting insulin only
  - Minimizes insulin variability
  - Replaces long-acting insulin
- Basal profile settings + bolus calculator



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Common Insulin Pump Features

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

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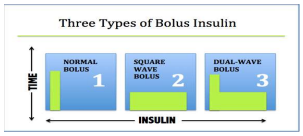
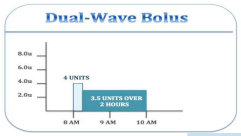
Extended Boluses

- Great for high-fat foods or people with gastroparesis





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Temp Basals

- Temporarily increase or decrease basal settings
- A great option for high stress, sick days, steroid bursts, exercise
- Start the temp basal 1-2 hours prior to exercise or activity requiring the change
- Depending on pump report view, you may not see the temp basals
- Hybrid-closed loop
  - Temp target option (Medtronic), 150mg/dL
  - Exercise mode (Tandem), 140-160mg/dL

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Safety Features

- Alarms for occlusion or low insulin reservoir
- Active insulin to prevent stacking
- Keypad lock
- Waterproof or watertight
- Communication with CGM for auto-suspend and auto adjustment of basal
- Reminders to bolus, change infusion set, etc

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Safety Pearls

- Back up plan for pump failure
  - Rx for long acting insulin, insulin pens, syringes
  - Written insulin pump settings
- Sick day management
- Ketone testing
- Glucagon
- Pump rotation
- Change infusion set and reservoir every 2-3 days
- Insulin spoilage in high temperatures
- Always carry back up supplies
  - Ex: Infusion sets/reservoirs, test strips/meter, insulin, batteries

https://www.diabeteseducator.org/docs/default-source/practice/educator-tools/troubleshooting_final.pdf?sfvrsn=4

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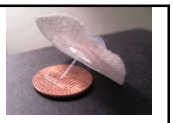
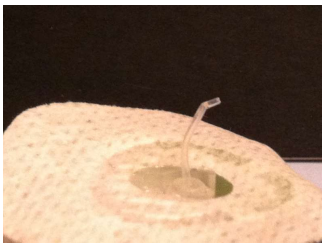
Infusion Sets



- 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

68

What Happens with a Bent Cannula?



A. Hyperglycemia
B. Hypoglycemia
C. No effect

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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

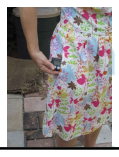
70

Where to Wear?

- Infusion set can go any place where insulin can be injected
- Pump can be worn on belt, in pocket or in a pouch

71

Where to Wear?



72

Ideal Pump Candidates

- Motivated
- Checking BG 4+ times/day or wearing CGM
- A1C <10%
- Carbohydrate counting or good with estimates
- Ability to learn pump programming
- Willing to follow up regularly with health care team
- Can afford the pump/supplies
- Following hyperglycemia treatment instructions

73

Pre-pump Diabetes Education

- Basal vs bolus
- Carbohydrate counting
- Carbohydrate ratios
- Sensitivity
- Insulin action time
- Hypoglycemia treatment
- Hyperglycemia treatment
- Problem solving
- Importance of glucose monitoring

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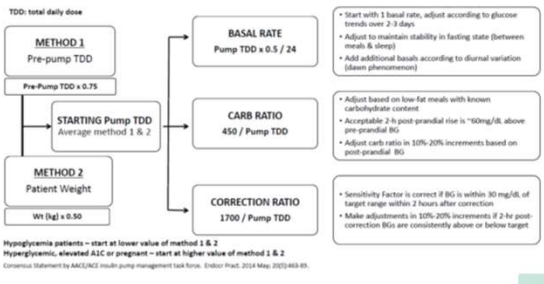
Initial Pump Calculations



75

Onboarding a New Patient

1. Pre-pump group class to learn about pump options
2. Individual diabetes education visit(s) for advanced carb counting as needed
3. Pump start (2-3 hour individual diabetes education visit)
4. Next day, check-in phone call
5. Patient downloads pump every 3-7 days for insulin pump adjustments
6. Advanced pumping follow-up office visit in 2-4 weeks
7. Provider follow-up in 4-6 weeks

Based on Cleveland Clinic insulin pump program

76

Insulin Pump Options

OmnipodDash
(Insulet)

t:slim X2 with G6 CGM
(Tandem/Dexcom)
Basal IQ
Control IQ

670G & 770G with
Guardian 3 (Medtronic)

Cleveland Clinic

77

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 3 days

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

78

Hybrid-Close Loop (HCL)

- Automates insulin delivery based on CGM readings
- All systems auto-adjust basal rates
- Some systems give auto-corrections
- All systems require the user to bolus for carbohydrates
- Requires user to use CGM and maximize time spent in HCL to get most benefits
- Current systems: Medtronic 670G/770G, Tandem Control IQ
- Up-coming: Medtronic 780G, Omnipod 5, Beta bionics ilet

79

Which pump is considered a hybrid-closed loop?

A. Cequr simplicity
B. Tandem Basal IQ
C. Medtronic 670G
D. Omnipod Dash

80

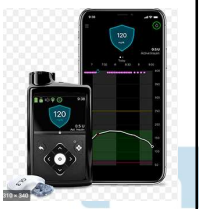
Omnipod Dash

- No tubing
- Pod (pump) includes infusion set
- All programming done via PDM
  - Locked Android smartphone
  - Bluetooth connection
- Rechargeable battery
- Food database
- 200 unit reservoir
- Dash blue tooth connected with contour meter
- Omnipod 5 (hybrid closed loop) on the horizon

81

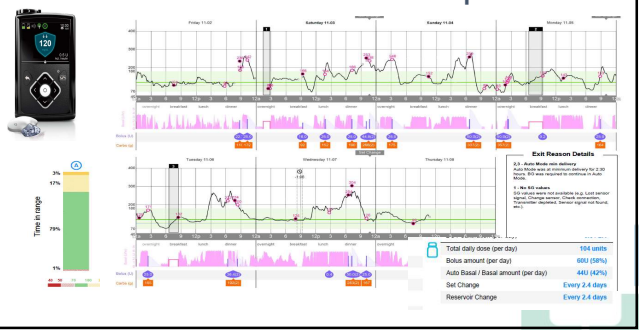
Medtronic 670G & 770G

- Auto Mode adjusts basal rates every 5 min. based on sensor glucose
- Indicated ages ≥ 7 years (670G) and ages ≥ 2 years (770G) with TDD ≥ 8 units
- Guardian 3 continuous glucose monitor (CGM)
  - 7 day wear time
  - Requires charging between use
  - 2-4 calibrations/day
- Suspend before/on low options (in manual mode)
- Additional BG checks to stay in auto mode
- BG target=120
- Temp target of 150 available
- 300 unit reservoir
- Connected contour meter (670G) or Accu-check Guide (770G)
- Mobile app for data sharing/viewing with 770G



82

Medtronic 670G Example



83

Tandem T:Slim X2 with Basal IQ

- Touch screen
- Lithium rechargeable battery
- 300-unit reservoir
- Indicated ages ≥ 6 years
- 0.001 unit basal increment
- Integration with Dexcom G6
- Basal IQ- suspends basal if CGM predicted to decrease to < 80 mg/dl within 30 minutes

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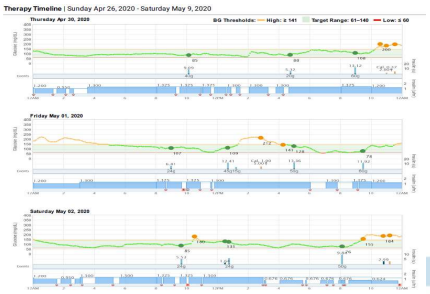
Basal IQ Example: Pregnant



85

Tandem T:Slim X2 with Control-IQ

- Advanced hybrid-closed loop system
- Algorithm adjusts insulin delivery from programed "manual" settings
- Automatic correction doses
  - Up to 1 every hour
  - Calculated at 60% of programmed correction factor (target of 110)
- User must still bolus for carbs (and additional correction doses)
- FDA approved 6+ years
- Basal-IQ users who update to Control-IQ cannot switch back to Basal-IQ mode

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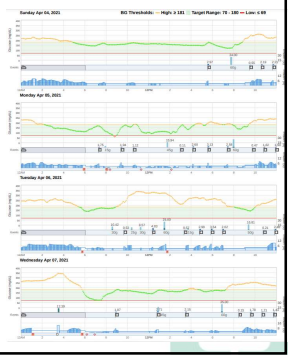
Control IQ Targets

		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

https://www.tandemdiabetes.com/providers/products/control-iq



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Critical Thinking

When should a provider consider discontinuing an insulin pump during hospitalization?

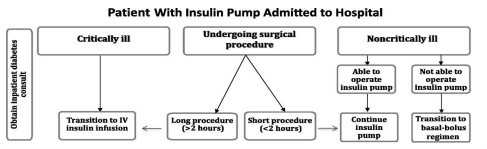
88

Technology in the Hospital

- Several inpatient studies have shown that CGM detected a greater number of hypoglycemic events than POC glucose testing
  - Overall, did not improve glucose control
- Patients who are comfortable using their diabetes devices (insulin pumps, sensor) should be given the chance to use them in an inpatient setting if they are competent to do so.
- Health care institutions must have clear policies and procedures to maximize safety and to comply with existing regulations related to self-management of medication.

Diabetes Care 2020 Jan; 43(Supplement 1): S77-S88
Umpierrez G et al. Diabetes Care 2018 Aug; 41(8): 1579-1589..

89



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.

90

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.

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Hybrid-Closed Loops Coming Soon

Insulet Omnipod 5 (formerly called Horizon)

Medtronic 780G

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Omnipod 5

- HCL system
- Glucose targets from 110-150mg/dL adjustable by time
- Adaptive basal rates
- HypoProtect for times of reduced insulin needs
  - Reduce insulin to target of BG 150
- SmartBolus calculator informed by Dexcom G6 CGM value and trend
- Control system from a compatible personal smartphone
- Adjustable settings: carb ratio, sensitivity, active insulin time, recommended bolus dose

Device Comparison — Panther Program (bdcpantherdiabetes.org)

93

Medtronic 780G

- HCL system
- Basal rate automation
- Adjustable target of 100mg/dL or 120mg/dL
- Adjustable settings: insulin action time, carb ratio, target
- Bluetooth connectivity, remote software upgrades
- Mobile app for secondary data display and wireless data uploads
- Automatic correction boluses every 5 min when glucose >120mg/dL
- >80% time in range goal, less auto mode exits vs 670/770G
- Guardian Sensor 4 non-adjunctive (no calibrations)
- Future:
  - Synergy sensor: disposable, 50% smaller, no calibrations

Device Comparison — Panther Program (bdcpantherdiabetes.org)

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What The Data Says..

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Comparing 3 Pivotal Trials

	Insulet Omnipod 5		Tandem Control-IQ		Medtronic MiniMed 780G	
Participants	129 type 1s, ages 14-70		168 type 1s, ages 14-71, 2:1 Control-IQ : SAP randomization		157 type 1s, ages 14-75	
	Baseline -> Study	**Change**	**Control -> Intervention**	**Change***	**Baseline -> Study**	**Change**
Time in Range	63% -> 74%	+2.2 hours/day	59% -> 71%	+2.6 hours/day	69% -> 75%	+1.4 hours/day
A1c	7.2% -> 6.8%	-0.4%	7.4% -> 7.1%	-0.3%	7.5% -> 7%	-0.5%
Mean glucose	161 -> 154 mg/dl	-7 mg/dl	170 -> 156 mg/dl	-13 mg/dl	153 -> 148 mg/dl	-5 mg/dl
Time >180 mg/dl	32% -> 25%	-1.8 hours/day	38% -> 27%	-2.4 hours/day	28% -> 23%	-1.2 hours/day
Time >250 mg/dl	10% -> 6%	-1 hour/day	--	--	6.2% -> 4.6%	-23 min/day
Time <70 mg/dl	2% -> 1.1%	-13 min/day	1.9% -> 1.4%	-13 min/day	3.3% -> 2.3%	-14 min/day
Time <54 mg/dl	0.22% -> 0.17%	-1 min/day	0.24% -> 0.21%	-1 min/day	0.8% -> 0.5%	-4 min/day
Overnight Time in Range	64% -> 78%	+14%	59% -> 76%	+17%	71% -> 81%	+10%
Time in closed loop	95%	--	90%	--	95%	--

*Note that the results for Control-IQ are presented as the SAP control group's outcome -> Control-IQ intervention group's outcome. Changes are presented as adjusted differences.

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HCL Real World Data

- Tandem Control IQ (N=9,451, average age: 42 years, 83% T1D, Baseline: using Tandem Basal IQ)
- Medtronic 780G (N=52, 100% T1D, average age: 43 years, Baseline: using Medtronic 640G)

	Tandem Control-IQ		Medtronic MiniMed 780G	
	Baseline	12-months	Baseline	1-month
Time in Range	64%	74%	67%	80%
Time >180 mg/dl	23%	19%	29%	17%
Time >250 mg/dl	12%	6%	7%	3%
Time <70 mg/dl	1%	1%	3%	3%
Time <54 mg/dl	0.1%	0.15%	1%	1%
GMI/A1c	7.3%	6.9%	7%	6.5%

Breton MD, Kovatchev BP. One Year Real-World Use of Control-IQ Advanced Hybrid Closed-Loop Technology. Diabetes Technol Ther. 2021 Mar 30. doi: 10.1089/dia.2021.0097. Epub ahead of print. PMID: 33784196.
Beato-Vibora PI, Gallego-Gamero F, Ambrojo-López A, Gil-Poch E, Martín-Romo I, Arroyo-Díez FJ. Rapid Improvement in Time in Range After the Implementation of an Advanced Hybrid Closed-Loop System in Adolescents and Adults with Type 1 Diabetes. Diabetes Technol Ther. 2021 Apr 20. doi: 10.1089/dia.2021.0037

97

CARES Framework

Calculate	• How does the algorithm calculate insulin delivery? • Which components are automated (ex. basal suspensions, basal modulation, high glucose corrections, food boluses, etc)
Adjust	• How can the user adjust insulin delivery? • Which parameters can be adjusted to influence insulin delivery during automation (Ex. Carb ratios, insulin action time, basal rates, sensitivity factors) • Which parameters are fixed?
Revert	• When should the person choose to revert to open-loop/no automation? • When will the system default to open loop/no automation? • How do open-loop settings compare to closed-loop settings?
Education	• What are key education points? (ex. essential training, tips, tricks) • How does the person optimize time spent in closed-loop? • Where can people find additional education?
Sensor/Share	• What are relevant sensor characteristics for each device (Ex. calibration, duration of wear) • What are system capabilities for remote monitoring and cloud-based sharing?

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HCL Pump Comparison

	MiniMed™ 670G / 770G	MiniMed™ 780G*	t:slim X2 with Control-IQ	OMNIPOD 5*
		 *AVAILABLE OUTSIDE US, NOT FDA APPROVED.		 * NOT FDA APPROVED, SUBJECT TO CHANGE.
CALCULATE				
What is automation called?	Auto Mode	Auto Mode	Control-IQ	Automated Mode
Basal automation?	Automated basal insulin delivery calculated based on total daily insulin from past 2-6 days (*auto basal*)	Automated basal insulin delivery calculated based on total daily insulin from past 2-6 days (*auto basal*)	Automated basal insulin delivery that increases or decreases programmed basal rates	Automated basal insulin delivery calculated from total daily insulin from last pod change (~3 days) (*adaptive basal*)
Bolus automation?	No (auto basal only to respond to hyperglycemia)	Auto-correction bolus if glucose > 120 mg/dL and at maximum "auto basal" delivery	Auto-correction bolus (max 1/hour) if glucose predicted to be >180 mg/dL delivers 60% of calculated dose	No (adaptive basal only to respond to hyperglycemia)
Algorithm target BG/range?	120 mg/dL	100 mg/dL OR 120 mg/dL	112.5-160 mg/dL (range)	110, 120, 130, 140, 150 mg/dl

Automated Insulin Delivery — Panther Program (bdcpantherdiabetes.org)

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Insulin Pump Data Management Tools

System	Website	Associated Mobile Apps	Integration
Glooko	glooko.com	Glooko Omnipod Demo PodderCentral Omnipod Display Omnipod View	Insulin pumps (Omnipod, Tandem), Dexcom, Eversense, many glucose meters
Carelink	carelink.medtronic.com	MiniMed 670G System Simulator	Medtronic insulin pumps and Medtronic CGM
Tidepool	tidepool.org	Tidepool Mobile	Insulin pumps (Medtronic, Tandem, Omnipod), FreeStyle Libre, Dexcom, Guardian Connect, many glucose meters
T:Connect	tconnect.tandemdiabetes.com	T:simulator T:connect mobile	Insulin pump (Tandem), Dexcom

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Connected Insulin Pens

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The Insulin Delivery Landscape

Smart Insulin Pens

Traditional Insulin Pen, Vial and Syringe

10.5% of US population with diabetes (34.2 million people)
7.2 million using insulin

Smart Insulin Pumps

Basic Patch Pumps, Inhaled Insulin

Diabetes Care 2018 Jun; 41(6): 1299-1311

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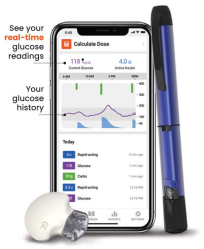
Connected Pen Options



InPen with Guardian Connect or Dexcom G6

Bigfoot Unity with Libre 2

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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

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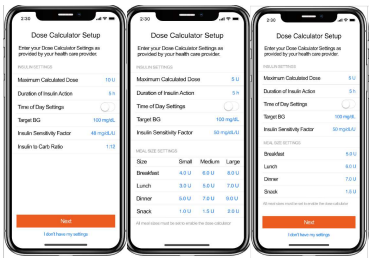
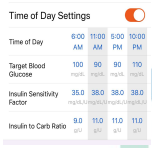
Therapy Settings





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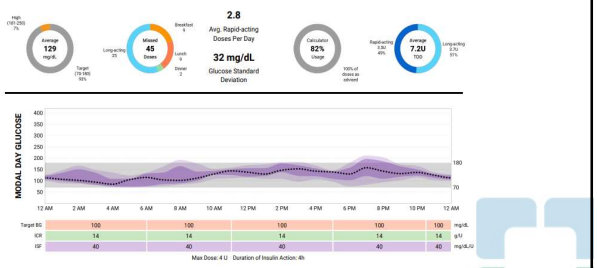
Connected Pen + CGM Data



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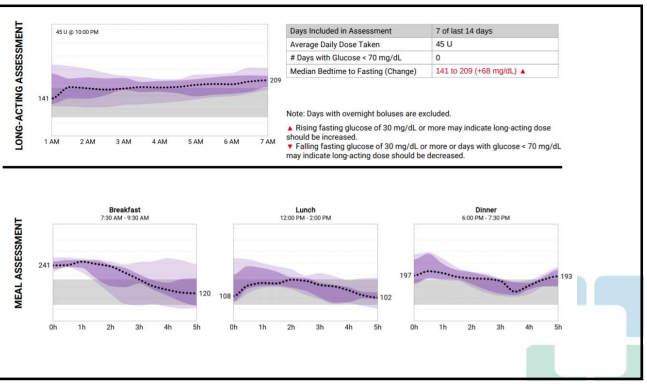

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Bigfoot Unity Diabetes Management System

- Cleared by the FDA for ages over 12 years
- Smart insulin pen caps fits onto most commercially available insulin pens
- 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
- Pen caps are rechargeable

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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

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Additional Resources

- Integrated Diabetes Services
  - https://integrateddiabetes.com/updated-insulin-pump-comparisons-and-reviews/
- ADCES Insulin pump therapy resources
  - https://www.diabeteseducator.org/practice/practice-tools/diabetes-management-tools/ipt-resources
- Diatribe.org
- Diabeteswise.org
- Danatech.org

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Cleveland Clinic

Every life deserves world class care.

2-minute stretch break while we get CV Risk Management Slides Ready

111

Integrating Mental Health with Body Health. Assessment Tools & Coping

Beverly Dyck Thomassian, RN, MPH, BC-ADM, CDE
President, Diabetes Education Services
2021

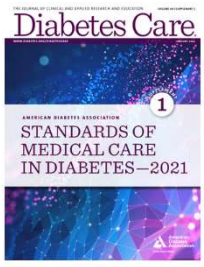
1

Promoting Well Being – From Population to the Individual.

- 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.

2

Population Health & Assessing Care



1. Improving Care and Promoting Health in Populations: *Standards of Medical Care in Diabetes—2021*
American Diabetes Association
Diabetes Care 2021 Jan; 44 (Supplement 1): S7-S14.

5. Facilitating Behavior Change and Well-being to Improve Health Outcomes: *Standards of Medical Care in Diabetes—2021*
American Diabetes Association
Diabetes Care 2021 Jan; 44 (Supplement 1): S53-S72.

3

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

4

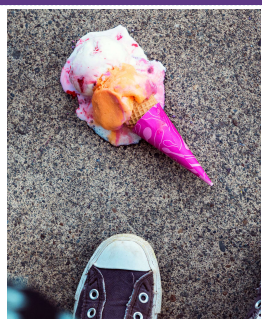
Diabetes is Complex

- Goal – achieve well being and satisfactory medical outcomes
- Psychological factors:
  - Environmental
  - Social
  - Behavioral
  - Emotional
- Keep it person centered while integrating care into daily life
  - Consider the individual

5

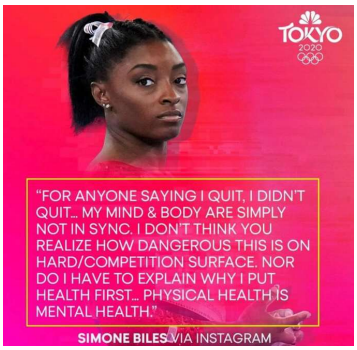
I am falling

- 53 yr old with type 1 diabetes.
- A1c 7.6
- B/P 130ish/80 ish
- No new meds started
- Teenager is “using drugs”
- Says they have fallen 3 times in last month



6

Physical Health is Mental Health



7

Well-Being Key Goal of Care

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

8

Improving Care - Population Health

- "health outcomes of a group of individuals
  - including the distribution of health outcomes within the group"
- These outcomes can be measured in terms of health outcome:
  - mortality, morbidity, health, and functional status
  - disease burden
    - (incidence and prevalence)
  - behavioral and metabolic factors
    - (exercise, diet, A1C, etc.)

ADA Standards 2021

9

Individualized Care Strategies

- Consider individualized care and create environmental structures to support people with:
  - Food insecurity
  - Cognitive dysfunction
  - Mental illness (2-3 x's higher rates of diabetes in schizophrenia, bipolar)
  - HIV (meds can cause pancreatic dysfunction)
- Health disparities related to:
  - Ethnicity, racism, culture, sex, socioeconomic status, LGBQT

10

Tailoring Treatment for Social Context

- Food Insecurity
- Homelessness and Housing Insecurity
- Migrant Workers
- Language Barriers
- Social Capital
- Chronic Pain
- Eating Disorders
- Youth & Older Adults

11

Homelessness

- The prevalence of diabetes in the homeless population is estimated to be around 8%
- Need secure places to keep supplies and meds
- Help connect with social resources

12

Migrant Workers

- Most agricultural workers in US are Latino
  - Higher risk of having diabetes
  - Poverty associated with high stress, food insecurity and higher risk of diabetes
  - Certain pesticides assoc w/ increased diabetes risk.
- Many barriers to care:
  - Migration
  - Culture and language
  - Lack of funds for transportation
  - Other barriers

13

Social Capital Matters

- Living with racism and discrimination may drive underlying causes of nonadherence to regimen behaviors.

- Health care community linkages promote translation of clinical goals into lifestyle changes in real world.
  - Community health workers
  - Peers supporters
  - Lay leaders helpful

14

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-."

AADE American Association of Diabetes Educators

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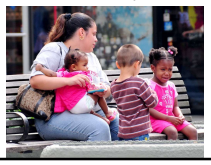
Food Insecurity

- *Food insecurity is the unreliable availability of nutritious food and the inability to consistently obtain food without resorting to socially unacceptable practices*
- Up to 20% in diabetes
  - Higher in African American, Latinos, low income, single moms
- Type 2 diabetes risk doubled in those with food insecurity



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Food Insecurity impact on self care

- Lower medication adherence
- Depression, distress
- Elevated glucose
- More hospital visits
- Interventions
  - Food prescription programs
  - Food banks & other
- Treatment priorities
  - Decrease severe hyper and hypoglycemia
  - Affordable medication plan
  - Connect with social services programs

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Assessing for Food Insecurity

- Within the past 12 months we worried whether our food would run out before we got money to buy more"
- *2*) "Within the past 12 months the food we bought just didn't last and we didn't have money to get more."
- An affirmative response to either statement had a sensitivity of 97% and specificity of 83%.

18

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

19

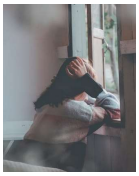
Take a Strength Based Approach

- 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

20

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?



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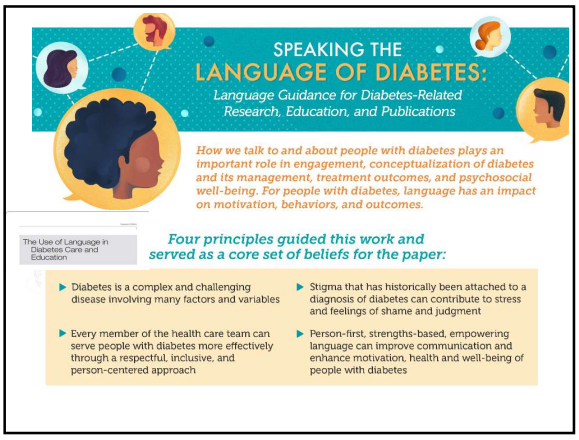

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Guiding Language Principles

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

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Person Centered Care

- Considers individual comorbidities and prognoses
- Provides care that is respectful and responsive to the individuals preferences, needs and values.
- Ensuring that the person's values guide all clinical decisions

24

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

25

Poll question 1

- 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

26

Improving Care and Promoting Health for Individuals and Populations

What we say and how we say it matters.

We bring our life experiences to each interaction.

27

Diabetes Specialists Role

- Assess – see standardized eval tools
- Determine if help is needed
- Have a list of mental health providers
- Resource list of phone helplines
- Help with problem solving and access
- If individual cannot act on behalf of themselves, help identify a support person

28

What to Assess?

- Performance of self-management behaviors
- Psychosocial factors impacting self-management.
- Life circumstances
- If find issue, try to address at visit.
  - If can't, schedule follow-up or refer to qualified behavioral health provider

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What to Assess?

- Using standardized/validated tools
  - Diabetes Distress
  - Depression
  - Anxiety
  - Disordered Eating
  - Cognitive Capacity
  - Adverse Childhood Experiences

See Psychosocial Care and Assess Resource Page
DiabetesEd.net > Articles > Psychological Assessment

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Psychosocial Assessment

- Include individual assessment of psychological and social situation as part of the ongoing medical management of diabetes
- Psychosocial screening may include:
  - Attitudes about diabetes
  - Expectations of medical management and outcomes
  - Affect/ mood and quality of life
  - Available resources (financial, social, emotional)
  - Psychiatric history

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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.

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Poll Question 2

- A 47 year old with new type 2 diabetes and an A1c of 9.3% enters your office and asks what kind of food they can eat to "get this diabetes to go away". What is the best response?

A. I am sorry, but according to your A1c level, it looks like you have diabetes.

B. Do you feel like you may be in denial about your diabetes?

C. Okay. Let's start with carb counting.

D. It sounds like you want to get rid of your diabetes?

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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;

34

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.

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Diabetes Distress

- High levels of diabetes distress significantly impact medication-taking behaviors and are linked to higher A1C, lower self-efficacy, and poorer dietary and exercise behaviors
- Address Distress
- Mindful Self-Compassion is important
- Counseling and DSME can help

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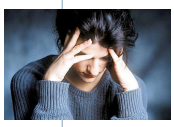
Diabetes Related Emotional Distress=DRED

- DRED - unique emotional issues directly related to the burdens and worries of living with a chronic disease. (embarrassed, guilty)
  - More than worry: can overlap with depression, anxiety and stress.
  - Normal-to some extent
  - Associated with stress of living with diabetes
  - Express high levels stress and depressive symptoms; but not clinical depression
  - Not rare: linked to poor health outcomes



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

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Diabetes Distress Scale cont.

1. Feeling that diabetes is taking up too much of my mental and physical energy every day.
2. Feeling that my doctor doesn't know enough about diabetes and diabetes care/ doesn't give me clear enough directions .
3. Feeling angry, scared, and/or depressed … think about living with diabetes
4. Feeling that I am not testing my blood sugars frequently enough.
5. Feeling that I am often failing with my diabetes routine.
6. Feeling that friends or family are not supportive enough of self-care efforts (planning activities that …, encourage me to eat the "wrong" foods).
7. Feeling that diabetes controls my life.
8. *Not feeling motivated* to keep up my diabetes self management.

DDS (17) Scoring

39

Poll question 3

- LR is a 16 year old on an insulin pump and Continuous Glucose Monitor and is feeling very distressed because their glucose keeps going above target range. What is an appropriate intervention?
- A. Encourage them to ask their provider about starting medications for anxiety.
- B. Help them set a SMART goal to improve carb to insulin ratios
- C. Support them in problem solving
- D. Remind them that alcohol can actually lower blood glucose

40

Strategies to handle DRED:

- People w/ DM
- 1 thing at a time
- Take it slowly
- Speak up to:
  - Family, PCP,
  - People that understand.
- **Set Appropriate Goals!!!**
- **Small, discreet**

- HCProviders (you!)
- Handle 1 thing at a time
- Take it slowly
- **Set Appropriate Goals. Small, discreet**
- **Be mindful, mundane, careful about the goal set- do not rush**
- **Paired testing before/after (more tangible)**

41

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

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Poll Question 4

- KL recently lost spouse and has type diabetes. Which of the following statements by KL reflects they are depressed?

A. I miss my wife so much.
B. I am struggling with cooking meals.
C. Most mornings, I just don't want to get out of bed.
D. I am so tired of everyone telling me to start meeting new people.

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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

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Depression Assessment

- Depression:
  - Over the last 2 weeks, have you felt down, depressed or hopeless?
  - Over the last 2 weeks, have you felt little pleasure in doing things?
- Depression
  - Pt. Health Questionnaire (PHQ-9) in resources page
  - Beck Depression Inventory (BDI)
  - Symptom Checklist (SCL-90)
- Referral to Mental Health:
- Refer to therapy (list ready!)
- Pharmacologic TX
  Anti-depressants: (2-8 weeks to work)

45

If say yes to screening question

Patient Health Questionnaire – Depression Screen PHQ-9

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		+	+	

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)

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Other Assessment Areas

- Literacy
- Chronic Pain
- Disordered eating
- Cognitive Impairment
- Adverse Childhood Experiences
- Coping Skills

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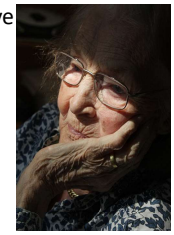
Keeps forgetting insulin

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

48

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



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Cognitive Impairment

- People with diabetes more like to have:
  - Dementia (associated with hyperglycemia and other causes)
  - Alzheimer's

- Treatment:
  - Refer to specialist for assessment
  - Achieve optimal BG control
  - Pharmacist to evaluate drug safety and potential drug interactions
  - Keep physically active

50

Cognitive Screening - Mini-Cog

- "I am going to say three words that I want you to remember now and later.
- The words are banana, sunrise, chair.
- Please say them now." Give the person three tries to repeat the words.
- You may repeat the words to them for each try.
- If they are unable to repeat the words back to you after three tries, go directly to the clock drawing.
- Next, ask them to draw a clock

https://mini-cog.com/mini-cog-instrument/standardized-mini-cog-instrument/

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Cognitive Screening – Mini-Cog

- Tasks - "Please draw a clock in the circle."
- "Put all the numbers in the circle"
- "Now set the hand to show ten past eleven."
- Recall the 3 items

banana, sunrise, chair.

- Score 1 for each task performed and for each item
- A score less than 3 of the 5 items suggests cognitive impairment

Example of the same person drawing a clock over time with increasing dementia

52

The impact of childhood trauma and Toxic Stress?

- Leads to:
  - Neuroendocrine dysregulation
  - Altered immune response
  - Disrupts DNA packaging
  - Epigenetic tags can alter genetic makeup

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Question - What is ACE?

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

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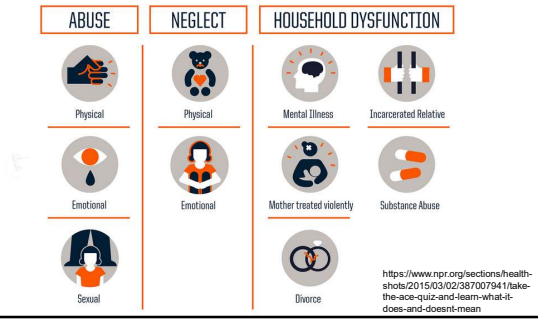
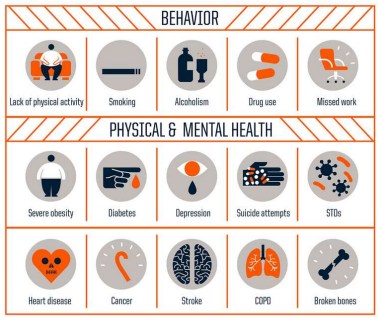
10 Assessment Areas for ACE – Use 10 Question Screening Tool to Assess



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

55

Impact of Childhood Trauma on Adults



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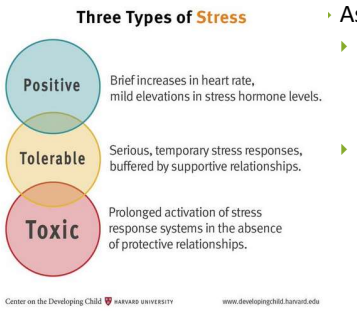
Toxic Stress (ACEs) in Childhood



- As Adults
  - Manifests as psychological issues (depression and anxiety)
  - But also manifests as diseases like diabetes (regardless of lifestyle factors)

https://numberstory.org/why-should-i-care-about-my-number-story/

57

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

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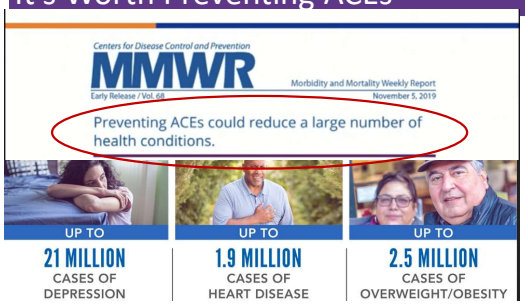
It's Worth Preventing ACEs



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Awareness >> to Healing

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What can Diabetes Specialists do?

- We can identify people who experienced toxic stress and take action.

Provide	Provide ACE screening tool as part of intake process.
Acknowledge	Acknowledge Results.
Provide	Provide trauma informed care.

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As health care providers, let's Ask!

- Trauma can have a significant impact on health
- What might be traumatic for one person may not be traumatic for another
- People may want to compartmentalize painful experiences from the past
- But chronic stress associated with trauma can wreak havoc on long term health.

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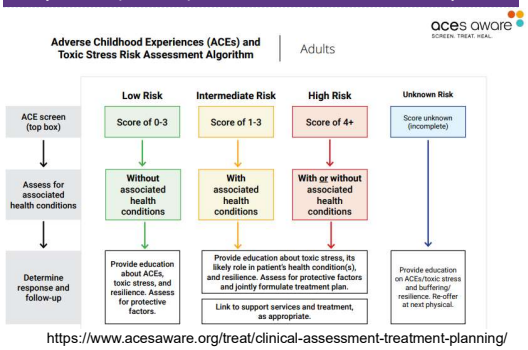
Provide ACE Screening tool. Ask how many ACEs they have (0 – 10) then use this treatment plan



https://www.acesaware.org/treat/clinical-assessment-treatment-planning/

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Client Action

- Not keeping appointments
- Not taking meds as prescribed
- Not adopting new behaviors

Providing Trauma Informed Approach

Provider Reaction

- Refrain from accusatory language or judgement
- Encourage collaboration
- Be curious
- Ask open ended questions

Diabetes Education SERVICES

64

How to Ask questions about trauma

In addition to the stresses of daily life, sometimes people with diabetes might have experienced something particularly difficult or traumatic.

We also know that experiencing violence is very common in many people's lives.

I'm just wondering if there's anything like this you might want to talk about?

65

The clinical response to identification of toxic stress should include:

1. Applying principles of trauma-informed care, including establishing trust, safety, and collaborative decision-making.

2. Supplementing usual care for ACE-Associated Health Conditions with patient education on toxic stress and discussing strategies that can help regulate the stress response, including:

- Supportive relationships, including with caregivers (for children), other family members, and peers
- High-quality, sufficient sleep
- Balanced nutrition
- Regular physical activity
- Mindfulness and meditation
- Experiencing nature
- Mental health care, including psychotherapy or psychiatric care, and substance use disorder treatment, when indicated

3. Validating existing strengths and protective factors.

4. Referrals to patient resources or interventions, such as educational materials, social workers, school agencies, care coordination or patient navigation, and community health workers.

https://numberstory.org/

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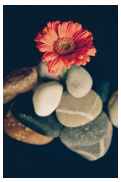
ACEs are Not Destiny

Diabetes Care Specialists can help interrupt intergenerational transmission of toxic stress



- 'With early detection and evidence-based intervention, we can transform health outcomes"

Nadine Burke Harris, MD
1st Surgeon General of California
Pediatrician, Activist, Role Model

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Trauma informed care saves lives

I finally feel like someone actually cares what happened to me and is providing me with help and support!

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Please visit this site | Free Training

www.ACEsAware.org

www.acesaware.org/heal/provider-toolkit/

69

Mental health – Build a Foundation

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

70

Look Beyond – What impacts DSM

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

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When Treatment Goals aren't met

- Reassess treatment regimen and barriers
  - Literacy
  - Diabetes related distress or depression
  - Poverty
  - Competing demands including those related to family responsibilities and dynamics
  - Culturally appropriate education?
  - Referral to social worker for assistance with insurance coverage
  - Medication taking behavior and regimen
  - Other?

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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

*Fear of hypoglycemia

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Supporting Resilience

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Optimism and Resilience

- Encourage Optimism and Resilience:
  - Hardiness and humor, resources, self confidence!
  - Develop network of specialists to help YOU for your own self balance and care!
  - Action Pack for Happiness

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GREAT DREAM

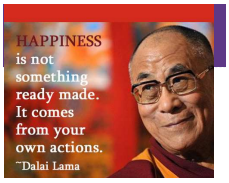
Ten keys to happier living

Action for Happiness has developed the 10 Keys to Happier Living based on a review of the latest scientific research relating to happiness.

Everyone's path to happiness is different, but the research suggests these ten things consistently tend to have a positive impact on people's overall happiness and well-being.

The first five relate to how we interact with the **outside** world in our daily activities. The second five come more from **inside** us and depend on our attitude to life.

GIVING	Do things for others
RELATING	Connect with people
EXERCISING	Take care of your body
APPRECIATING	Notice the world around
TRYING OUT	Keep learning new things
DIRECTION	Have goals to look forward to
RESILIENCE	Find ways to bounce back
EMOTION	Take a positive approach
ACCEPTANCE	Be comfortable with who you are
MEANING	Be part of something bigger



"People will forget what you said, people will forget what you did, but people will never forget how you made them feel" – Maya Angelou

ACTION FOR HAPPINESS Actionforhappiness.org

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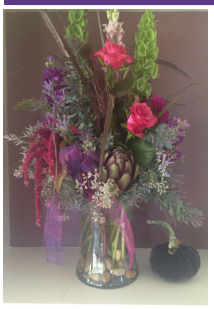
Thank You



- Questions?
- Email info@diabetesed.net
- Web www.diabeteseduniversity.net
- Phone: 530/ 893-8635

Diabetes Education SERVICES

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