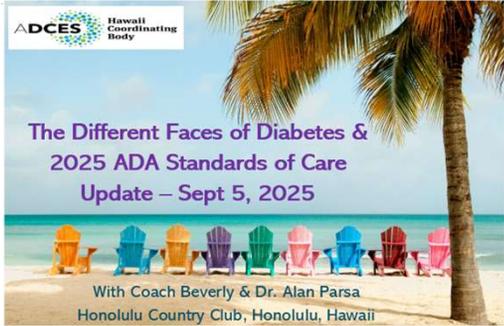


Diabetes Education SERVICES **25** years growth, connection, inspiration

**ADCES** Hawaii Coordinating Body



**The Different Faces of Diabetes & 2025 ADA Standards of Care Update – Sept 5, 2025**

With Coach Beverly & Dr. Alan Parsa  
Honolulu Country Club, Honolulu, Hawaii

Beverly Thomassian, RN, MPH, BC-ADM, CDCES  
Pronouns: She, her and hers Founder - [www.DiabetesEd.net](http://www.DiabetesEd.net)

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**Hawaii ADCES Coordinating Body**



Hawaii Chapter President Naomi Fukuda, APRN, BC-ADM, CDCES  
Camlyn Masuda, PharmD, CDCES, BCACP & Kourtney Inoue

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Diabetes Education SERVICES

QR Code for Handouts PDF & Resources



**Coupon Code Aloha25 (Save \$250). – CDCES Deluxe Prep Bundle on DiabetesEd Online University for only \$299 (usually \$549).**

The coupon code Aloha25 and will be active for 1 year. Expires on Sept 7, 2026.

[www.DiabetesEd.net](http://www.DiabetesEd.net) (search Hawaii)

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## Speakers & Agenda

**Agenda:**

08:00 am – 9:40 am	Updates to the ADA Standards of Care- Beverly Thomassian
09:40 am – 10:10 am	Break and visit exhibitors
10:10 am – 11:50 am	Identify the key elements of the standards that improve clinical care for people with diabetes - Beverly Thomassian
11:50 am – 1:00 pm	Lunch and visit exhibitors
1:00 pm – 2:05 pm	Discuss the diagnosis and symptoms of the different types of immune mediated diabetes - Beverly Thomassian
2:05 pm – 2:25 pm	Break and visit exhibitors
2:25 pm – 3:30 pm	Describe clinical manifestations of type 2, GDM, type 3, type 3c and MODY - Beverly Thomassian
3:30 pm – 4:30 pm	Practical approaches to treat these different types of diabetes presentations in clinical care – Dr. Alan Parsa

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## Coach Bev has no Conflict of Interest

- ▶ She's not on any speaker's bureau.
- ▶ Does not invest or have any financial relationships with diabetes related companies.
- ▶ Gathers information from reading package inserts, research and articles.
- ▶ The ADA Standards of Medical Care is main resource for course content.



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## Standards of Care Update & The Different Faces of Diabetes

**Objectives:**

1. State 3 changes and updates to the annual ADA Standards of Medical Care in Diabetes.
2. List at least one key element of the discussed standard that improve clinical care for people with diabetes.
3. Describe strategies to use the ADA hyperglycemia algorithm to determine appropriate use of the latest medications that address hyperglycemia and cardiorenal health.
4. Discuss the diagnosis and symptoms of the different types of immune mediated diabetes.
5. Describe clinical manifestations of type 2, GDM, type 3, type 3c and MODY.
6. Share practical approaches to treat these different types of diabetes presentations in clinical care.



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## First part Course topics

1. State the changes and updates to the annual ADA Standards of Medical Care in Diabetes.
2. Identify key elements of the position statement.
3. Discuss how healthcare professionals can apply this information in their clinical setting



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## 17. Diabetes Advocacy

- ▶ People living with diabetes deserve to be free from the burden of discrimination.
- ▶ We need to all be a part of advocating to ensure a healthy and productive life for people living with diabetes.
- ▶ Decrease barriers to diabetes self-management.



Diabetes Care needs to meet outlined standards in all settings.

- In school setting
- Young children in childcare
- For Drivers
- In work settings
- In Detention Facilities
- Insulin Access & Affordability

17. Diabetes Advocacy: Standards of Care in Diabetes—2025  
American Diabetes Association | Diabetes Care | Volume 48 | Number 1 | January 2025

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## CDC Announces



35% of  
Americans will  
have Diabetes  
by 2050

Boyle, Thompson, Barker, Williamson  
2010, Oct 22:8(1)29  
[www.pophealthmetrics.com](http://www.pophealthmetrics.com)

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## Poll Question 1

▶ According to the CDC, what best describes the current prevalence of prediabetes and diabetes in the U.S.?



- a. 30% of people above the age of 20 have type 2 diabetes.
- b. The rate of type 1 and type 2 diabetes have tripled since 2010.
- c. A total of 50% of people have prediabetes or diabetes.
- d. 1 out of 2 persons above age 20 have prediabetes.

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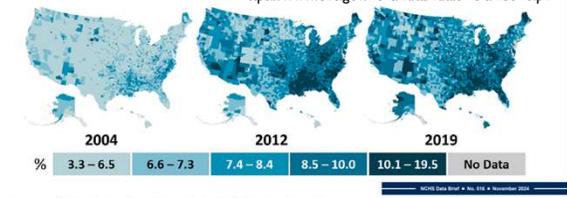
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## Type 2 Diabetes in America 2025

- ▶ 16.8% with Diabetes
  - ▶ 11% don't know they have it
- ▶ 38% with Prediabetes – 97 million adults

Figure 3. Age-adjusted, county-level prevalence of diagnosed diabetes among adults aged 20 years or older, United States, 2004, 2012, and 2019

<https://www.cdc.gov/nchs/data/databriefs/db516.pdf>



Data sources: US Diabetes Surveillance System; Behavioral Risk Factor Surveillance System. Prevalence of Total, Diagnosed, and Undiagnosed Diabetes in Adults: United States, August 2021–August 2023. doi:10.1093/ajph/2024.141.1000. Published online 2024.

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## Diabetes in Hawaii



### Hawaii's diabetes epidemic:

Approximately 154,365 people in Hawaii, or 13.1% of the adult population, have diabetes.

- Of these, an estimated 46,000 have diabetes but don't know it, greatly increasing their health risk.
- In addition, 442,000 people in Hawaii, 41.5% of the adult population, have prediabetes with blood glucose levels higher than normal but not yet high enough to be diagnosed as diabetes.
- Every year an estimated 8,000 people in Hawaii are diagnosed with diabetes.

**Diabetes and prediabetes cost an estimated \$1.5 billion in Hawaii each year.**

The serious complications include heart disease, stroke, amputation, end-stage kidney disease, blindness – and death.

13% with diabetes  
 About 1/3 of people don't know they have it  
 41% with Prediabetes  
 Costs Hawaii \$1.5 billion a year

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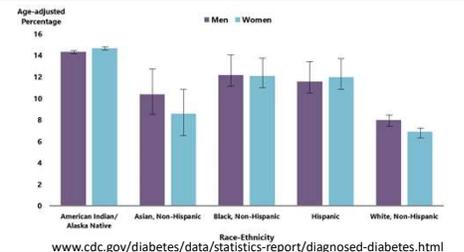


## Diabetes Prevalence by Ethnic Group

For adults, diabetes prevalence highest among:

- American Indians and Alaska Natives (14.5%),
- Non-Hispanic Blacks (12.1%),
- People of Hispanic origin (11.8%),
- Non-Hispanic Asians (9.5%)

Figure 2. Age-adjusted estimated prevalence of diagnosed diabetes by race/ethnicity group and sex for adults aged 18 years or older, United States, 2018-2019



[www.cdc.gov/diabetes/data/statistics-report/diagnosed-diabetes.html](http://www.cdc.gov/diabetes/data/statistics-report/diagnosed-diabetes.html)

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## 1. Improving Care - Population Health

- For optimal outcomes individualize care across **life span**.
- Improve population health through a combination of policy-level, system-level, and person-level approaches.



- Integrated person-centered care:**
  - ensures individual's values guide all clinical decisions
  - is respectful of and responsive to individual preferences, needs, and values;
  - considers comorbidities and prognoses

Improving Care and Promoting Health in Populations: Standards of Care in Diabetes-2023

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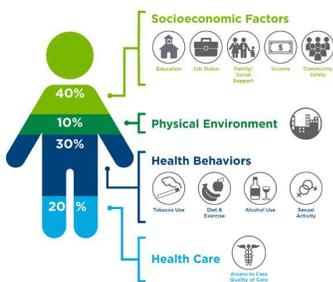
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## Address Barriers to Self Management

- Barriers exist within health system, payer, health care professional & individual.
- Address barriers through innovation, including community health workers, telehealth, other digital health solutions.
- Consider social determinants of health in the target population when designing care.

### What Goes Into Your Health?



Improving Care and Promoting Health in Populations: Standards of Care in Diabetes-2023

Source: Institute for Clinical Systems Improvement, Using Behavioral Change Models to Improve Population Health (2016)

<https://coveragetoolkit.org/health-equity/defining-health-equity/>

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## Social Determinants of Health

► The conditions in which people:

- Play
- Live
- Work
- Learn
- Pray



Directly affects their health risks and outcome

*AADE Population Health & Diabetes Educators Evolving Role 2019*

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## Social Determinants of Health

► SDOH are defined as the economic, environmental, political, and social conditions in which people live and are responsible for a major part of health inequality worldwide.



1. Improving Care and Promoting Health in Populations: Standards of Care in Diabetes—2021

Greater exposure to adverse SDOH over the life course results in poor health. Use quality data to identify inequities & take action.

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## Status of Diabetes Care

► In 2015–2018, U.S. community-dwelling adults with diabetes achieved:

- A1C <7% by 50.5%
  - 75.4% achieved A1C <8%.
- BP target of <130/80 achieved by 47.7%
  - 70.4% achieved blood pressure <140/90 mmHg.
- Lipid control (non-HDL cholesterol) <130 mg/dL, achieved by 55.7%
- 22.2% met targets for all three risk factors
- Many not receiving adequate lifestyle or pharmacotherapy.



1. Improving Care and Promoting Health in Populations: Standards of Care in Diabetes—2021

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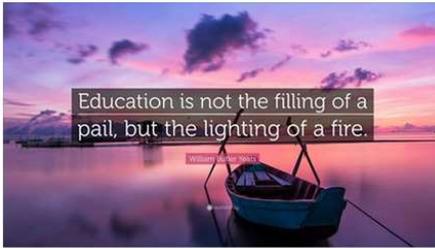
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Let's meet people where they are at.




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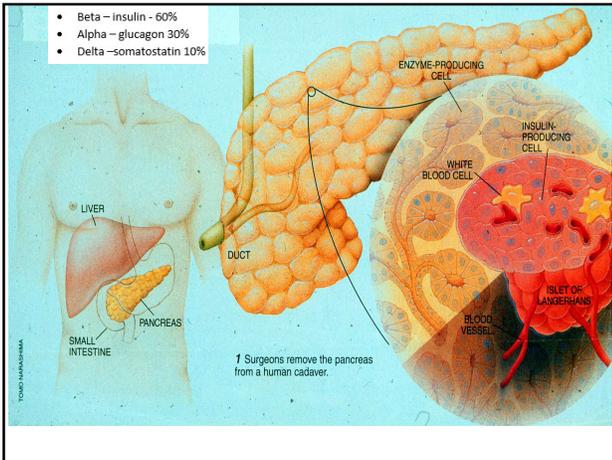
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BT1

### Hormones Effect on Glucose

Hormone	Effect
▶ Glucagon (pancreas)	⬆️
▶ Stress hormones (kidney)	⬆️
▶ Epinephrine (kidney)	⬆️
▶ Insulin (pancreas)	⬇️
▶ Amylin (pancreas)	⬇️
▶ Gut hormones	⬇️
▶ incretins (GLP-1) released by L cells of small intestine and colon	⬇️
▶ GIP found in K cells in duodenum and some in small intestine	⬇️

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**BT1** Added gut hormone info

Beverly Thomassian, 2025-08-25T01:23:14.042

## Poll Question 2

- Which of the following level is considered pre-diabetes range?
- Fasting BG of 62
  - A1c of 5.9 %
  - After meal BG of 137
  - A1c of 7.1 %




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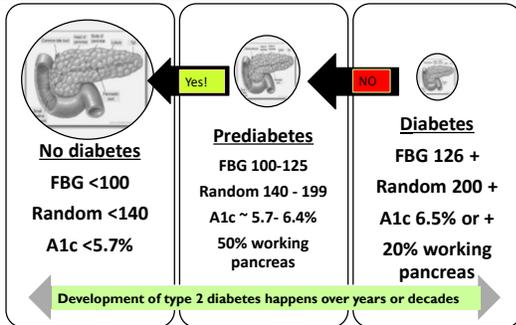
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## 2. Diagnosis and Classification of Diabetes Natural History of Diabetes




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## Pre Diabetes & Type 2- Screening Guidelines (ADA 2025 Clinical Practice Guidelines)

- Start screening all people at age 35.
- Screen at any age if BMI  $\geq$  25 (Asians BMI  $\geq$  23) plus one or > additional **risk factor**:
  - First-degree relative w/ diabetes
  - Member of a high-risk ethnic population
  - Habitual physical inactivity
  - History of heart disease
  - Check more frequently if taking high risk meds; antiretrovirals, 2<sup>nd</sup> generation antipsychotics or steroids, thiazide diuretics, statins
  - History of pancreatitis, prediabetes, GDM, periodontitis




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## Diabetes 2 - Who is at Risk?

(ADA 2024 Clinical Practice Guidelines)



Screen using A1C, Fasting Blood Glucose or OGTT.

Repeat screening at least every 3 years if negative.

\*If prediabetes or on high risk meds, recheck yearly

3. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2024

### Risk factors cont'd

- ▶ HTN - BP > 130/80
- ▶ HDL < 35 or triglycerides > 250
- ▶ History of Gestational Diabetes Mellitus
- ▶ Polycystic ovary syndrome (PCOS)
- ▶ Other conditions associated w/ insulin resistance:
  - ▶ Elevated BMI, acanthosis nigricans (AN)

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## Diabetes Screening Guidelines

(ADA 2025 Clinical Practice Guidelines – Cheat Sheet)

### RECOMMENDATIONS FOR DIAGNOSIS AND CLASSIFICATION OF DIABETES – 2025

CRITERIA FOR SCREENING FOR DIABETES AND PREDIABETES IN ASYMPTOMATIC ADULTS – TABLE 1

DIABETES TYPE	RISK FACTORS and FREQUENCY OF SCREENING and TESTING FOR DIABETES
Type 1	Screen those at risk for presymptomatic type 1 diabetes, by testing autoantibodies to insulin, GAD, islet antigen 2 or ZnT8. Also test antibodies for those with type 1 phenotypic risk (younger age, weight loss, ketoacidosis, etc.)
2	<ol style="list-style-type: none"> <li>1. Test all adults starting at age 35 for prediabetes and diabetes using Fasting Plasma Glucose, A1C or OGTT.</li> <li>2. Perform risk-based screening if BMI ≥ 25 or BMI ≥ 23 in Asian Americans 10yrs+ with 1 or more risk factors:                             <ul style="list-style-type: none"> <li>• History of cardiovascular disease</li> <li>• Physical inactivity</li> <li>• First or second degree relative with diabetes</li> <li>• HDL ≤ 35 mg/dl or triglyceride ≥ 250 mg/dl</li> <li>• High risk ethnicity or ancestry</li> <li>• Hypertension ≥ 130/80 mmHg or on therapy for HTN</li> <li>• Other conditions associated with insulin resistance (PCOS, Acanthosis Nigricans, Steatosis)</li> </ul> </li> <li>3. If results normal, repeat test at a minimum of 3-year intervals or more frequently based on risk status.</li> <li>4. Test Yearly if A1C ≥ 5.7% or Impaired Fasting Glucose or History of GDM (test at least every 1-3 years)</li> </ol> <p>Closely monitor high-risk groups (before taking 2<sup>nd</sup> generation antipsychotics, steroids, thiazide diuretics, statins, HIV meds and/or initiating therapy) with history of pancreatitis, or periodontal disease.</p>

3. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2025

DiabetesEd Cheat Sheets

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## Poll Question 3

- ▶ What best describes prediabetes in the U.S.?
  - a. Prediabetes affects 18-20% of people above the age of 20.
  - b. The prevalence of prediabetes and diabetes are almost equal.
  - c. Most people with BMI of 30 or greater have prediabetes.
  - d. Prediabetes is associated with increased risk of CV disease




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## PreDiabetes is FREAKING ME OUT

- ▶ 96 million people in US
- ▶ 80% don't know they have it
- ▶ In 3-5 years, about 30% of predm will get diabetes
- ▶ Associated with higher rates of heart attack, stroke, neuropathy and vessel disease



Do I look like I am freaking out?

3. Prevention or Delay of Diabetes and Associated Comorbidities: Standards of Care in Diabetes—2025

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## 3. Prevent or Delay Diabetes for those with Prediabetes

- ▶ Prediabetes defined as:
  - ▶ A1c 5.7 – 6.4% or fasting BG 100 -125mg/dl
- ▶ Action:
  - ▶ Screen yearly for diabetes
  - ▶ For adults with BMI 23/25
    - ▶ Refer to DPP approved programs
    - ▶ Includes intensive behavioral lifestyle interventions with 7% wt reduction goal + 150 min exercise week
    - ▶ Provide in person or certified assisted programs



3. Prevention or Delay of Diabetes and Associated Comorbidities: Standards of Care in Diabetes—2025

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## Get About 7 Hours of Quality Sleep to Prevent Diabetes

- ▶ Poor sleep quality was associated with a 40–84% increased risk of developing type 2 diabetes in a meta-analysis.
- ▶ Chronotype preference has been linked with many chronic diseases, including type 2 diabetes.
  - ▶ For those with a preference for evenings (i.e., going to bed late and getting up late)
    - ▶ 2.5-fold higher odds ratio for type 2 diabetes than for those with a preference for mornings (i.e., going to bed early and getting up early),
    - ▶ Independent of sleep duration and sleep sufficiency



3. Prevention or Delay of Diabetes and Associated Comorbidities: Standards of Care in Diabetes—2025

*The composition of the gut microbiome may also affect the likelihood of developing type 2 diabetes.*

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### 3. Pharmacologic Interventions

- ▶ Use more intensive approach for high-risk individuals:
  - ▶ BMI of 35+
  - ▶ If A1C is ~6.0 or FPG is 110
  - ▶ History of GDM
- ▶ No FDA approved med for prevention (off label)
- ▶ Consider Metformin Therapy for Prediabetes
  - ▶ Monitor B12 level (esp with neuropathy or anemia)
- ▶ CV Risk Mitigation important.
- ▶ Statin can increase BG, stop if notice elevation
- ▶ Consider low dose pioglitazone (Actos) if history of stroke.



3. Prevention of Onset of Diabetes and Associated Complications: Standards of Care in Diabetes—2025

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### Indications for Insulin Sensitizers

Rosiglitazone (Avandia), Pioglitazone (Actos)

- ▶ **Action:** decrease insulin resistance by making muscle and adipose cells more sensitive to insulin. Decrease free fatty acids
- ▶ **Names:**
  - ▶ pioglitazone (Actos) – bladder cancer warning
  - ▶ Dosing: 15-45 mg daily
  - ▶ Consider adding low dose if history of stroke or with steatosis
- ▶ **Efficacy/ Considerations**
  - ▶ Reduce A1C ~0.5-1.0%
  - ▶ 6 weeks for maximum effect
  - ▶ Pioglitazone \$5 a month
  - ▶ Can cause fluid retention, not indicated w/ CHF



Class/Action	Name(s)	Daily Dose Range	Considerations
Thiazolidinediones "TZD"	pioglitazone	15-45 mg daily	Black Box Warning: 2x risk for bladder cancer. Monitor for edema and weight gain. Increased potential for heart failure. Actos may increase risk of bladder cancer. (www.fda.gov/oc/ohrt/actos)

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes—2025

### Metabolic dysfunction–associated steatotic liver disease (MASLD)

- ▶ Recent studies estimate that MASLD is prevalent in >70% of adults with type 2.
- ▶ 50% of people with diabetes have MASH (Metabolic Associated Steatohepatitis)
  - ▶ MASH = 5% plus hepatic steatosis with inflammation and hepatocyte injury (hepatocyte ballooning), with or without evidence of liver fibrosis



4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes—2025

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## Liver Nomenclature Update

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

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## Screening for MASH – FIB-4

### Fibrosis-4 (FIB-4) Calculator

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

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

▶ The American College of Gastroenterology considers Upper limit of normal ALT levels:

- ▶ 29–33 units/L for males
- ▶ 19–25 units/L for female individuals

[mdcalc.com/calc/2200/fibrosis-4-fib-4-index-liver-fibrosis](http://mdcalc.com/calc/2200/fibrosis-4-fib-4-index-liver-fibrosis).

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

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

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### Diagnostic Algorithm for the Prevention of Cirrhosis in People With Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD)

\*Consider ELF if LSM not available. Refer to liver specialist if ELF ≥ 9.8

Figure 4.2—LSM, liver stiffness measurement, as measured by vibration-controlled transient elastography. “Fibroscan” \*In the absence of LSM, consider ELF enhanced liver fibrosis test; a diagnostic alternative. If ELF ≥ 9.8, an individual is at high risk of MASH with advanced liver fibrosis (≥F3–F4) and should be referred to a liver specialist.

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## Poll Question 4



In the 2025 ADA Standards they recommend pharmacologic agents along with lifestyle interventions to treat people with diabetes and Metabolic Associated Steatohepatitis (MASH). Which of the following are the recommended diabetes medications to treat MASH?



- A. Vitamin E and SGLT-2
- B. Pioglitazone and/or GLP-1 RA / GIP
- C. Fish oil supplements and statin
- D. Metformin and/or bolus insulin therapy

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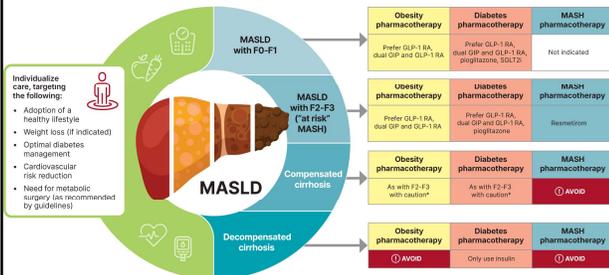
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### Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD) Treatment Algorithm



Individualized care and close monitoring needed in compensated cirrhosis given limited safety data available.

F0-F1, no to minimal fibrosis; F2-F3, moderate fibrosis; F4, cirrhosis;

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes—2025

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## Step Wise Approach to Hyperglycemia 2025

- ▶ Usually, start one medication at a time
- ▶ However, evidence supports initial combo therapy if A1C 8.5% or more, to quickly reach goals and slow decline of glucose control.
- ▶ Where to start?
  - ▶ Individual values
  - ▶ CVD, Heart failure or Kidney Disease
  - ▶ Minimize Hypoglycemia
  - ▶ Minimize wt gain or promote wt loss
  - ▶ Consider Cost




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**Common Oral Diabetes Meds**

Diabetes Education SERVICES

DiabetesGAD Success! Get Our Free CDDES Coach App

Class/Main Action	Name(s)	Daily Dose Range	Considerations
<b>Biguanides</b> • Decreases hepatic glucose output • First line med at diagnosis of type 2	metformin (Glucophage)	500 - 2550 mg (usually BID w/ meal)	<b>Side effects:</b> nausea, bloating, diarrhea, B12 deficiency. To minimize GI Side effects, use XR and take w/ meals. <b>Obtain GFR before starting.</b> <ul style="list-style-type: none"> <li>• If GFR &lt;30, do not use.</li> <li>• If GFR &lt;45, don't start Metformin</li> <li>• If pt on Metformin and GFR falls to 30-45, eval risk vs. benefit; consider decreasing dose.</li> </ul> <b>For dye study,</b> if GFR <60, liver disease, alcoholism or heart failure, restart metformin after 48 hours if renal function stable. <b>Benefits:</b> lowers cholesterol, no hypo or weight gain, cheap. Approved for pediatrics, 10 yrs + Lowers A1c 1.0%-2.0%.
	Riomet (liquid metformin)	500 - 2550 mg 500mg/5mL	
	Extended Release-XR (Glucophage XR) (Glumetza) (Fortamet)	(1x daily w/dinner) 500 - 2000 mg 500 - 2000 mg 500 - 2500 mg	

Biguanide derived from: Goat's Rue *Galega officinalis*, French Lilac  
 Does NOT harm kidneys  
 \$10 for 3-month supply from Walmart & other pharmacies

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**Metformin and Kidney Disease – 2025 Update**

- ▶ Metformin is also a preferred agent in CKD due to well-documented efficacy and safety profile in type 2 diabetes.
- ▶ However, there is no documented direct kidney benefit.
- ▶ Don't start metformin if eGFR is <45
- ▶ Reduce dose of metformin if eGFR is <45 individual is already on metformin.
- ▶ Stop metformin once eGFR is <30

Pharmaceutical Approaches to Optimize Treatment Standards for CKD in Diabetes-2025-2028

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**Medication Taking Behaviors**

- ▶ Adequate medication taking is defined as 80%
- ▶ 23% of time, if A1c, B/P, lipids above target - due to med taking behavior
- ▶ Assess for barriers
- ▶ If taking meds 80% of time and goals not met, consider medication intensification

Barriers include:  
 Forgetting to fill Rx, forgetting to take, fear, depression, health beliefs, med complexity, cost, knowledge gap, system factors, etc.

**Work on targeted approach for specific barrier**

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## Wait, What About Emotions?




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## Diabetes Admit for Hyperglycemia

- ▶ John is admitted for hyperglycemia because he stopped taking his diabetes meds.
- ▶ HCP says, "Don't you realize you are going to get complications, like kidney disease or amputation if you don't take your medications?"
- ▶ Door Closed – No Connection made

### How Does John Feel?

- ▶ Embarrassed
- ▶ Ashamed
- ▶ Defeated
- ▶ Angry
- ▶ Unheard



### How does HCP feel?

- ▶ Frustrated
- ▶ Defeated
- ▶ Worried

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## Diabetes Visit – Let's Go through

### A small adjustment can make a BIG Difference

- ▶ HCP says, "John, I am worried about you and your elevated blood glucose. Can you share what is going on in your life?"
- ▶ Door Open – Connection made

### How Does John Feel?

- ▶ Heard & Seen
- ▶ Recognized
- ▶ Connected
- ▶ Engaged

### How does the HCP feel?

- ▶ Connected
- ▶ Concerned
- ▶ Collaborative




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## Create a Judgement Free Zone – Roll out the Carpet of Acceptance

There are no bad or good blood glucose numbers.  
 There is no such thing as cheating.  
 You are not failing at your diabetes.  
 It is not your fault you have diabetes.  
 Thank you for showing up today.




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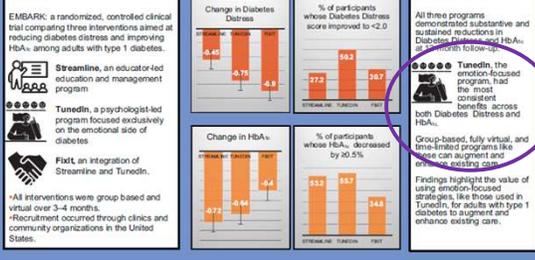
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## EMBARC Trial

Adults with type 1 diabetes experienced reductions in diabetes distress and HbA<sub>1c</sub> after participating in a virtual emotion-focused and/or education/behavioral program



EMBARC: A Randomized, Controlled Trial Comparing Three Approaches to Reducing Diabetes Distress and Improving HbA<sub>1c</sub> in Adults With Type 1 Diabetes. *Diabetes Care* 2024; 47:2324-2332. <https://doi.org/10.2337/24.23.2452>

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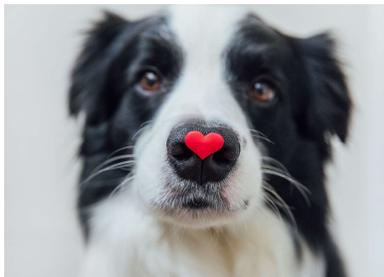
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## Embark Trial – Emotions as Priority

I have finally given myself permission to make addressing the emotional aspects of diabetes a priority.

~Coach Beverly




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## Sexual and Dental Health

- ▶ Screen for those with prediabetes and diabetes for **sexual dysfunction**.
- ▶ Men – erectile dysfunction
- ▶ Women – desire, orgasm difficulty, vaginal dryness, bladder issues.



- ▶ **Dental health**
- ▶ Coordinate efforts between medical and dental teams.
- ▶ Refer for dental exam at least once a year.
- ▶ Treatment can lower A1C 0.4%

4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes—2025   
American Diabetes Association Professional Practice Committee

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## Diabetes is Complex

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



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### Wild Geese, by Mary Oliver

You do not have to be good.  
You do not have to walk on your knees  
for a hundred miles through the desert repenting.  
You only have to let the soft animal of your body  
love what it loves.

Tell me about despair, yours, and I will tell you mine.  
Meanwhile the world goes on.  
Meanwhile the sun and the clear pebbles of the rain  
are moving across the landscapes,  
over the prairies and the deep trees,  
the mountains and the rivers.

Meanwhile the wild geese, high in the clean blue air,  
are heading home again.

Whoever you are, no matter how lonely,  
the world offers itself to your imagination,  
calls to you like the wild geese, harsh and exciting—  
over and over announcing your place  
in the family of things.



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## DiaBingo

- Frequent skin and yeast infections
- A BMI of \_\_\_\_ or greater indicates increased pre/diabetes risk?
- To reduce complications, control **A1c**, **Blood pressure**, **Cholesterol**
- PreDiabetes – fasting glucose level of \_\_\_\_ to \_\_\_\_
- Erectile dysfunction indicates greater risk for \_\_\_\_
- Diabetes – fasting glucose level \_\_\_\_ or greater
- Type 1 diabetes is best described as an \_\_\_\_ disease
- People with diabetes are \_\_\_\_ times more likely to die of heart dx
- Elevated triglycerides, < HDL, smaller dense LDL
- Each percentage point of A1C = \_\_\_\_ mg/dl glucose
- At dx of type 2, about \_\_\_\_% of the beta cell function is lost
- Diabetes – random glucose \_\_\_\_ or greater

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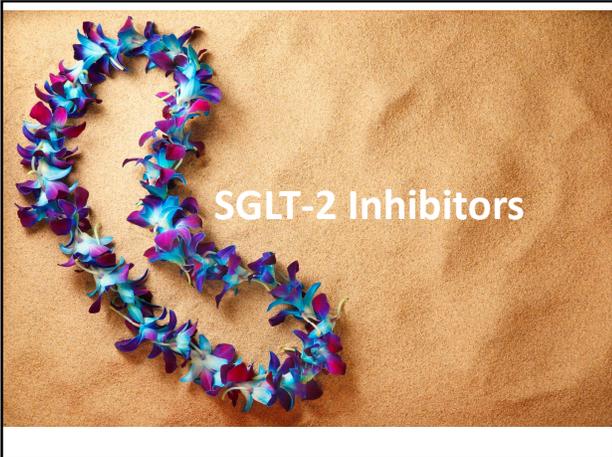
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## Poll Question 6

- ▶ RL is a 43 year old who was on insulin after experiencing GDM. She then was started on a GLP-1, Metformin and an SGLT-2, and stopped the insulin completely. Her daughter told her, “Your breath smells funny”. A1C 7.9%. What are you worried about?
- a. Euglycemic DKA
  - b. Dental caries
  - c. Renal failure
  - d. Steatosis



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## Side Effects of SGLT-2 Inhibitors

Genitourinary infections

Volume depletion

Increased urination

Hypotension

UTI

Diabetes ketoacidosis (DKA)

Amputation risk? Fournier's gangrene?

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## SGLT-2i Indications Summary

Drug	Lower BG	Reduce CV Risk?	Use to treat Heart Failure?	Slow renal disease?
<b>Dapagliflozin</b> (Farxiga)	Yes	Yes	Yes +/- Diabetes	Yes
<b>Empagliflozin</b> (Jardiance)	Yes	Yes	Yes +/- Diabetes	Yes
<b>Canagliflozin</b> (Invokana)	Yes	Yes	Yes w/ Diabetes	Yes
<b>Ertugliflozin</b> (Steglatro)	Yes	No	Yes w/ Diabetes	Yes
<b>Bexagliflozin</b> (Brenzavvy)	Yes	NA	NA	NA

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## Case Study KR – Poll 7

KR is a 47yoM with type 2 diabetes x 5 years. Complains of dizziness/shakiness 3x a week, especially after surfing. Last A1C 6.7%. Which of their medications is most likely causing hypoglycemia?

- A. Metformin
- B. Sitagliptin (Januvia)
- C. Glimepiride (Amaryl)
- D. Pioglitazone (Actos)




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## Sulfonylureas - Squirters

- ▶ Mechanism: Stimulate beta cells to release insulin
- ▶ Dosed 1-2x daily before meals
- ▶ Adverse effects
  - ▶ Hypoglycemia, Weight gain, watch renal function
- ▶ Low cost, \$12 for 3 months supply
- ▶ Can help with glucose toxicity, lowers A1C 1-2%



Sulfonylureas • Stimulates sustained insulin release	glyburide: (DiaBeta) (Glynase PresTabs)	1.25 – 20 mg 0.75 – 12 mg	Can take once or twice daily before meals. Low cost generic. <b>Side effects:</b> hypoglycemia and weight gain. Eliminated via kidney. <b>Caution:</b> Glyburide most likely to cause hypoglycemia. Lowers A1c 1.0% – 2.0%.
	glipizide: (Glucotrol) (Glucotrol XL)	2.5 – 40 mg 2.5 – 20 mg	
	glimepiride (Amaryl)	1.0 – 8 mg	

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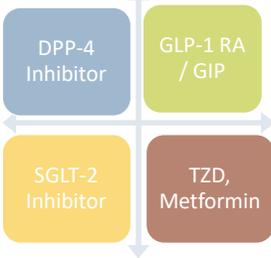
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## Hypoglycemia & Next Steps

Do NOT Cause Hypoglycemia



Can Cause Hypoglycemia

- ▶ Sulfonylurea
- ▶ Meglitinides
- ▶ Insulin

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## Hypoglycemia (Glucose) Alert Values

- ▶ **BG < 70mg/dl – Level 1**
- ▶ Follow 15/15 rule and contact provider to make needed changes. At increased hypo risk.
- ▶ **BG < 54mg/dl – Level 2**
- ▶ Indicates serious hypo. Reassess BG Goals. Consider med decrease. Predictive of Level 3 Hypo. Needs Glucagon Emergency Kit
- ▶ **Severe Hypoglycemia – Level 3**
- ▶ Altered mental, physical functioning.
- ▶ Requires external assistance – no threshold



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### Hypoglycemia: Identify, Treat, & Prevent

**Step 1**

Identify your signs of hypoglycemia or low blood sugar:

- Sweaty
- Shaky
- Hungry
- Can't think straight
- Headache
- Irritated, grouchy
- Other

**Step 2**

If have signs of hypo, treat with carbs until glucose reaches 70+, then eat usual meal.

- Sugary drink, 4–8oz
- Piece of fruit
- Raisins, handful
- Glucose tabs, 4+
- Honey/glucose gel
- Skittles candy, 15+

**Step 3**

Have glucagon rescue meds available.

In case of severe hypo, identify someone (ahead of time) who can get medical help & give a glucagon rescue medication.

**Notify your provider of low blood sugar events.**

**Hypoglycemia Levels:**

Level 1 – Glucose less than 70  
 Level 2 – Glucose less than 54  
 Level 3 - Severe, needs assistance

**Identify Causes of Hypo & Problem Solve to Prevent Future Episodes**

» Low carb meal	» Delayed, missed meal
» Extra activity	» Too much insulin/meds
» Drinking alcohol	» Insulin timing

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### Quick Question 8

▶ JZ is excited about his A1c of 5.4%. He takes rapid acting insulin 4-6 times a day using a pen to keep his BG to target. Plus, adjusts glargine as needed if his pm BG is elevated. What is your biggest concern?



- Does he change his needle each time?
- Why is he adjusting glargine?
- Is he adjusting insulin for exercise?
- How many hypoglycemic events per week?

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### Hypo Marker of CV Events & Mortality



Severe hypoglycemia a potent marker of high absolute risk of cardiovascular events and mortality.



HCP need to be vigilant in preventing hypoglycemia.



Avoid aggressively attempting to achieve near-normal A1C levels if such goals cannot be safely and reasonably achieved.

6. Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes—2025

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## SDOH and Hypoglycemia

Food insecurity, housing instability, underinsured, under-resourced living areas is associated with increased risk of hypoglycemia-related emergency department visits

Identify if fasting part of religious observances

Young children and older adults at highest risk

Insulin pumps with automated low-glucose suspend and automated insulin delivery systems have been shown to be effective in reducing hypoglycemia in type 1 diabetes

6. Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes—2025

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## Assess for Hypo

Review history of hypoglycemia at every clinical encounter for all individuals at risk for hypoglycemia

Evaluate hypoglycemic events

Screen for impaired hypoglycemia awareness at least annually.

Consider individual's risk for hypoglycemia when selecting diabetes medications and glycemic goals.

Use of CGM is beneficial and recommended for individuals at high risk for hypoglycemia.

6. Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes—2025

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## Hypoglycemia: Clinical Risk Factors

**Table 6.5—Assessment of hypoglycemia risk among individuals treated with insulin, sulfonyleureas, or meglitinides**

Clinical and biological risk factors	Social, cultural, and economic risk factors
<b>Major risk factors</b> <ul style="list-style-type: none"> <li>Recent (within the past 3–6 months) level 2 or 3 hypoglycemia</li> <li>Intensive insulin therapy*</li> <li>Impaired hypoglycemia awareness</li> <li>End-stage kidney disease</li> <li>Cognitive impairment or dementia</li> </ul>	<b>Major risk factors</b> <ul style="list-style-type: none"> <li>Food insecurity</li> <li>Low-income status§</li> <li>Housing insecurity</li> <li>Fasting for religious or cultural reasons</li> <li>Underinsurance</li> </ul>
<b>Other risk factors</b> <ul style="list-style-type: none"> <li>Multiple recent episodes of level 1 hypoglycemia</li> <li>Basal insulin therapy*</li> <li>Age ≥75 years†</li> <li>Female sex</li> <li>High glycemic variability‡</li> <li>Polypharmacy</li> <li>Cardiovascular disease</li> <li>Chronic kidney disease (eGFR &lt;60 mL/min/1.73 m<sup>2</sup> or albuminuria)</li> <li>Neuropathy</li> <li>Retinopathy</li> <li>Major depressive disorder</li> <li>Severe mental illness</li> </ul>	<b>Other risk factors</b> <ul style="list-style-type: none"> <li>Low health literacy</li> <li>Alcohol or substance use disorder</li> </ul>

6. Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes—2025

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## Tx of Level 2 & 3 Hypoglycemia

- ▶ If can swallow w/out risk of aspiration, try gel, honey, etc. inside cheek
- ▶ If unable to swallow, D50 IV or Glucagon
- ▶ Glucagon injection (need Rx)
  - ▶ Inform and instruct caregivers, school personnel, family, coworkers of hypo signs and appropriate action
  - ▶ Dosing: Adults 1mg, Children <20kg 0.5mg
  - ▶ Glycemic effect 20 - 30mg, short lived
  - ▶ Must intake carb as soon as able
- ▶ If on Insulin or level 2 or 3 hypo, (<54), get Glucagon ER Kit. Re-evaluate diabetes med treatment plan.




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## Glucagon Rescue Medications for Diabetes-Related Hypoglycemia

Name/Delivery	Supplied	Adult	Dose Range		Age / Route / Storage
			Peds / Age	WT Dosing	
Glucagon Emergency Kit Injection requires mixing glucagon powder	1mg / 1mL vial + syringe	1mg		0.03mg/kg or < 6yrs or < 25 kgs   0.5mg ≥ 6yrs or > 25kgs   1mg	All ages approved SubQ or IM admin Expires in 2 years at room temp.
Baqsimi Nasal glucagon powder	3 mg intranasal device	3 mg	< 1 yrs: not recommended 1 yrs or older   3mg dose		Approved Age 1+ Nasal admin Expires ~ 2 years at room temp (keep in shrink-wrapped tube).
Gvoke Injectable liquid stable glucagon solution	0.5mg or 1.0mg in -Prefilled syringe -HypoPen auto-injector -Kit with vial and syringe	1 mg	< 2yrs: not recommended 2-12 yrs < 45kg   0.5mg ≥ 45kg   1mg 12 yrs or older   1mg		Approved Age 2+ SubQ admin in arm, thigh, abdomen Expires in 2 years at room temp (keep in foil pouch).
Dasiglucagon (Zegalogue) Stable liquid glucagon analog	0.6mg/0.6mL Prefilled syringe Autoinjector	0.6mg	< 6yrs: not recommended 6 yrs or older   0.6mg		Approved Age 6+ SubQ in abdomen, buttocks, thigh outer upper arm Expires in 1 year at room temp. (store in red protective case).

\*All raise BG 20+ points. Can cause nausea, vomiting. After admin, roll person on side. Seek medical help. If no response after 1st dose, give 2nd dose in 15 mins. When awake, give oral carbs ASAP when safe to swallow. Please consult package insert for detailed info.  
All PacketCard content is for educational purposes only. Please consult prescribing information for detailed guidelines.  
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## If on insulin or sulfonylurea – special precautions required

- ▶ Carb source on person, car, by bed at all times
- ▶ Identification
  - ▶ Phone (ICE)
  - ▶ Wallet Card
  - ▶ Bracelet
- ▶ If pattern of lows, med adjustment required
- ▶ Pre-meal target
  - ▶ 100-130?
- ▶ Post meal
  - ▶ Less than 180
- ▶ Bedtime
  - ▶ 110 - 180




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## ADA Standards 2025 – Section 5

“People eat food, not nutrients, nutrient recommendations need to be applied to WHAT people eat”



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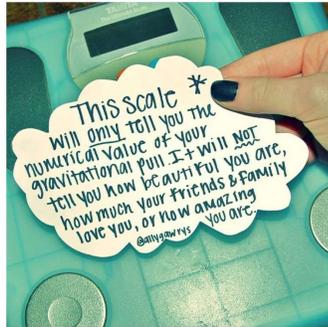
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## Weight is a Heavy Issue



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## Weight Stigma

- ▶ Weight stigma, fat bias, and anti-fat bias are ways to describe the bias toward people living in larger bodies.
- ▶ Fat bias is prevalent among health care professionals and general public.
- ▶ Health care professionals are strongly encouraged to increase their awareness of implicit and explicit weight-biased attitudes.
- ▶ Increasing empathy and understanding about the complexity of weight management among health care professionals is a useful avenue to help reduce weight bias.



5. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes—2025

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## Health Behavior Change: Shifting Focus

### Health at Every Size (HAES) Principles

- ▶ Weight Inclusivity
- ▶ Health Enhancement
- ▶ Eating for Well-being
- ▶ Respectful Care
- ▶ Life-Enhancing Movement

"People might think they can tell who's fit and who's not by looking at them, but in fact, it's trickier than that."

"Lots of people are fat and fit—many avid dancers, runners, lifters, and sports team members are big to start with and stay that way. They tend to be far healthier than thin people who don't move around much or eat a nutritious mix of foods."

*Health at Every Size: The Surprising Truth About Your Weight.* Bacon holds a Ph.D. in physiology with a focus on nutrition and weight regulation.

"Health at Every Size is about taking care of your body without worrying about whether you're 'too' big or small."

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## Get a Tape Measure & Other Assessments



- ▶ WHO defines Obesity as: *abnormal or excessive fat accumulation that presents a risk to health*
- ▶ BMI poor indicator for "excessive fat" and health risk

Overall - assess individual's

- adipose tissue mass
- using waist circumference
  - 35" woman, 40" man
- waist-to-hip ratio
  - Waist smaller than hips
- waist-to-height ratio
  - Waist < half height
- presence of associated health or well-being consequences: metabolic, physical, or psychological well-being

STANDARDS OF CARE | DECEMBER 30, 2024  
8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes-2025

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## Interested in Weight Loss?

- ▶ Ask Permission
- ▶ Assess readiness/willingness to engage in changes for weight loss
- ▶ Use non-judgmental language
- ▶ Action-Based Goals
  - ▶ Use shared-decision making for weight-loss goals & intervention strategies
  - ▶ Strategies may include dietary changes, physical activity, behavioral therapy, pharmacologic therapy, medical devices, & metabolic surgery



STANDARDS OF CARE | DECEMBER 30, 2024  
8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes-2025

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## Weight Loss is Helpful

3-7 % Wt Loss

**Diabetes Mgmt** Improves glycemia, BP, Lipids, intermediate CVD risk, reduce RX, Reduced progression to diabetes

> 7% Wt Loss

**Diabetes Prevention** DPP weight loss goal is ≥ 7%, associated with reduced progression to diabetes

> 10% Wt Loss

**Diabetes Mgmt** May lead T2DM remission, improved CVD & metabolic comorbidities & reduced mortality Reduces need for medications

**Optimal goal is healthy weight maintenance: Continue monitoring & support**



“For individuals with diabetes & overweight/obesity any magnitude of weight loss may benefit.”

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## Limit Highly Processed Carbs and Added Sugars

Eat more HIGH Fiber foods:

- Choose High fiber carbs loaded with vitamins, minerals and phytonutrients
- “Power Carbs” include:
  - Beans/Lentils
  - Veggies
  - Whole Fruits
  - Low-fat, low sugar milk/yogurt
  - Whole Grain foods
    - as culturally appropriate



Replace highly processed and ultra-processed foods with whole or minimally processed foods for a healthier eating pattern that supports health.

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## Fiber – the New “F” Word

- ▶ Goal: minimum
  - ▶ 14 gms / 1000 calories, ~ 30 gms a day
- ▶ How?
  - ▶ Avoid highly processed foods
  - ▶ Choose > 3 gm fiber per serving
  - ▶ Foods: Whole intact grains, legumes, fruits, veggies, nuts/seeds, avocados
- ▶ Why?
  - ▶ Lower all cause mortality and reduced risk of type 2 diabetes
  - ▶ Increased microbiome diversity

**Nutrition Facts**

Serving Size 1 cup (230g)  
Servings Per Container about 2

Amount Per Serving		% Daily Value*	
<b>Calories</b> 260 Calories from Fat 130			
<b>Total Fat</b> 14g		22%	
Saturated Fat 5g		25%	
Trans Fat 0g			
<b>Cholesterol</b> 35mg		12%	
<b>Sodium</b> 990mg		41%	
<b>Total Carbohydrate</b> 19g		6%	
Dietary Fiber 3g		12%	
Sugars 4g			
<b>Protein</b> 15g		29%	
Vitamin A 10%	Vitamin C 0%		
Calcium 4%	Iron 8%		

\*Percent Daily Values are based on a 2,000 calorie diet.

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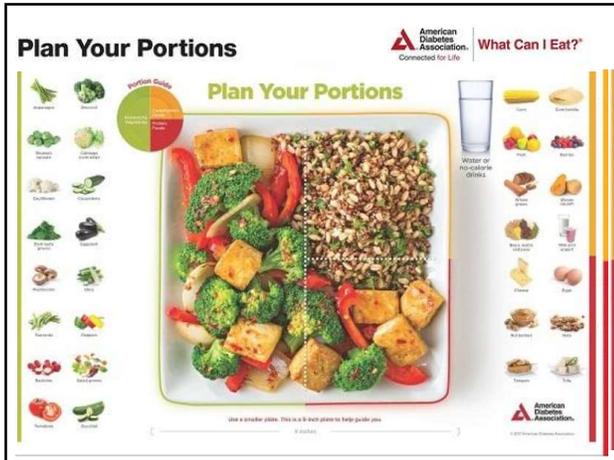
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**Case Study Question 9**

MZ is complaining of nausea, and increased eructation?  
 What class of medication may be causing these side effects?

a. GLP-1/GIP Receptor Agonists  
 b. Metformin  
 c. SGLT-2 Inhibitor  
 d. DPP-IV Inhibitor




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**Incretins: GLP & GIP Receptor Agonists**



GLP-1: glucagon like peptide 1  
 GIP: glucose-dependent insulinotropic polypeptide

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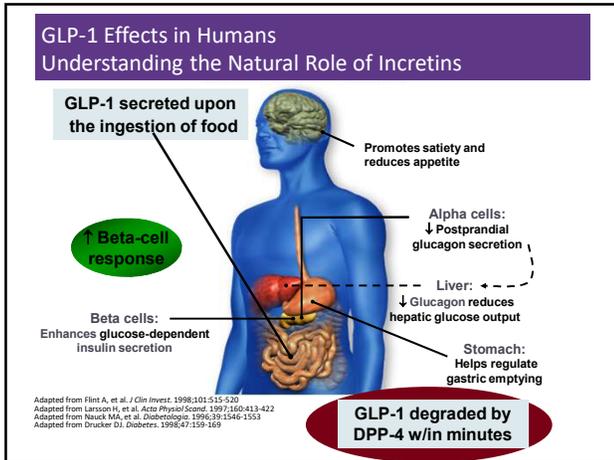
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### Pocket Card: GLP-1 & GIP RA

#### GLP-1 & GIP Receptor Agonists

Class/Main Action	Name	Dose Range	Considerations
<b>GLP-1 RA - Glucagon Like Peptide Receptor Agonist</b> <b>"Incretin Mimetic"</b> <ul style="list-style-type: none"> <li>Increases insulin release with food</li> <li>Slows gastric emptying</li> <li>Promotes satiety</li> <li>Suppresses glucagon</li> </ul>	exenatide (Byetta)	5 and 10 mcg BID	<b>Side effects:</b> nausea, vomiting, weight loss, injection site reaction. Report signs of acute pancreatitis or intestinal blockage (ileus) and stop med. <b>Black box warning:</b> Thyroid C-cell tumor warning (avoid if family history of medullary thyroid tumor).  *Significantly reduces risk of CV death, heart attack, and stroke. †Approved to reduce risk of CKD ‡Approved for pediatrics 10-17 yrs  Lowers A1C 0.5 – 1.6% Weight loss: 4-6% body weight loss.
	exenatide XR† (Bydureon)	2 mg 1x a week Pen injector - Bydureon BCise	
	liraglutide** (Victoza)	0.6, 1.2 and 1.8 mg daily	
	dulaglutide*† (Trulicity)	0.75, 1.5, 3.0 and 4.5 mg 1x a week pen injector	
	semaglutide*‡ (Ozempic) (Rybelsus) Oral tablet	0.25, 0.5, 1.0 and 2.0 mg 1x a week pen injector 3, 7, 14 mg - Original dosing. 1.5, 4, 9 mg - New dosing. AM dose, pre-food, w/ water sip	
<b>GLP-1 &amp; GIP Receptor Agonist</b> Activates receptors for GLP-1 (see above) & Glucose-dependent Insulinotropic Polypeptide (GIP).	Tirzepatide (Mounjaro)	2.5, 5.0, 7.5, 10, 12.5 and 15 mg 1x a week injection Single dose via prefilled pen or vial.  Adjust dose based on shared decision making and individual goals.	<b>Side effects:</b> nausea, diarrhea, injection site reaction. Report pancreatitis, signs of intestinal blockage. <b>Black box warning:</b> Avoid if family history of medullary thyroid tumor.  Lowers A1C ~ 1.8 - 2.4% Weight loss: 7-13% body weight loss at max dose.

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### Benefits of GLP-1 RA & GIP/GLP-1 Receptor Agonists

A1C lowering

Substantial Weight loss

Cardiovascular benefits\*

Decrease appetited

Lowers post meal glucose

Ease of use

\*semaglutide, liraglutide, dulaglutide

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## GLP-1/GIP Receptor Agonist Indications

Drug	Lower BG	Reduce CV / Kidney Risk?	Wt loss /other approved?
Exenatide IR ( <b>Byetta</b> ) Lixisenatide ( <b>Adlyxin</b> ) Semaglutide ( <b>Rybelsus</b> )	Yes		<small>Approved for use in patients with type 2 diabetes mellitus.   * Pharmacologic Agonism to Glucagon Treatment. Benefits of Care in Diabetes-2019-2020</small>
Exenatide ER ( <b>Bydureon</b> )	Yes for 10 yrs and older		
Dulaglutide ( <b>Trulicity</b> )	Yes for 10 yrs and older	Yes	
Semaglutide ( <b>Ozempic</b> )	Yes	Yes Approved for CKD	Wegovy 2.4mg Approved for Steatosis/CV disease
Liraglutide ( <b>Victoza</b> )	Yes for 10 yrs and older	Yes	Yes Saxenda 3mg
Tirzepatide ( <b>Mounjaro</b> )	Yes	?	Zepbound up to 15 mg Sleep apnea approved

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## Incretin Therapy: Nutrition Strategies

Adverse Effect	Nutrition Intervention
<b>Prevent Malnutrition &amp; Sarcopenia</b>	Sufficient protein (min. 60 gm, up to 1.2-1.5 gm/kg). Nutrient-dense foods eating pattern to support needs Encourage resistance training
<b>Nausea</b>	Small frequent meals Limit high fat foods Stay hydrated, limit carbonation
<b>Constipation</b>	Fiber, Fluids & Movement Consider stool softener as needed.
<b>Diarrhea</b>	Fiber & Fluids Limit sugar alcohols, coffee, dairy, alcohol and carbonation

Incretin-Based Therapies and Lifestyle Interventions: The Evolving Role of Registered Dietitian Nutritionists in Obesity Care  
Gigliotti, Linda et al. Journal of the Academy of Nutrition and Dietetics

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## Poll Question 10

AR is 36 years old with type 2 diabetes and a BMI of 41kg/m<sup>2</sup>. Current diabetes medications include: metformin, sitagliptin (Januvia) and empagliflozin (Jardiance) at maximum doses. AR is prescribed tirzepatide (Mounjaro). Based on this information, what action do you recommend to the provider?

- A. Verify kidney function first.
- B. Stop the sitagliptin when initiating tirzepatide.
- C. Decrease the dose of metformin to prevent hypoglycemia.
- D. Evaluate thyroid function before starting tirzepatide.




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## Metabolic (Bariatric) Surgery

- ▶ Consider for adults with:
  - ▶ BMI >30 (> 27.5 for Asian Americans) who are otherwise good surgical candidates
- ▶ Perform at high volume center with an experienced team
- ▶ Need lifelong medical & behavioral support & monitoring
- ▶ Screen psychological & behavioral health prior to & ongoing
- ▶ Monitor for post surgery hypoglycemia



8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes—2023  
American Diabetes Association Professional Practice Committee

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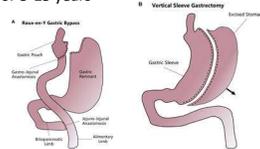
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## Metabolic Surgery Benefits

### More likely to have remission\*:

- ▶ Younger age, duration of diabetes (< 8 yrs), no pre-surgical insulin, greater visceral fat to lose (Asian Americans)
- ▶ **Year 5 Remission: 86.1% (RYGB) & 83.5% (VSG)**
- ▶ 35 – 50% re-developed diabetes
- ▶ Average remission time 8.3 years
  - ▶ Majority maintain improved glycemia for 5-15 years

\*complete remission =  
A1c levels <6.5%  
without meds



8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes—2023  
American Diabetes Association Professional Practice Committee

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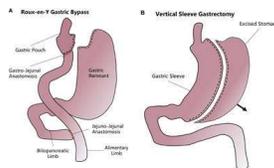
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## Metabolic Surgery Benefits

- ▶ Superior glycemic mgmt & CVD risk reduction for people w/T2DM & Obesity compared to non-surgical interventions.
- ▶ reduces microvascular disease
- ▶ Improves quality of life
- ▶ cancer risk reduction
- ▶ Improved MASH
- ▶ All cause mortality



8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes—2023  
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## Assessing Malnutrition

- ▶ At Risks Groups:
  - ▶ Individuals on GLP-1 or GIP RA or after metabolic surgery
  - ▶ Individuals with multiple chronic conditions
  - ▶ Older age groups
  - ▶ Food insecurity and poverty
- ▶ Screen:
  - ▶ For malnutrition and sarcopenia
- ▶ Recommend:
  - ▶ Whole- food-based eating pattern
  - ▶ Adequate protein
  - ▶ Resistance training

Malnutrition is defined by the World Health Organization as "deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients."



STANDARDS OF CARE | DECEMBER 19 2024  
5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: Standards of Care in Diabetes—2025

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## 6. Glycemic Goals & Hypo

A1C

Blood Pressure

Cardiovascular risk  
reduction




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## ADA 2025 Summary

A1c less than 7%  
(individualize)

- Pre-meal BG 80-130
- Post meal BG <180
- Time in Range (70-180) 70% of time

Blood Pressure  
<130/80



Cholesterol

- Statin therapy based on age & risk status
- If 40+ with ASCVD Risk, decrease LDL by 50%, LDL <70
- If 40+ with ASCVD, decrease LDL by 50%, LDL <55

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## Poll Question 11



- ▶ Which of the following methods can be used to assess glycemic status?
  - A. A1C
  - B. Blood glucose monitoring
  - C. Time in Range
  - D. Fructosamine
  - E. All of the above




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## Assess Glycemic Status

- ▶ A1C measurement
- ▶ Blood glucose monitoring (BGM)
  - ▶ by capillary (finger-stick) devices
- ▶ Continuous glucose monitoring (CGM)
  - ▶ using time in range (TIR) or
  - ▶ mean CGM glucose.
- ▶ Fructosamine – 2-4 wk glucose average
  - ▶ glycated albumin for those with anemia or hemoglobinopathies



6. Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes—2025

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## A1c and Estimated Avg Glucose (eAG)

A1c (%)	eAG
5	97 (76-120)
6	126 (100-152)
7	154 (123-185)
8	183 (147-217)
9	212 (170 -249)
10	240 (193-282)
11	269 (217-314)
12	298 (240-347)



6. Glycemic Targets: Standards of Medical Care in Diabetes—2020

$eAG = 28.7 \times A1c - 46.7 \sim 29 \text{ pts per } 1\%$   
 Translating the A1c Assay into eAG – ADAG Study

American Diabetes Association  
 Diabetes Care 2020 Jan; 43(Supplement 1): S66-S76.  
<https://doi.org/10.2337/DC20-S066>

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## Ambulatory Glucose Profile

- ▶ Standardized report with visual cues for those on CGM devices
- ▶ For most with type 1 or type 2 diabetes
  - > 70% of readings within BG range of 70-180mg/dL
  - < 4% of readings < 70 mg/dL
  - < 1% of readings < 54 mg/dL
  - < 25% of readings > 180 mg/dL
  - < 5% of readings > 250 mg/dL



For those with frailty or at high risk of hypoglycemia recommend:

- Target of 50% time in range
- Less than 1% time below range

6. Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes—2025 [ADA](#)

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## Time in Range (TIR)

- ▶ Strong correlation between TIR and A1C, with a goal of 70% TIR aligning with an A1C of ~7%
- ▶ For older adults using CGM, the recommended percent time spent in target range of 70–180 mg/dL is 50%, Hypo < 1%
- ▶ *Critical that the glycemic goals be woven into an individualized, person-centered strategy*



6. Glycemic Goals and Hypoglycemia: Standards of Care in Diabetes—2025 [ADA](#)

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## Time In Range – Person Centered

- ▶ “Hyperglance-emia”
- ▶ Healthy Good Enough – not perfection
- ▶ Each 1% is 15 minutes
- ▶ There is 24 hours in a day.
  - ▶ 17 hours in range
  - ▶ 7 hours outside of range.
- ▶ You are not defined by your blood glucose.
- ▶ What range feels safe for you?
- ▶ Try and step back and take in the whole picture.
- ▶ Sometimes you need shaved ice!



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**"The highest form of wisdom is kindness."  
The Talmud**



**Diabetes Education Services**

Published by Beverly Thomassian [?] · July 7 ·

Kindness matters!

Learning to be less harsh or judgmental and more compassionate to oneself may help people with diabetes manage their disease and stave off depression, a recent study suggests.



**Self-compassion may help people with diabetes achieve better glucose control and less depression**

By Reyna Gobel(Reuters Health) – Learning to be less harsh or judgmental and more...

REUTERS.COM | BY REYNA GOBEL

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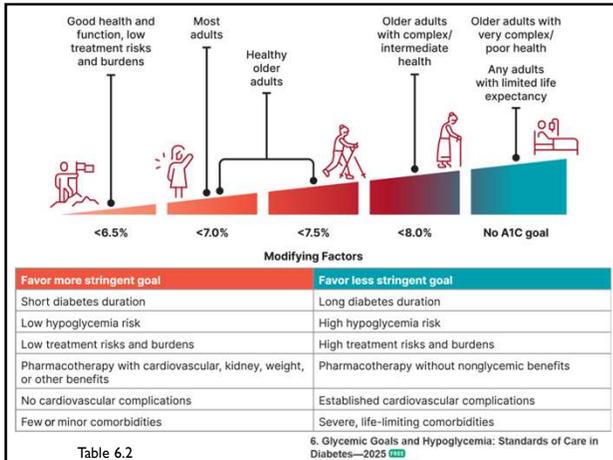
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**Cardiac and Renal Disease**

- ▶ The combination of 3 comorbidities has been termed *cardiorenal metabolic disease* or *cardiovascular-kidney-metabolic* health
  - ▶ ASCVD, heart failure, and chronic kidney disease (CKD)
- ▶ Recognized interrelationship of cardiometabolic risk factors leading to cardiovascular disease and adverse kidney outcomes in people with diabetes.
  - ▶ 3 comorbidities frequently associated with metabolic risk factors & extra weight
  - ▶ Incidence of all three conditions rises with increasing A1C levels.



10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2025

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## Diabetes Meds Lower CardioRenal Risk

- ▶ If diabetes plus ASCVD risk factors
  - ▶ SGLT-2s\* and GLP-1s\* reduce risk of major adverse CV events
  - ▶ Plus ACE or ARB
  - ▶ Post MI, continue beta blockers for 3 years.
- ▶ If type 2 diabetes and heart failure
  - ▶ SGLT-2s reduce risk of heart failure and hospitalization.
  - ▶ Also consider beta blocker



10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2025

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## CKD— 2025 Update



- ▶ Optimize glucose and BP to protect kidneys
- ▶ Use SGLT-2 with demonstrated benefit to reduce CKD and CVD\*
- ▶ To reduce CV risk and CKD, use a GLP-1\* with demonstrated benefit.
- ▶ In people with CKD and albuminuria, a nonsteroidal MRA effective if GFR 25+
- ▶ Aim to reduce urinary albumin by ≥30% in people with CKD

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

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

- ▶ \*SGLT-2i's
  - Empagliflozin (Jardiance), canagliflozin (Invokana), dapagliflozin (Farxiga)
- ▶ \*GLP-1 RA's
  - Semaglutide (Ozempic)-has indication, liraglutide (Victoza), dulaglutide (Trulicity)

11. Chronic Kidney Disease and Risk Management: Standards of Care in Diabetes—2025

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## Poll Question 12

- ▶ Evaluating kidney function is important to determine most beneficial treatment interventions. Which of the following measurements would indicate that JR has healthy kidney function?
  - Urinary albumin creatinine ratio of 30-299 mg/g with GFR of 45.
  - GFR of 60 or greater and urinary albumin creatinine ratio of 12 mg/g.
  - Urinary albumin creatinine ratio less than 30 mg/g and GFR of 30-45.
- ▶ Creatinine of 1.5 and urinary albumin creatinine ratio of 300 mg/g or greater.




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## Diabetes + CKD – Increases CVD Risk

- ▶ Chronic kidney disease (CKD) is a frequent complication in diabetes
  - ▶ Type 1 diabetes ~30%
  - ▶ Type 2 diabetes ~40%
- ▶ In several studies, participants on SGLT2i with GFRs of 30-60 (stage 3) reduced ASCVD risk and improved renal function
  - ▶ Slowed kidney disease or death
  - ▶ Reduced albuminuria

National Kidney Foundation.  
<https://www.kidney.org/atoz/content/diabetes>

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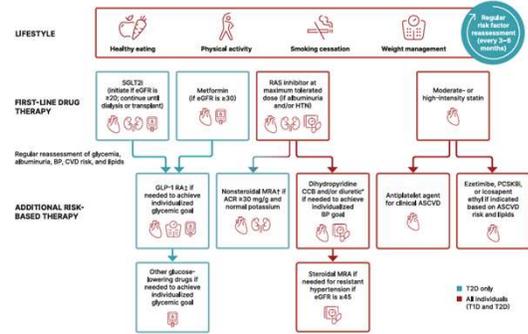
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Figure 11-12 Holistic Approach to Diabetes + CKD



11. Chronic Kidney Disease and Risk Management: Standards of Care in Diabetes—2025

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## Finerenone Resource

### New nonsteroidal MRAs for Type 2 and Chronic Kidney Disease

#### Nonsteroidal Selective Mineralocorticoid Antagonist

Indicated for people with chronic kidney disease (CKD) associated with Type 2 diabetes. Reduces the risk of kidney function decline, kidney failure, cardiovascular death, non-fatal heart attacks, and hospitalization for heart failure in adults with chronic kidney disease associated with type 2 diabetes. The mineralocorticoid receptor antagonist blocks the effects of aldosterone and reduces the risk of kidney function decline as well as heart failure.

Class / Action	Generic / Trade Name	Daily Dose	Frequency	Considerations
<b>Nonsteroidal, selective mineralocorticoid antagonist.</b> Blocks mineralocorticoid receptor mediated sodium reabsorption and mineralocorticoid overactivation in epithelial (for example kidneys) and nonepithelial (for example heart, blood vessels) tissues.	Finerenone / Kerendia	10-20 mg	Once daily	Monitor potassium 4 weeks after initiation or dose adjustment (although impact on potassium is much less than non-selective mineralocorticoid antagonists like spironolactone). Since medication is a CYP3A4 substrate, avoid taking with other strong cyp3A4 inhibitors. Avoid grapefruit or grapefruit juice. May take with or without food.

Contributor: Diana Isaacs, PharmD, BCPS, BCACP, BC-ADM, CDECS, FADCES, FCCP 2022

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## Slide 122

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**D11**    **New slide**

Diana Isaacs, 2025-08-25T02:19:23.837

## Kidney Goals and MNT

- ▶ In people with chronic kidney disease with UACR  $\geq 300$  mg/g
- ▶ Goal is a reduction of 30% or greater in mg/g urinary albumin to slow chronic kidney disease progression
- ▶ Nutrition Recommendations
  - ▶ For people with non-dialysis-dependent stage 3 or higher chronic kidney disease
    - ▶ dietary protein intake aimed to a target level of 0.8 g/kg body weight per day.
  - ▶ For those on dialysis,
    - ▶ consider protein intake of 1.0–1.2 g/kg/day since protein energy wasting is a major problem in some individuals on dialysis
- ▶ Refer to nephrology
  - ▶ If GFR < 30 or uncertain CKD etiology



11. Chronic Kidney Disease and Risk Management: Standards of Care in Diabetes—2025 [ADA](#)  
American Diabetes Association Professional Practice Committee

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## 10. Cardiovascular Disease and Risk Management

- ▶ Higher risk of Atherosclerotic cardiovascular disease (ASCVD):
  - ▶ history of acute coronary syndrome,
  - ▶ myocardial infarction (MI),
  - ▶ stable or unstable angina,
  - ▶ coronary or other arterial revascularization,
  - ▶ stroke, transient ischemic attack,
  - ▶ or peripheral artery disease (PAD) including aortic aneurysm.
- ▶ 2x high risk of Heart Failure
- ▶ Leading cause of morbidity and mortality in people with diabetes



Large benefits are seen when multiple CV risk factors are addressed simultaneously

With more aggressive goals, rates of CVD have decreased.

CV Risks predicted to increase in future.

10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2025 [ADA](#)  
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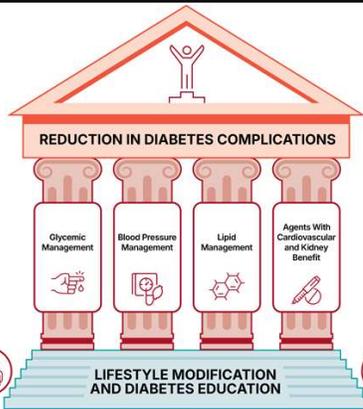
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10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2025 [ADA](#)  
American Diabetes Association Professional Practice Committee

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## Poll Question 14

RZ is 47 years old with type 2 diabetes and hypertension. RZ takes metformin 1000 mg BID, plus lisinopril 20mg daily. RZ's LDL is 130 mg/dL. Based on the most recent ADA Standards, what is the LDL Cholesterol target for RZ?



- A. LDL less than 100 mg/dL.
- B. Lower LDL by 30%.
- C. LDL target of 65 mg/dL or less.
- D. Determine LDL target based on ASCVD risk.

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## Lipid Monitoring and Lifestyle Treatment Strategies

- ▶ **Lipid Goals**
  - ▶ LDL < 70 or 55 based on risk
  - ▶ HDL >40
  - ▶ Triglycerides <150
- ▶ Weight loss if indicated
- ▶ Mediterranean or DASH Diet
- ▶ Reduction of saturated fat intake
- ▶ Increase of omega-3 fatty acids, viscous fibers and plant stanols/sterols
- ▶ Increase activity level
- ▶ BG lowering helps lower triglycerides and increase HDL

### Monitoring:

If **not** taking statins and under age of 40.  
- check at time of diagnosis and every 5 yrs.

### On statin

Monitor lipids at diagnosis and yearly.  
Monitor lipids 4-12 weeks after statin dose adjustment.

10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2025

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## Statin Therapy

- ▶ **High intensity statins (lowers LDL 50%):**
  - ▶ atorvastatin (Lipitor) 40-80mg
  - ▶ rosuvastatin (Crestor) 20-40mg
- ▶ **Moderate intensity (lowers LDL 30-50%):**
  - ▶ atorvastatin (Lipitor) 10-20mg
  - ▶ rosuvastatin (Crestor) 5-10mg
  - ▶ simvastatin (Zocor) 20-40mg
  - ▶ pravastatin (Pravachol) 40-80mg
  - ▶ lovastatin (Mevacor) 40 mg
  - ▶ fluvastatin (Lescol) XL 80mg
  - ▶ pitavastatin (Livalo) 1-4mg



10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2025

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## A 37 yr old, smokes ppd

- ▶ A1C 8.9% (down from 10.4%)
- ▶ B/P 139/76 AM BG 100, 2 hr pp 190
- ▶ Chol – TG 54, HDL 46, LDL 98
- ▶ GFR 47, UACR 34 mg/g



### ▶ Meds:

- ▶ Insulin – 28 units basaglar insulin
- ▶ Losartan 25mg – ARB for blood pressure
- ▶ Metoprolol 50mg – Beta blocker
- ▶ Glyburide 5mg BID - Sulfonylurea

Any special instructions?  
Any meds missing?  
Stop any meds?

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## A 37 yr old, smokes ppd

- ▶ A1c 8.9% (down from 10.4%)
- ▶ B/P 139/76 AM BG 100, 2 hr pp 190
- ▶ Chol – TG 54, HDL 46, LDL 98
- ▶ GFR 47, UACR 34 mg/g

### ▶ Meds:

- ▶ Insulin – 28 units basaglar insulin
- ▶ Losartan 25mg – ARB for blood pressure
- ▶ Metoprolol 50mg – Beta blocker
- ▶ Glyburide 5mg BID - Sulfonylurea

Any special instructions?  
Any meds missing?  
- Statin  
- SGLT 2  
- Aspirin  
Stop any meds?

Special instruction – sweating may indicate hypoglycemia

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## ABC's of Diabetes

### ▶ A1c less than 7% (individualize)

- ▶ Pre-meal BG 80-130
- ▶ Post meal BG <180
- ▶ AGP - Time in Range (70-180) 70% of time



### ▶ Blood Pressure < 130/80

### ▶ Cholesterol

- ▶ Statin therapy based on age & risk status
- ▶ If 40+ with ASCVD Risk, decrease 50%, LDL <70
- ▶ If 40+ with ASCVD, decrease 50%, LDL <55

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## DiaBingo- G

- G ADA goal for A1c is less than \_\_\_\_%
- G People with DM need to see their provider at least every month
- G Blood pressure goal is less than \_\_\_\_\_
- G People with DM should see eye doctor (ophthalmologist) at least \_\_\_\_\_
- G The goal for triglyceride level is less than \_\_\_\_\_
- G Goal for LDL cholesterol for people 40+ with diabetes is \_\_\_\_\_
- G The goal for blood sugars 1-2 hours after a meal is less than: \_\_\_\_\_
- G People with DM should get this shot every year \_\_\_\_\_
- G People with DM need to get urine tested yearly for \_\_\_\_\_
- G Periodontal disease indicates increased risk for heart disease
- G The goal for blood sugar levels before meals is: \_\_\_\_\_
- G The activity goal is to do \_\_\_ minutes on most days

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## Lived Experiences & Advocacy



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## Beta-Cell Mass Loss

- ▶ In both type 1 and type 2 diabetes,
- ▶ *genetic and environmental factors can result in the progressive loss of  $\beta$ -cell mass and/or function*
- ▶ that manifests clinically as hyperglycemia.
- ▶ Once hyperglycemia occurs, people with all forms of diabetes are at risk for developing the same chronic complications, although rates of progression may differ.



2 Diagnosis and Classification of Diabetes. Standards of Care in Diabetes-2023. ADA

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## Slide 150

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**D11** The diagram was messed up, so I went back to the original source and replaced.  
Diana Isaacs, 2025-07-20T20:04:33.070

## T1D is Often Misdiagnosed as T2D in Adults DI1

**TYPE 1 Diabetes**

**~40%** of adults with T1D are initially **misdiagnosed**

**75%** of those are misdiagnosed as T2D<sup>1,4†</sup>

**TYPE 2 Diabetes**

Poor disease management from misdiagnosis can have **severe outcomes**<sup>2,3</sup>

Inadequate glucose control<sup>2</sup>
Diabetic ketoacidosis (DKA)<sup>2</sup>
Poor quality of life<sup>3</sup>

\*Three quarters of T1D is misdiagnosed as T2D. †Based on a US retrospective online survey of 2526 adults (aged >18 years) with T1D or caregiver of child with T1D. T1D=type 1 diabetes; T2D=type 2 diabetes. 1. Mander C, et al. *Diabetes*. 2019;70(12):2176-2181. 2. Manohar AE, et al. *Diabetes*. 2021;70(12):2176-2181. 3. The Lancet Regional Health-Europe. *Lancet Reg Health Eur*. 2023;29:100661.

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## Screen people at increased risk of T1D

**Screening for T1D autoantibodies is recommended by**



**First-degree relatives of individuals with T1D**

**~15x greater risk**

of T1D versus the general population

**Individuals with personal or family history of select autoimmune diseases**

2-3x greater risk of T1D in individuals with select autoimmune diseases

  
 Thyroid disorders  
 • Hashimoto's thyroiditis  
 • Graves' disease

  
 Celiac disease

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## Benefits of early detection of pre-symptomatic T1D

**Lower HbA1C**

Screened & diagnosed	Not screened
6.8%	10.5%

**Decreased frequency of insulin treatment at diagnosis**

Screened and diagnosed	Not screened
72.3%	98.1%

**Lower rates of DKA**

Screened & diagnosed	Not screened
6%	62%

Sims E, et al. *Diabetes*. 2022 Apr 1;71(4):610-623. Hummel S, et al. *Diabetologia*. 2023 Sep;66(9):1633-1642.

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## Slide 151

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### DI1 New slide

Diana Isaacs, 2025-07-20T20:15:42.458

## Slide 153

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### DI1 Added citation

Diana Isaacs, 2025-07-20T20:09:56.981

## Signs of Type 1 Diabetes

- ▶ Sudden onset of nighttime bedwetting
- ▶ Weight loss, thirst, hunger
- ▶ 40-60% discovered with acute DKA
  - ▶ Fruity breath
  - ▶ Hypothermic
  - ▶ Poor skin turgor
  - ▶ "Out of it"
  - ▶ Ketone positive (blood or urine)
  - ▶ Acidosis
  - ▶ Other



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## Type 1 is 5- 10% of all Diabetes

- Auto-immune pancreatic beta cells destruction
- Most commonly expressed at age 10 – 14
- Insulin sensitive (require 0.5 - 1.0 units/kg/day)
- Expression due to a combo of genes and environment:
  - Autoimmunity tends to run in families
  - Exposure to virus or other environmental factors



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## Type 1 Diabetes Features?



▶ For JR, a 28 admitted to the ICU with a blood glucose of 476 mg/dl, pH of 7.1, anion gap of 15. Recently lost 13 pounds.

### Type 1 Most Discriminative Features

- Younger than 35 years at diagnosis
- Lower BMI (<25 kg/m<sup>2</sup>)
- Unintentional weight loss
- Ketoacidosis
- Glucose 360 mg/dl or greater.

Misdiagnosis is common and can occur in ~40% of adults with new type 1 diabetes

2. Diagnosis and Classification of Diabetes. Standards of Care in Diabetes—2025

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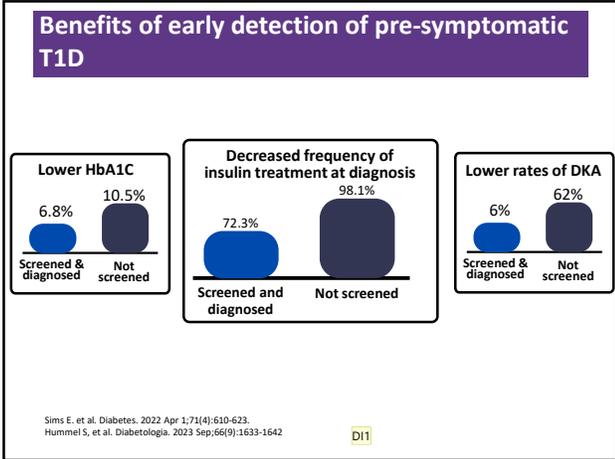
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### Type 1 & Lifestyle Prevention

- ▶ Observational studies in those with antibodies, shed light on factors that **increase**  $\beta$ -cell demand:
  - ▶ Less physical activity
  - ▶ Consuming higher glycemic index foods
  - ▶ Sugar intake
- ▶ Factors that **reduced risk** of progression from TEDDY study:
  - ▶ Daily minutes spent doing vigorous physical exercise.
  - ▶ More info needed

STANDARDS OF CARE | DECEMBER 09 2024  
3. Prevention or Delay of Diabetes and Associated Comorbidities:  
Standards of Care in Diabetes—2025 **D11**  
American Diabetes Association Professional Practice Committee

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### Monitoring for T1D Progression

- ▶ Screen for AAB's and if positive:
- ▶ How to monitor for stage 2 adults:
  - ▶ Screen A1C every 6 months
  - ▶ 75- OGTT every year
  - ▶ Modify screening based on antibodies and glycemic metrics.
  - ▶ May benefit from CGM to monitor progression
- ▶ In kids, monitor every 3 months

**T1D Risk Screening**

Offered at no cost to relatives of people with T1D, T1D risk screening detects the disease in its earliest stages, so you can take steps to try to change the course of the disease.

Trialnet.org

Phillip M, et al. Diabetes Care. 2024 Aug 1;47(8):1276-1298.  
STANDARDS OF CARE | DECEMBER 09 2024  
3. Prevention or Delay of Diabetes and Associated Comorbidities:  
Standards of Care in Diabetes—2025 **D11**  
American Diabetes Association Professional Practice Committee

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## Slide 157

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**DI1** Added citation  
Diana Isaacs, 2025-07-20T20:09:56.981

## Slide 159

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**DI1** Changed action to how to monitor  
Diana Isaacs, 2025-07-20T20:27:53.984

**DI1 0** Updated title, citation and added last bullet on how to monitor in kids.  
Diana Isaacs, 2025-08-24T02:06:20.607

## Antibody Testing for Type 1

► 5–10% of people with type 1 diabetes do not have antibodies.

► In those diagnosed at <35 years of age who have no clinical features of type 2 diabetes or monogenic diabetes, a negative result does not change the diagnosis of type 1 diabetes,

► Rate of type 1 progression depends on:

- age at first detection of autoantibody,
- number of autoantibodies,
- autoantibody specificity, and autoantibody titer.
- Glucose and A1C levels may rise well before the clinical onset of diabetes



3. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2023 (8)

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## Poll Question 15



JR's mom has type 1 diabetes and JR's dad has type 2 diabetes. JR is 28 years old and in the emergency room with a glucose of 482 mg/dl. Besides checking glucose, ketones and A1C levels, what else needs to be evaluated?

- A. Endogenous insulin titer
- B. Glutamic Acid Decarboxylase
- C. Beta cells auto antibodies
- D. Langerhan's antibody




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## Ordering Autoantibodies

**AAbs are currently the only available serum immune marker to identify T1D prior to hyperglycemia and/or symptom onset**

	GADA	IAA	IA-2A	ZnT8A	ICA	Blood draw location	Sampling method
Local laboratories (e.g. Quest Diagnostics, Labcorp)	✓	✓	✓	✓	✓	Local laboratory or healthcare provider's office	Blood draw
Online ordering, delivery to doctor's office	✓	✓	✓			Testing kits from vendors such as Enable Biosciences through online ordering	In-clinic finger poke blood test
TrailNet			✓	✓	✓	TrailNet-sponsored event, health fair, at-home kit (by mail)	Blood draw or at-home finger poke
Autimmunity screening for kids	✓	✓	✓	✓		Barbra Davis Center, Children's Hospital Colorado, UC Health Laboratory, at-home kit (by mail)	Blood draw or at-home finger poke

Glutamic acid decarboxylase 65 autoantibody (GADA)

Zinc transporter 8 autoantibody (ZnT8A) Insulin autoantibody (IAA)

Islet cell autoantibody (ICA) Insulinoma-associated antigen 2 autoantibody (IA-2A)

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## Slide 162

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**D11** Added the abbreviations for AA at the bottom.  
Diana Isaacs, 2025-08-24T01:55:16.461

RECOMMENDATIONS FOR DIAGNOSIS AND CLASSIFICATION OF DIABETES – 2025			
CRITERIA FOR SCREENING FOR DIABETES AND PREDIABETES IN ASYMPTOMATIC ADULTS – TABLE 1			
DIABETES TYPE	RISK FACTORS and FREQUENCY OF SCREENING and TESTING FOR DIABETES		
	Type 1	Type 2	Type 2
	Screen those at risk for presymptomatic type 1 diabetes, by testing autoantibodies to insulin, GAD, islet antigen 2 or ZnT8. Also test antibodies for those with type 1 phenotypic risk (younger age, weight loss, ketonuria/diuria, etc.)		
	Stage 1	Stage 2	Stage 3
Characteristics	<ul style="list-style-type: none"> <li>Autoimmunity</li> <li>Normoglycemia</li> <li>Presymptomatic</li> </ul>	<ul style="list-style-type: none"> <li>Autoimmunity</li> <li>Dysglycemia</li> <li>Presymptomatic</li> </ul>	<ul style="list-style-type: none"> <li>Autoimmunity</li> <li>Overt hyperglycemia</li> <li>Symptomatic</li> </ul>
Diagnostic criteria	<ul style="list-style-type: none"> <li>2 or more islet autoantibodies</li> <li>Glucose levels are in normal range</li> <li>FBG &lt;100mg/dL</li> <li>A1C &lt;5.6%</li> <li>2-h PG &lt;140mg/dL</li> </ul>	<ul style="list-style-type: none"> <li>2 or more islet autoantibodies</li> <li>Dysglycemia:               <ul style="list-style-type: none"> <li>Elevated IFG and/or IGT</li> <li>FPG 100–125 mg/dL</li> <li>2-h PG 140–199 mg/dL</li> <li>A1C 5.7–6.4% or ≥10% increase in A1C</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Autoantibodies may disappear over time (5–10% may not express antibodies)</li> <li>Diabetes diagnosed by standard criteria</li> </ul>

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### Determine if Type 1 - Use AABCC Approach

- ▶ **Age**
  - ▶ e.g., for individuals <35 years old, consider type 1 diabetes
- ▶ **Autoimmunity**
  - ▶ e.g., personal or family history of autoimmune disease or polyglandular autoimmune syndromes
- ▶ **Body habitus**
  - ▶ e.g., BMI <25 kg/m2
- ▶ **Background**
  - ▶ e.g., family history of type 1 diabetes
- ▶ **Control**
  - ▶ e.g., level of glucose control on noninsulin therapies
- ▶ **Comorbidities**
  - ▶ e.g., treatment with immune checkpoint inhibitors for cancer can cause acute autoimmune type 1 diabetes or presence of other autoimmune conditions




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### Pharmacologic Intervention to Delay Symptomatic Type 1 (in Stage 2)

- ▶ Teplizumab-Tzielid (CD3-monoclonal antibody)
- ▶ 14-day infusion can delay the onset of symptomatic type 1 diabetes (stage 2)
- ▶ An option in selected individuals aged ≥8 years with stage 2 type 1 diabetes.
- ▶ In a single trial, 44 individuals received 14-day course of teplizumab vs 32 placebo.
- ▶ The median time to stage 3 diagnosis of type 1
  - ▶ 48.4 months in tep group
  - ▶ 24.4 months placebo
- ▶ Cost: \$193,000
- ▶ Financial assist programs available.

126 Herold KC, Bundy BN, Long SA, et al., Type 1 Diabetes TrialNet Study Group. An anti-CD3 antibody, teplizumab, in relatives at risk for type 1 diabetes. *N Engl J Med* 2019;381:603–613

3 Prevention or Delay of Diabetes and Associated Comorbidities: Standards of Care in Diabetes—2024

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## Quick Question 16

▶ **Question:** LT has just been diagnosed with stage 1, type 1 diabetes. He has 2 positive autoantibodies and his blood sugars are slightly elevated. He asks you if he is a candidate for “that therapy” that can protect beta cells and slow progression of type 1 diabetes. **What is the most accurate response?** D11

- a. Unfortunately, you are not a candidate, since you already have 2 positive autoantibodies.
- b. Let’s talk to your provider about the possibility of starting Teplizumab therapy.
- c. With your blood sugar elevation, the best early intervention is insulin therapy.
- d. Since you are in stage 1, the therapy is not indicated, but let’s talk about monitoring.

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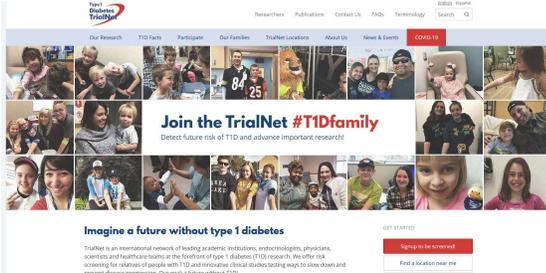
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## Type 1 (stage 2) Delayed with Teplizumab by 2 years [www.DiabetesTrialNet.org](http://www.DiabetesTrialNet.org)

▶ **How to get families linked to screening?**



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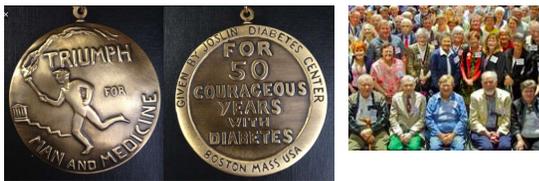
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## Medalist Study – Harvard Joslin Diabetes Center

- ▶ After 50 years with diabetes
  - ▶ Many still produced some insulin
  - ▶ Many had no eye disease



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## Slide 166

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**DI1** Changed choice D to the therapy is not indicated.  
Diana Isaacs, 2025-08-24T02:09:09.586

## Other Types of Diabetes

- ▶ LADA
- ▶ Ketosis Prone
- ▶ Other Types
  - ▶ 3c, 3



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## What type of Diabetes?

- ▶ 72 Years old
- ▶ A1c 3 months prior 6.2%
- ▶ A1c now 13.9%
- ▶ BMI 24.5
- ▶ Lost about 10 pounds over last month



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## What about Latent Autoimmunity Diabetes in Adults (LADA)

- ▶ Slowly progressive autoimmune diabetes with an adult onset should be termed:
  - ▶ LADA or type 1 diabetes.
  - ▶ Slow autoimmune  $\beta$ -cell destruction can lead to a long duration of marginal insulin secretory capacity.
  - ▶ For this classification, all forms of diabetes mediated by autoimmune  $\beta$ -cell destruction independent of age of onset are included under the rubric of type 1 diabetes.



2. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2019. ADA

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## Latent Autoimmunity Diabetes in Adults (LADA)

- ▶ Antibody positive to 1-2 of below
  - ▶ GAD-65 autoantibodies
  - ▶ Insulin Autoantibodies
  - ▶ Islet Cell antigen-2
  - ▶ ZnT8
- ▶ Adult Age at onset
- ▶ Usually benefit from insulin w/in first 6 months of diagnosis
- ▶ Early insulin therapy may preserve beta cell function



Latent Autoimmune Diabetes  
Venkatesan Rajkumar, Steven N. Levine  
\* Author Information and Affiliations  
Last Update: June 21, 2022

Diabetes Care 26:536-538, 2003  
Jerry P. Palmer, MD and Irl B. Hirsch, MD

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## LADA Clinical Features Compared to Type 2

Feature	LADA	Type 2
▶ Age <50	63%	19%
▶ Acute hyperglycemia	66	24
▶ BMI < 25	33	13
▶ Hx of autoimmune dx	27	12
▶ Family hx autoimmune	46	35

Latent Autoimmune Diabetes  
Venkatesan Rajkumar, Steven N. Levine  
\* Author Information and Affiliations  
Last Update: June 21, 2022

Practical Diabetology March 08, Unger MD

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## Poll Question 17

▶ **Diabetes Type 3c is often misdiagnosed as type 2 diabetes. A colleague asks you to clarify what is meant by Diabetes Type 3c. What is the most accurate response?**

- ▶ A. A form of diabetes caused by autoantibodies attacking pancreatic beta cells, typically in early adulthood.
- ▶ B. A form of diabetes that results from damage to the exocrine pancreas due to conditions like pancreatitis, pancreatic surgery, or cystic fibrosis.
- ▶ C. A genetic form of diabetes caused by mutations affecting insulin production or function.
- ▶ D. A form of diabetes that affects cognition and is associated with increased risk of dementia.

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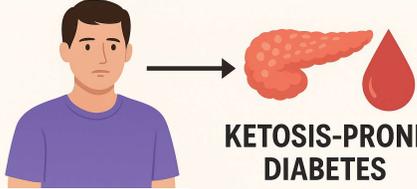
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## KETOSIS-PRONE DIABETES



**KETOSIS-PRONE DIABETES**

A form of diabetes characterized by episodes of ketoacidosis

- ▶ A unique diabetes phenotype characterized by diabetic ketoacidosis (DKA) at onset, without autoimmune markers or obesity.
- ▶ Transient insulin deficiency with preserved or recoverable beta-cell function
- ▶ Can resemble type 1 or type 2 diabetes
- ▶ Often in non-obese individuals
- ▶ More common in Black, Hispanic, and Asian populations

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## Ketosis-Prone Diabetes (KPD)

**Presentation & Future**

- ▶ Present with DKA
- ▶ Negative for islet cell autoantibodies (GAD, IA-2)
- ▶ C-peptide testing post-recovery to assess insulin production
- ▶ Insulin often tapered or discontinued
- ▶ Transition to oral agents in some cases
- ▶ Requires ongoing monitoring for recurrence of ketosis



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## Type 5 Diabetes

- ▶ Form of diabetes linked to chronic malnutrition or prolonged starvation
- ▶ This condition primarily affects young, undernourished individuals in low- and middle-income countries, particularly in regions like Asia and Africa.
- ▶ Estimates suggest that up to 25 million people worldwide may be affected with type 5 diabetes.

**Mechanism:**

- ▶ Severe beta-cell dysfunction from malnutrition
- ▶ Impaired insulin secretion (not autoimmune)
- ▶ May present with hyperglycemia & ketosis
- ▶ Genetic component



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## Features and Management

- ▶ Typical features:
  - ▶ Onset in adolescents/young adults
  - ▶ History of prolonged malnutrition
  - ▶ Thin body habitus with muscle wasting
  - ▶ Hyperglycemia + recurrent ketosis, but not autoimmune
- ▶ Management:
  - ▶ High-protein, low-carbohydrate diet
  - ▶ Micronutrient supplementation
  - ▶ Careful monitoring of insulin therapy, as inappropriate insulin administration can be harmful.
  - ▶ Improving nutrition and addressing poverty/food insecurity are central to treatment.



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## Diabetes During Pregnancy

- ▶ Prevalence of diabetes in pregnancy is increasing
- ▶ Definitions
  - ▶ Pre-gestational diabetes: pre-existing type 1 or type 2 diabetes in pregnancy
  - ▶ Gestational diabetes: diabetes diagnosed in the 2<sup>nd</sup> or 3<sup>rd</sup> trimester of pregnancy



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## Prevalence of Diabetes in Pregnancy



Total:  
8-12%



Gestational:  
8-10% (US)  
14-17% (Worldwide)



Pre-Diagnosed  
Type 1 and 2:  
1-2%

▶ Centers for Disease Control and Prevention. [www.cdc.gov/](https://www.cdc.gov/), <https://my.clevelandclinic.org/health/diseases/9012-gestational-diabetes>

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## Gestational Diabetes (GDM)

- ▶ Detected at 24-28 weeks of pregnancy (most insulin resistant phase)
- ▶ GDM prevalence increased by
  - ▶ ~10–100% during the past 20 yrs
- ▶ Women getting pregnant later
- ▶ More obesity



Standards of Care in Diabetes—2025. Diabetes Care, January 2025; 48 (Supplement\_1): S306-320. <https://doi.org/10.2337/dc25-S015>

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## Rates of GDM and Diabetes in Pregnancy increasing

- ▶ 1% to 2% have type 1 or type 2 during pregnancy
- ▶ From 2000 to 2010
  - ▶ GDM rates increased 56%
  - ▶ Type 1 or type 2 before pregnancy increased 37%.
- ▶ Asian and Hispanic women have higher rates of GDM
- ▶ Black and Hispanic women have higher rates of type 1 or type 2 diabetes during pregnancy.

CDC [Diabetes During Pregnancy | Maternal Infant Health](#) | CDC



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## Screening in early Pregnancy

- ▶ Checking glucose levels before 15 weeks of gestation:
  - ▶ Can find undetected diabetes or hyperglycemia
  - ▶ Prevent fetal exposure to hyperglycemia
  - ▶ Allows providers and pregnant people to take action to prevent complications
- ▶ Use standard diabetes diagnostic criteria.
  - ▶ If positive, diagnosis “Diabetes complicating pregnancy”
- ▶ If fasting BG 110+ or A1C 5.9%+
  - ▶ At higher risk of adverse outcomes and more likely to experience GDM and need insulin.



Standards of Care in Diabetes—2025. Diabetes Care, January 2025; 48 (Supplement\_1): S306-320. <https://doi.org/10.2337/dc25-S015>

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## Hyperglycemia and Fetal Risk

During 2-3<sup>rd</sup> trimester insulin resistance increases =hyperglycemia

Maternal glucose can cross the placenta

Maternal insulin can NOT cross placenta

Fetus exposed to maternal glucose, but not maternal insulin. Fetus makes insulin.

Insulin stimulates fetal growth, increase in adipose tissue

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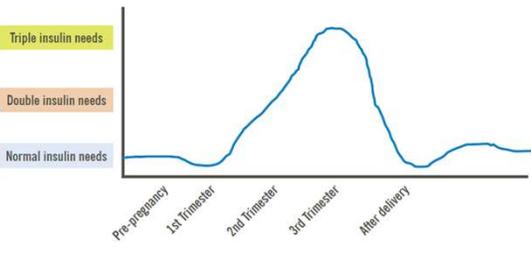
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## Insulin Needs During Pregnancy

### Changing Insulin Needs During Pregnancy



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## Risks of Diabetes in Pregnancy

- ▶ Spontaneous abortion
- ▶ Fetal anomalies
- ▶ Preeclampsia
- ▶ Fetal demise
- ▶ Macrosomia
- ▶ Neonatal hypoglycemia
- ▶ Neonatal hyperbilirubinemia
- ▶ Neonatal respiratory distress syndrome

Exposure to hyperglycemia in utero increases risks of obesity, hypertension, and T2D later in life

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## Gestational Diabetes and Pregnancy

- ▶ Test for GDM at 24-28 weeks
- ▶ Test GDM women for post partum diabetes at 4-12 weeks, using OGTT
- ▶ Women with GDM need lifelong screening for prediabetes/diabetes at least every 3 yrs
- ▶ Women with hx of GDM, found to have prediabetes need intensive lifestyle interventions or metformin to prevent diabetes.



Standards of Care in Diabetes—2025. Diabetes Care, January 2025; 48 (Supplement\_1): S306-S320. <https://doi.org/10.2337/dc25-S015>

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## See Diabetes and Pregnancy Level 2

### Screening and Diagnosis of Diabetes Cheat Sheet

#### GESTATIONAL DIABETES (GDM)\*

PREGNANCY SCREENING	TEST	DIAGNOSTIC CRITERIA
Screen to identify abnormal glucose metabolism before 15 weeks gestation Test those w/ risk factors (table 1) to identify undiagnosed prediabetes or diabetes at first prenatal visit.	Standard Diagnostic Testing and Criteria as listed in Diagnosing Diabetes—Table 2	Standard Diagnostic Testing and Criteria as listed in Diagnosing Diabetes—Table 2 Those with fasting of 110-125 or A1C of 5.9% to 6.4% are at higher risk of adverse outcomes (GDM, need insulin, preeclampsia and other)
Screen for GDM at 24–28 wks gestation for those without known diabetes.  Screen those with GDM for diabetes 4–12 wks postpartum with 75-g OGTT. Lifelong screening at least every 3 yrs. *Please see reference below for complete guidelines.	Can use either IADPSG consensus: "One Step" 75-g OGTT fasting and at 1 and 2 h (perform after overnight fast of at least 8 h)  "Two step" NIH Consensus – Step 1: 50gm glucose load (non fasting) w/ plasma BG test at 1 hr. If BG ≥ 130-140*, go to Step 2 >	One Step: GDM diagnosis when ANY of following BG values are exceeded: <ul style="list-style-type: none"> <li>• Fasting ≥92 mg/dl,</li> <li>• 1 h ≥180 mg/dl</li> <li>• 2 h ≥155 mg/dl</li> </ul> Two Step -Step 2 - 100g OGTT (fasting) GDM diagnosis if at least 2 of 4 BG measured at fasting, 1h, 2h, 3h after OGTT meet or exceed 95, 180, 155, 140 mg/dL respectively.

\*Reference – Diagnosis & Classification of Diabetes. American Diabetes Association Standards of Medical Care in Diabetes. Diabetes Care 2025 Jan; 48 (Supplement 1): S27-S49. Compliments of Diabetes Education Services [www.DiabetesEd.net](http://www.DiabetesEd.net)

2. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2025

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## Perinatal care makes a difference

- ▶ Reaching out before pregnancy has the potential for slowing the diabetes epidemic

#### Focus:

- ▶ Prenatal,
- ▶ perinatal and
- ▶ postnatal health




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## Other Specific Types of DM

- ▶ Medications such as: steroids, protease inhibitors and Prograf®
- ▶ Secondary to Agent Orange
- ▶ Liver failure
- ▶ TPN or tube feedings
- ▶ **Diabetes Type 3c**
  - ▶ Cystic fibrosis, **pancreatitis**
  - ▶ Pancreatic cancers or removal
  - ▶ Hemochromatosis



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Regardless of the cause, hyperglycemia needs to be treated.



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## Type 3c Diabetes (Pancreatogenic)

- ▶ Includes both structural and functional loss of insulin secretion in the context of exocrine pancreatic dysfunction.
- ▶ About 5-10% of diabetes, often misdiagnosed as type 2 diabetes.
- ▶ The diverse set of etiologies includes:
  - ▶ pancreatitis (acute and chronic) ~70%
  - ▶ trauma or pancreatectomy
  - ▶ neoplasia
  - ▶ cystic fibrosis
  - ▶ hemochromatosis
  - ▶ fibrocalculous pancreatopathy
  - ▶ rare genetic disorders, and idiopathic

3. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes—2019

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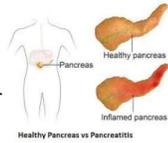
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## Pancreatitis

- ▶ People with diabetes 2xs risk of acute pancreatitis
- ▶ After episode of pancreatitis, one third of people will get prediabetes or diabetes
- ▶ About 25% to 80% of people with chronic pancreatitis develop Type 3c diabetes.
- ▶ Pancreatitis is an exocrine dysfunction:
  - ▶ Disrupts global architecture or physiology of pancreas
  - ▶ Results in both exocrine and endocrine dysfunction.



3. Progression and Classification of Diabetes: Standards of Care in Diabetes—2023 (3)

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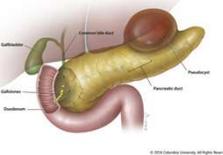
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## Pancreatitis

- ▶ Pancreatitis caused by digestion of the organ from pancreatic enzymes normally carried to the SI through pancreatic duct.
- ▶ Detected through elevated Amylase levels & pain
- ▶ Causes:
  - ▶ HIV meds and other meds
  - ▶ Alcohol ingestion
  - ▶ Gallstones blocking pancreatic enzyme flow to small intestine
  - ▶ Elevated triglycerides
  - ▶ Cancer, injury and other



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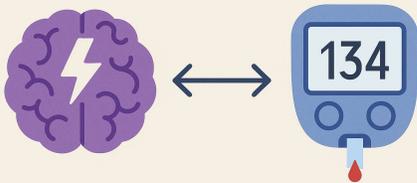
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## Diabetes Type 3

### TYPE 3 DIABETES



The link between insulin resistance and neurodegeneration

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## What is 'Type 3 Diabetes'?

- ▶ A term linking Alzheimer's disease to insulin resistance in the brain.
- ▶ Not an official diagnostic category.
- ▶ Still an emerging field with ongoing studies
- ▶ Suggests that Alzheimer's may be a form of brain-specific diabetes.



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## Key Concepts

- ▶ Type 2 Diabetes increases Alzheimer's risk by 60–80%
- ▶ Reduced insulin receptors in brains of people with Alzheimer's
- ▶ The brain uses insulin for memory and learning
- ▶ Insulin resistance contributes to cognitive decline
- ▶ Amyloid beta plaques and tau tangles are influenced by insulin signaling

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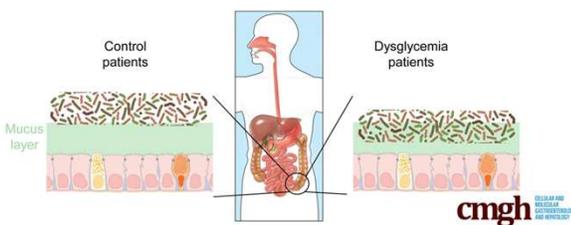
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## Colonic Microbiota Encroachment Correlates With Dysglycemia in Humans



Benoit Chassaing, Shreya M. Raja, James D. Lewis, Shanthi Srinivasan, Andrew T. Gewirtz  
Cellular and Molecular Gastroenterology and Hepatology (September 2017)

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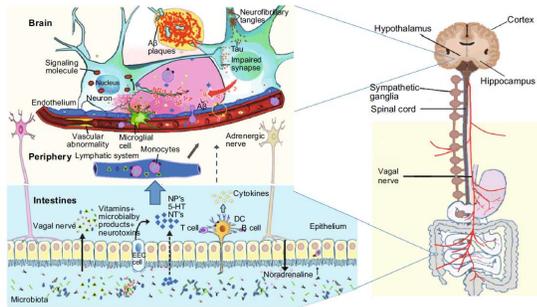
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## Link Between Gut and Brain



Benoit Chassaing, Shreya M. Raja, James D. Lewis, Shanthi Srinivasan, Andrew T. Gewirtz  
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## Potential Interventions

- ▶ Lifestyle: Mediterranean diet, physical activity.
- ▶ Optimize glucose and blood pressure.
- ▶ Investigational: Intranasal insulin, GLP-1 agonists
- ▶ Reduce systemic inflammation.
- ▶ Improved nutrition and gut health.




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'Type 3 Diabetes' reflects the link between metabolic and brain health



Early intervention can support cognitive function



Encourages whole-person, compassionate care

## Summary




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## What kind of Diabetes?

- ▶ 58 yr old, states she has had type 1 diabetes for 18 years. Quit smoking a year ago and gained about 20 lbs. BMI 25.
- ▶ Meds
  - ▶ Humalog 18-23 units before each meal
  - ▶ Glargine 28 units at bedtime
  - ▶ Metformin 500mg TID
- ▶ What tests would you recommend?



**25% of ind's with Type 1 also have type 2 diabetes.**  
ADA Post Grad, 2010

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## Type 1 & Type 2 - Double Diabetes?

- ▶ May be appropriate to recognize a person with type 1 diabetes *and* features classically associated with type 2 diabetes (e.g., insulin resistance, obesity, and other metabolic abnormalities).
- ▶ Can help facilitate access to appropriate treatment:
  - ▶ (e.g., GLP-1 RA or SGLT-2 inhibitor therapies for potential weight and other cardiometabolic benefits) and monitoring systems.



2 Progression and Classification of Diabetes: Standards of Care in Diabetes—2023

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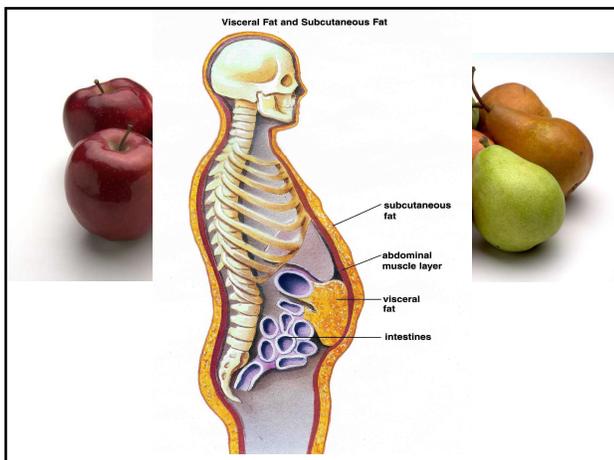
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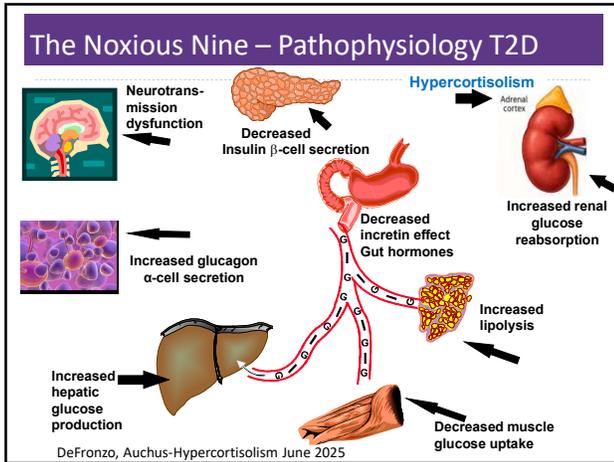
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### CATALYST Study Findings

► Findings from the CATALYST study, the largest prospective trial of its kind, suggest that hypercortisolism may be a significant contributing factor in as many as one in four patients with difficult-to-control type 2 diabetes.

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### CATALYST Study: Hypercortisolism & Difficult-to-Control Type 2 Diabetes

- **Study Design Overview** Prospective observational screening of ~1,000 adults with HbA1c 7.5–11.5%, on multiple antihyperglycemic agents.
- Screening tool: Overnight 1 mg dexamethasone suppression test (DST).
- Hypercortisolism defined as post-DST cortisol >1.8 µg/dL with adequate dexamethasone levels.

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## Study Design & Prevalence

### ► Multicenter trial (36 sites)

- 1,057 adults
- **Inclusion:** T2D, A1c 7.5–11.5% despite multiple meds.
- Adults aged 18–80 years with established type 2 diabetes (diagnosed  $\geq$  1 year prior)
  - $\geq$  3 diabetes medications,
  - or Insulin plus any other diabetes drug(s),
  - Or  $\geq$  2 diabetes meds and at least one micro- or macrovascular complication,
  - Or  $\geq$  2 diabetes meds and  $\geq$  2 antihypertensive medications

### ► Findings

- 23.8% had hypercortisolism
- Prevalence 36.6% in those on  $\geq$ 3 antihypertensives
- 33% adrenal abnormalities on CT
- 25% adrenal tumors.
- Some cases may benefit from surgical intervention.

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## HyperCortisolism in Type 2

Cortisol increases gluconeogenesis in the liver

Reduces peripheral glucose uptake  $\rightarrow$  insulin resistance

Stimulates protein catabolism and lipolysis

Chronic cortisol elevation  $\rightarrow$  persistent hyperglycemia

► Can lead to “Difficult to Control Type 2 Diabetes”

► CATALYST study revealed about 24% of people with elevated BG despite meds, may be due to hypercortisolism.

► Treatment with mifepristone decreased weight, waistline, BG.



DeFronzo, Auchus-Hypercortisolism June 2025

[pmc.ncbi.nlm.nih.gov/3HCP](https://pmc.ncbi.nlm.nih.gov/3HCP)

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## Signs of Hypercortisolism

### SIGNS OF HYPERCORTISOLISM



### ► Other signs

- muscle weakness,
- high blood pressure,
- diabetes,
- excessive hair growth,
- acne,
- bone loss and
- mood changes like irritability and depression.

Hypothalamus  $\rightarrow$  CRH  $\rightarrow$  Pituitary  $\rightarrow$  ACTH  $\rightarrow$  Adrenal  $\rightarrow$  Cortisol

► Cortisol effects: gluconeogenesis, insulin resistance, fat redistribution

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**Slide 209**

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**BT1** Added this slide

Beverly Thomassian, 2025-08-26T01:27:55.691

## Study Design – Part 2 (Intervention)

Randomized, double-blind, placebo-controlled intervention

N = 136 participants with confirmed hypercortisolism

Mifepristone: 300 mg daily escalating up to 900 mg over 24 weeks

Primary endpoint: HbA1c reduction; Secondary: weight, meds, safety.

DST is simple and accessible for high-risk patients.

Cortisol screening may redirect treatment strategies.

Supports expanding endocrine evaluation in uncontrolled diabetes.

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A1c ↓ ~1.5% vs. 0.2% in placebo group



Weight ↓ ~10 pounds; waist circumference ↓ ~2 inches



Many reduced or stopped other diabetes meds, including insulin.

### Intervention Outcomes

Adverse events mostly mild to moderate (glucocorticoid withdrawal symptoms).

Hypokalemia observed; manageable clinically.

Discontinuation ~28.6%, mostly due to tolerability issues.

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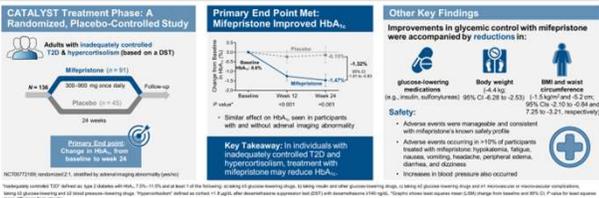
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## CATALYST Treatment Outcomes

### CATALYST Inadequately Controlled Type 2 Diabetes and Hypercortisolism: Improved Glycemia With Mifepristone Treatment



Mifepristone significantly improves glycemic control and weight  
Next steps: broader screening, novel cortisol-targeted therapies, long-term outcomes.

ORIGINAL ARTICLE | JUNE 21, 2023  
Inadequately Controlled Type 2 Diabetes and Hypercortisolism: Improved Glycemia With Mifepristone Treatment

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**Diabetes Bingo**  
**“DiaBingo” Shout out Right Answer**




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**DiaBingo - N**

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

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**Mahalo**



- ▶ Questions?
- ▶ Email: [info@diabetesed.net](mailto:info@diabetesed.net)
- ▶ Web: [www.diabetesed.net](http://www.diabetesed.net)
- ▶ Phone 530-893-8635




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# MODY

## MATURITY-ONSET DIABETES OF THE YOUNG

- A rare, inherited form of diabetes caused by a mutation in a single gene
- Autosomal dominant inheritance
- Typically presents before age 25
- Non-insulin dependent (in most types)



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## What is MODY?

- ▶ Maturity-Onset Diabetes of the Young
- ▶ Autosomal dominant inheritance
- ▶ Typically presents before age 25
- ▶ Non-insulin dependent (in most types)
- ▶ Often misdiagnosed as Type 1 or Type 2 diabetes



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## When to Suspect MODY

- ▶ Diagnosis before age 25
- ▶ Non-obese, non-insulin-dependent
- ▶ Strong family history
- ▶ Negative for autoantibodies
- ▶ Atypical response to insulin or oral meds



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## Diagnosis and Genetic Testing

- ▶ C-peptide and autoantibodies (GAD, IA2)
- ▶ Consider MODY if autoantibodies negative
- ▶ Confirm with genetic testing
- ▶ Personalized treatment options available



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## MODY 1 – HNF4A Mutation

- ▶ Gene: Hepatocyte Nuclear Factor 4 Alpha (HNF4A)
- ▶ Features:
  - ▶ - Progressive beta-cell dysfunction
  - ▶ - Sensitive to sulfonylureas
  - ▶ - Low triglycerides
  - ▶ - Macrosomia, neonatal hypoglycemia
- ▶ Treatment: Oral agents, esp. sulfonylureas

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## MODY 2 – GCK Mutation

- ▶ Gene: Glucokinase (GCK)
- ▶ Features:
  - ▶ - Mild, stable fasting hyperglycemia
  - ▶ - HbA1c typically < 7.5%
  - ▶ - No symptoms or complications
- ▶ Treatment: Often none
- ▶ Note: Poor response to insulin or oral agents

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## MODY 3 – HNF1A Mutation

- ▶ Gene: Hepatocyte Nuclear Factor 1 Alpha (HNF1A)
- ▶ Most common MODY subtype
- ▶ Features:
  - ▶ Progressive hyperglycemia
  - ▶ Sulfonylurea-sensitive
  - ▶ Glycosuria at lower glucose thresholds
- ▶ Treatment: Low-dose sulfonylureas

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## Comparing Common MODY Types

Slide 6: Comparing the Most Common MODY Types

Feature	MODY 1 (HNF4A)	MODY 2 (GCK)	MODY 3 (HNF1A)
Onset	Childhood/Adolescence	From birth	Childhood/Adolescence
Hyperglycemia severity	Moderate	Mild, stable	Progressive
Treatment	Sulfonylureas	Usually none	Sulfonylureas
Key Clues	Neonatal hypoglycemia	Stable FBG ~100–140 mg/dL	Glycosuria at lower BG

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## Why MODY Matters

- ▶ Prevent misdiagnosis and overtreatment
- ▶ Tailor therapies based on gene subtype
- ▶ Genetic counseling for families
- ▶ Precision medicine opportunity

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