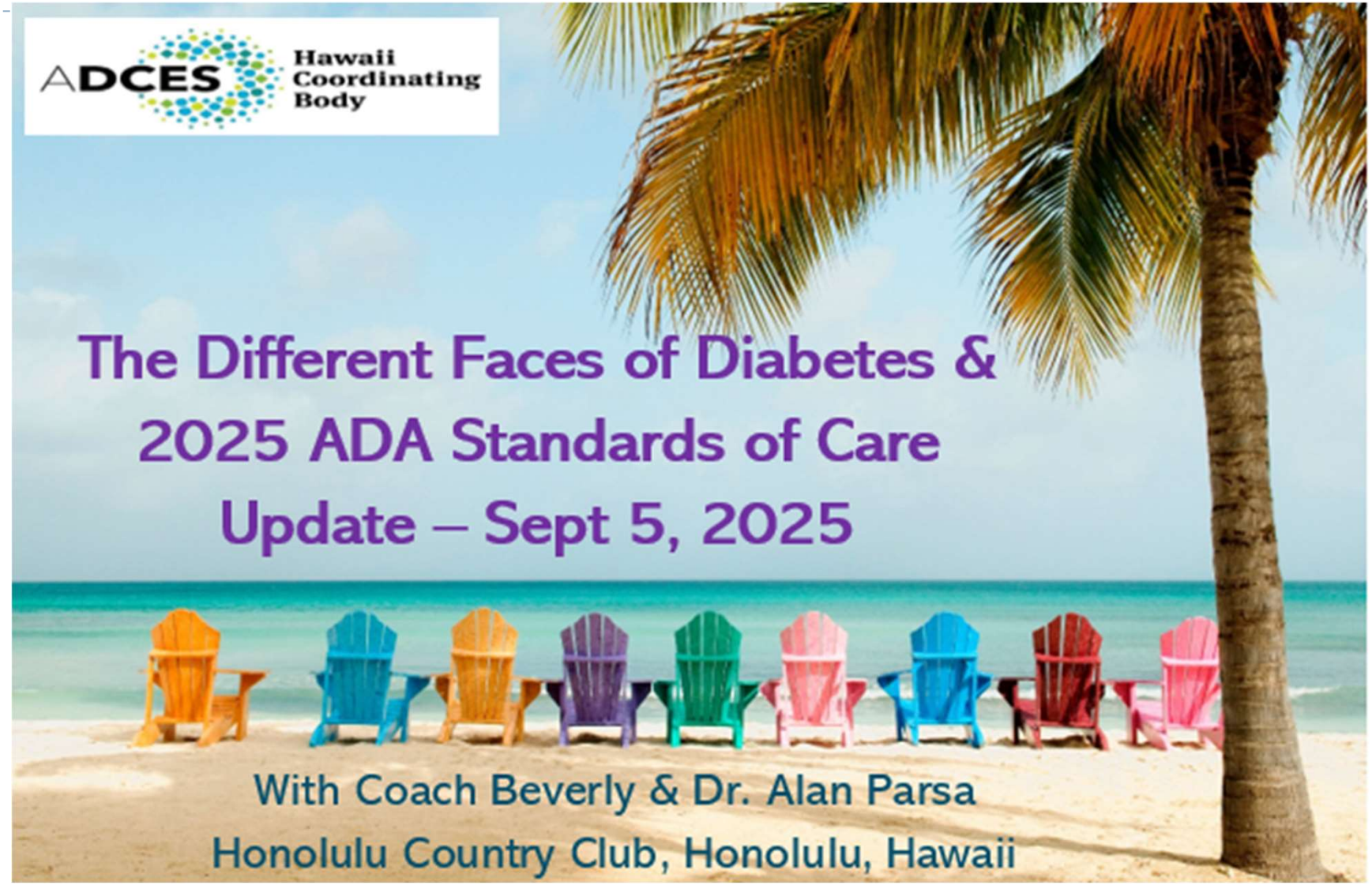
Diabetes Education SERVICES™

25 years growth, connection, inspiration




Beverly Thomassian, RN, MPH, BC-ADM, CDCES
Pronouns: She, her and hers  Founder - www.DiabetesEd.net

# Hawaii ADCES Coordinating Body


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

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**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 (search Hawaii)

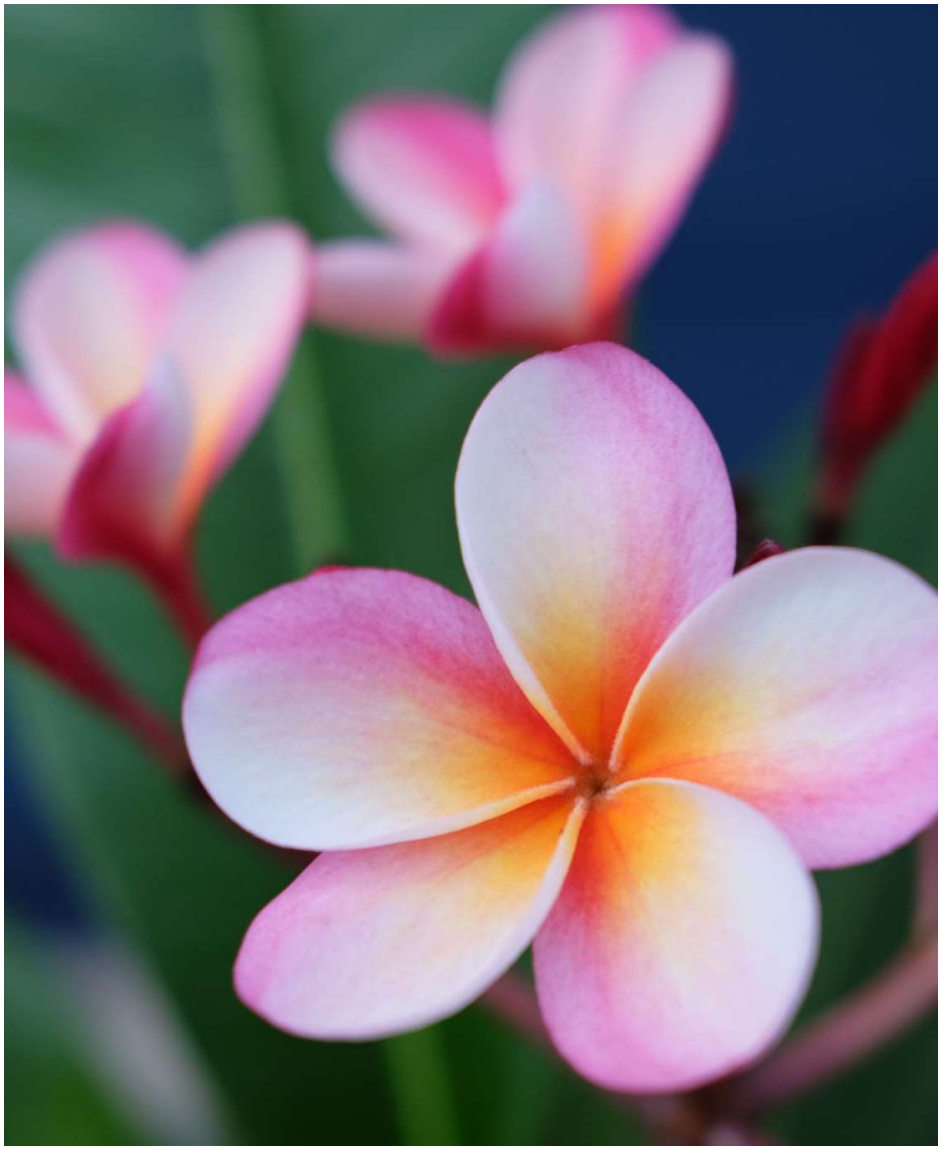
# Speakers & Agenda

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 |

# 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.



# 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.

# 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

# 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

# CDC Announces

35% of Americans will have Diabetes by 2050

*Boyle, Thompson, Barker, Williamson*

*2010, Oct 22:8(1)29*

*www.pophealthmetrics.com*

# Poll Question 1

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

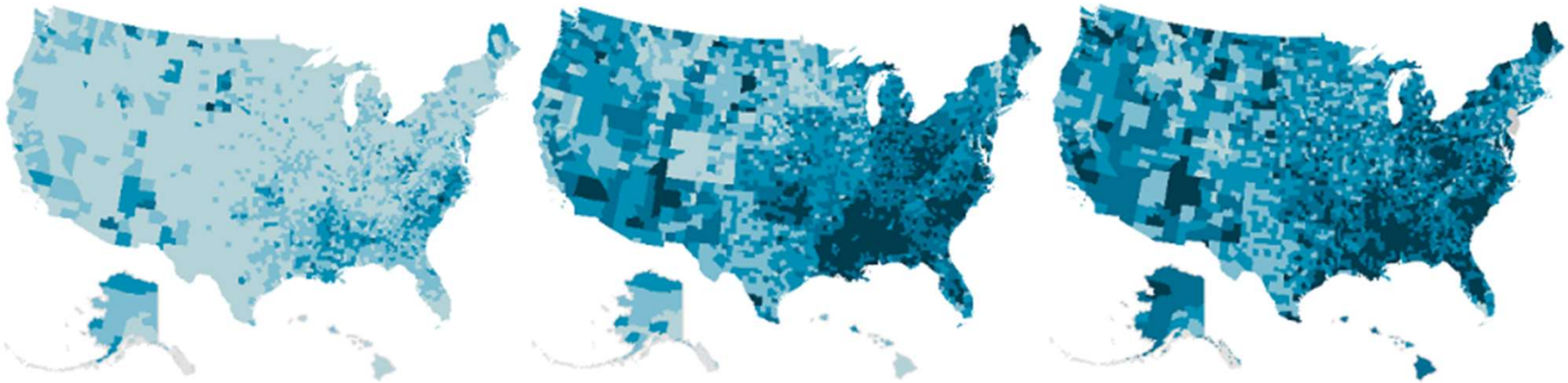
a. 30% of people above the age of 20 have type 2 diabetes.
b. The rate of type 1 and type 2 diabetes have tripled since 2010.
c. A total of 50% of people have prediabetes or diabetes.
d. 1 out of 2 persons above age 20 have prediabetes.

# 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



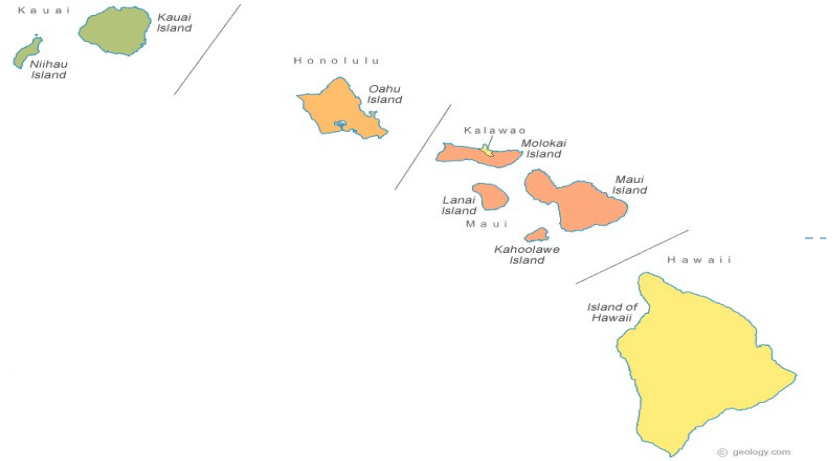

Data sources: US Diabetes Surveillance System; Behavioral Risk Factor Surveillance System.

NCHS Data Brief ■ No. 516 ■ November 2024

**Prevalence of Total, Diagnosed, and Undiagnosed Diabetes in Adults: United States, August 2021–August 2023**

Jane A. Gwira, M.D., M.P.H., Cheryl D. Fryar, M.S.P.H., and Qiuping Gu, M.D., Ph.D.

# 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

American Diabetes Association.

ASIAN AMERICAN
NATIVE HAWAIIAN
& PACIFIC ISLANDER
AANHPI INITIATIVE™

# Asian Americans, Native Hawaiians and Pacific Islanders are at greater risk for type 2 diabetes at any weight.

## YOU COULD BE AT RISK TOO.

If you can check one of these boxes, you are at risk for type 2 diabetes.

- I am of Asian descent
- I am of Hawaiian descent
- I am of Pacific Islander descent
- I am overweight/obese
- I do not exercise regularly
- I am over 45 years old
- I have family members with diabetes

## WHAT IS DIABETES?

Diabetes is a disease that affects every part of your body. If untreated, diabetes can lead to heart attack, stroke, kidney disease, blindness, amputations and death.

The good news is you can prevent or delay getting type 2 diabetes by eating healthy and getting regular physical activity.

**Ask your doctor if you should be screened for type 2 diabetes.**

"I couldn't believe it when I was diagnosed with type 2 diabetes. I was at risk even though I've never been overweight."

STOP DIABETES.

The American Diabetes Association is committed to supporting Asian Americans, Native Hawaiians and Pacific Islanders in preventing and living with diabetes.

**Call 1-800-DIABETES (1-800-342-2383) or visit diabetes.org for more information about diabetes and to get involved.**

# Native Hawaiian & Pacific Islander Adults with Diabetes

| Age-adjusted percentage of persons 18 years of age and over with diabetes, 2018 | | |
|---|---|---|
| **Population** | **Percent** | **Population / White Ratio** |
| White | 7.9 | -- |
| Native Hawaiian/Pacific Islander | 15.2 | 1.9 |
| Native Hawaiian | 14.2 | 1.8 |
| Pacific Islander | 17.7 | 2.2 |
| Samoan | 22.1 | 2.8 |
| Guamanian or Chamorro | 14.8 | 1.9 |
| Other Pacific Islander | 15.8 | 2.0 |

Source; CDC, 2017. Health Conditions and Behaviors of Native Hawaiian and Pacific Islander Persons in the United States, 2014. Vital and Health Statistics, Series 3, No. 40. Table 9.
https://www.cdc.gov/nchs/data/series/sr_03/sr03_040.pdf

OMH
U.S. Department of Health and Human Services
Office of Minority Health

Office of Minority Health Resource Center
Toll Free: 1-800-444-6472 / Fax: 301-251-2160
Email: info@minorityhealth.hhs.gov

# Death Rates from Diabetes In Hawaii

## Death Rates

| Age-adjusted diabetes death rates per 100,000 (2018) | | | |
|---|---|---|---|
| | **Non-Hispanic Native Hawaiian/Pacific Islander<** | **Non-Hispanic White** | **Non-Hispanic Native Hawaiian/Pacific Islander / Non-Hispanic White Ratio** |
| Male | 56.5 | 24.3 | 2.3 |
| Female | 40.1 | 14.3 | 2.8 |
| Total | 48.1 | 18.9 | 2.5 |

Source: CDC 2021. National Vital Statistics Report. Vol. 69, No. 13. Table 10. https://www.cdc.gov/nchs/data/nvsr/nvsr69/nvsr69-13-508.pdf [PDF | 2.05MB]

## Risk Factors

There are several risk factors related to diabetes. Some of these risk factors are:

**Obesity and Overweight -** See Obesity and Native Hawaiians/Pacific Islanders
**Hypertension -** See Heart Disease and Native Hawaiians/Pacific Islanders
**High Cholesterol -** See Heart Disease and Native Hawaiians/Pacific Islanders
**Cigarette Smoking -** See Heart Disease and Native Hawaiians/Pacific Islanders

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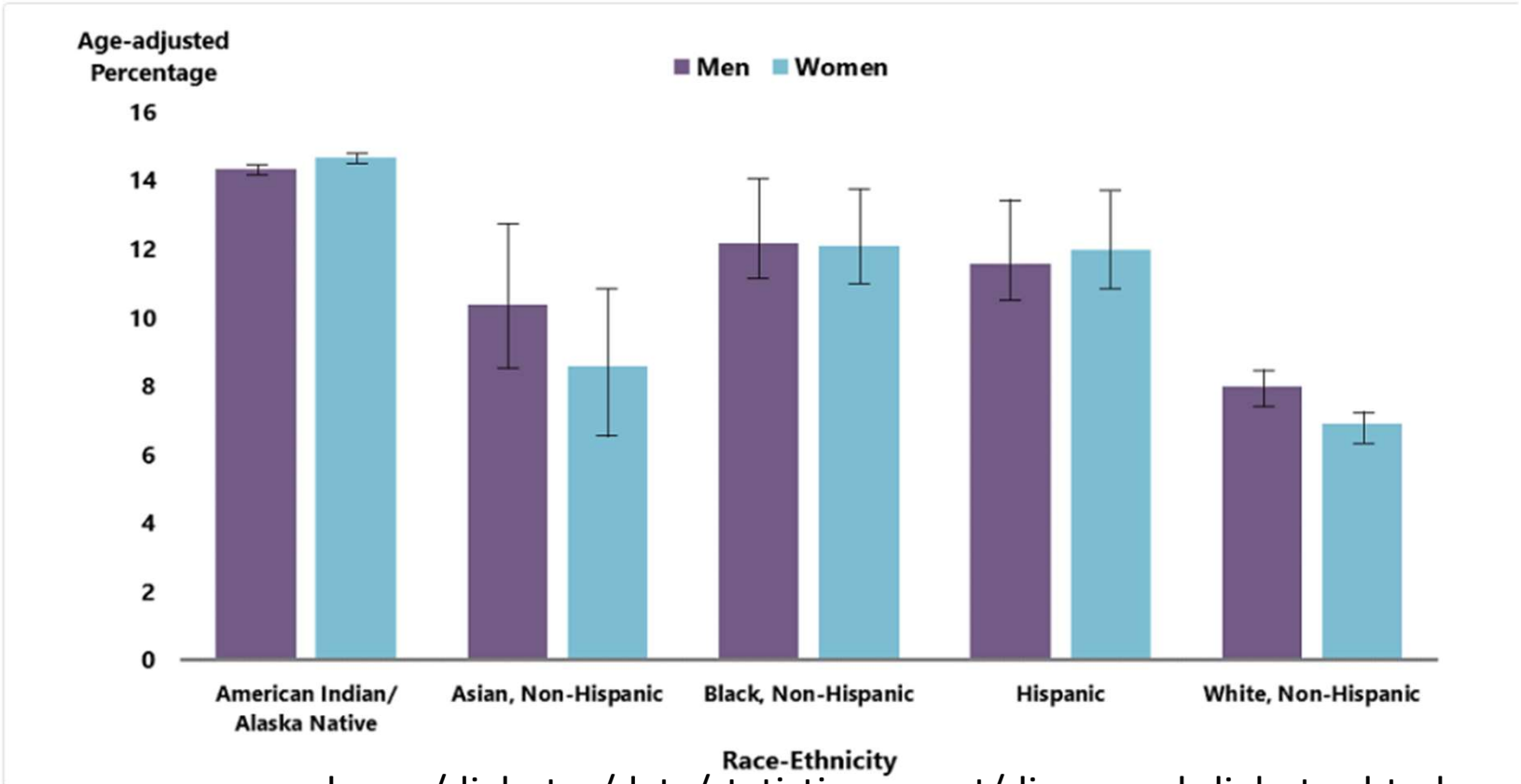
# Diabetes Prevalence by Ethnic Group

- 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

# 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

1. Improving Care and Promoting Health in Populations: Standards of Care in Diabetes—2025 FREE

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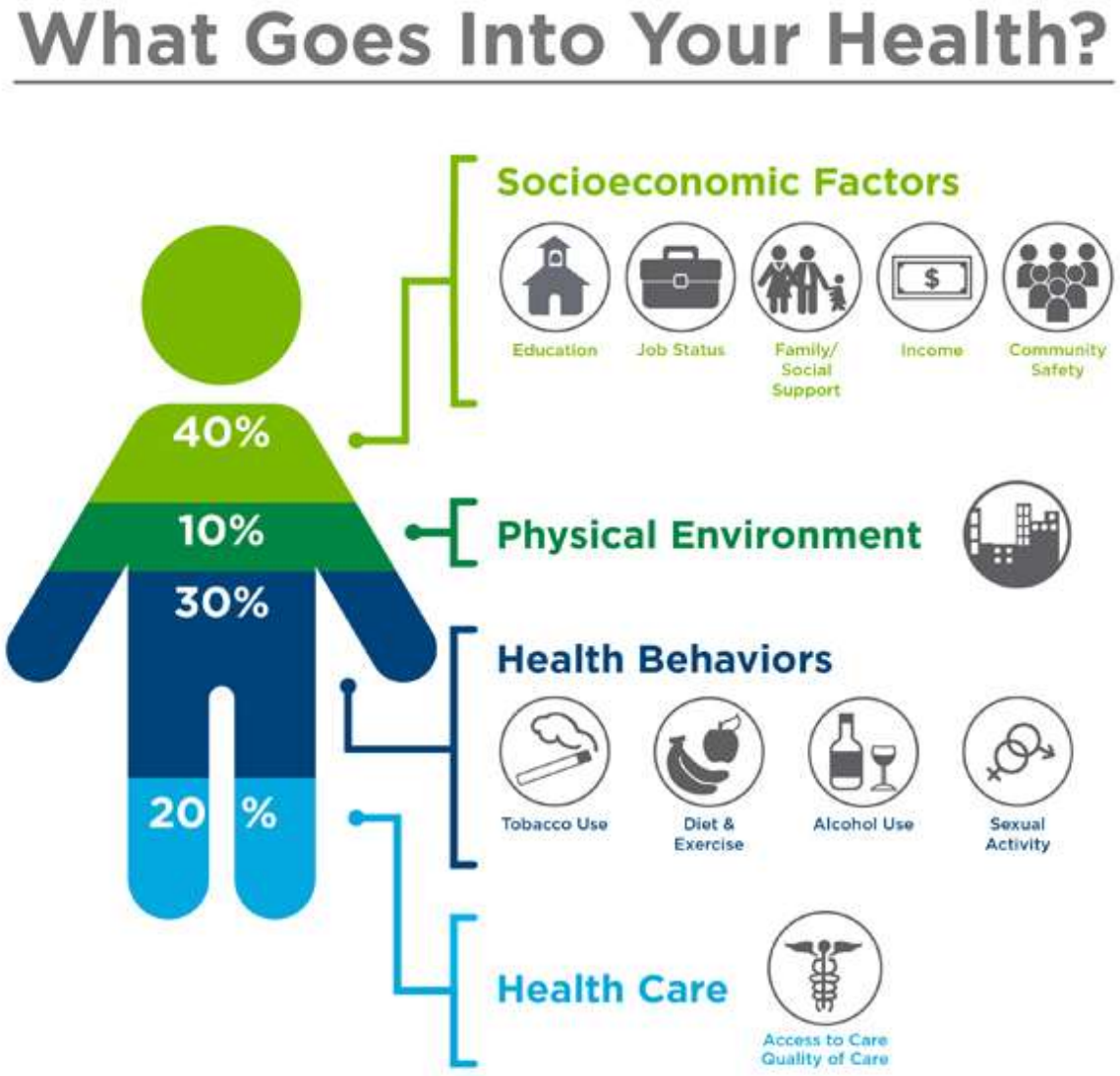
# Address Barriers to Self Management

- **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.




Source: Institute for Clinical Systems Improvement, Going Beyond Clinical Walls: Solving Complex Problems (October 2014)

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*

# 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.

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

# 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.

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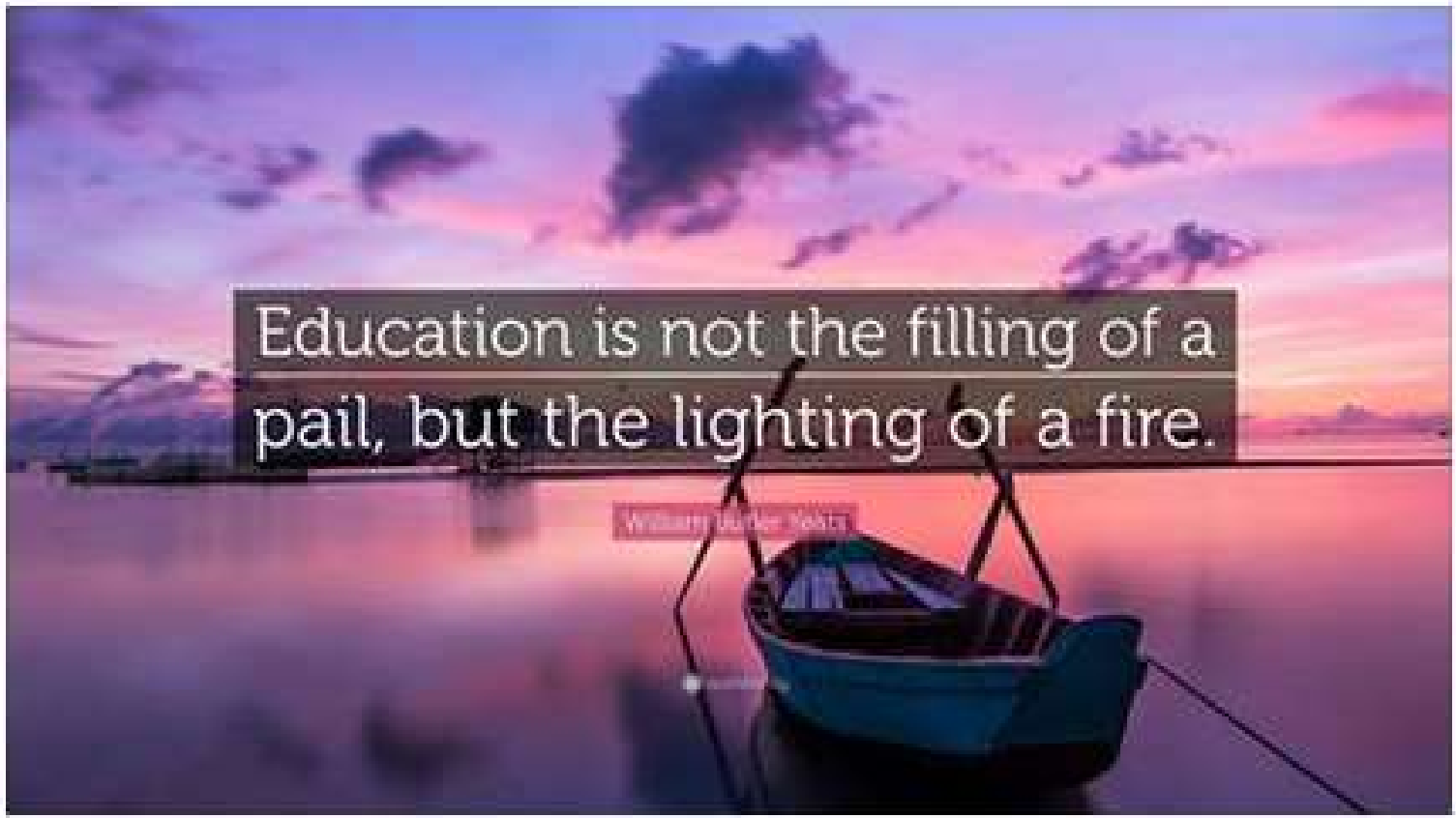
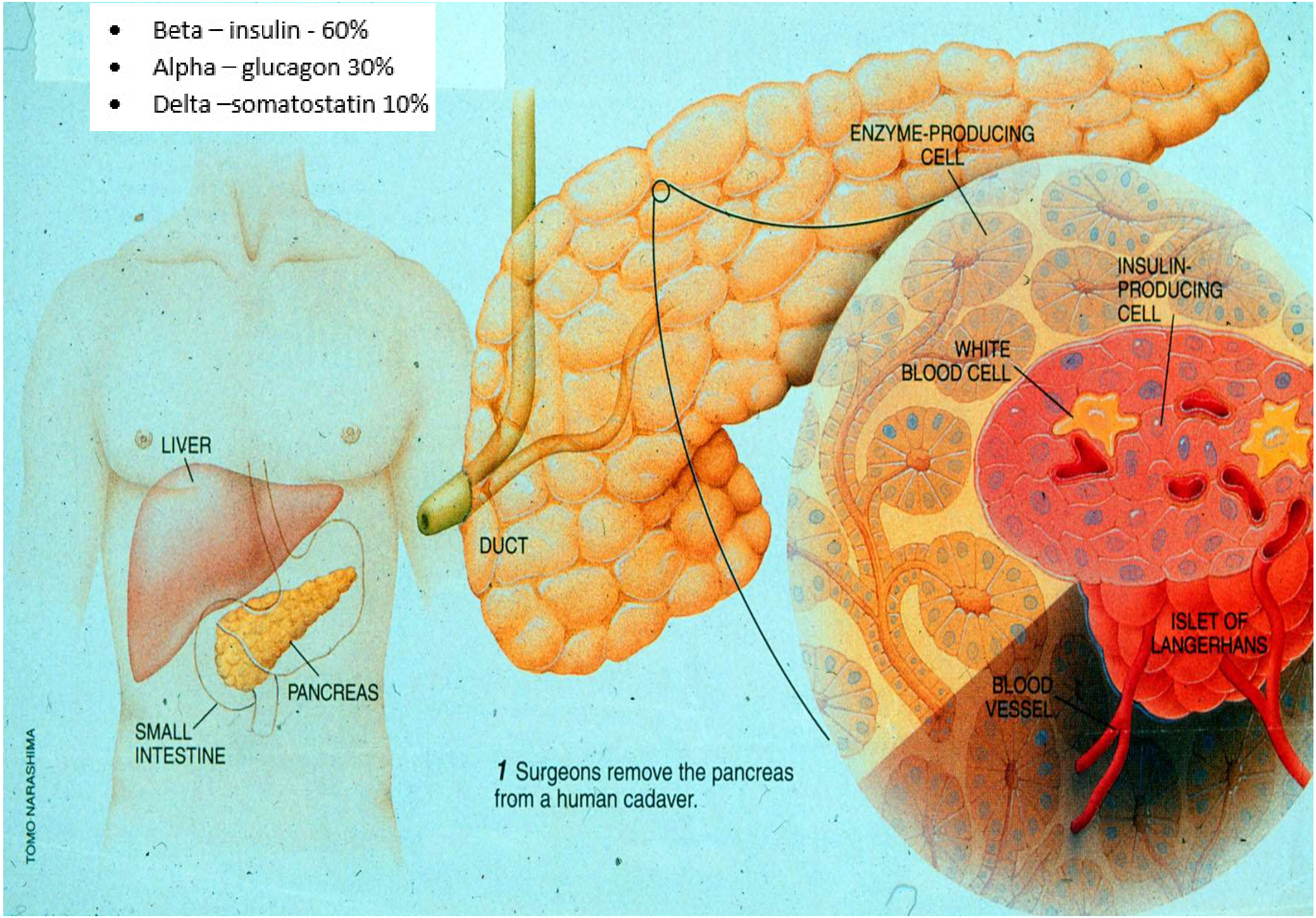
# Let’s meet people where they are at.



- Beta – insulin - 60%
- Alpha – glucagon 30%
- Delta –somatostatin 10%



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 | |

## Slide 24

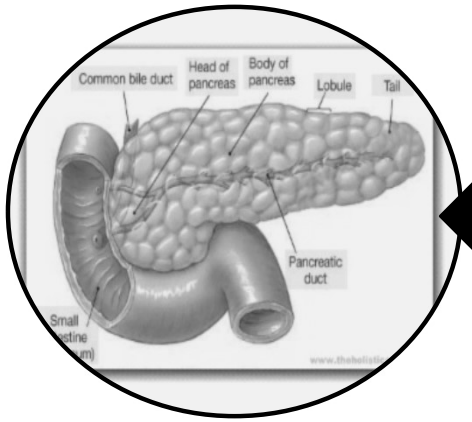
**BT1** Added gut hormone info

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

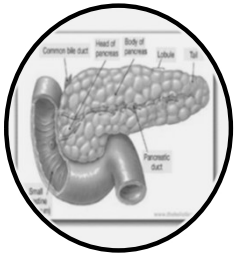
# Poll Question 2

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

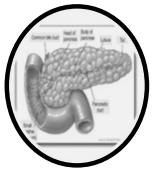
# 2. Diagnosis and Classification and of Diabetes Natural History of Diabetes




Yes!



NO



**No diabetes**

**FBG <100**

**Random <140**

**A1c <5.7%**

**Prediabetes**

**FBG 100-125**

**Random 140 - 199**

**A1c ~ 5.7- 6.4%**

**50% working pancreas**

**Diabetes**

**FBG 126 +**

**Random 200 +**

**A1c 6.5% or +**

**20% working pancreas**

**Development of type 2 diabetes happens over years or decades**

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

1. Start screening all people at age 35.
2. Screen at any age if BMI ≥ 25 (Asians BMI ≥ 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, 2nd generation antipsychotics or steroids, thiazide diuretics, statins
- History of pancreatitis, prediabetes, GDM, periodontitis

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

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**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)

# 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.) |

1. Test all adults starting at age **35** for prediabetes and diabetes using Fasting Plasma Glucose, A1C or OGTT.
2. Perform risk-based screening if BMI ≥ 25 or BMI ≥ 23 in Asian Americans 10yrs+ with 1 or more risk factors:
   - History of cardiovascular disease
   - First or second degree relative with diabetes
   - High risk ethnicity or ancestry
   - Other conditions associated with insulin resistance (PCOS, Acanthosis Nigricans, Steatosis)
   - Physical inactivity
   - HDL ≤ 35 mg/dl or triglyceride ≥ 250 mg/dl
   - Hypertension ≥ $^{130}/_{80}$ or on therapy for HTN
3. If results normal, repeat test at a minimum of 3-year intervals or more frequently based on risk status.
4. **Test Yearly** if A1C ≥ 5.7% or Impaired Fasting Glucose or History of GDM ( test at least every 1- 3 years)

**Closely monitor high-risk groups** (before taking 2nd generation antipsychotics, steroids, thiazide diuretics, statins, HIV meds *and* after initiating therapy) with history of pancreatitis, or periodontal disease.

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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

# 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 FREE

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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 FREE

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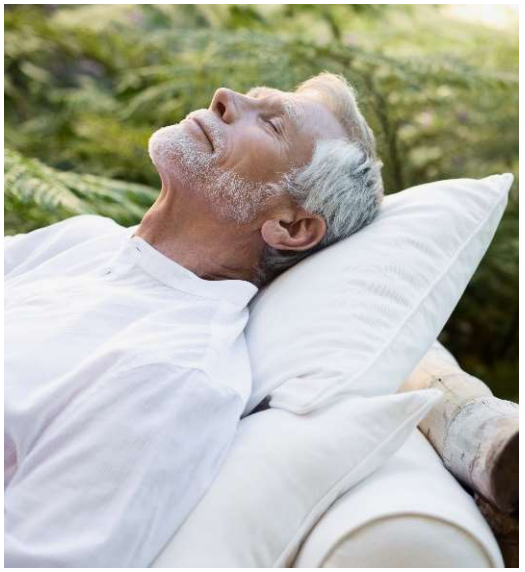
# Get About 7 Hours of Quality Sleep to Prevent Diabetes

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

# 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)

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

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- CV Risk Mitigation important.
- Statin can increase BG, stop if notice elevation
- Consider low dose pioglitazone (Actos) if history of stroke.

# 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
  - Pioglitzone $5 a month
  - Can cause fluid retention, not indicated w/ CHF

| Class/Main Action | Name(s) | Daily Dose Range | Considerations |
|---|---|---|---|
| **Thiazolidinediones "TZDs"**<br>• Increases insulin sensitivity | pioglitazone (Actos)<br>rosiglitazone | 15 – 45 mg daily<br>4 – 8 mg daily | Black Box Warning: TZDs may cause or worsen CHF. Monitor for edema and weight gain. Increased peripheral fracture risk. Actos may increase risk of bladder cancer.<br>Lowers A1c 0.5% – 1.0% |

# 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** FREE

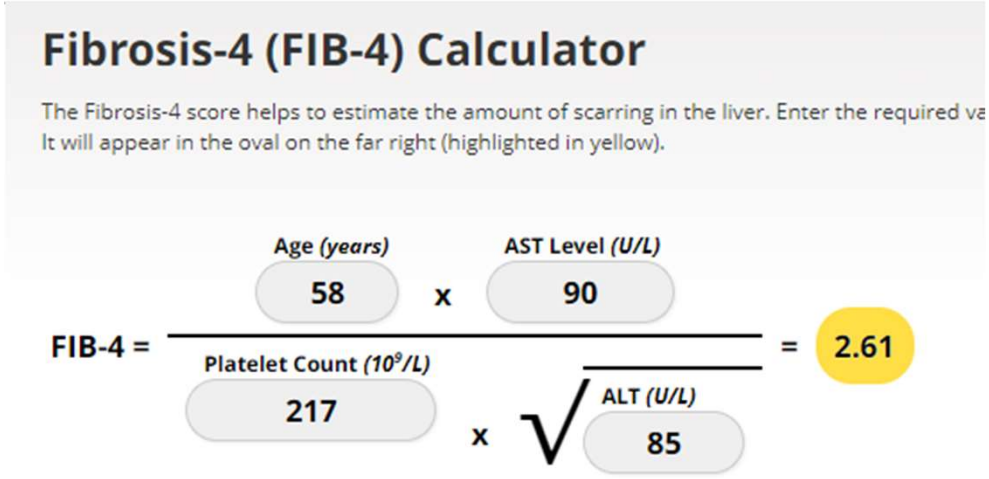
American Diabetes Association Professional Practice Committee

# Liver Nomenclature Update

AASLD
AMERICAN ASSOCIATION FOR THE STUDY OF LIVER DISEASES

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

# Screening for MASH – FIB-4




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

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

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**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).

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

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

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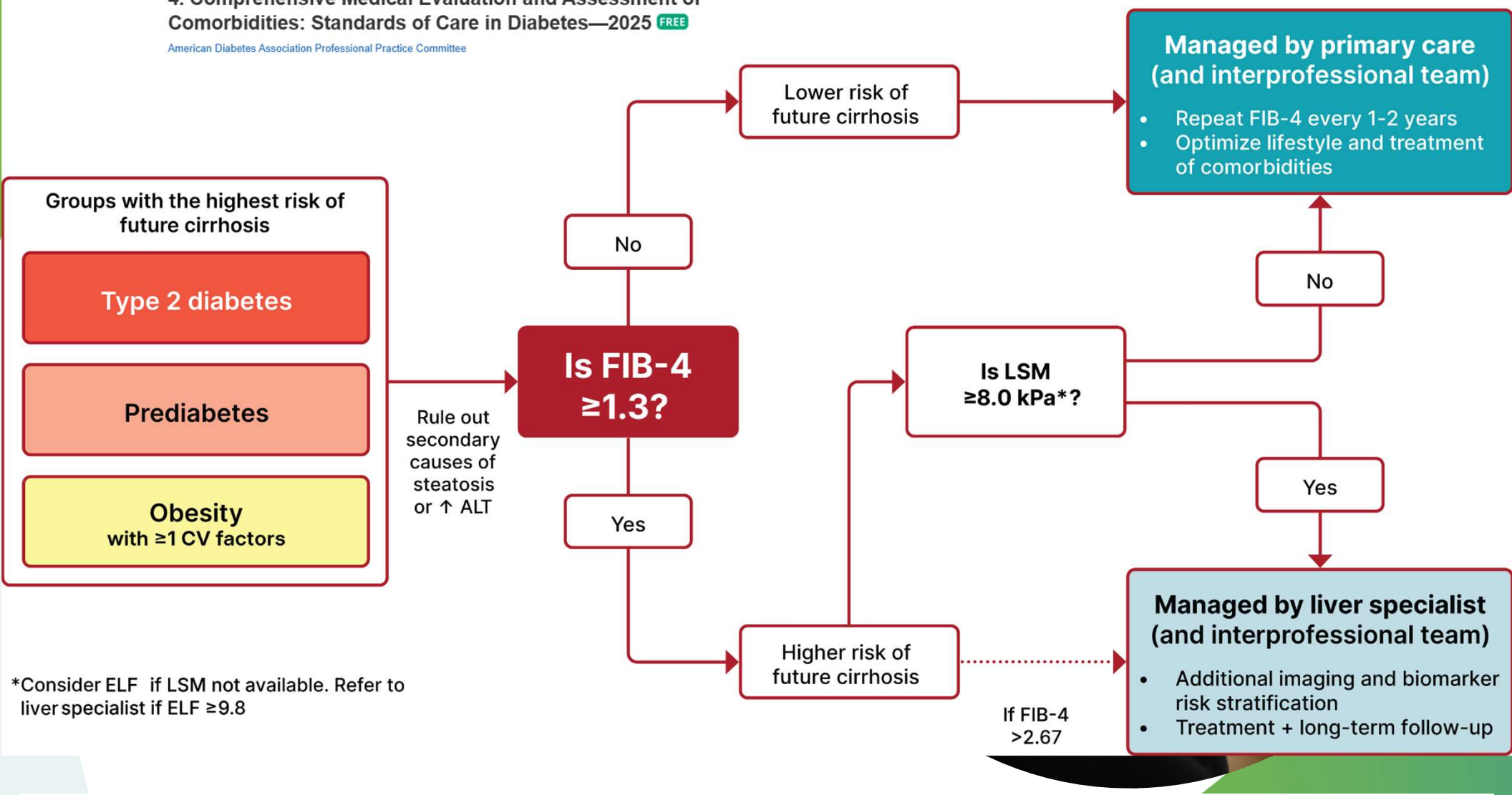


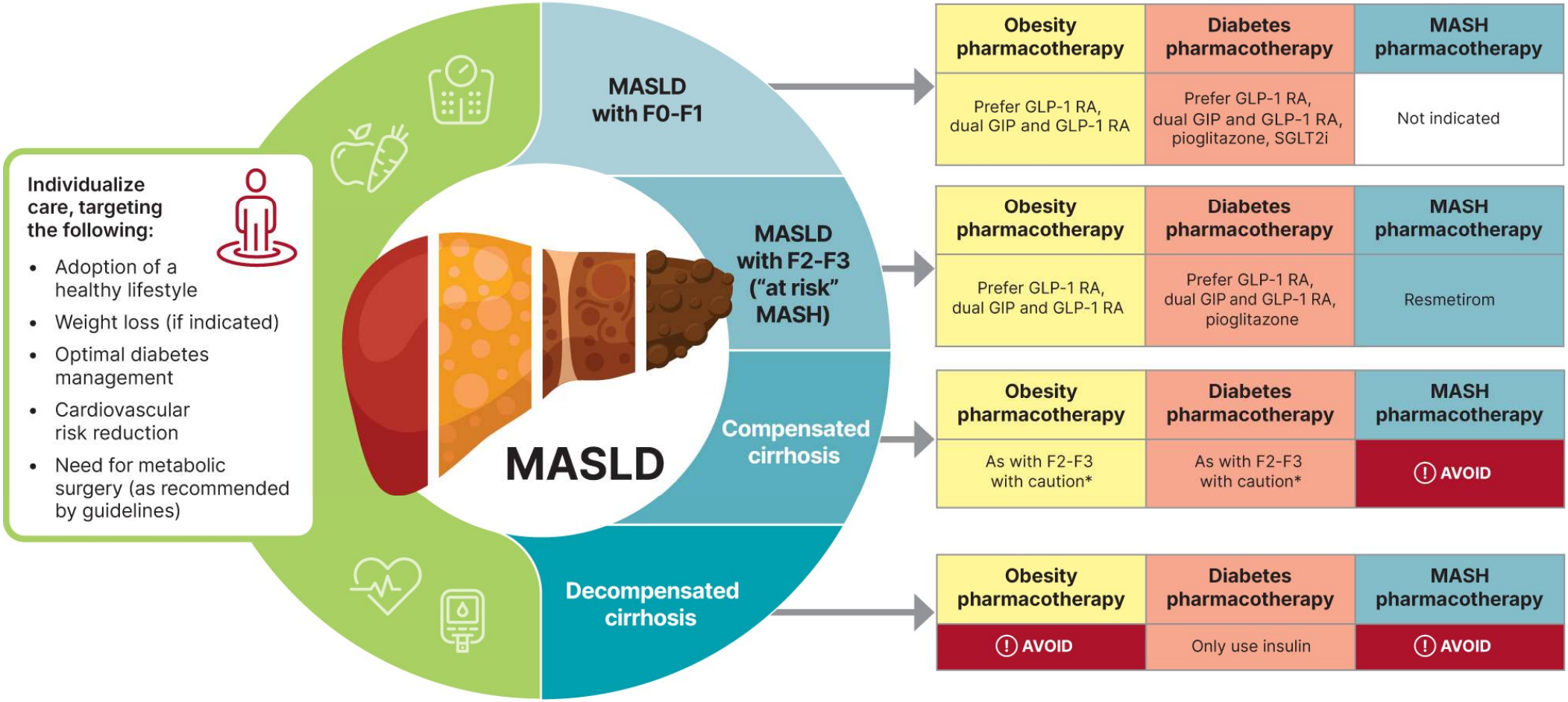

Figure 4.2—LSM, liver stiffness measurement, as measured by vibration-controlled transient elastography. "Fibroscan" *In the absence of LSM, consider ELF enhanced liver fibrosis test; a diagnostic alternative. If ELF ≥ 9.8, an individual is at high risk of MASH with advanced liver fibrosis (≥F3–F4) and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

# 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

# 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;

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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

# Use of Glucose-Lowering Medications in the Management of Type 2 Diabetes

**HEALTHY LIFESTYLE BEHAVIORS; DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT; SOCIAL DETERMINANTS OF HEALTH**

To avoid therapeutic inertia, reassess and modify treatment regularly (3–6 months)

## Goal: Cardiovascular and Kidney Risk Reduction in High-Risk Individuals with Type 2 Diabetes*

### +ASCVD†

### +Indicators of high CVD risk

**+ASCVD/indicators of high CVD risk***

- GLP-1 RA* with proven CVD benefit
- OR
- SGLT2i‡ with proven CVD benefit

**If A1C is above goal**

- For individuals on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit or vice versa
- Pioglitazone^

### +HF

Current or prior symptoms of HF with documented HFrEF or HFpEF

**SGLT2i‡**

with proven HF benefit in this population

### +CKD

eGFR <60 mL/min/1.73 m² OR albuminuria (ACR ≥3.0 mg/mmol [30 mg/g]). Repeat measurement is required to confirm CKD

**+CKD (on maximally tolerated dose of ACEi or ARB)**

SGLT2i‡ with primary evidence of reducing CKD progression

- SGLT2i can be started with eGFR ≥20 mL/min/1.73 m²
- Continue until initiation of dialysis or transplantation
- Glucose-lowering efficacy is reduced with eGFR <45 mL/min/1.73 m²

OR

GLP-1 RA* with proven CKD benefit

If A1C is above goal, for individuals on SGLT2i, consider incorporating a GLP-1 RA or vice versa

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**If additional cardiovascular and kidney risk reduction, management of other metabolic comorbidities, and/or glycemic lowering is needed**

## Goal: Achievement and Maintenance of Weight and Glycemic Goals

### +Weight management

**Efficacy for weight loss**

**Very high:** Semaglutide, tirzepatide

**High:** Dulaglutide, liraglutide

**Intermediate:** GLP-1 RA (not listed above), SGLT2i

**Neutral:** Metformin, DPP-4i

### +Achievement and maintenance of glycemic goals

Metformin or other agent (including combination therapy) that provides adequate EFFICACY to achieve and maintain glycemic treatment goals

Prioritize avoidance of hypoglycemia in high-risk individuals

**Efficacy for glucose lowering**

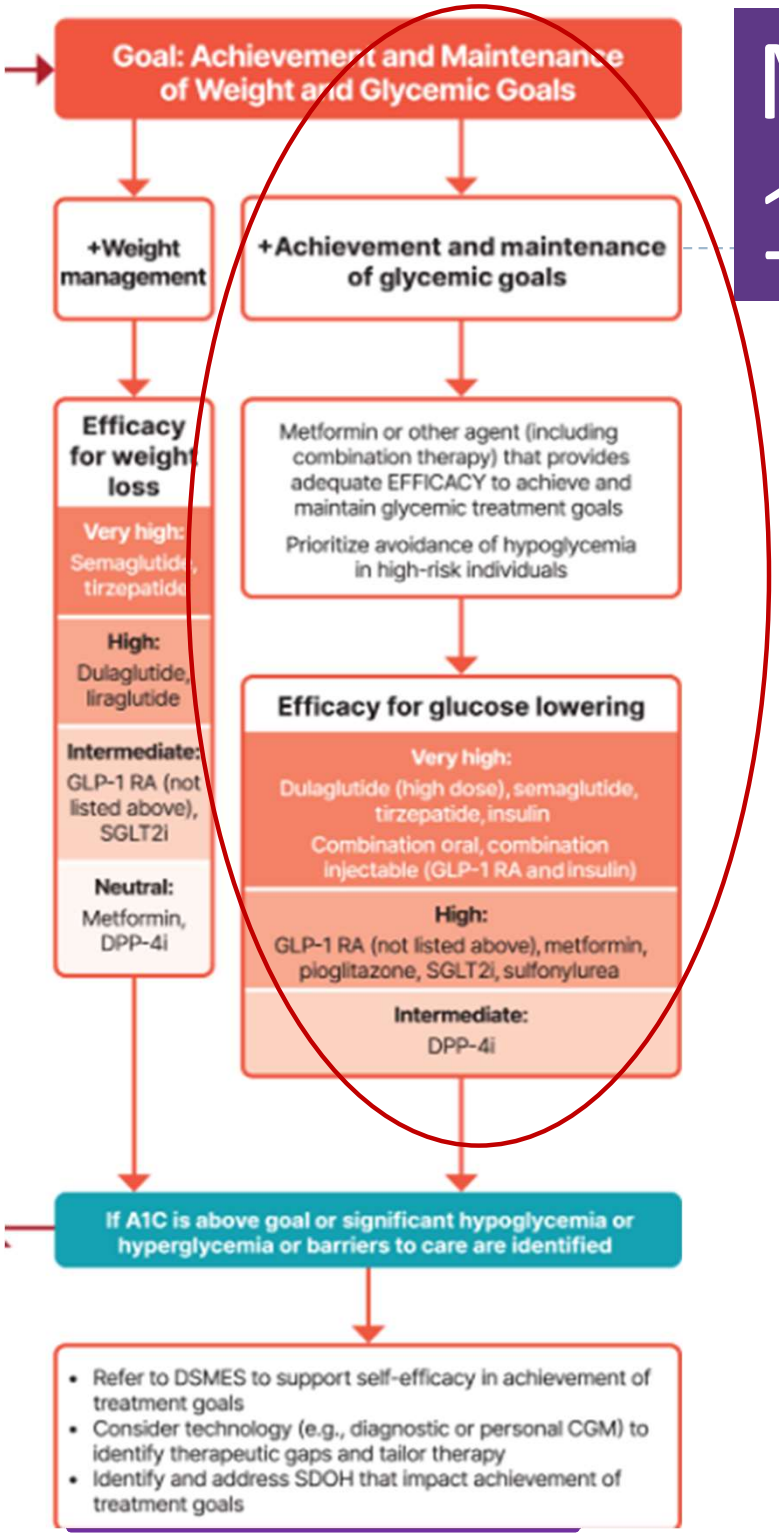
**Very high:** Dulaglutide (high dose), semaglutide, tirzepatide, insulin

Combination oral, combination injectable (GLP-1 RA and insulin)

**High:** GLP-1 RA (not listed above), metformin, pioglitazone, SGLT2i, sulfonylurea

**Intermediate:** DPP-4i

**If A1C is above goal or significant hypoglycemia or hyperglycemia or barriers to care are identified**




# Metformin is "Usually" 1st Line

- Why metformin?
  - Longstanding evidence
  - High efficacy and safety
  - Inexpensive - 3 months for $12
  - Weight neutral
  - Check B12 levels at intervals especially if anemia or neuropathy.

- If ASCVD, HF or CKD or high ASCVD risk, use SGLT2i or GLP-1 RA +/- metformin
- If A1C ≥ 8.5%, consider combo therapy.

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# Quick Question 5

- RT, a 61-year-old woman with BMI of 28 and type 2 diabetes 3 months. She wanted to try to manage diabetes with diet and exercise. GFR in 90s, UACR 14mg/gm, A1c 7.4%. Based on this info, which medication would you start?
- A. Pioglitazone (Actos)
- B. Metformin
- C. GLP1-RA
- D. Sulfonylurea

# Common Oral Diabetes Meds

Diabetes Education SERVICES

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| Class/Main Action | Name(s) | Daily Dose Range | Considerations |
|---|---|---|---|
| **Biguanides**<br>• Decreases hepatic glucose output<br>• First line med at diagnosis of type 2 | metformin (Glucophage)<br><br>Riomet (liquid metformin) | 500 - 2550 mg (usually BID w/ meal)<br><br>500 - 2550 mg<br>500mg/5mL | **Side effects:** nausea, bloating, diarrhea, B12 deficiency. To minimize GI Side effects, use XR and take w/ meals.<br>**Obtain GFR before starting.**<br>• If GFR <30, do not use.<br>• If GFR <45, don't start Meformin<br>• If pt on Metformin and GFR falls to 30-45, eval risk vs. benefit; consider decreasing dose.<br>**For dye study,** if GFR <60, liver disease, alcoholism or heart failure, restart metformin after 48 hours if renal function stable.<br>**Benefits:** lowers cholesterol, no hypo or weight gain, cheap. Approved for pediatrics, 10 yrs +<br>Lowers A1c 1.0%-2.0%. |
| | Extended Release-XR (Glucophage XR)<br>(Glumetza)<br>(Fortamet) | (1x daily w/dinner)<br>500 – 2000 mg<br>500 – 2000 mg<br>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

# 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

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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**

# Wait, What About Emotions?

# 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

# 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?

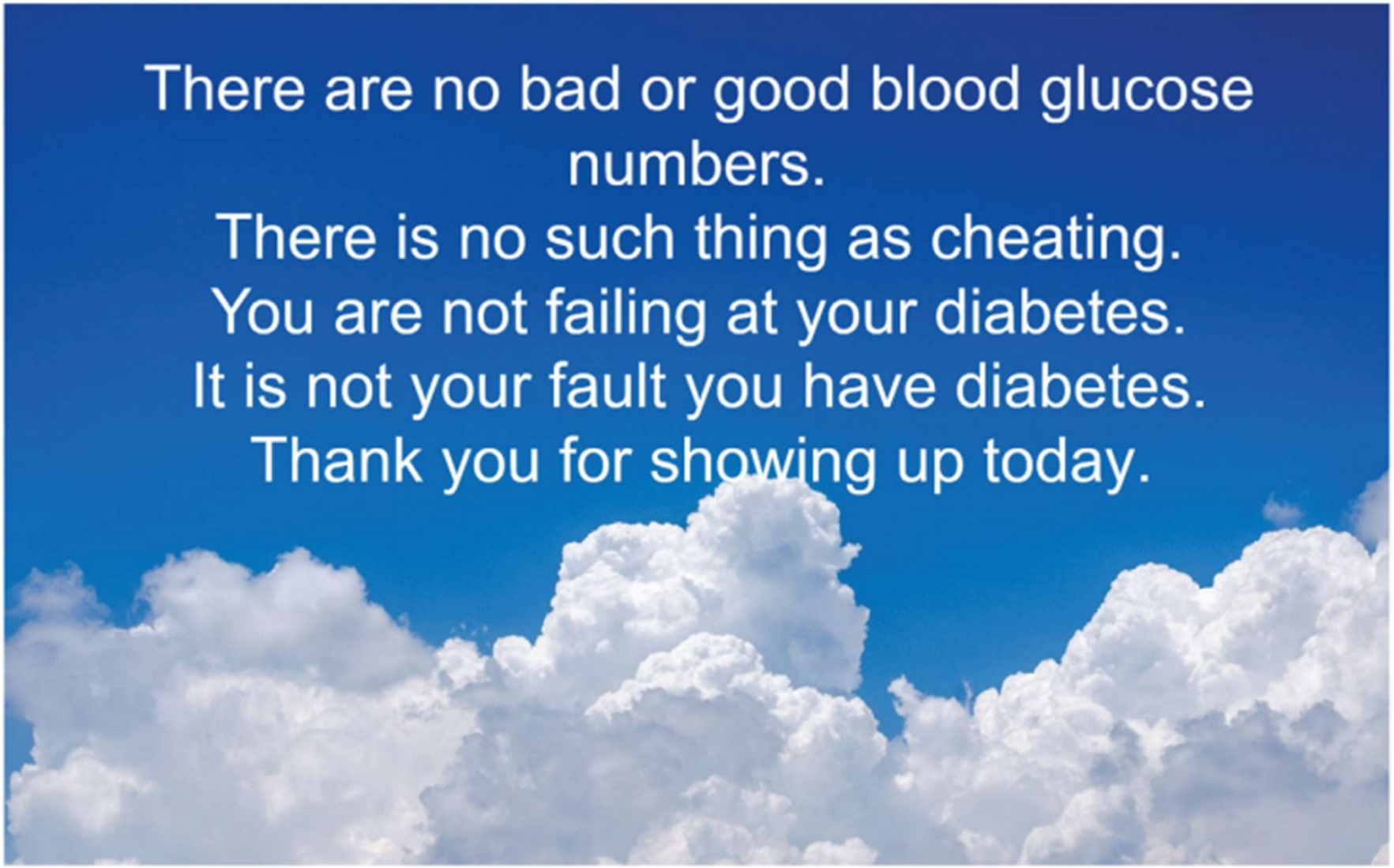
- Connected
- Concerned
- Collaborative

Healing to HCP

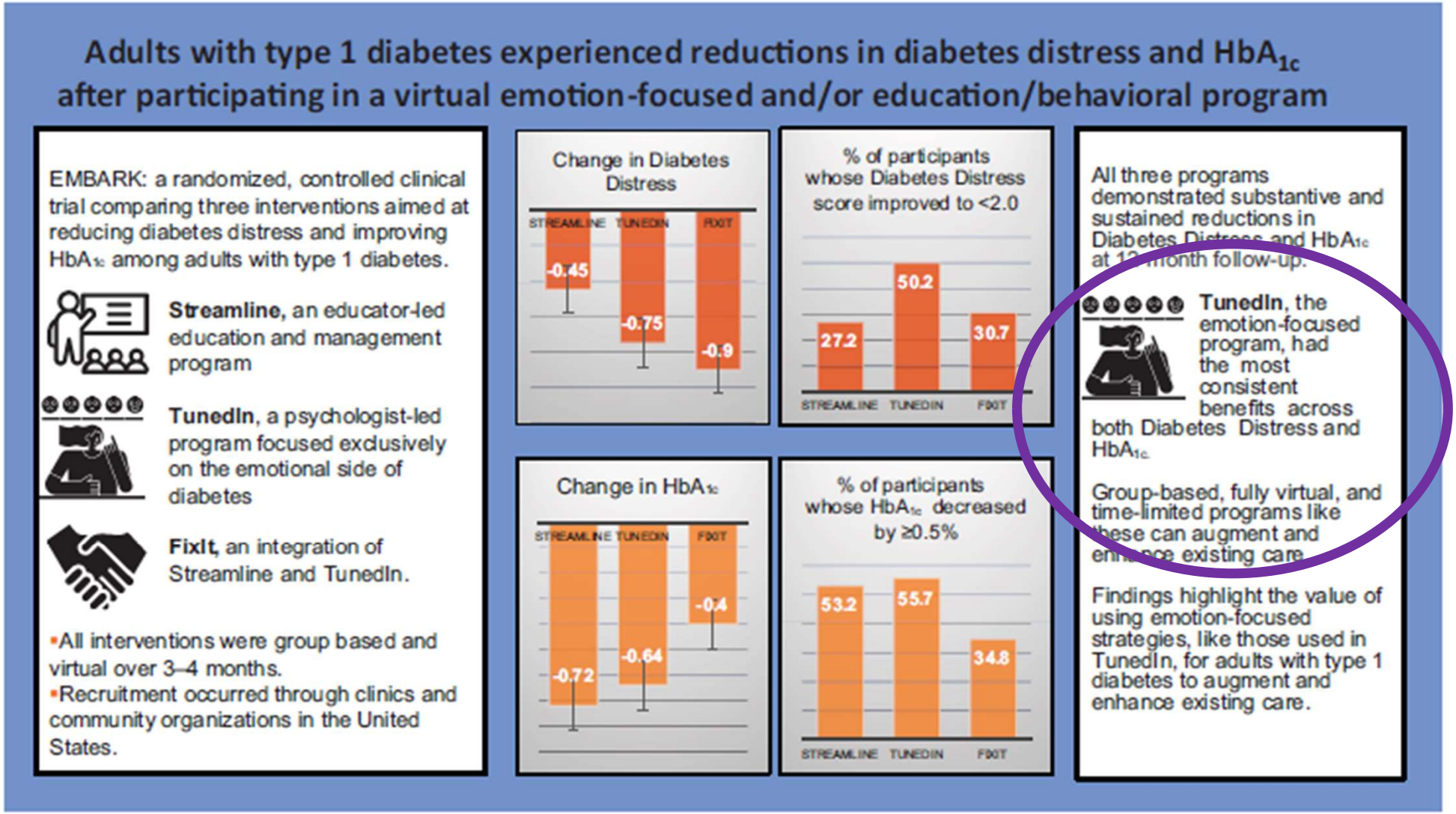
**Bidirectional Healing**

Healing to Person

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



# EMBARK Trial




EMBARK: A Randomized, Controlled Trial Comparing Three Approaches to Reducing Diabetes Distress and Improving $HbA_{1c}$ in Adults With Type 1 Diabetes. *Diabetes Care* 2024; dc232452. https://doi.org/10.2337/dc23-2452

# Embark Trial – Emotions as Priority

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

**~Coach Beverly**

# 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%

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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

**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.

# DiaBingo

**B** Frequent skin and yeast infections

**B** A BMI of ____ or greater indicates increased pre/diabetes risk?

**B** To reduce complications, control **A**1c, **B**lood pressure, **C**holesterol

**B** PreDiabetes – fasting glucose level of ___ to ____

**B** Erectile dysfunction indicates greater risk for ____

**B** Diabetes – fasting glucose level____ or greater

**B** Type 1 diabetes is best described as an _____ disease

**B** People with diabetes are _____ times more likely to die of heart dx

**B** Elevated triglycerides, < HDL, smaller dense LDL

**B** Each percentage point of A1C = _____ mg/dl glucose

**B** At dx of type 2, about __% of the beta cell function is lost

**B** Diabetes – random glucose ____ or greater


SGLT-2 Inhibitors

# 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

# SGLT-2 Inhibitors – DKA Warning

## Common Oral Diabetes Meds

| Class/Main Action | Name(s) | Daily Dose Range | Considerations |
|---|---|---|---|
| **SGLT2 Inhibitors**<br>"Glucoretic"<br>• Decreases glucose reabsorption in kidneys | Canagliflozin* (Invokana) | 100 - 300 mg 1x daily | **Side effects:** hypotension, UTIs, genital infections, increased urination, weight loss, ketoacidosis.<br>**Heart Failure, CV & Kidney Protection:** 1st line therapy for Heart Failure (HF), Kidney Disease (CKD), Cardiovascular Disease, before or with metformin<br>**Considerations:** If GFR ≥ 20, use SGLT-2 to reduce CVD, Heart Failure and Chronic Kidney Disease. Limited BG lowering effect if GFR <45. See package insert for GFR cut-offs and dosing.<br>**Benefits:** SGLT-2s* reduce BG, CV death & HF, slow CKD.<br>†Approved for peds, 10 yrs +.<br>Lowers A1C 0.6% to 1.5%. |
| | Dapagliflozin*† (Farxiga) | 5 - 10 mg 1x daily | |
| | Empagliflozin*† (Jardiance) | 10 - 25 mg 1x daily | |
| | Ertugliflozin (Steglatro) | 5 – 15 mg 1x daily | |
| | Bexagliflozin (Brenzavvy) | 20 mg 1x daily | |

FDA Warning of DKA – Not approved for Type 1 (but used off-label)

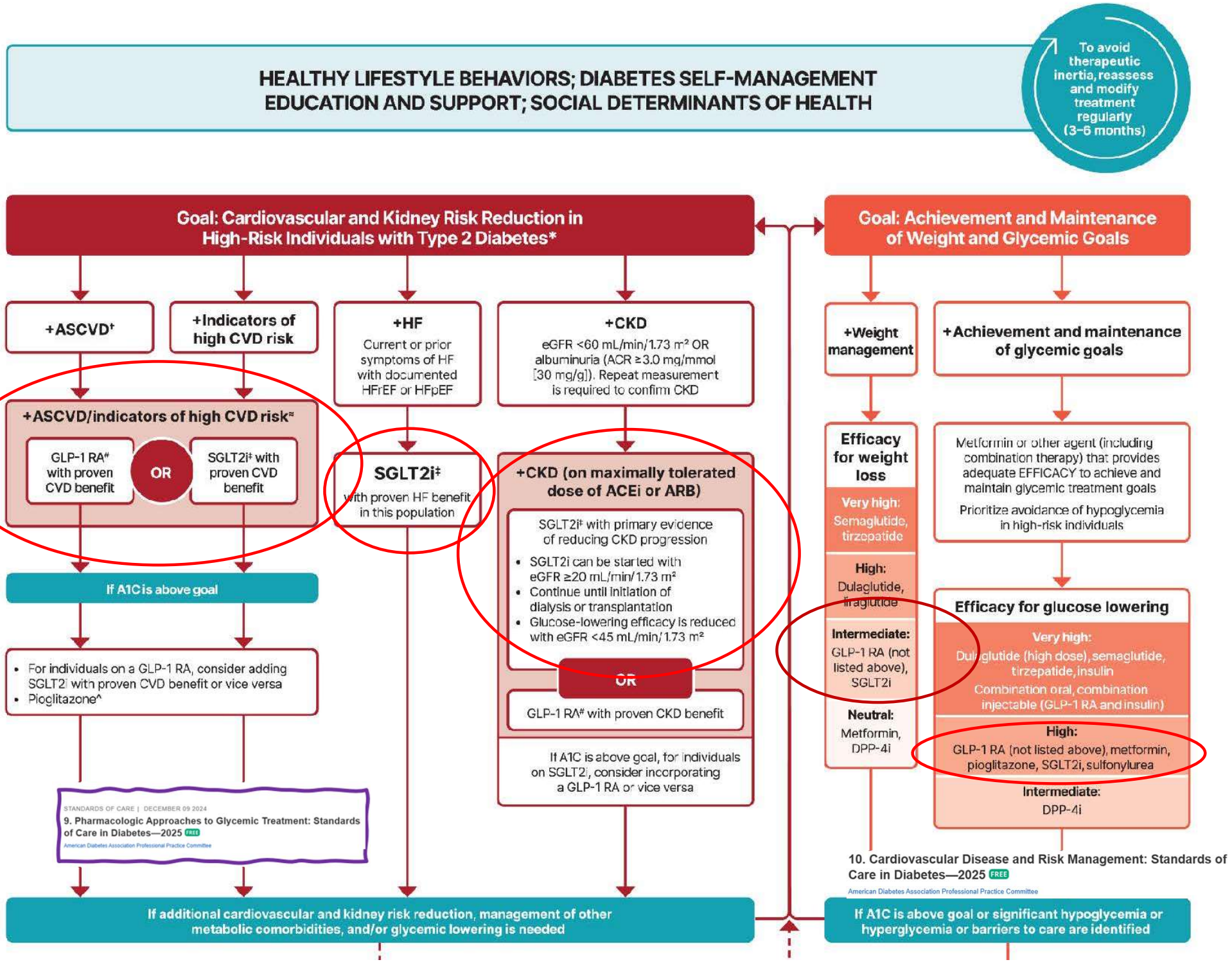
~ increases risk of EDKA by 4-6%

Increased risk for those with type 2 on insulin + SGLT-2 Inhibitor

Decreased insulin dose due to lower BG on SGLT-2 Inhibitors

Can lead to insulin deprivation and ketoacidosis

# Use of Glucose-Lowering Medications in the Management of Type 2 Diabetes



# Benefits of SGLT-2 Inhibitors

- A1C lowering
- Weight loss
- Cardiovascular
- Renal
- Heart failure
- Blood pressure lowering

# Side Effects of SGLT-2 Inhibitors

| | | |
|---|---|---|
| Genitourinary infections | Volume depletion | Increased urination |
| Hypotension | UTI | Diabetes ketoacidosis (DKA) |

Amputation risk? Fournier's gangrene?

# SGLT-2i Indications Summary

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

# 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)

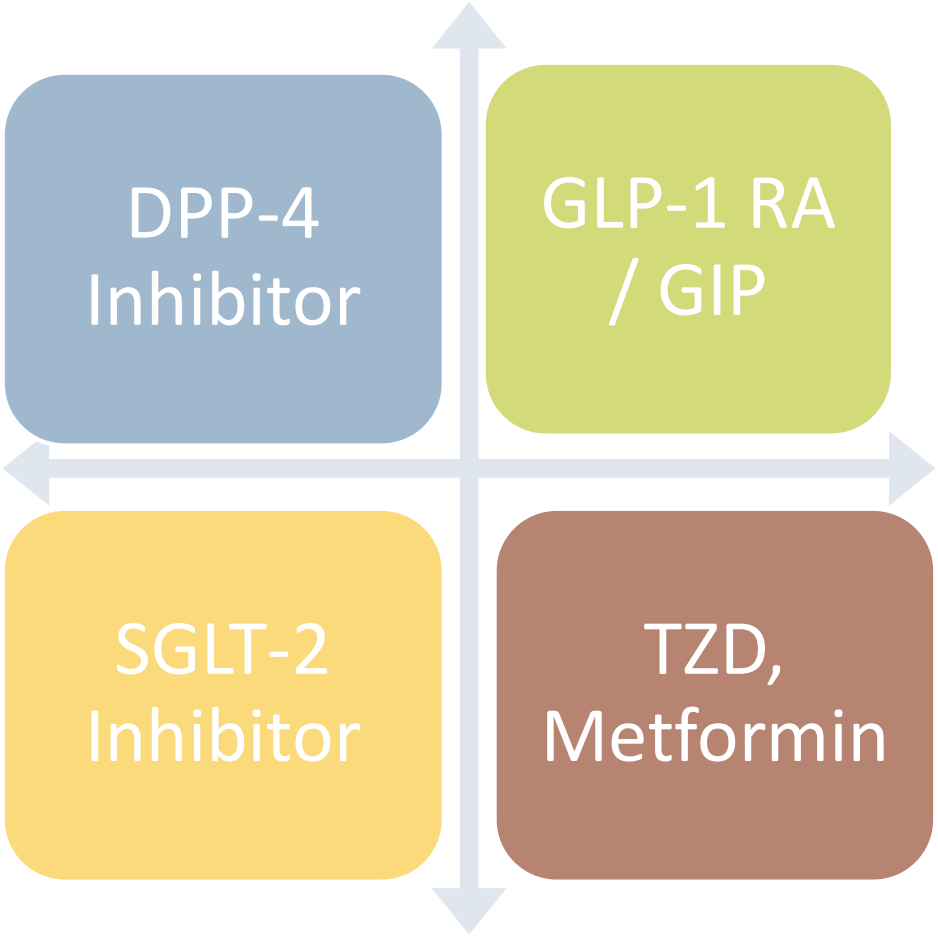
# Sulfonylureas - Squirters

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

# Hypoglycemia & Next Steps

**Do NOT Cause Hypoglycemia**




**Can Cause Hypoglycemia**

- Sulfonylurea
- Meglitinides
- Insulin

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

# 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?

A. Does he change his needle each time?

B. Why is he adjusting glargine?

C. Is he adjusting insulin for exercise?

D. How many hypoglycemic events per week?

# 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

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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.

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# Hypoglycemia: Clinical Risk Factors

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

| Clinical and biological risk factors | Social, cultural, and economic risk factors |
|---|---|
| Major risk factors<br>• Recent (within the past 3–6 months) level 2 or 3 hypoglycemia<br>• Intensive insulin therapy*<br>• Impaired hypoglycemia awareness<br>• End-stage kidney disease<br>• Cognitive impairment or dementia | Major risk factors<br>• Food insecurity<br>• Low-income status§<br>• Housing insecurity<br>• Fasting for religious or cultural reasons<br>• Underinsurance |
| Other risk factors<br>• Multiple recent episodes of level 1 hypoglycemia<br>• Basal insulin therapy*<br>• Age ≥75 years†<br>• Female sex<br>• High glycemic variability‡<br>• Polypharmacy<br>• Cardiovascular disease<br>• Chronic kidney disease (eGFR <60 mL/min/1.73 $m^2$ or albuminuria)<br>• Neuropathy<br>• Retinopathy<br>• Major depressive disorder<br>• Severe mental illness | Other risk factors<br>• Low health literacy<br>• Alcohol or substance use disorder |

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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.

# Glucagon Rescue Medications for Diabetes-Related Hypoglycemia

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

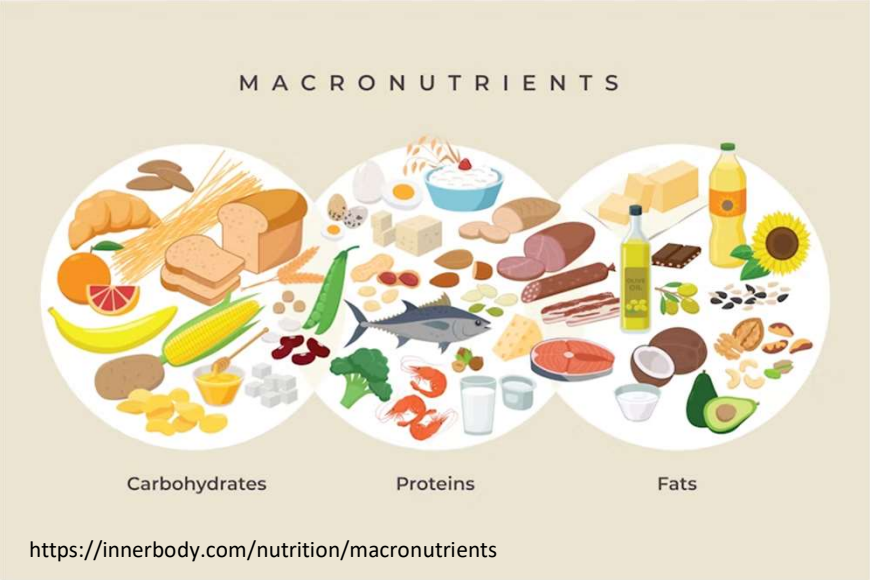
***All PocketCard content is for educational purposes only. Please consult prescribing information for detailed guidelines.***

# 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

# ADA Standards 2025 – Section 5

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




https://innerbody.com/nutrition/macronutrients

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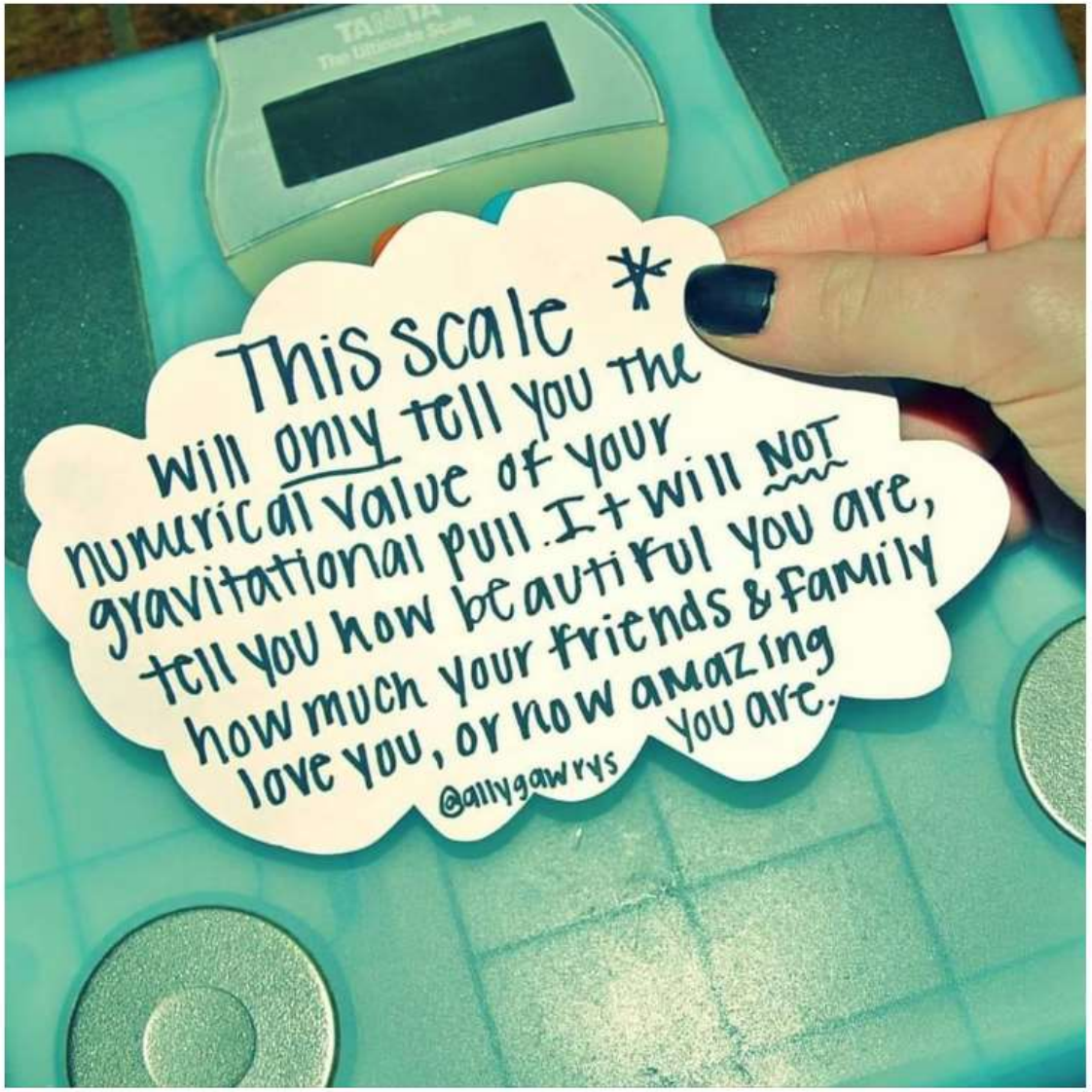
# Weight is a Heavy Issue




# 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.

8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes–2025 FREE

# 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."

*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.

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

# 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

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**8. Obesity and Weight Management for the Prevention and Treatment of Type 2 Diabetes: Standards of Care in Diabetes–2025** FREE

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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

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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 | |

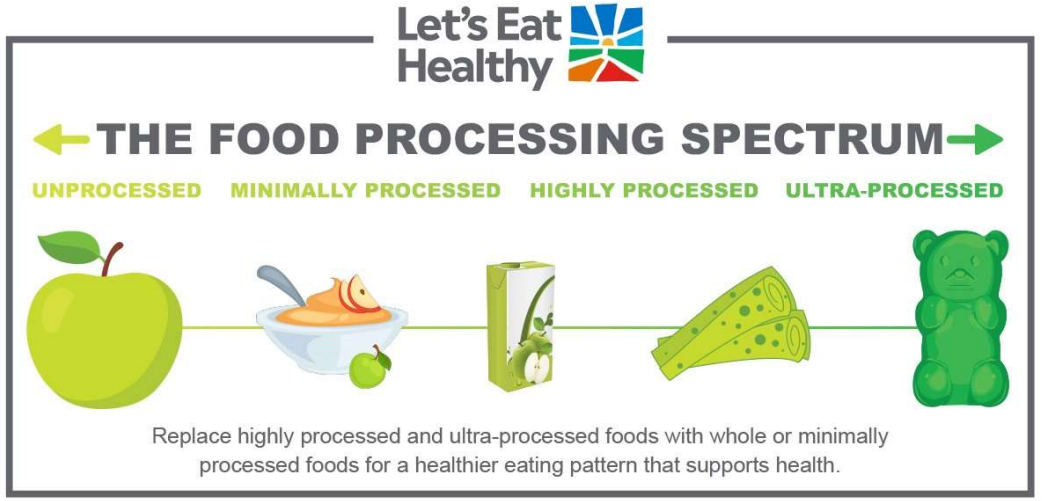
| > 10% Wt Loss | | |
|---|---|---|
| **Diabetes Mgmt** | May lead T2DM remission, improved CVD & metabolic comorbidities & reduced mortality | Reduces need for medications |


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

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

# 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



# 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 (236g)
Servings Per Container about 2

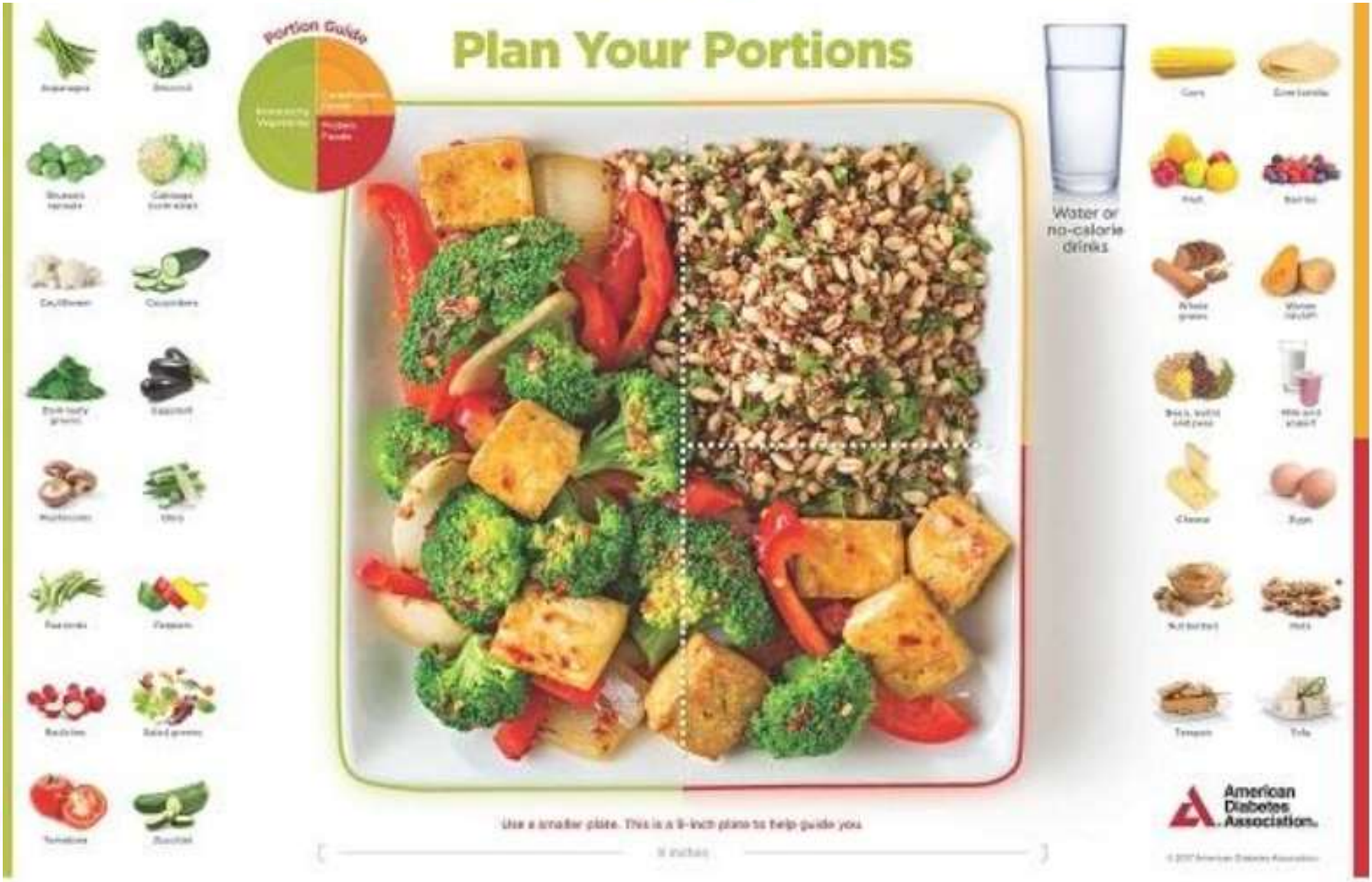
| Amount Per Serving | |
|---|---|
| **Calories** 260 Calories from Fat 130 | |
| | **% Daily Value*** |
| **Total Fat** 14g | **22%** |
| Saturated Fat 5g | **25%** |
| *Trans* Fat 0g | |
| **Cholesterol** 35mg | **12%** |
| **Sodium** 990mg | **41%** |
| **Total Carbohydrate** 19g | **6%** |
| Dietary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

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

# Plan Your Portions

American Diabetes Association.
Connected for Life

What Can I Eat?®

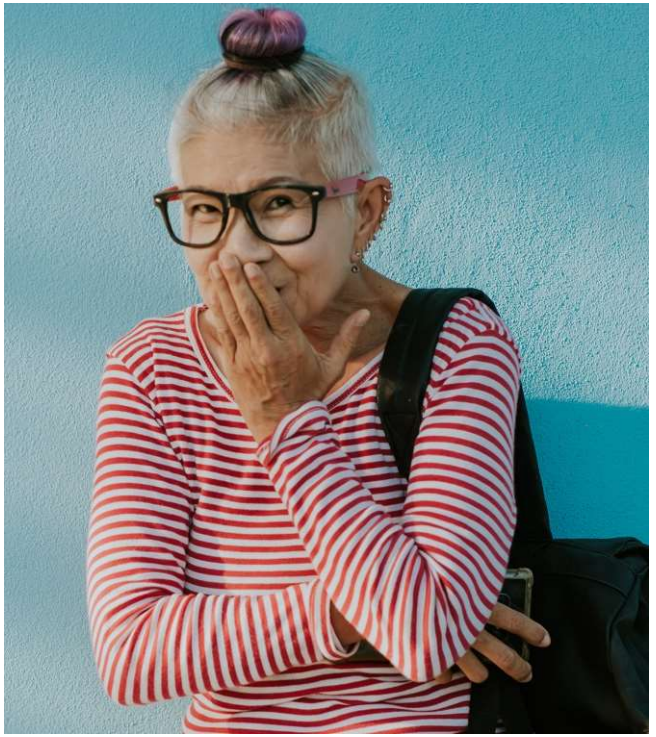


# Case Study Question 9

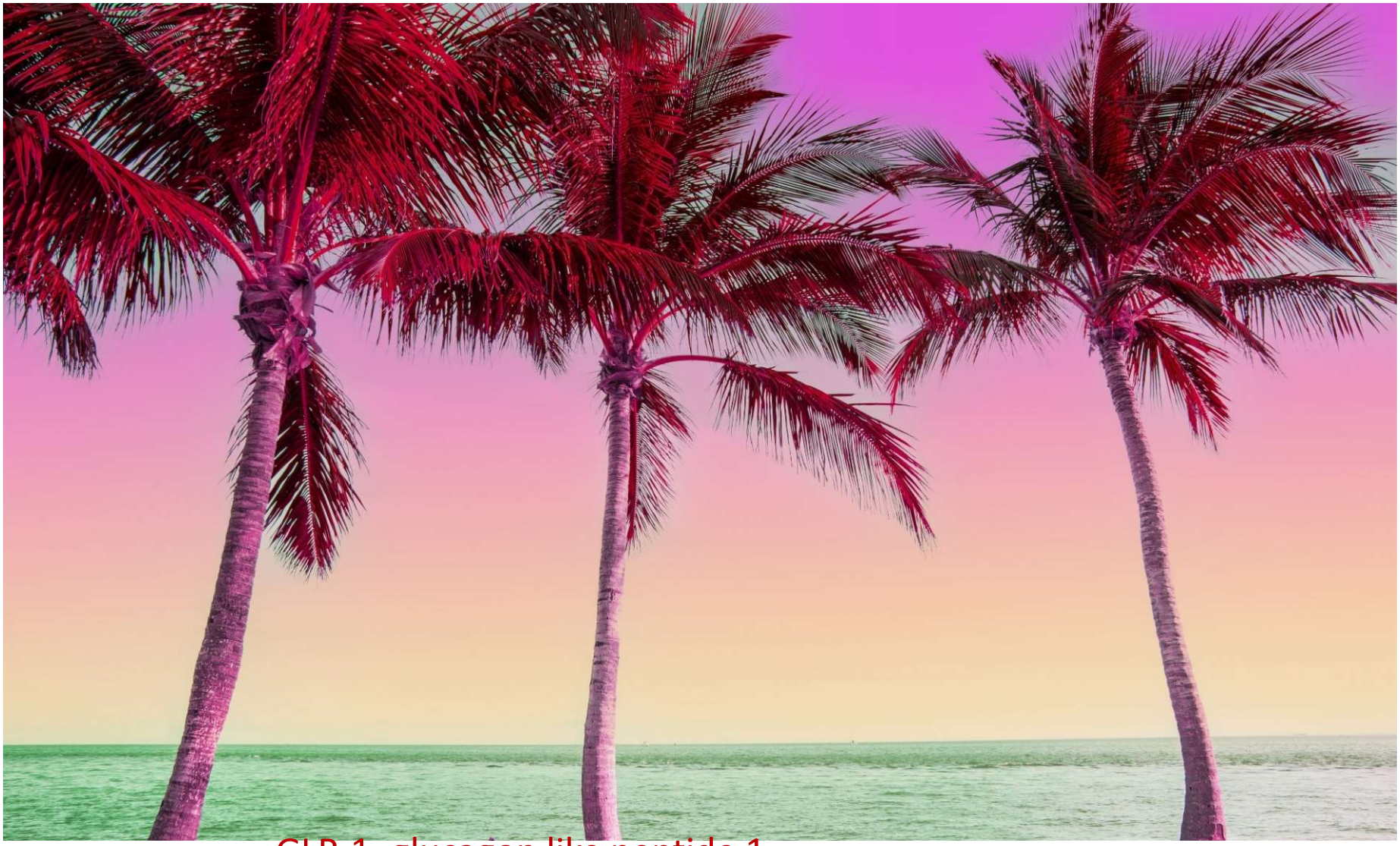
MZ is complaining of nausea, and increased eructation?

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



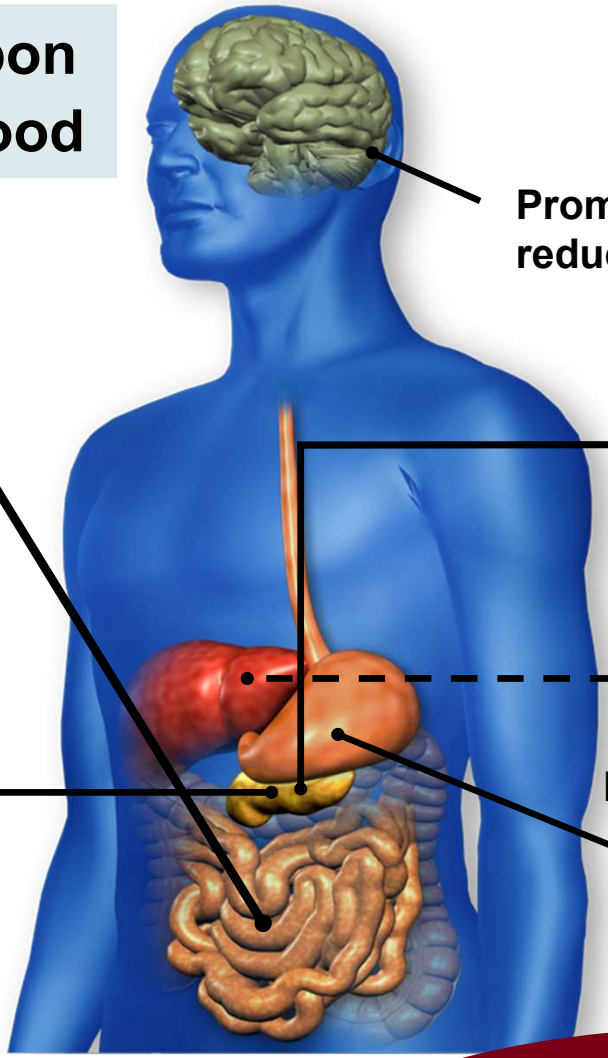
# Incretins: GLP & GIP Receptor Agonists



GLP-1: glucagon like peptide 1

GIP: glucose-dependent insulinotropic polypeptide

# GLP-1 Effects in Humans
# Understanding the Natural Role of Incretins



**GLP-1 secreted upon the ingestion of food**

**↑ Beta-cell response**

**Promotes satiety and reduces appetite**

**Alpha cells:**
**↓ Postprandial glucagon secretion**

**Liver:**
**↓ Glucagon reduces hepatic glucose output**

**Beta cells:**
**Enhances glucose-dependent insulin secretion**

**Stomach:**
**Helps regulate gastric emptying**

**GLP-1 degraded by DPP-4 w/in minutes**


Adapted from Flint A, et al. *J Clin Invest*. 1998;101:515-520
Adapted from Larsson H, et al. *Acta Physiol Scand.* 1997;160:413-422
Adapted from Nauck MA, et al. *Diabetologia*. 1996;39:1546-1553
Adapted from Drucker DJ. *Diabetes*. 1998;47:159-169

# Pocket Card: GLP-1 & GIP RA

## GLP-1 & GIP Receptor Agonists

| Class/Main Action | Name | Dose Range | Considerations |
|---|---|---|---|
| **GLP-1 RA - Glucagon Like Peptide Receptor Agonist**<br><br>**"Incretin Mimetic"**<br>• Increases insulin release with food<br>• Slows gastric emptying<br>• Promotes satiety<br>• Suppresses glucagon | exenatide (Byetta) | 5 and 10 mcg BID | **Side effects:** nausea, vomiting, weight loss, injection site reaction. Report signs of acute pancreatitis or intestinal blockage (ileus) and stop med.<br>**Black box warning:** Thyroid C-cell tumor warning (avoid if family history of medullary thyroid tumor).<br><br>*Significantly reduces risk of CV death, heart attack, and stroke.<br>§Approved to reduce risk of CKD<br>†Approved for pediatrics 10-17 yrs<br><br>Lowers A1C 0.5 – 1.6%<br>Weight loss: 4-6% body weight loss. |
| | exenatide XR† (Bydureon) | 2 mg 1x a week<br>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<br>1x a week pen injector | |
| | semaglutide*§ (Ozempic) | 0.25, 0.5, 1.0 and 2.0 mg<br>1x a week pen injector | |
| | (Rybelsus)<br>Oral tablet | 3, 7, 14 mg - Original dosing.<br>1.5, 4, 9 mg - New dosing.<br>AM dose, pre-food, w/ water sip | |
| **GLP-1 & GIP Receptor Agonist**<br><br>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<br><br>1x a week injection<br>Single dose via prefilled pen or vial.<br><br>Adjust dose based on shared decision making and individual goals. | **Side effects:** nausea, diarrhea, injection site reaction. Report pancreatitis, signs of intestinal blockage.<br>**Black box warning:** Avoid if family history of medullary thyroid tumor.<br><br>Lowers A1C ~ 1.8 - 2.4%<br>Weight loss: 7-13% body weight loss at max dose. |

# 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

# Counseling Points: GLP-1 RA & GLP-1/GIP

- Avoid if personal or family history of medullary thyroid cancer
- Avoid in combo with DPP-4 inhibitors
- Watch for intestinal obstruction
- Use of non-FDA *compounded* products not recommended
- Avoid with history pancreatitis
- If on tirzepitide, use back up contraception for first 4 weeks
- Ask about recent eye exam
  - Potential increase in diabetes retinopathy

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Sudden discontinuation of semaglutide and tirzepitide results in regain of one-half to two-thirds of the weight loss within 1 year. Consider trying lowest effective dose, using intermittent therapy, or stopping medication followed by close weight monitoring.

# Use of Glucose-Lowering Medications in the Management of Type 2 Diabetes

**HEALTHY LIFESTYLE BEHAVIORS; DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT; SOCIAL DETERMINANTS OF HEALTH**

To avoid therapeutic inertia, reassess and modify treatment regularly (3–6 months)

## Goal: Cardiovascular and Kidney Risk Reduction in High-Risk Individuals with Type 2 Diabetes*

### +ASCVD†

### +Indicators of high CVD risk

### +ASCVD/indicators of high CVD risk‖

GLP-1 RA# with proven CVD benefit **OR** SGLT2i‡ with proven CVD benefit

**If A1C is above goal**

- For individuals on a GLP-1 RA, consider adding SGLT2i with proven CVD benefit or vice versa
- Pioglitazone^

### +HF

Current or prior symptoms of HF with documented HFrEF or HFpEF

**SGLT2i‡** with proven HF benefit in this population

### +CKD

eGFR <60 mL/min/1.73 m² OR albuminuria (ACR ≥3.0 mg/mmol [30 mg/g]). Repeat measurement is required to confirm CKD

**+CKD (on maximally tolerated dose of ACEi or ARB)**

SGLT2i‡ with primary evidence of reducing CKD progression

- SGLT2i can be started with eGFR ≥20 mL/min/1.73 m²
- Continue until initiation of dialysis or transplantation
- Glucose-lowering efficacy is reduced with eGFR <45 mL/min/1.73 m²

**OR**

GLP-1 RA# with proven CKD benefit

If A1C is above goal, for individuals on SGLT2i, consider incorporating a GLP-1 RA or vice versa

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**If additional cardiovascular and kidney risk reduction, management of other metabolic comorbidities, and/or glycemic lowering is needed**

## Goal: Achievement and Maintenance of Weight and Glycemic Goals

### +Weight management

**Efficacy for weight loss**

- **Very high:** Semaglutide, tirzepatide
- **High:** Dulaglutide, liraglutide
- **Intermediate:** GLP-1 RA (not listed above), SGLT2i
- **Neutral:** Metformin, DPP-4i

### +Achievement and maintenance of glycemic goals

Metformin or other agent (including combination therapy) that provides adequate EFFICACY to achieve and maintain glycemic treatment goals

Prioritize avoidance of hypoglycemia in high-risk individuals

**Efficacy for glucose lowering**

- **Very high:** Dulaglutide (high dose), semaglutide, tirzepatide, insulin; Combination oral, combination injectable (GLP-1 RA and insulin)
- **High:** GLP-1 RA (not listed above), metformin, pioglitazone, SGLT2i, sulfonylurea
- **Intermediate:** DPP-4i

10. Cardiovascular Disease and Risk Management: Standards of Care in Diabetes—2025 FREE
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**If A1C is above goal or significant hypoglycemia or hyperglycemia or barriers to care are identified**

# GLP-1 /GIPs Approved for Weight Loss

- Liraglutide:
  - Victoza 1.8 mg (diabetes)
  - Saxenda 3 mg (wt loss)
  - 6% wt loss, $1349 a mo
- Semaglutide:
  - Ozempic 2mg (diabetes)
  - Wegovy 2.4mg (wt loss)
  - 6% wt loss, $1349 a mo

- Tirzepatide
  - Mounjaro 15mg (diabetes)
  - Zepbound 15mg (wt loss)
  - 13% wt loss - $1056 a mo

**All 3 Approved for use in adults with a:**

- BMI of ≥ 30 or
- BMI of ≥ 27 or greater who have hypertension, type 2 diabetes, or dyslipidemia.

# GLP-1/GIP Receptor Agonist Indications

| Drug | Lower BG | Reduce CV / Kidney Risk? | Wt loss /other approved? |
|---|---|---|---|
| Exenatide IR **(Byetta)**<br>Lixisenatide **(Adlyxin)**<br>Semaglutide **(Rybelsus)** | Yes | |  |
| Exenatide ER **(Bydureon)** | Yes for 10 yrs and older | | |
| Dulaglutide **(Trulicity)** | Yes for 10 yrs and older | Yes | |
| Semaglutide **(Ozempic)** | Yes | Yes<br>Approved for CKD | Wegovy 2.4mg<br>Approved for Steatosis/CV disease |
| Liraglutide **(Victoza)** | Yes for 10 yrs and older | Yes | Yes<br>Saxenda 3mg |
| Tirzepatide **(Mounjaro)** | Yes | ? | Zepbound up to 15 mg<br>Sleep apnea approved |

# Incretin Therapy: Nutrition Strategies

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

# Poll Question 10

AR is 36 years old with type 2 diabetes and a BMI of 41kg/m$^2$. 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.

# 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

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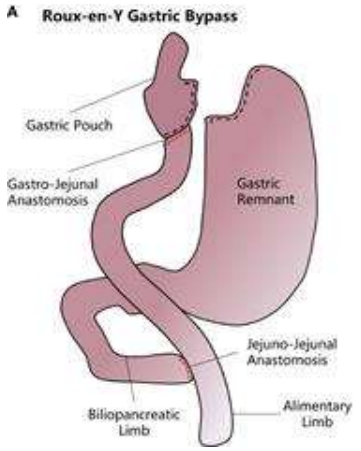
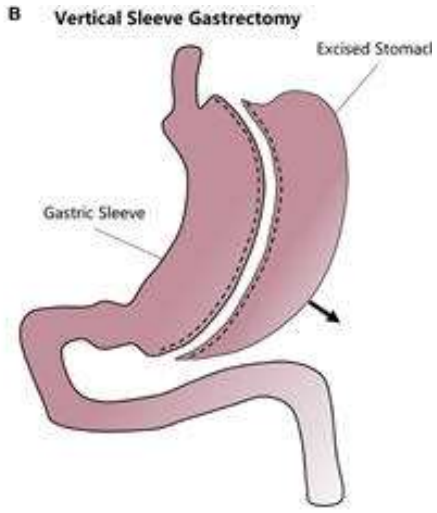
# Metabolic Surgery Benefits

**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

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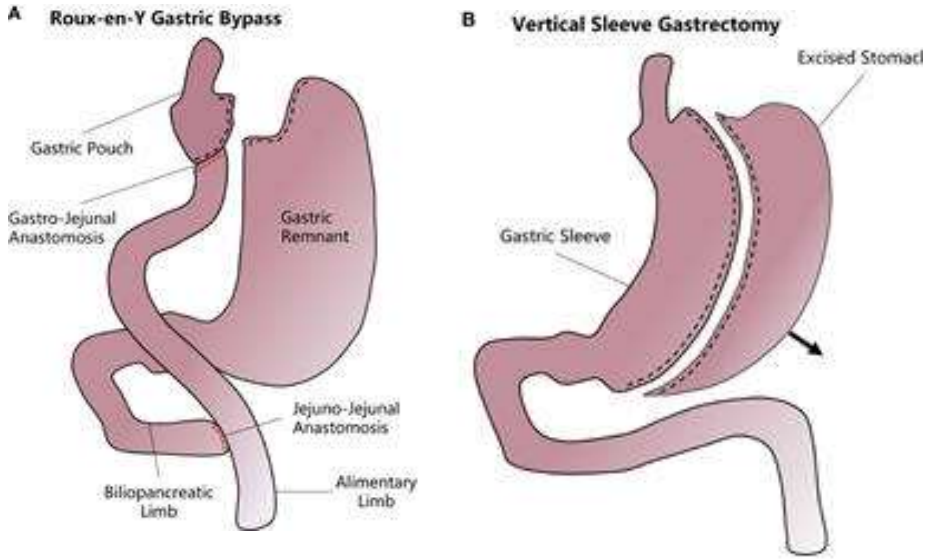
# Metabolic Surgery Benefits

- 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

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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."

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**5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: Standards of Care in Diabetes—2025** FREE

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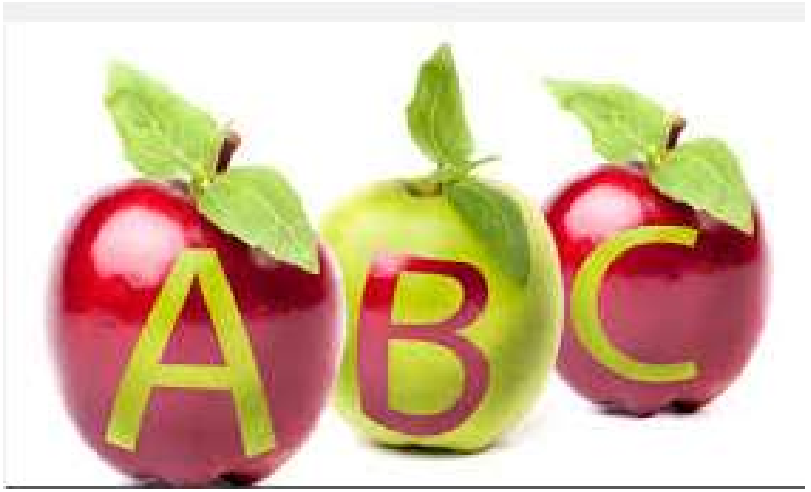
# 6. Glycemic Goals & Hypo

A1C

Blood Pressure

Cardiovascular risk reduction



# 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

# 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

# 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.

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

- Fructosamine – 2-4 wk glucose average
  - glycated albumin for those with anemia or hemoglobinopathies

# 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) |

***eAG = 28.7 x A1c-46.7 ~ 29 pts per 1%***
***Translating the A1c Assay Into eAG – ADAG Study***

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

American Diabetes Association
Diabetes Care 2020 Jan; 43(Supplement 1): S66-S76.
https://doi.org/10.2337/dc20-S006

# 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 FREE

# Time in Range (TIR)

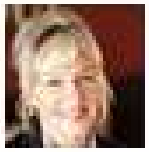
- Strong correlation between TIR and A1C, with a goal of 70% TIR aligning with an A1C of ~7%
- For older adults using CGM, the recommended percent time spent in target range of 70–180 mg/dL is 50%, Hypo < 1%
- *Critical that the glycemic goals be woven into an individualized, person-centered strategy*

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

# 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!

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



**Diabetes Education Services**

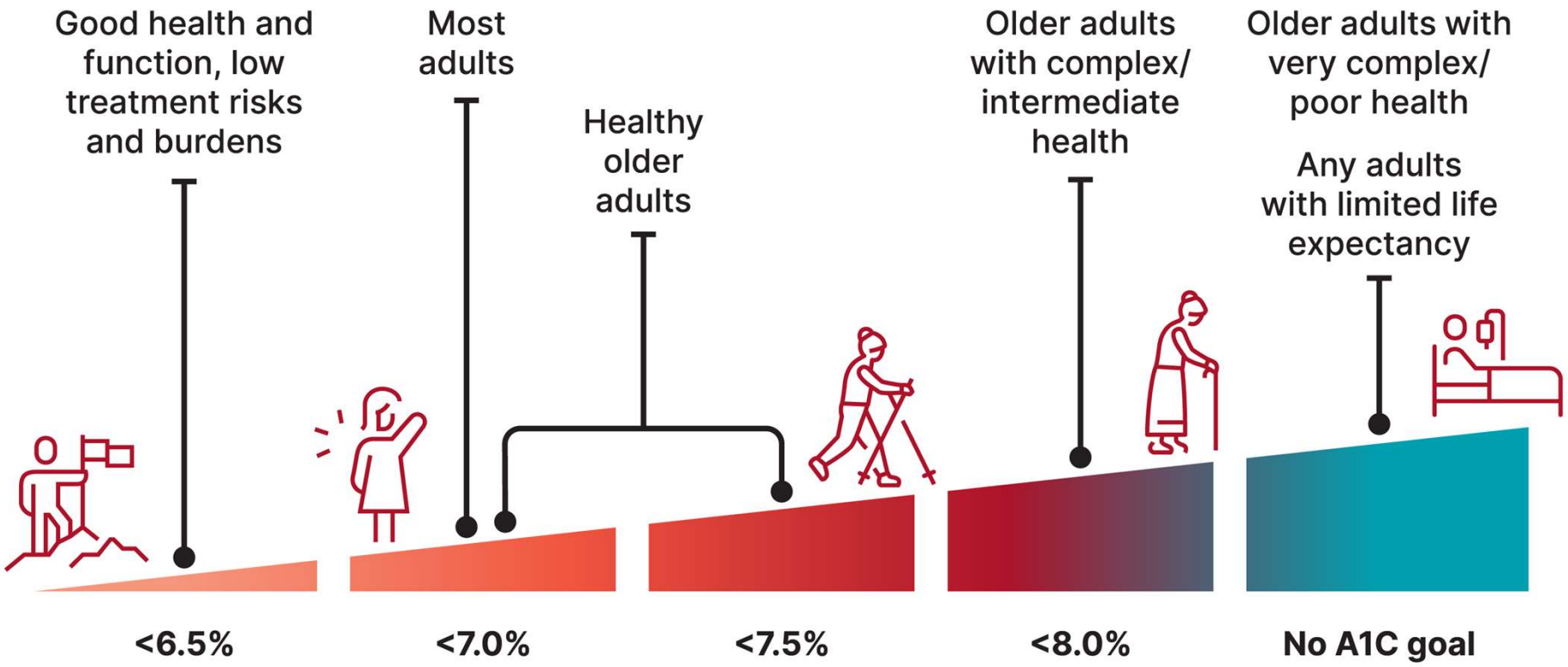
Published by Beverly Thomassian [?] · July 7 ·

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




**Modifying Factors**

| Favor more stringent goal | Favor less stringent goal |
|---|---|
| Short diabetes duration | Long diabetes duration |
| Low hypoglycemia risk | High hypoglycemia risk |
| Low treatment risks and burdens | High treatment risks and burdens |
| Pharmacotherapy with cardiovascular, kidney, weight, or other benefits | Pharmacotherapy without nonglycemic benefits |
| No cardiovascular complications | Established cardiovascular complications |
| Few or minor comorbidities | Severe, life-limiting comorbidities |

Table 6.2

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

# 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 FREE

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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

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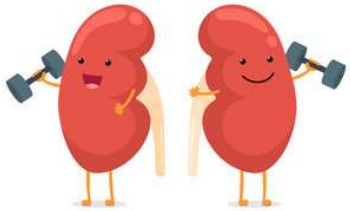
# CKD– 2025 Update



- 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 Creatine Ratio (UACR) |
|---|---|
| Normal to mildly increased – A1 | < 30 mg/g |
| Moderately increased – A2 | 30 – 299 mg/g |
| Severely increased – A3 | 300 mg/g + |

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

- *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 FREE

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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?

A. Urinary albumin creatinine ratio of 30-299 mg/g with GFR of 45.
B. GFR of 60 or greater and urinary albumin creatinine ratio of 12 mg/g.
C. Urinary albumin creatinine ratio less than 30 mg/g and GFR of 30-45.

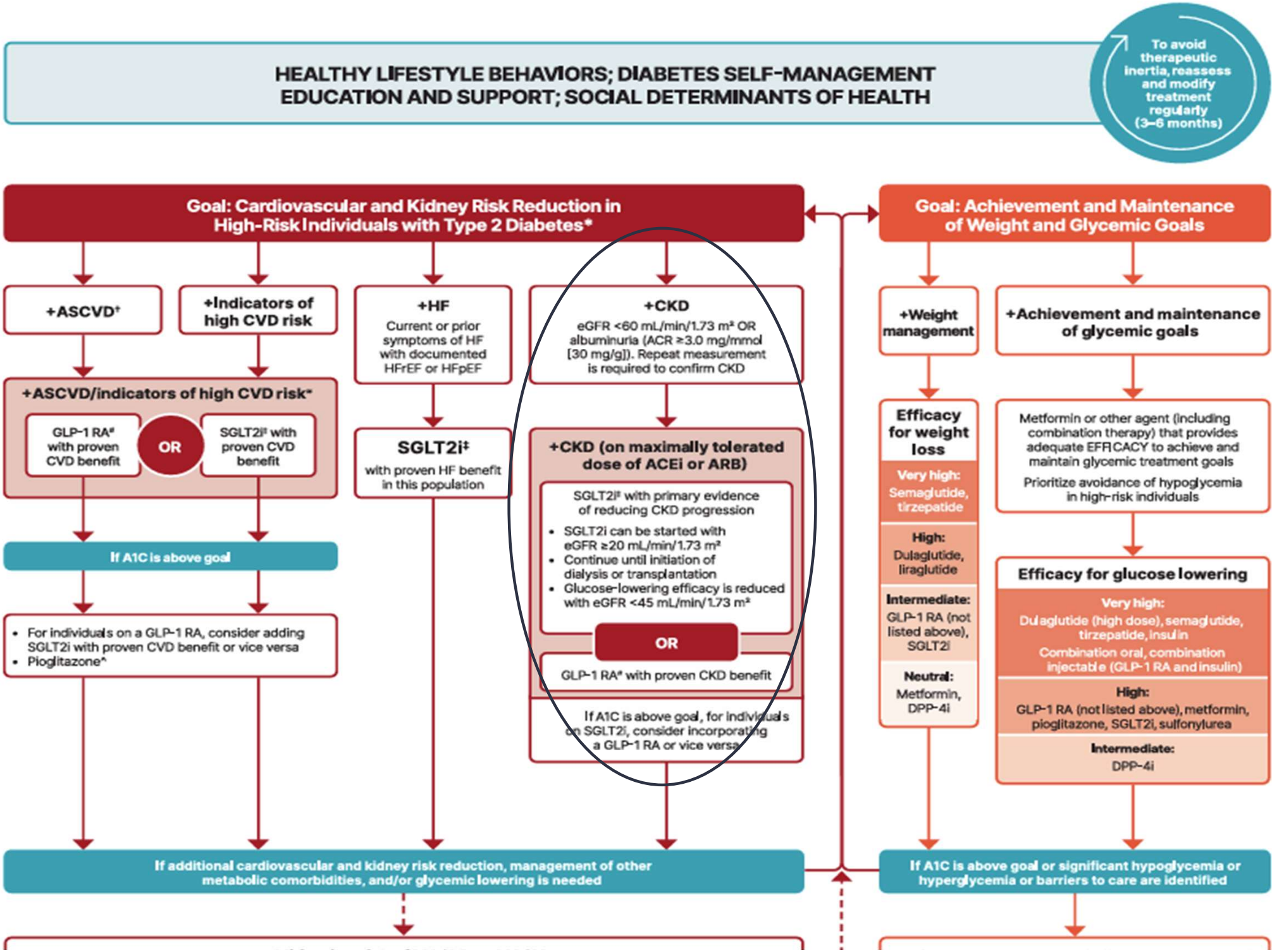
- Creatinine of 1.5 and urinary albumin creatinine ratio of 300 mg/g or greater.

# Standard 11 – Protect Kidneys

- Diabetes with a
  - GFR ≥20 and
  - UACR ≥200 mg/g
- Start SGLT2 to reduce chronic kidney disease progression and cardiovascular events.

- If type 2 diabetes and established Chronic Kidney Disease (CKD)
  - Start nonsteroidal mineralocorticoid receptor antagonist (Finerenone) and/or GLP-1 RA recommended for cardiovascular risk reduction.

# Use of Glucose-Lowering Medications in the Management of Type 2 Diabetes



# Risk of CKD Progression, CVD

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**CKD is classified based on:**

- **GFR (G)**
- **Albuminuria (A)**

| GFR categories (mL/min/1.73 m²) Description and range | | | | Albuminuria categories Description and range | | |
|---|---|---|---|---|---|---|
| | | | | **A1** | **A2** | **A3** |
| | | | | Normal to mildly increased | Moderately increased | Severely increased |
| | | | | <30 mg/g <3 mg/mmol | 30-299 mg/g 3-29 mg/mmol | ≥300 mg/g ≥30 mg/mmol |
| | **G1** | Normal or high | **≥90** | Screen 1 | Treat 1 | Treat and refer 2 |
| | **G2** | Mildly decreased | **60-89** | Screen 1 | Treat 1 | Treat and refer 2 |
| | **G3a** | Mildly to moderately decreased | **45-59** | Treat 1 | Treat 2 | Treat and refer 3 |
| | **G3b** | Moderately to severely decreased | **30-44** | Treat 2 | Treat and refer 3 | Treat and refer 3 |
| | **G4** | Severely decreased | **15-29** | Treat and refer 3 | Treat and refer 3 | **Treat and refer 4+** |
| | **G5** | Kidney failure | **<15** | **Treat and refer 4+** | **Treat and refer 4+** | **Treat and refer 4+** |

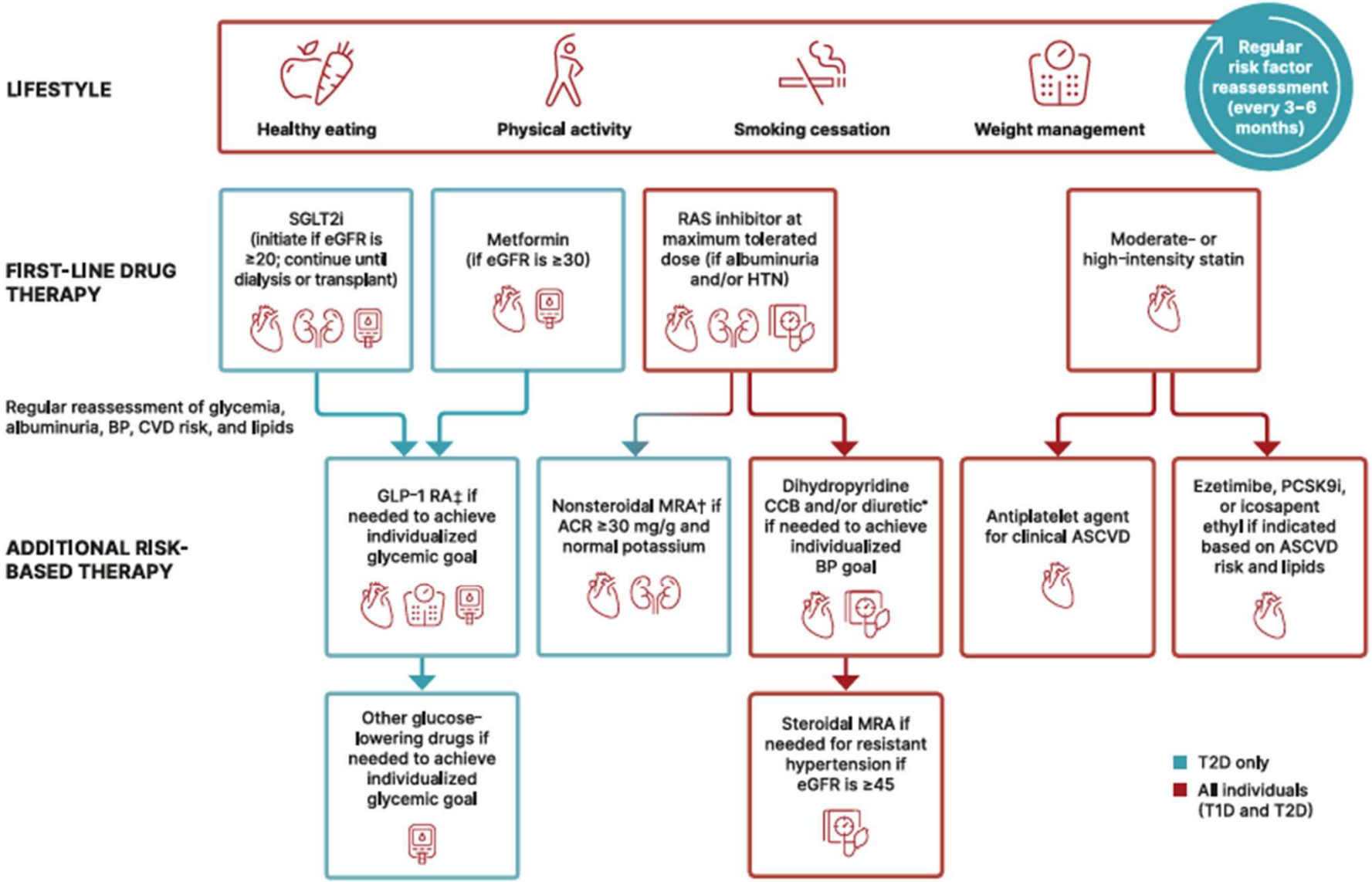
- Low risk (if no other markers of kidney disease, no CKD)
- Moderately increased risk
- High risk
- Very high risk

# 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

# Figure 11-12 Holistic Approach to Diabetes + CKD

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DI1

## Slide 122

**DI1** New slide

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

# 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 |
|---|---|---|---|---|
| **Nonsteroidal, selective mineralocorticoid antagonist.** 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-slective mineralocorticoid antagonists like spironolactone).<br>Since medication is a CYP3A4 substrate, avoid taking with other strong cype3A4 inhibitors.<br>Avoid grapefruit or grapefruit juice.<br>May take with or without food. |

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

# Kidney Goals and MNT

- In people with chronic kidney disease with UACR ≥300 mg/g
- Goal is a reduction of 30% or greater in mg/g urinary albumin to slow chronic kidney disease progression

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- 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

# 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.

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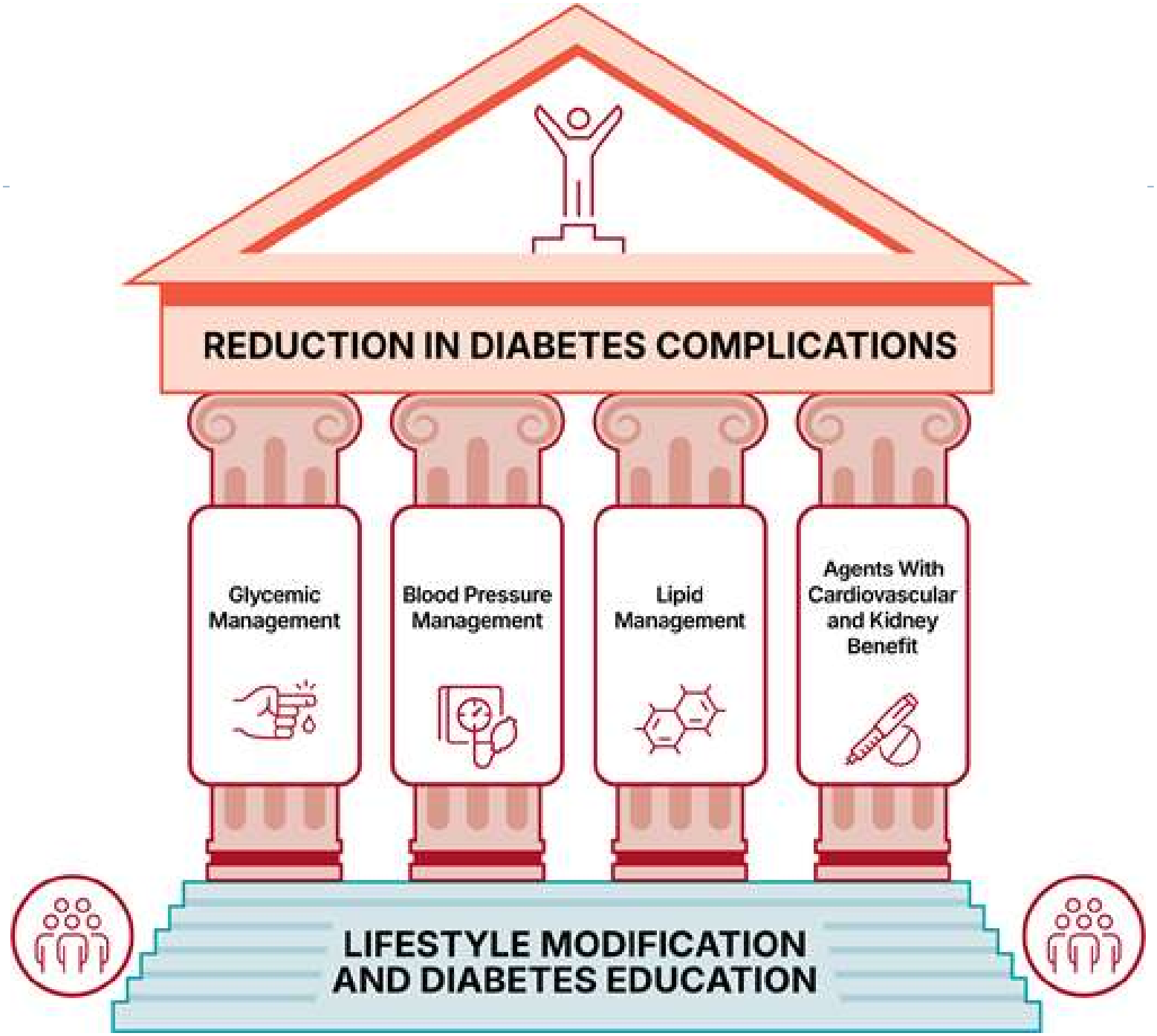


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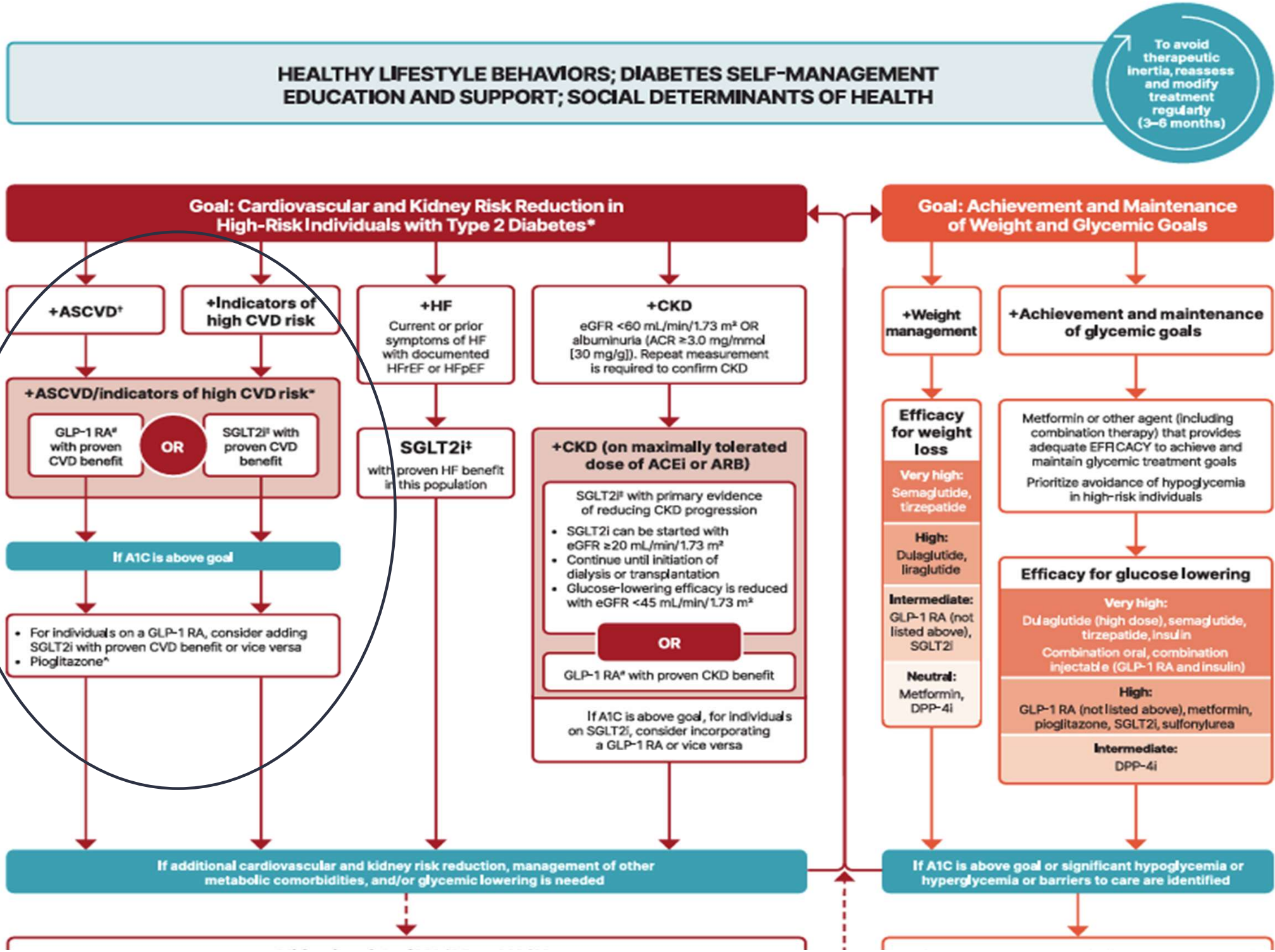
# Use of Glucose-Lowering Medications in the Management of Type 2 Diabetes



# Assess ASCVD and Heart Failure Risk Yearly

- Duration of diabetes & 55+
- BMI
- Hypertension
- Dyslipidemia
- Smoking
- Family history of premature coronary disease
- Chronic kidney disease – presence of albuminuria

*Treat modifiable risk factors as described in ADA guidelines.*

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# Poll Question 13

- RJ is a healthy 52 yr old with diabetes. RJ takes an ACE Inhibitor, insulin and a statin. According to ADA Standards of Care 2025, what is the blood pressure target for RJ?
- A. Less than 120/70
- B. Less than 130/80
- C. Less than 140/90
- D. Less than 135 /85

# BP Treatment in addition to Lifestyle

- **First Line BP Drugs if 130/80 +**
  - With albuminuria or CAD
    - Start either ACE or ARB*
  - No albuminuria - Any of the 4 classes of BP meds can be used:
    - ACE Inhibitors, ARBs, thiazide-like diuretics or calcium channel blockers.
    - Monitor K+/Scr 7-14 days after initiation and dose increase for diuretics, ACEI/ARB
  - Avoid ACE and ARB at same time
  - Multiple Drug Therapy often required
- **If BP ≥ 150 /90 start 2 drug combo**

*Albuminuria = Urinary albumin creatinine ratio of 30+

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# Lipid and HTN Meds Cheat Sheets

## Cholesterol Medications

**LDL Lowering Medications**

| Class / Action | Generic / Trade Name | Usual Daily Dose Range | LDL % Lowering | Considerations |
|---|---|---|---|---|
| **"Statins"** HMG- CoA Reductase Inhibitors<br><br>Inhibits enzyme that converts HMG-CoA to mevalonate - limits cholesterol production | Atorvastatin / Lipitor* | 10 – 80 mg | 20- 60 | Lowers TGs 7-30%<br>Raise HDL 5-15%<br>Take at night.<br>**Side effects**: weakness, muscle pain, elevated glucose levels.<br>Review package insert for specific dosing adjustments based on drug, food interactions (ie grapefruit). |
| | Fluvastatin / Lescol*<br>Lescol XL | 20 – 80 mg<br>80 mg | 20- 35 | |
| | Lovastatin*<br>Mevacor<br>Altoprev XL | <br>20 - 80 mg<br>10 - 60 mg | 20- 45 | |
| | Pravastatin / Pravachol* | 10 - 80 mg | 20- 45 | |
| | Rosuvastatin / Crestor | 5 – 40 mg | 20- 60 | |
| | Simvistatin / Zocor* | 20 – 80 mg | 20- 55 | |
| | Pitavastatin / Livalo | 2 – 4 mg | | |
| Bile Acid Sequestrants<br>**Action:** Bind to bile acids in intestine, decreasing cholesterol production.<br>Secondary action – raise HDL | Cholestyramine/ Questran* | 4 to 16 g per day powder – 1 scoop 4g | Lower LDL by 15-30% | May raise TG levels.<br>Raise HDL 3-5%.<br><br>Avoid taking in same timeframe w/ other meds – may affect absorption (see package insert).<br>Side effects: GI in nature |
| | Colesevelam / Welchol<br>**Lowers A1c 0.5%** | 3.75 x 1 daily<br>1.875 x 2 daily<br>(625mg tablets) | | |
| | Colestipol / Colestid | 2 - 16 gms per day tabs<br>Powder – 1 scoop = 5g<br>5 to 20 gm per day<br>Mix w/ fluid | | |
| Cholesterol Absorption Inhibitors | Ezetimibe / Zetia | 10 mg – 1x daily | 15-20% | Usually used in combo w/statin. Headache, rash. |
| Plant Stenols | Benecol | 3 servings daily | 14% | Well tolerated |
| Plant Sterols | Take Control | 2 servings daily | 17% | |

**Triglyceride Lowering / HDL Raising Medications**

If TG> 500, lower TG first, then reduce LDL.

## Antihypertensive Medications

**ACE and ARBs are preferred therapy for diabetes with hypertension and albuminuria** – If B/P not at goal with either of these agents, add a diuretic or other class. Do not use during pregnancy or in persons w/ renal or hepatic dysfunction. Start w/ low dose, gradually increase. If one class is not tolerated, the other should be substituted. For those treated with an ACE inhibitor, angiotensin receptor blocker, or diuretic, serum creatinine/estimated glomerular filtration rate and serum potassium levels should be monitored at least annually. ADA Standards CV Disease Risk Management

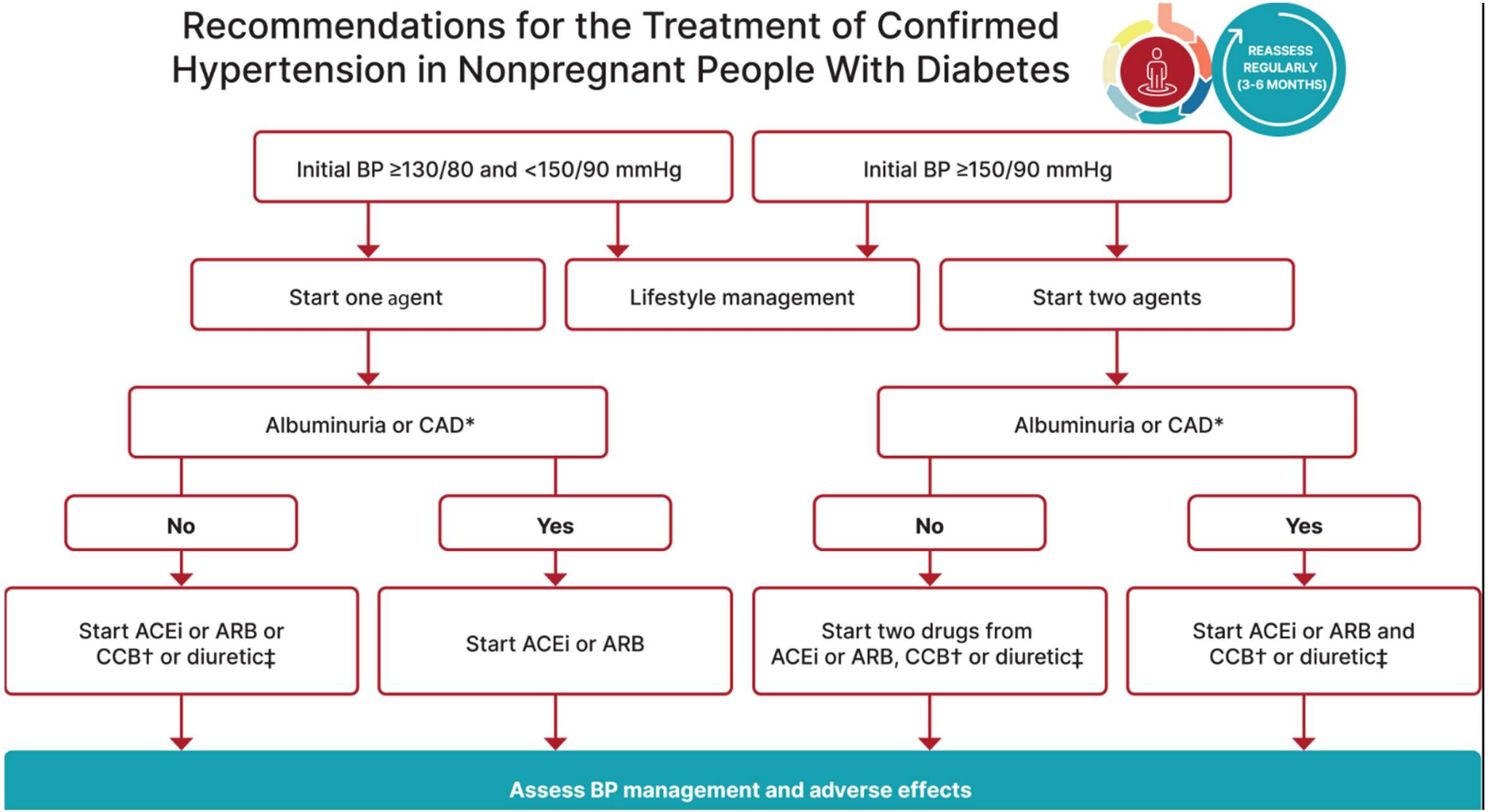
| Class / Action | Generic / Trade Name | Usual Daily Dose Range | Frequency | Considerations |
|---|---|---|---|---|
| **ACE Inhibitors** Angiotensin Converting Enzyme<br><br>**Action** - Block the conversion of AT-I to AT-II. Also stimulates release of nitric oxide causing vasodilation. | benazepril / Lotensin† | 10 – 40 mg | 1 x a day | Try to take same time each day. Effects seen w/in 1 hr of admin, max effects in 6 hrs.<br><br>**Side effects**: Can cause cough (due to increased bradykinin) – can try different med in same class. Also can cause fatigue, dizziness, hypotension.<br><br>†These meds are also available as a combo w/ low dose HCTZ (hydrochlorothiazide).<br><br>‡These meds are also available as a combo w/ CCB (calcium channel blocker) usually amlodipine |
| | captopril /Capoten*† | 12.5 - 100 mg | 2-3 x a day | |
| | Enalopril/ Vasotec*† | 2.5 - 40 mg | 1-2 x a day | |
| | Fosinopil / Monopril† | 10- 40 mg | 1 x a day | |
| | Lisinopril *†<br>Prinivil<br>Zestril | <br>10 – 40 mg<br>10 - 40 mg | | |
| | Ramipril / Altace*† | 2.5 – 10 mg | | |
| | Moexipril / Univasc† | 3.75 - 15 mg | | |
| | Perindopril/Aceon‡<br><br>Perindopril/ Indapamide combo (Coversyl) | 2-16 mg<br><br>2 - 8 mg<br>0.625 - 2.5 mg | | |
| | Quinapril /Accupril† | 5 – 40 mg | | |
| | Trandolapril/ Mavik<br><br>Trandolapril/ Verapamil combo (TARKA) | 1.0 – 4 mg<br><br>1-4 mg<br>180 to 240 mg | | |
| **ARBs** -Angiotensin Receptor Blockers<br>**Action** -Block AT-I receptor which reduces aldosterone secretion and vasoconstriction | Azilsartan/Edarbi<br><br>Azilsartan/ Chlorthalidone combo (Edarbyclor) | 40 - 80 mg<br><br>40 mg<br>12.5 - 25 mg | 1 x daily | Try to take same time each day<br><br>**Side effects**- Can cause dizziness, drowsiness, diarrhea, hyperkalemia, hypotension. |
| | Candesartan/Atacand† | 8 – 32 mg | | |
| | Eprosartan/Teveten† | 400 - 600 mg | | |

Website: https://diabetesed.net/coach-bevs-diabetes-cheat-sheets/

On CDCES Coach App too

For exam, know major classes, when used, side effects and considerations.

# Hypertension Management

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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. RZs 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.

# Lipid Monitoring and Lifestyle Treatment Strategies

- Lipid Goals
  - LDL < 70 or 55 based on risk
  - HDL >40
  - Triglycerides <150

**Monitoring:**
If **not** taking statins and underage 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.

- 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

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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

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# New Lipid Lowering Medications

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

## PCSK9 Inhibitors Lipid Medications

### Proprotein convertase subtilisin/kexin type 9

| | Alirocumab (Praluent) | Evolocumab (Repatha) |
|---|---|---|
| **FDA-approved indications** | • Primary hyperlipidemia (HLD)<br>• Homozygous familial hypercholesterolemia (HoFH)<br>• Secondary prevention of cardiac events | |
| **Dosing** | • **HoFH**: 150 mg SC q2 weeks<br>• **HLD or secondary cardiac prevention**: 75 mg SC q2 weeks or 300 mg SC q4 weeks; if adequate LDL response not achieved, may increase to max of 150 mg q2 weeks | • **HoFH**: 420 mg SC q4 weeks; may increase to 420 mg q2 weeks if meaningful response not achieved in 12 weeks<br>• **HLD or secondary cardiac prevention**: 140 mg q2 weeks or 420 mg q4 weeks |
| **Dosage forms** | • Auto-injector 75 mg/mL or 150 mg/mL | • Repatha Sure Click (auto-injector) 140 mg/mL<br>• Repatha Pushtronex System (single use infusor with pre-filled cartridge) 420 mg/3.5 mL – administered over 9 minutes |
| **Storage** | • Store in refrigerator in outer carton until used<br>• Once used, keep at room temperature, use within 30 days | |
| **Injection clinical pearls** | • Do not shake or warm with water<br>• Administer by SC injection into thigh, abdomen, or upper arm<br>• Rotate injection site with each injection | |
| **Drug interactions** | • No known significant interactions | |
| **Monitoring parameters** | • Lipid panel before initiating therapy, 4-12 weeks after initiating, and q3-12 months thereafter | |
| **Side effects** | • Injection site reaction (4-17%)<br>• Hypersensitivity reaction (9%)<br>• Influenza (6%)<br>• Myalgia (4-6%)<br>• Diarrhea (5%) | • Nasopharyngitis (6-11%)<br>• Upper respiratory tract infection (9%)<br>• Diabetes mellitus (9%)<br>• Influenza (8-9%)<br>• Injection site reaction (6%)<br>• Myalgia (4%) |

From Meds Cheat Sheet Page

# Lipid Therapy in Diabetes by Age

- All ages 20+ *with* ASCVD, add high-intensity statin to lifestyle
- 20–39 and additional ASCVD risk factors
  - may be reasonable to initiate statin therapy in addition to lifestyle.
- 40-75 years
  - Moderate to high intensity statin based on risk (see previous slides)
- 75 years or older and already on statin
  - it is reasonable to continue statin treatment.
- 75 years or older
  - it may be reasonable to initiate moderate-intensity statin therapy after discussion of potential benefits and risks.

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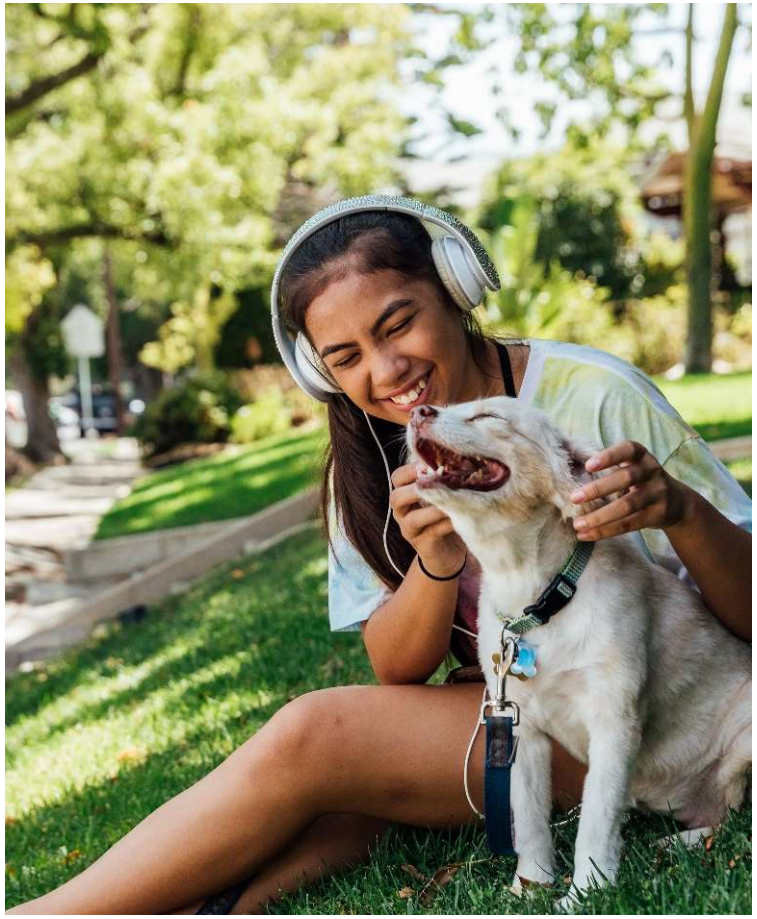
# Tobacco, Electronic Cigarettes, Alcohol, and Cannabis

## Advise all youth with diabetes not to use cannabis recreationally in any form.

- 2 to 3 times higher risk of developing DKA.
- Can lead to cannabis hyperemesis syndrome

- Screen adolescents and young for tobacco or nicotine, electronic cigarettes, substance use, and alcohol use at diagnosis and regularly thereafter.

- Discourage smoking in youth who do not smoke and encourage smoking cessation in those who do smoke (including electronic cigarette use or vaping)



14. Children and Adolescents: Standards of Care in Diabetes —2025 FREE

# 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?

# 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

Special instruction – sweating may indicate hypoglycemia

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

Stop any meds?

# 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

# 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**

# Lived Experiences & Advocacy

# Beta-Cell Mass Loss

- In both type 1 and type 2 diabetes,
- *genetic and environmental factors can result in the progressive loss of β-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.

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# Subpopulations of People with Diabetes

**Table 1.1—Considerations for engaging interprofessional members of a comprehensive, person-centered diabetes care team to identify and meet the needs of people with diabetes across the life span**

| Subpopulation of a person with diabetes | Team members to engage in care | Unique care considerations |
|---|---|---|
| All adults with diabetes | Primary care clinician, CDCES, RDN, and other specialists as available and appropriate to treat comorbidities (**Table 4.1**) | Assess for and address social determinants of health. |
| Adults treated with intensive insulin therapy, including multiple daily injections of insulin and insulin pump therapy | Clinicians and other health care team members experienced in advanced diabetes management, including technology use | |
| All youth with diabetes | Primary care clinician, pediatric endocrinologist, CDCES, RDN, other specialists as available and appropriate to treat comorbidities (**Table 14.1**), daycare or school nurse or other professional, behavioral health professional (as needed), and parent(s) or caregiver(s) | Assess for and address social determinants of health and barriers to safety, well-being, and academic performance in school.<br>Engage professionals within the school and extracurricular/after-school activities to ensure safe diabetes management. An individualized diabetes medical management plan should be developed in collaboration with school professionals and parent(s) or caregiver(s).<br>Support gradual developmentally appropriate transfer of self-management from caregivers to the youth with diabetes. |
| Individuals with diabetes and diabetes-related complications or comorbidities | Specialist referrals as appropriate and available (e.g., behavioral health professional, cardiologist, eye specialist, gastroenterologist or hepatologist, neurologist, nephrologist, obesity medicine specialist, or podiatrist), care coordinator/navigator or case manager, and clinical pharmacist (for those with polypharmacy or complex medication plans) | Screen for functional, cognitive, financial, and logistical barriers to self-management and evidence that self-care demands exceed capacity and available resources and support systems. |

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# Subpopulations of People with Diabetes

| | | |
|---|---|---|
| Individuals with social and/or structural barriers to care | Care coordinator/navigator, social services professional, insurance specialist/navigator, peer-to-peer support (as available), community health worker and/or community paramedic (as available), public health professional, and interpreter (as applicable) | Consider each person's psychosocial needs, available resources, and support systems. |
| Older adults | Geriatric medicine specialist, social services professional, case manager, community services provider, and physical and/or occupational therapist as available and appropriate based on functional status and independence | Consider the older adult's nutritional status, including ability to afford (financial barriers), acquire (accessibility), prepare (cooking), and consume (oral health) nutritious food.<br>Assess for and address needs related to vision, hearing, dexterity, cognition, mobility, and other challenges. |
| Individuals in long-term care settings | Long-term care facility clinicians, nurses, other health care professionals, physical and occupational therapists, and RDN | Engage professionals within the long-term care facility to ensure safe and appropriate diabetes management. |
| Pregnant individuals with diabetes | Maternal-fetal medicine specialist or obstetrician experienced in the care of pregnant individuals with diabetes (particularly for individuals with type 1 diabetes or requiring intensive insulin therapy), CDCES, RDN, eye specialist (particularly for individuals with preexisting type 1 or type 2 diabetes), other specialists as appropriate, and lactation consultant as appropriate | Ensure appropriate postpartum follow-up and care, including transition from obstetric care to established primary care. |
| Individuals with behavioral health conditions | Behavioral health professional, care coordinator/navigator, and social services professional as age and situation appropriate | Use age- and situation-appropriate screening protocols for general and diabetes-related psychosocial concerns. |

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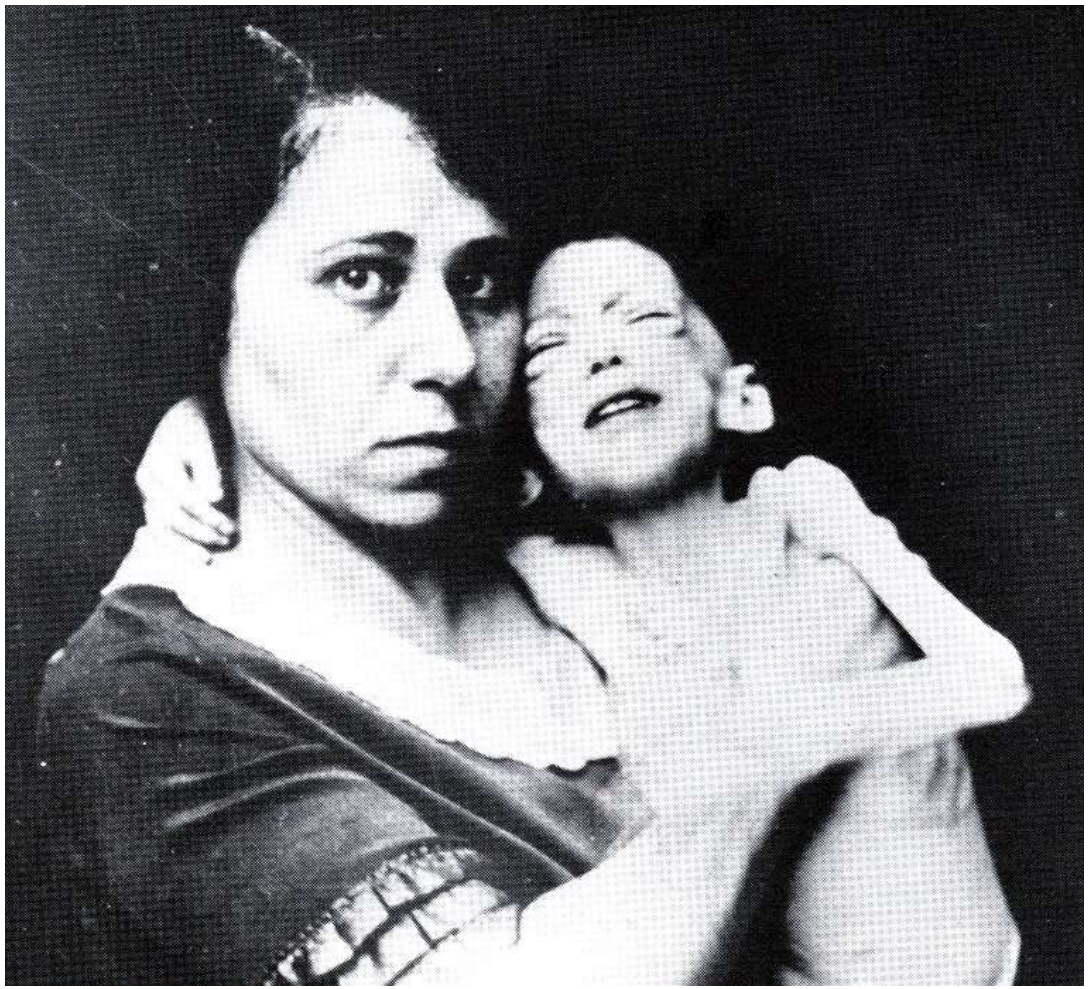
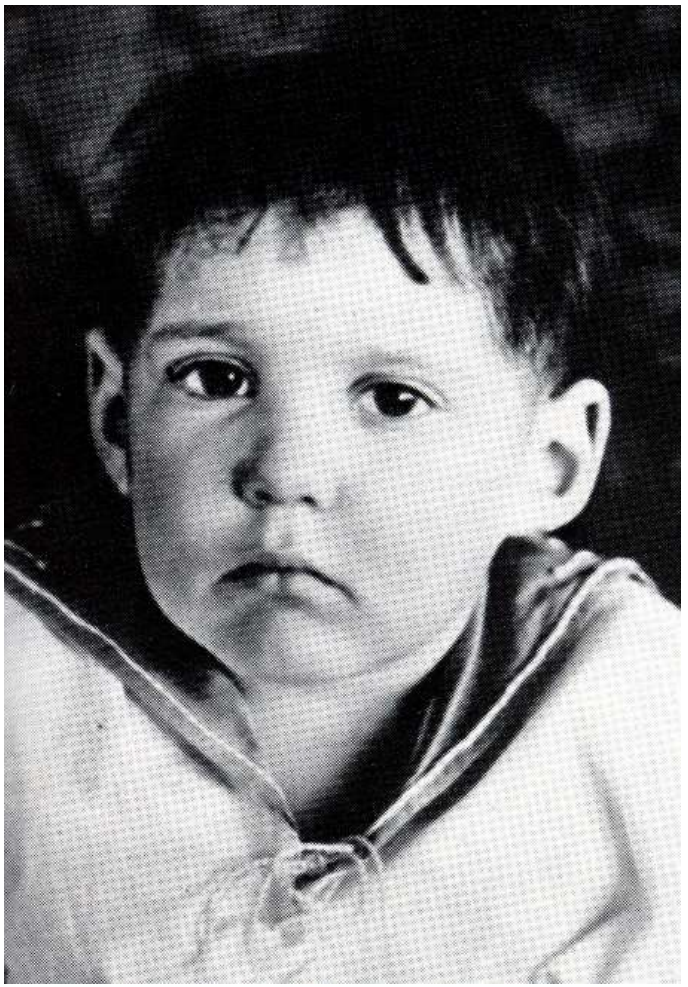
# Miracle of Insulin



**Patient J.L., December 15, 1922**



**February 15, 1923**

# Type 1 ~ Immune Mediated
# 5-10% of Diabetes


1.5 Million people have type 1 in U.S.

Prevalence increasing:

2001 – 1.48 per 1000 youths diagnosed with diabetes

2017 - 2.15 per 1000 youths diagnosed with diabetes

Incidence & Prevalence increasing

Highest incidence in Finland or Northern Europe.

ADCES In Practice - March 2024

Recent Advances in Type 1 Diabetes: Teplizumab (Tzeild®)

Karen S. Fiano, PHARMD, BCACP, Devada Singh-Franco, PHARMD, CDCES, Young M. Kwon, BS, PHD

# What Kind of Diabetes?

- AJ, a 43-year-old admitted to the ICU with a blood glucose of 476 mg/dl, pH of 7.1. They recently lost 13 pounds.
- What further questions and or testing is needed to determine if they have type 1 or type 2 diabetes?

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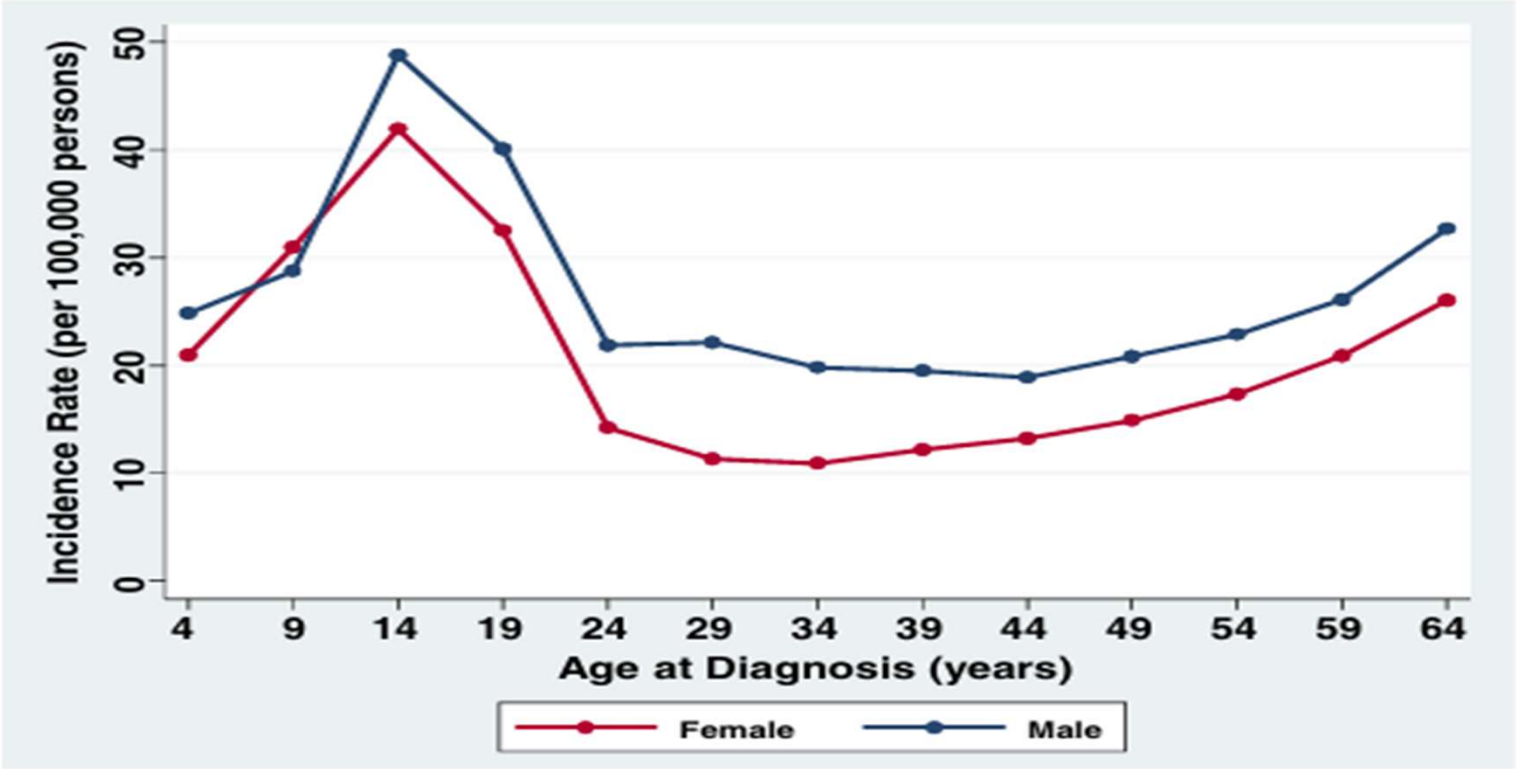
# Clinical onset of T1D can occur at any age

DI1




* A longitudinal study comprising 32,476 commercially insured Americans aged 0-64 years who developed T1D between 2001 and 2015.

Rogers MAM, et al. BMC Med. 2017;15(1):199.

## Slide 150

**DI1** The diagram was messed up, so I went back to the original source and replaced.
Diana Isaacs, 2025-07-20T20:04:33.070

DI1

# T1D is Often Misdiagnosed as T2D in Adults

**TYPE 1 Diabetes**

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

**75%** of those are misdiagnosed as T2D[1]*†

**TYPE 2 Diabetes**

Poor disease management from **misdiagnosis** can have **severe outcomes**[2,3]

- **Inadequate glucose control**[2]
- **Diabetic ketoacidosis (DKA)**[2]
- **Poor quality of life**[3]

*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.** Munoz C, et al. *Clin Diabetes.* 2019;37(3):276–281. **2.** Manov AE, et al. *Cureus*. 2023;15(7):e42459. **3.** The Lancet Regional Health-Europe. *Lancet Reg Health Eur*. 2023;29:100661.

## Slide 151

**DI1** New slide

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

# Screen people at increased risk of T1D

**Screening for T1D autoantibodies is recommended by**

American Diabetes Association.

ISPAD
International Society for Pediatric and Adolescent Diabetes

Breakthrough T1D™
Formerly JDRF

## 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

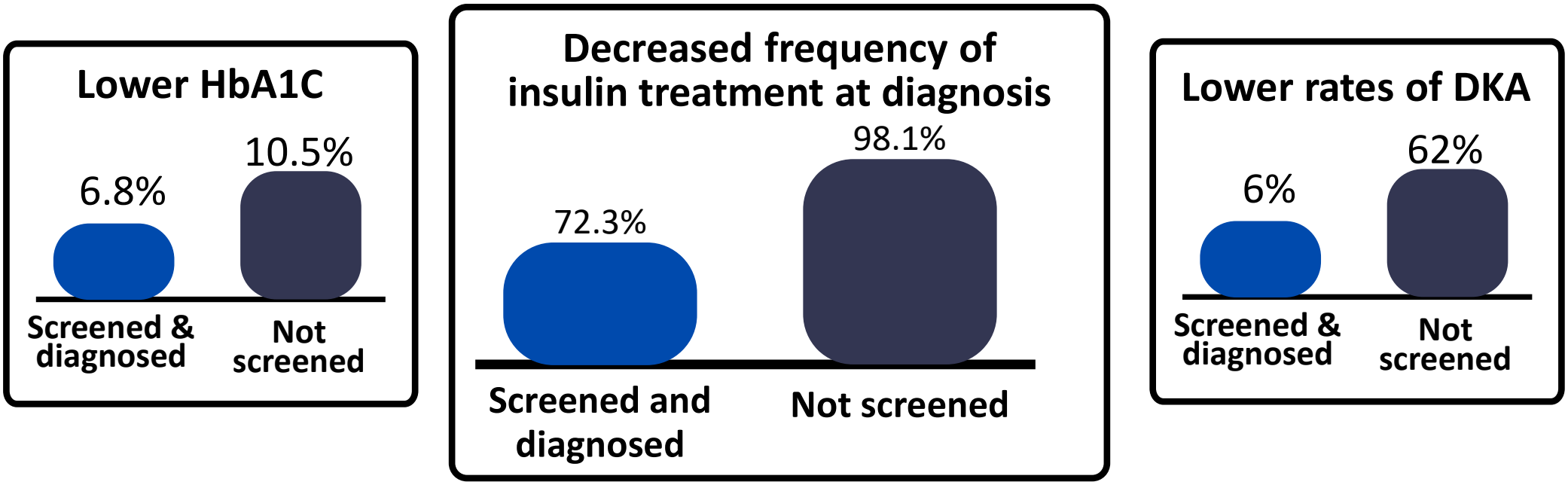
2-3X greater risk of T1D in individuals with select autoimmune diseases

**Thyroid disorders**

- Hashimoto's thyroiditis
- Graves' disease

**Celiac disease**

# Benefits of early detection of pre-symptomatic T1D




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

## Slide 153

**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

# 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

# Type 1 Diabetes Features?

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

- 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$^2$)
- Unintentional weight loss
- Ketoacidosis
- Glucose 360 mg/dl or greater.

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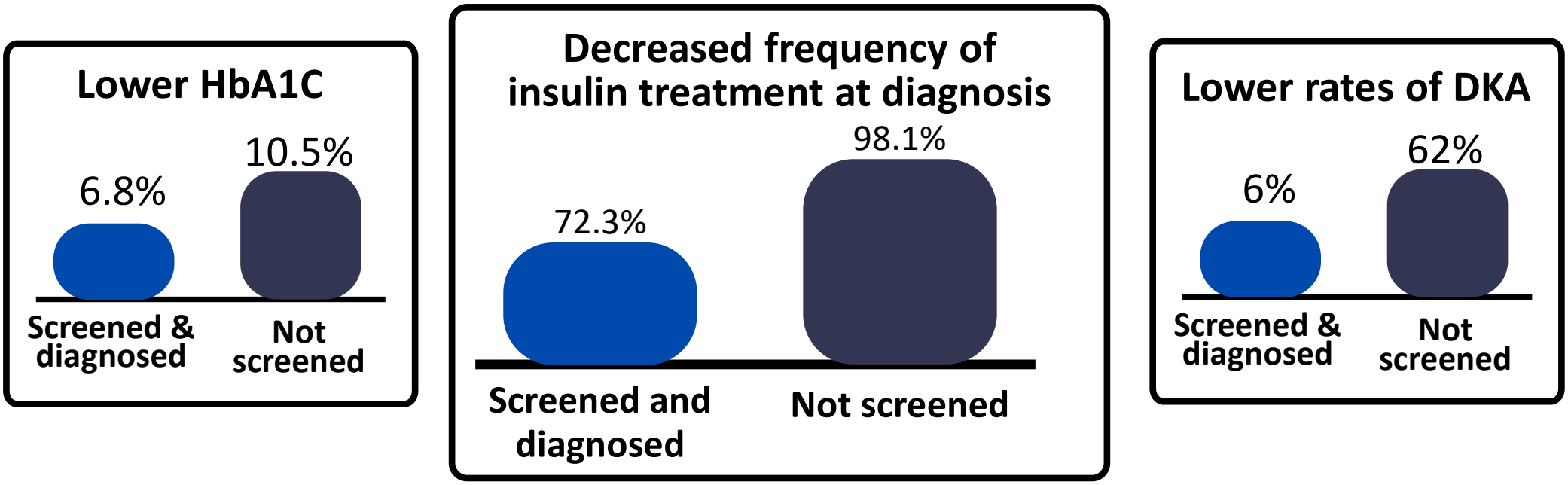
# Benefits of early detection of pre-symptomatic T1D




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

## Slide 157

**DI1** Added citation

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

# Type 1 & Lifestyle Prevention

- Observational studies in those with antibodies, shed light on factors that ***increase*** β-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

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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

DI1

**T1D Risk Screening**

Offered at no cost to relatives of people with T1D, TrialNet 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.

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## Slide 159

**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

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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

DI1

# 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, Guest 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 |
| Autoimmunity 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)

## Slide 162

**DI1** 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* | 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.) |

| | **Stage 1** | **Stage 2** | **Stage 3** |
|---|---|---|---|
| Characteristics | • Autoimmunity | • Autoimmunity | • Autoimmunity |
| | • Normoglycemia | • Dysglycemia | • Overt hyperglycemia |
| | • Presymptomatic | • Presymptomatic | • Symptomatic |
| Diagnostic criteria | • 2 or more islet autoantibodies<br><br>Glucose levels are in normal range<br>FBG<100mg/dL<br>A1C<5.6%<br>2-h PG <140mg/dL | • 2 or more islet autoantibodies<br><br>Dysglycemia:<br>Elevated IFG and/or IGT<br>• FPG 100–125 mg/dL<br>• 2-h PG 140–199 mg/dL<br>• A1C 5.7–6.4% or ≥10% increase in A1C | • Autoantibodies may disappear over time<br>(5-10% may not express antibodies)<br>• Diabetes diagnosed by standard criteria |

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# Determine if Type 1 - Use AABBCC Approach

- **A**ge
  - e.g., for individuals <35 years old, consider type 1 diabetes
- **A**utoimmunity
  - e.g., personal or family history of autoimmune disease or polyglandular autoimmune syndromes
- **B**ody habitus
  - e.g., BMI <25 kg/m2
- **B**ackground
  - e.g., family history of type 1 diabetes
- **C**ontrol
  - e.g., level of glucose control on noninsulin therapies
- **C**omorbidities
  - 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-Tzield (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

# Quick Question 16

DI1

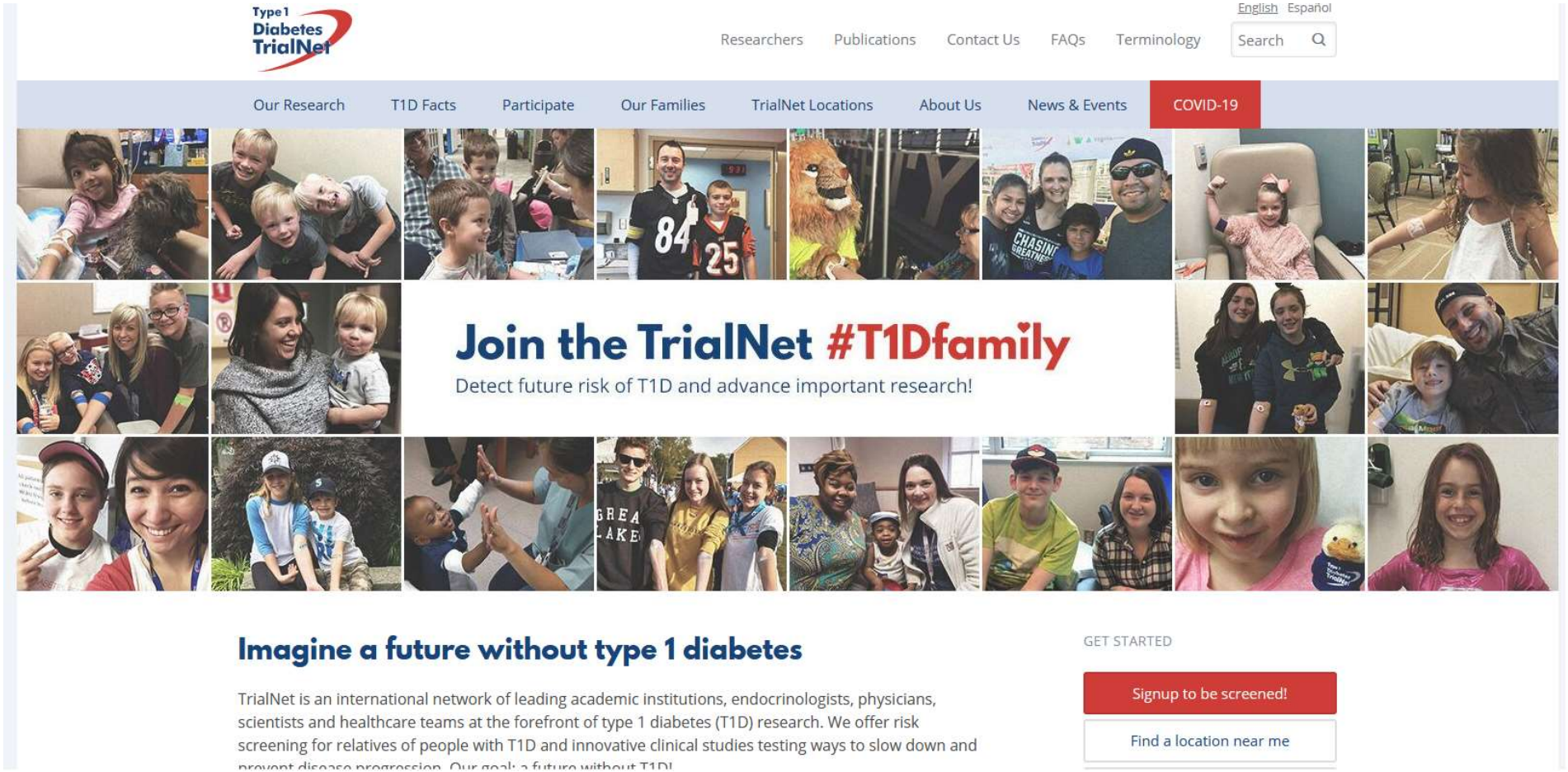
- **Question:** LT has just been diagnosed with stage 1, type 1 diabetes. He has 2 positive autoantibodies and his blood sugars are slightly elevated. He asks you if he is a candidate for "that therapy" that can protect beta cells and slow progression of type 1 diabetes. **What is the most accurate response?**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

## Slide 166

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

# Type 1 (stage 2) Delayed with Teplizumab by 2 years www.DiabetesTrialNet.org

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



# Medalist Study – Harvard Joslin Diabetes Center

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


# Other Types of Diabetes

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

# 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

# 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 β-cell destruction can lead to a long duration of marginal insulin secretory capacity.
  - For this classification, all forms of diabetes mediated by autoimmune β-cell destruction independent of age of onset are included under the rubric of type 1 diabetes.

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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**

Venkatraman 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

# 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**

Venkatraman Rajkumar; Steven N. Levine.

Author Information and Affiliations

Last Update: June 21, 2022.

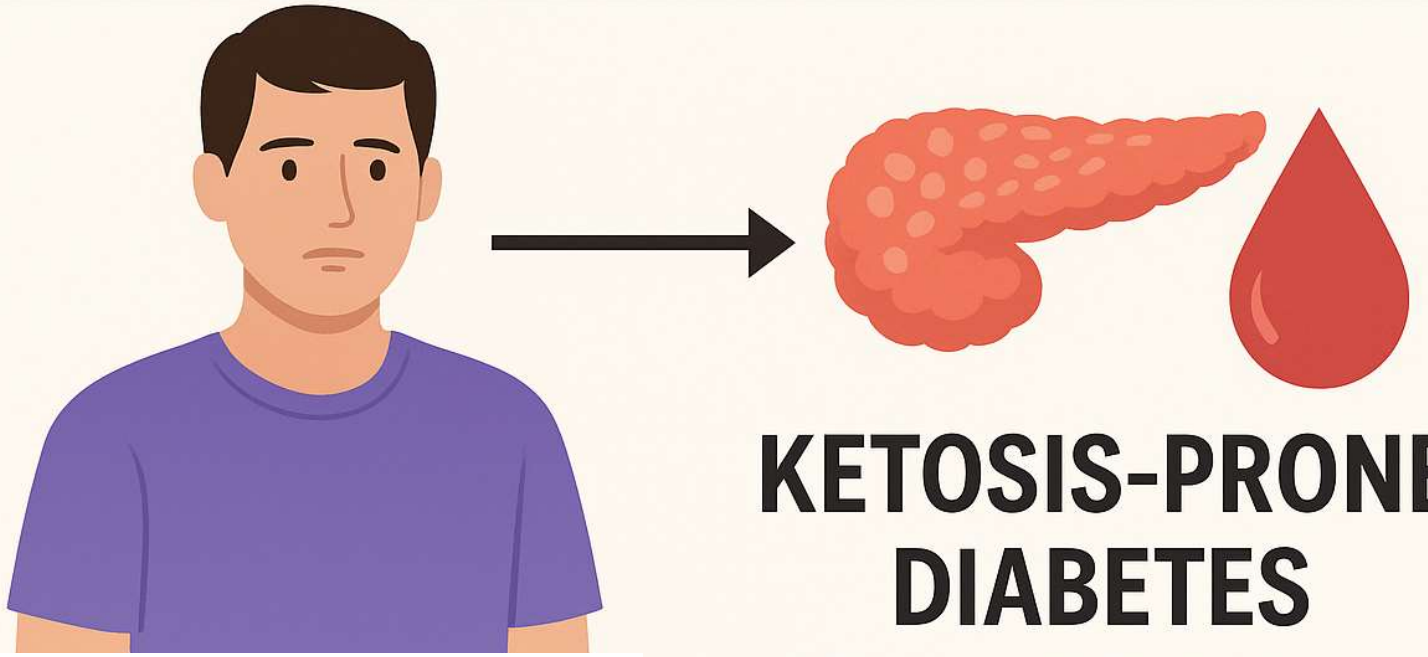
*Practical Diabetology March 08, Unger* MD

# 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.

# KETOSIS-PRONE DIABETES




- 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

# 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

# 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

# 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.

# 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 2nd or 3rd trimester of pregnancy

# Prevalence of Diabetes in Pregnancy

**Total:**

8-12%

**Gestational:**

8-10% (US)

14-17% (Worldwide)

**Pre-Diagnosed Type I and 2:**

1-2%


- Centers for Disease Control and Prevention. www.cdc.gov., https://my.clevelandclinic.org/health/diseases/9012-gestational-diabetes

# 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

# Rates of GDM and Diabetes in Pregnancy increasing

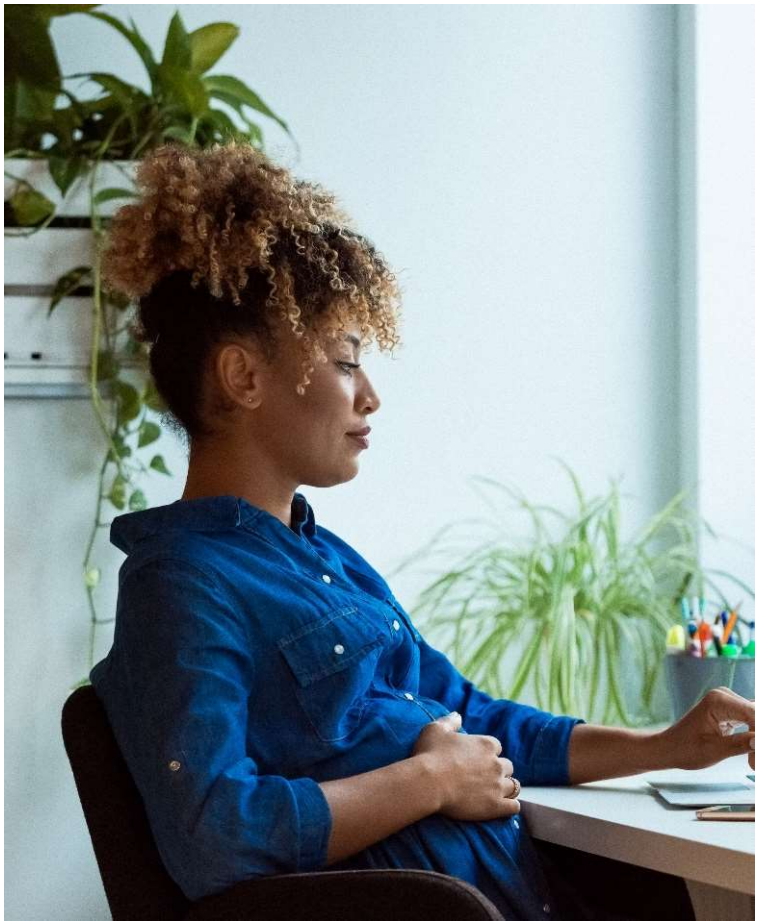
- 1% to 2% have type 1 or type 2 during pregnancy
- From 2000 to 2010
  - GDM rates increased 56%
  - Type 1 or type 2 before pregnancy increased 37%.

CDC Diabetes During Pregnancy | Maternal Infant Health | CDC

- 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.

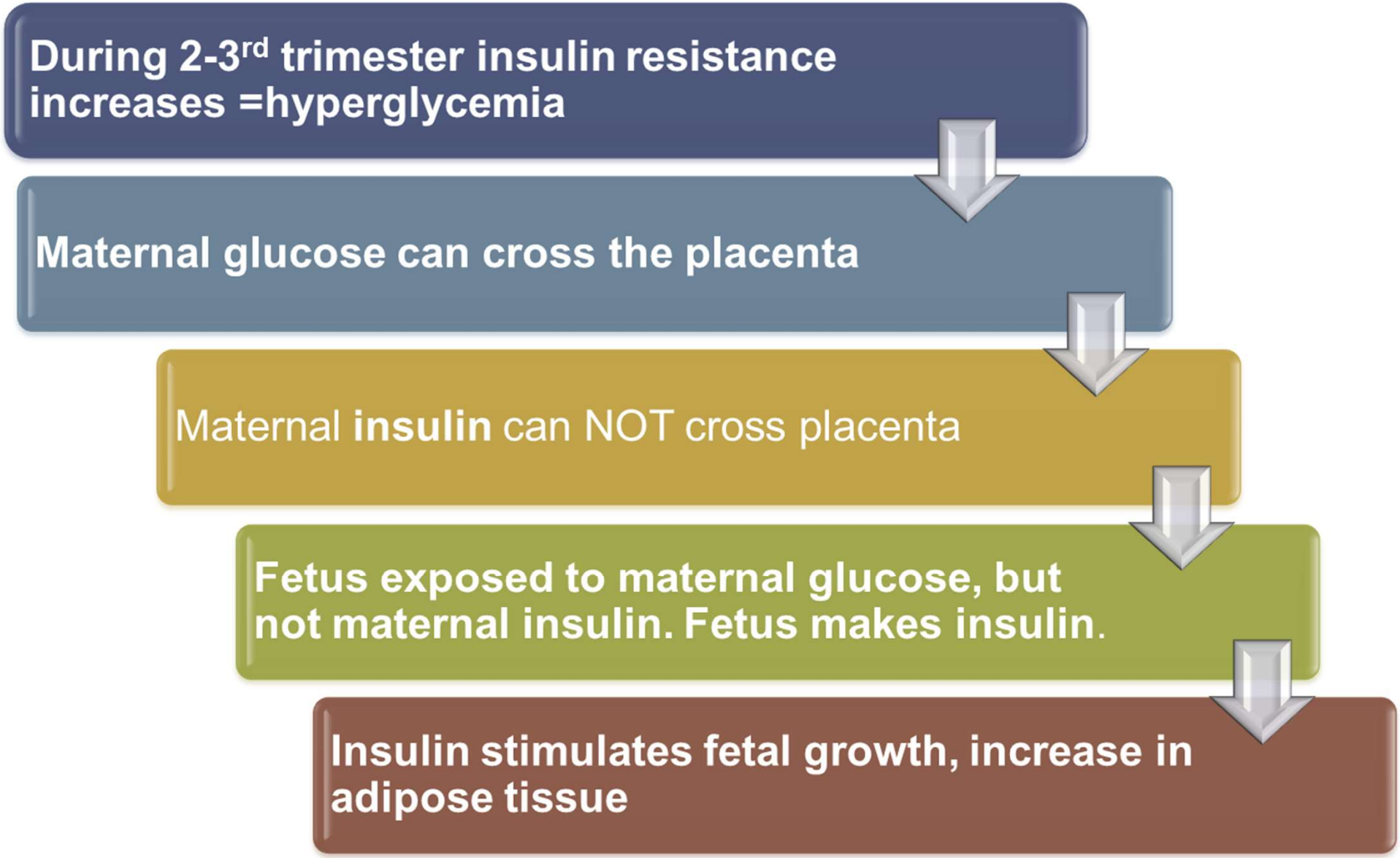
# Screening in early Pregnancy

- 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.

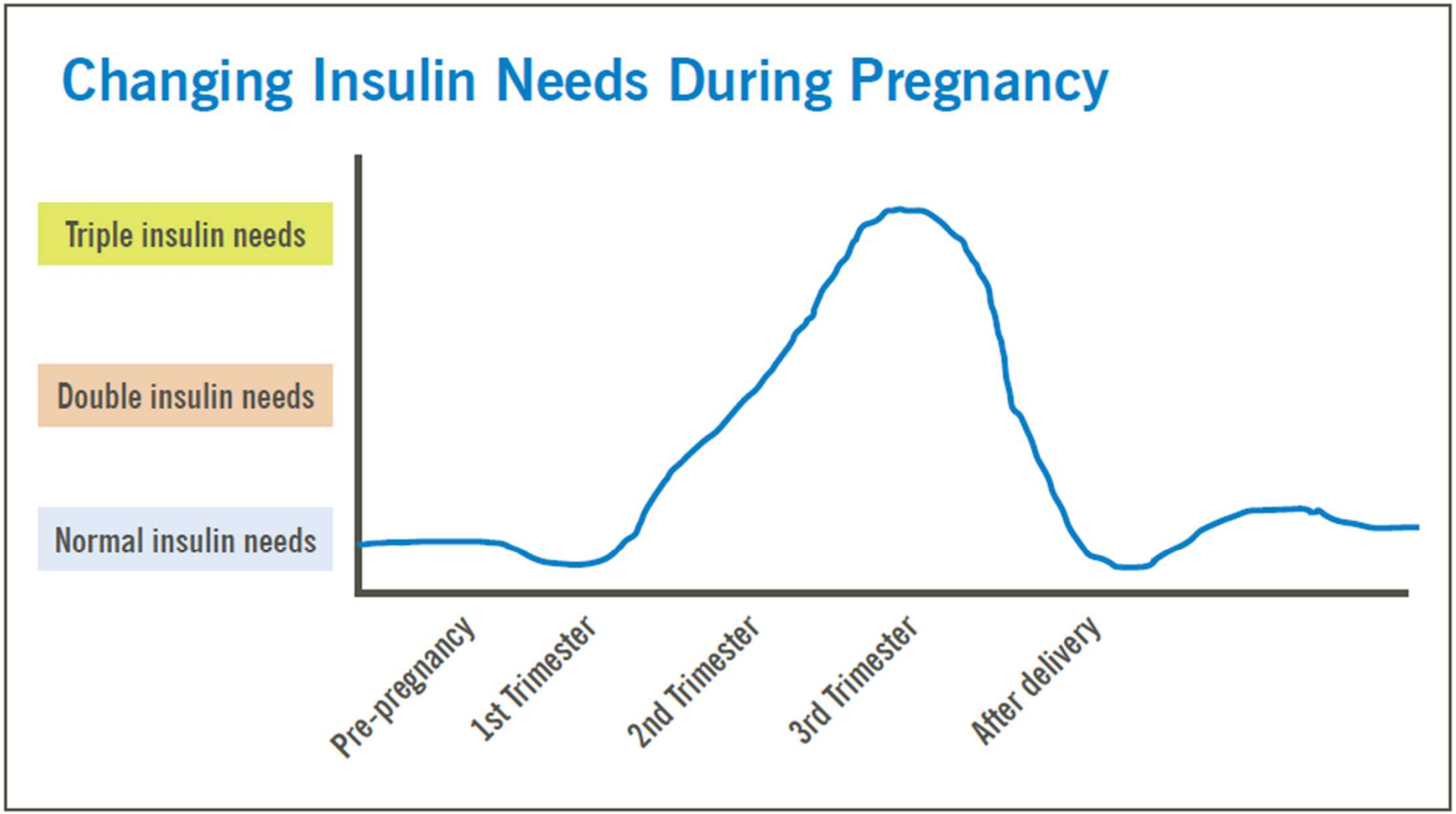


Standards of Care in Diabetes—2025. Diabetes Care, January 2025; 48 (Supplement_1): S306-320. https://doi.org/10.2337/dc25-S015

# Hyperglycemia and Fetal Risk



# Insulin Needs During Pregnancy



# 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

# 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): S306-320. https://doi.org/10.2337/dc25-S015

# 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<br>Those with fasting of 110-125 or A1C of 5.9% to 6.4% are at higher risk of adverse outcomes (GDM, need insulin, preeclampisa and other) |
| Screen for GDM at 24–28 wks gestation for those without known diabetes.<br><br>Screen those with GDM for diabetes 4 - 12 wks postpartum with 75-g OGTT. Lifelong screening at least every 3 yrs.<br>**Please see reference below for complete guidelines.* | Can use either IADPSG consensus:<br>**"One Step" 75-g OGTT** fasting and at 1 and 2 h (perform after overnight fast of at least 8 h)<br><br>**"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:<br>• Fasting ≥92 mg/dl,<br>• 1 h ≥180 mg/dl<br>• 2 h ≥153 mg/dl<br><br>**Two Step -Step 2** - 100g OGTT (fasting)<br>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. 

# *Perinatal care makes a difference*

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

- Focus:
  - Prenatal,
  - perinatal and
  - postnatal health

# 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

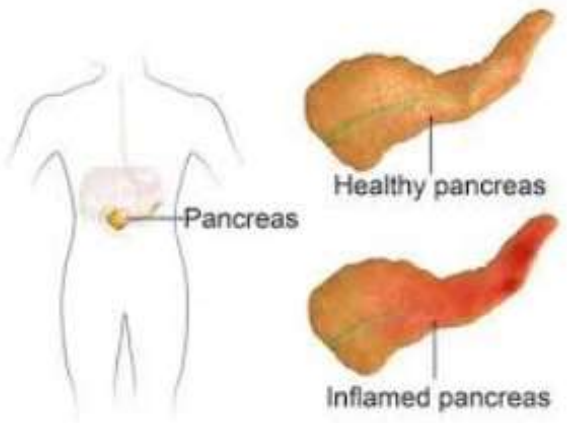
# Regardless of the cause, hyperglycemia needs to be treated.

# 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

# 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.



Healthy Pancreas vs Pancreatitis

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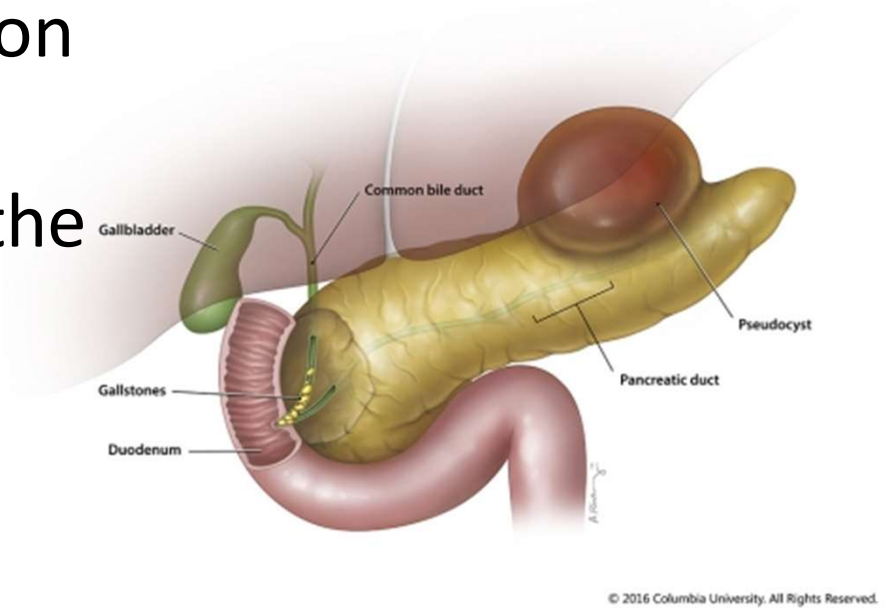
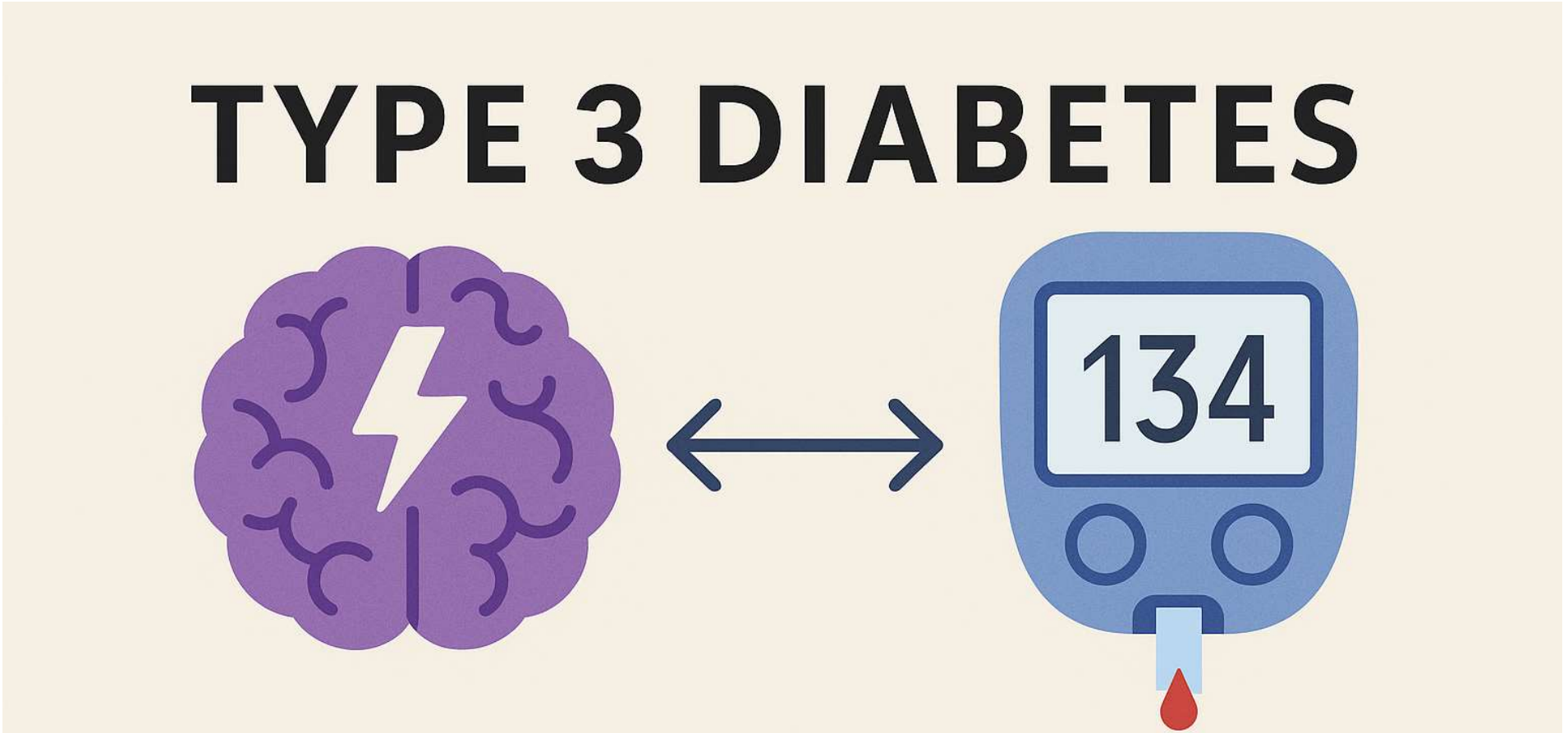
# Pancreatitis

- 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

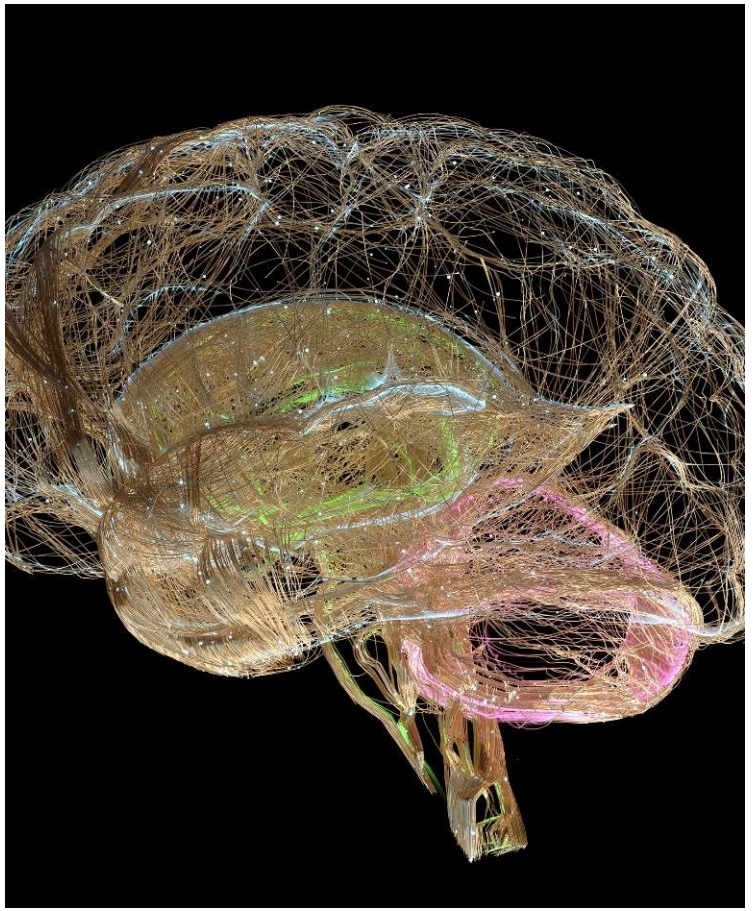


# Diabetes Type 3



# What is 'Type 3 Diabetes'?

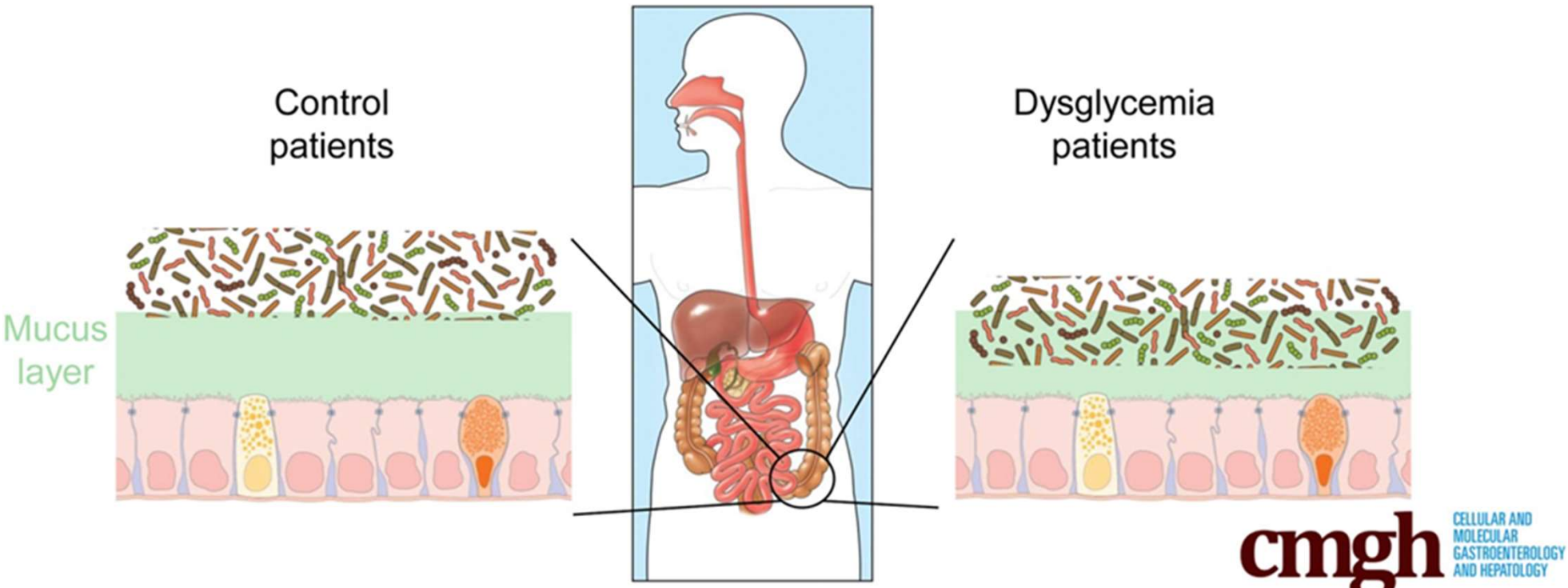
- A term linking Alzheimer's disease to insulin resistance in the brain.
- Not an official diagnostic category.
- Still an emerging field with ongoing studies
- Suggests that Alzheimer's may be a form of brain-specific diabetes.



# Key Concepts

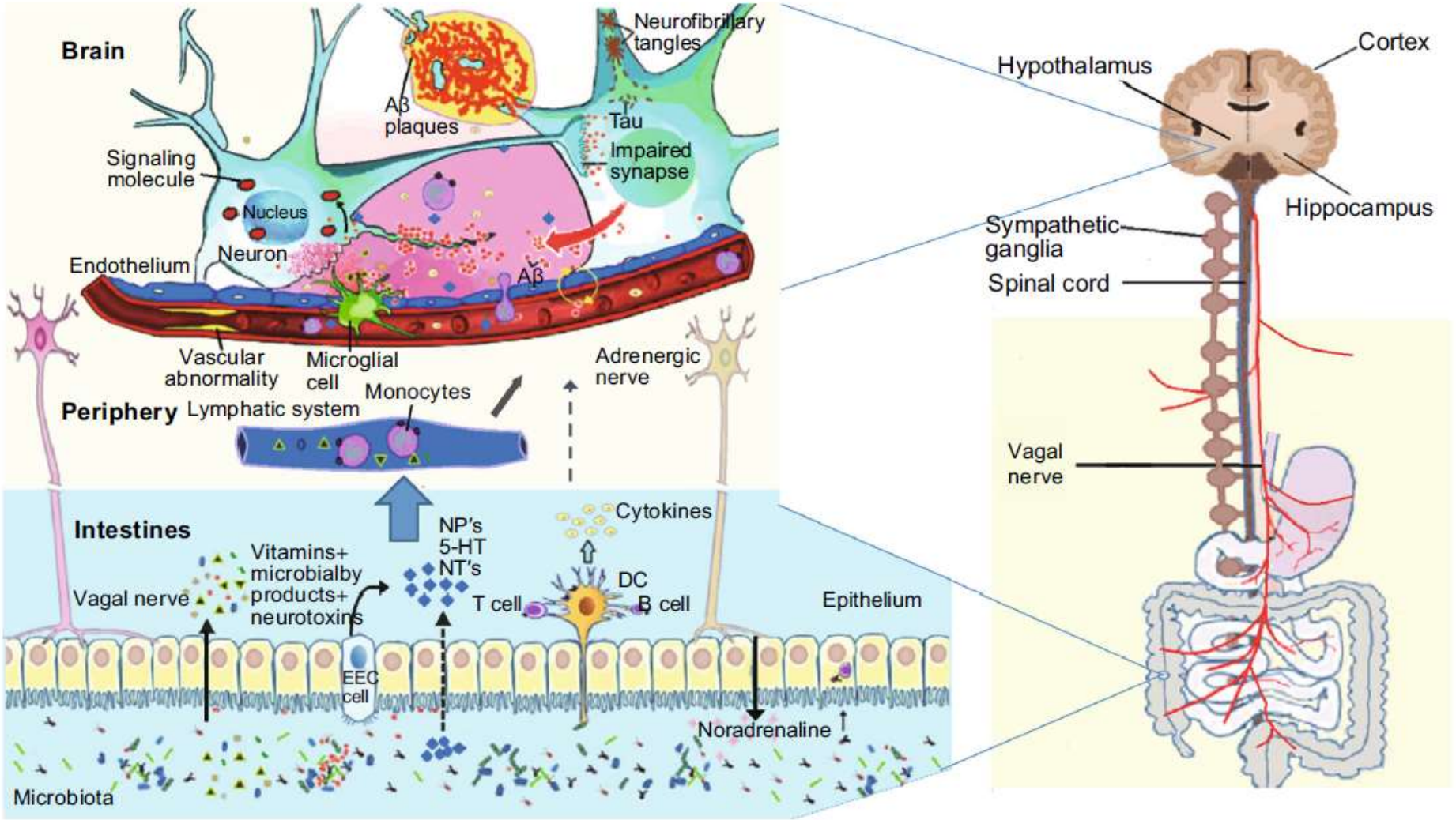
- Type 2 Diabetes increases Alzheimer's risk by 60–80%
- Reduced insulin receptors in brains of people with Alzheimer's
- The brain uses insulin for memory and learning
- Insulin resistance contributes to cognitive decline
- Amyloid beta plaques and tau tangles are influenced by insulin signaling

# *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)

# Link Between Gut and Brain




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

# 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.

# Summary

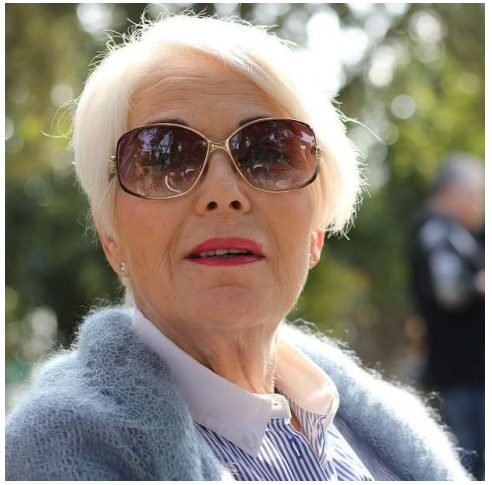
'Type 3 Diabetes' reflects the link between metabolic and brain health

Early intervention can support cognitive function

Encourages whole-person, compassionate care

# 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.**

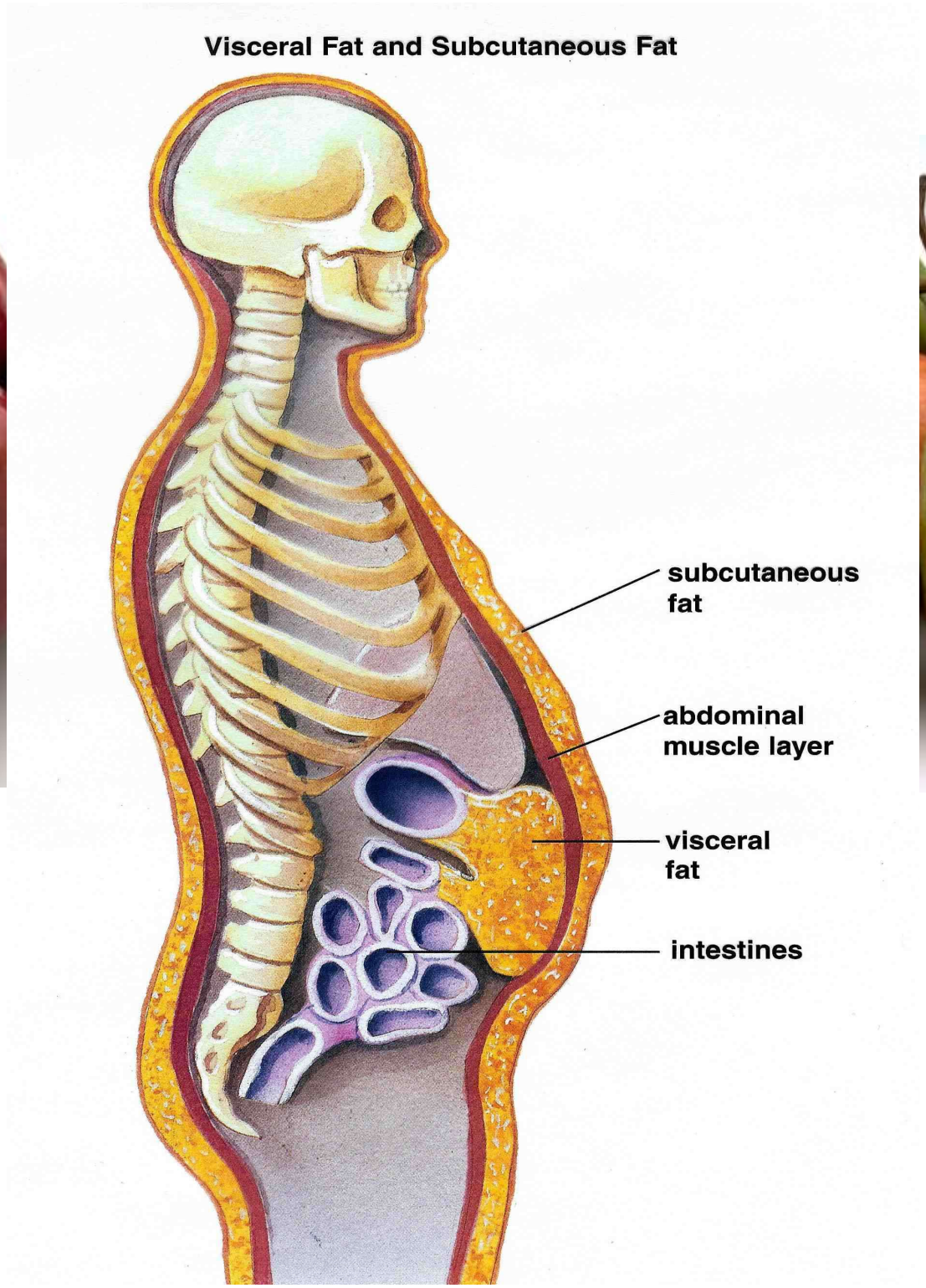
**ADA Post Grad, 2010**

# Type 1 & Type 2 - Double Diabetes?

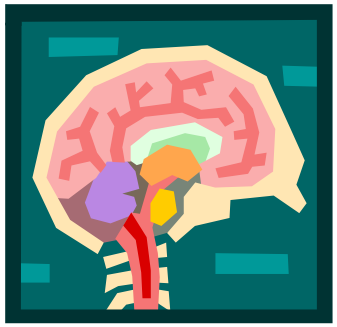
- May be appropriate to recognize a person with type 1 diabetes *and* features classically associated with type 2 diabetes (e.g., insulin resistance, obesity, and other metabolic abnormalities.
- Can help facilitate access to appropriate treatment:
  - (e.g., GLP-1 RA or SGLT-2 inhibitor therapies for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

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

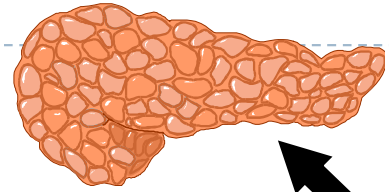
American Diabetes Association Professional Practice Committee


Visceral Fat and Subcutaneous Fat
subcutaneous fat
abdominal muscle layer
visceral fat
intestines

# The Noxious Nine – Pathophysiology T2D

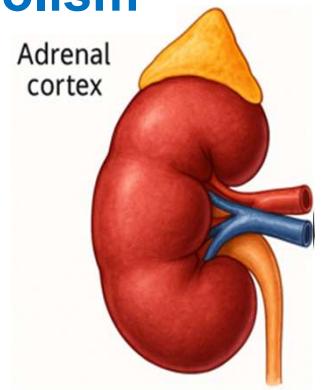


Neurotrans-
mission
dysfunction

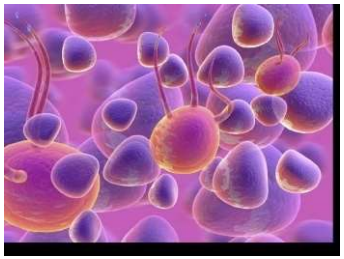


Decreased
Insulin β-cell secretion

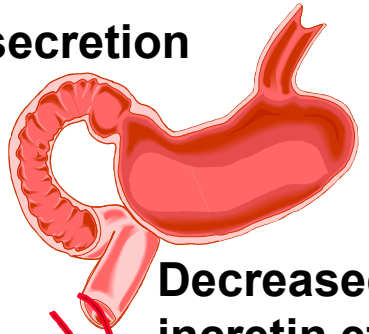
Hypercortisolism



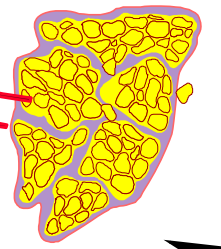

Increased renal
glucose
reabsorption



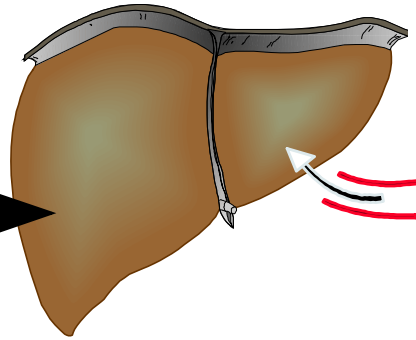
Increased glucagon
α-cell secretion



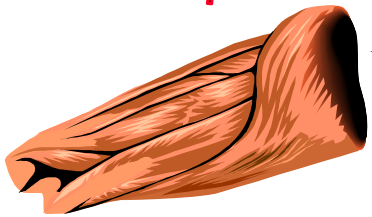
Decreased
incretin effect
Gut hormones



Increased
lipolysis



Increased
hepatic
glucose
production



Decreased muscle
glucose uptake

DeFronzo, Auchus-Hypercortisolism June 2025

# 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.

# 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.

# 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 ≥ 1 year prior)
    - ≥ 3 diabetes medications,
    - or Insulin plus any other diabetes drug(s),
    - Or ≥ 2 diabetes meds and at least one micro- or macrovascular complication,
    - Or ≥ 2 diabetes meds and ≥ 2 antihypertensive medications

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

BT1

# Hypercortisolism in Type 2

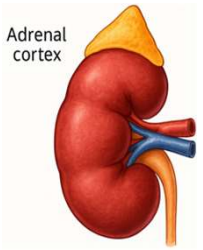
Cortisol increases gluconeogenesis in the liver

Reduces peripheral glucose uptake → insulin resistance

Stimulates protein catabolism and lipolysis

Chronic cortisol elevation → 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

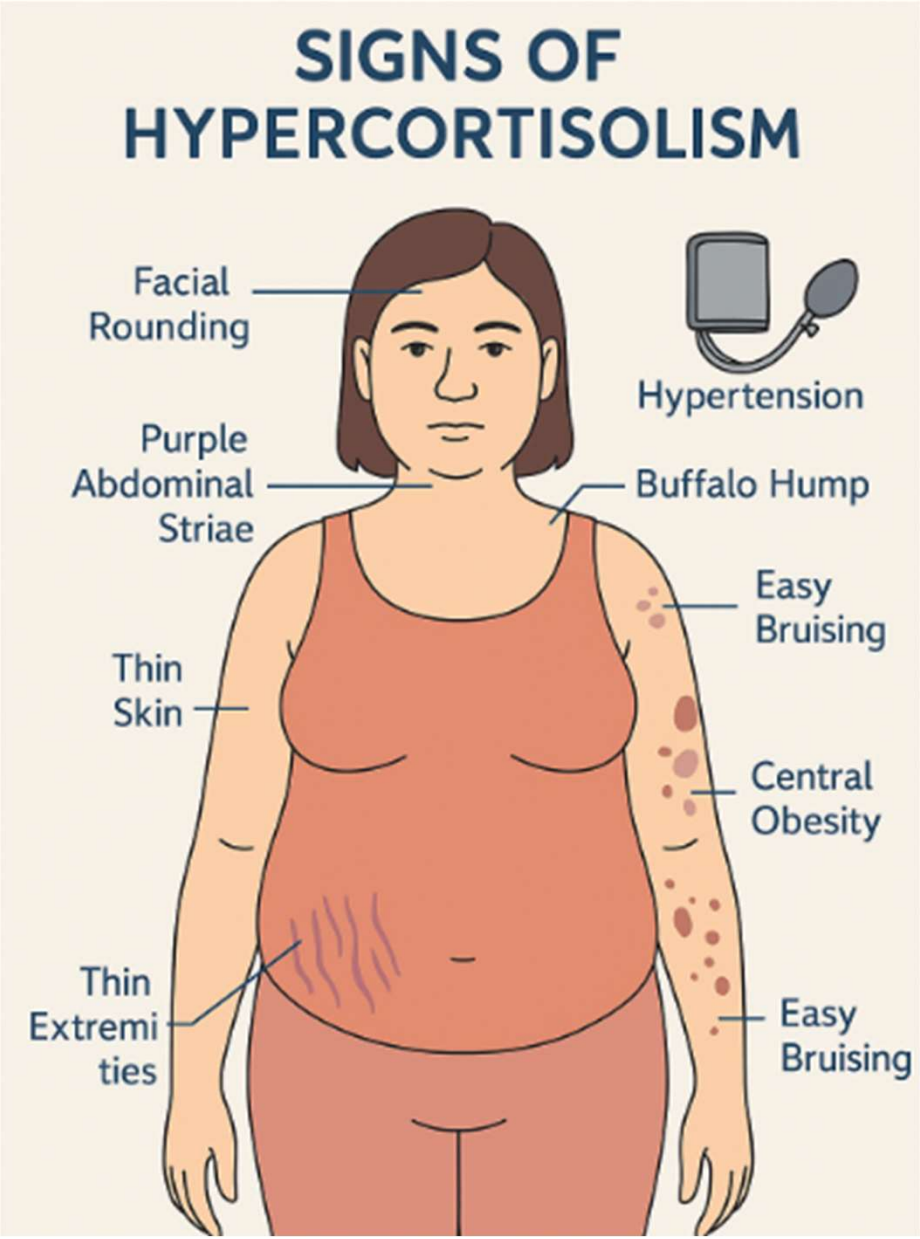
pmc.ncbi.nlm.nih.gov+3HCP

## Slide 209

**BT1** Added this slide

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

# 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 → CRH → Pituitary → ACTH → Adrenal → Cortisol

- Cortisol effects: gluconeogenesis, insulin resistance, fat redistribution

# 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.

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.

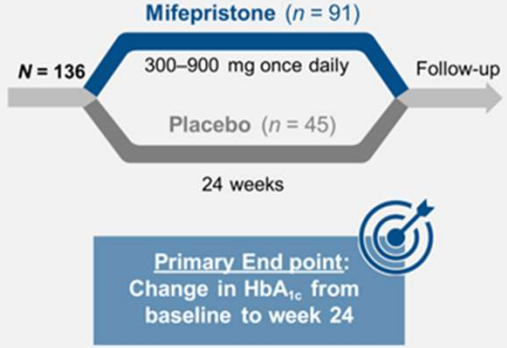
# CATALYST Treatment Outcomes

CATALYST
Study of Hypercortisolism in Patients with Difficult-to-Control Type 2 Diabetes

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

### CATALYST Treatment Phase: A Randomized, Placebo-Controlled Study

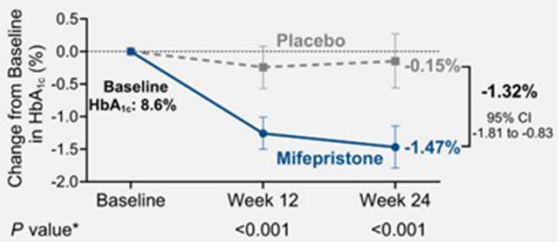
Adults with inadequately controlled T2D & hypercortisolism (based on a DST)




Primary End point: Change in $HbA_{1c}$ from baseline to week 24

NCT05772169; randomized 2:1, stratified by adrenal imaging abnormality (yes/no)

### Primary End Point Met: Mifepristone Improved $HbA_{1c}$




*P* value* <0.001 <0.001

- Similar effect on $HbA_{1c}$ seen in participants with and without adrenal imaging abnormality

**Key Takeaway:** In individuals with inadequately controlled T2D and hypercortisolism, treatment with mifepristone may reduce $HbA_{1c}$.

### Other Key Findings

**Improvements in glycemic control with mifepristone were accompanied by reductions in:**

**glucose-lowering medications** (e.g., insulin, sulfonylureas)

**Body weight** (-4.4 kg; 95% CI -6.28 to -2.53)

**BMI and waist circumference** (-1.5 $kg/m^2$ and -5.2 cm; 95% CIs -2.10 to -0.84 and 7.25 to -3.21, respectively)

**Safety:**

- Adverse events were manageable and consistent with mifepristone's known safety profile
- Adverse events occurring in >10% of participants treated with mifepristone: hypokalemia, fatigue, nausea, vomiting, headache, peripheral edema, diarrhea, and dizziness
- Increases in blood pressure also occurred

"Inadequately controlled T2D" defined as: type 2 diabetes with $HbA_{1c}$ 7.5%–11.5% and at least 1 of the following: a) taking ≥3 glucose-lowering drugs, b) taking insulin and other glucose-lowering drugs, c) taking ≥2 glucose-lowering drugs and ≥1 microvascular or macrovascular complications, taking ≥2 glucose-lowering and ≥2 blood pressure–lowering drugs. "Hypercortisolism" defined as cortisol >1.8 µg/dL after dexamethasone suppression test (DST) with dexamethasone ≥140 ng/dL. *Graphic shows least squares mean (LSM) change from baseline and 95% CI; *P* value for least squares mean difference from placebo.

Mifepristone significantly improves glycemic control and weight

Next steps: broader screening, novel cortisol-targeted therapies, long-term outcomes.

ORIGINAL ARTICLE | JUNE 23 2025

**Inadequately Controlled Type 2 Diabetes and Hypercortisolism: Improved Glycemia With Mifepristone Treatment** FREE

Ralph A. DeFronzo; Vivian Fonseca; Vanita R. Aroda; Richard J. Auchus; Timothy Bailey; Irina Bancos; Robert S. Busch; John B. Buse; Elena A. Christofides; Bradley Eilerman; James W. Findling; Yehuda Handelsman; Steven E. Kahn; Harold J. Miller; Jonathan G. Ownby; John C. Parker; Athena Philis-Tsimikas; Richard Pratley; Julio Rosenstock; Michael H. Shanik; Lance A. Sloan; Guillermo Umpierrez; Samir Shambharkar; Iulia Cristina Tudor; Tina K. Schlafly; Daniel Einhorn; CATALYST Investigators

# Diabetes Bingo
# “DiaBingo”  Shout out Right Answer

# DiaBingo - N

**N** DPP demonstrated that exercise and diet reduced risk of DM by__%

N Average A1c of 7% = Avg BG of ____

**N** The goal is to eat 14 gms per 1000 cals of this nutrient a day

**N** Rebound hyperglycemia

**N** Scare tactics are effective at motivating behavior change

**N** Get LDL less than ____for most people with diabetes 40 years+

**N** Drugs that can cause hyperglycemia

**N** 2/3 cups of rice equals _____ serving carbohydrate

**N** 1% A1c = how many points of blood sugar _____

**N** One % drop in A1c reduces risk of complications by ___ %

**N** 1 gm of fat equal _____kilo/calories

**N** Metabolic syndrome = hyperinsulinemia, hyperlipidemia, hypertension

**N** Average American consumes 15 teaspoons of sugar a day.

**N** Medication derived from the saliva of the Gila Monster

# Mahalo

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

Diabetes Education SERVICES

# 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)

# 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

# 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

# Diagnosis and Genetic Testing

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

# 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

# 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

# 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

# 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 |

# Why MODY Matters

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