IT'S MORE THAN NUMBERS ON A GLUCOMETER

CURRENT PRIORITIES OF DIABETES MANAGEMENT

Freepic.com

Christine Kessler MN, CNS, ANP-BC, BC-ADM, FAANP
Metabolic Medicine Associates
Journeys Weight Loss Clinic

DISCLOSURES

- **Novo Nordisk**: Advisor/Speaker (obesity, T2DM);
- **Acella:** Speaker: Hypothyroidism, desiccated thyroid extract (DTE)

All financial disclosures have been mitigated

OBJECTIVES

- List the FIVE categories of diabetes and clues to their presentation
- Identify those at risk for diabetes and/or insulin resistance
- Review the pathogenesis of Type 2 diabetes including at least 8 contributing metabolic impairments leading to dysglycemia
- Discuss laboratory findings in diagnosing prediabetes, Type 1 Diabetes and Type 2 diabetes
- Discuss how to obtain useful fingerstick blood glucose data
- Review risks and treatment of hypoglycemia
- Identify underlying neuropathy, retinopathy, and nephropathy using appropriate assessment tools

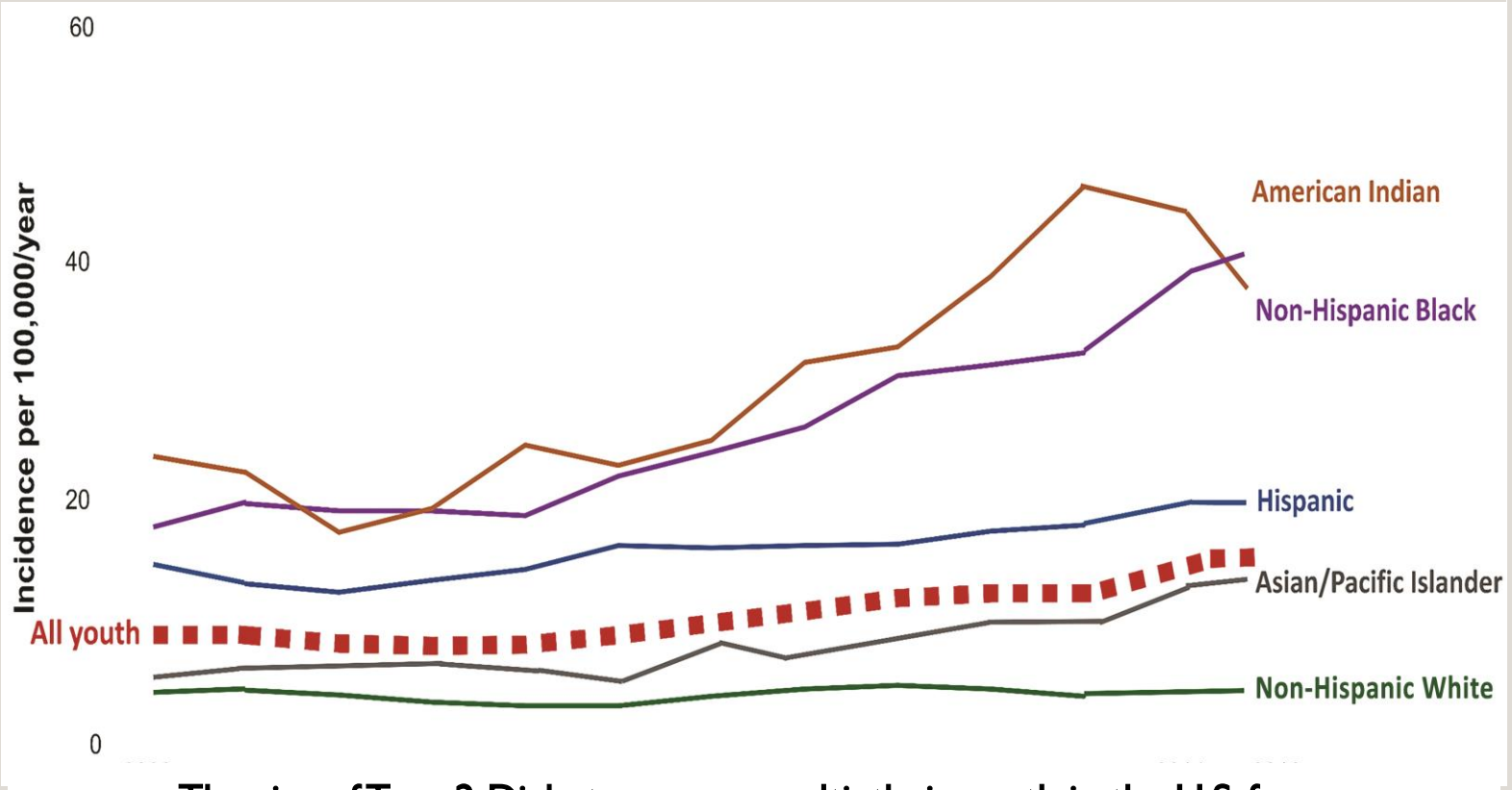
THE DIABETES EPIDEMIC

THE SWEETEST PEOPLE IN THE WORLD

- **DIABETES**
- **Total:** 37.3 million (11.3%) of the US population have diabetes
- **Diagnosed:** 28.7 million
- **Undiagnosed:** 8.5 million people
- **PREDIABETES**
- **Total:** 96 million (38.0%) adults (over 18 yrs) have prediabetes
- **65 years or older:** 26.4 million (48.8%) have prediabetes!
- 1 in 3 people estimated to have diabetes by 2050
- Every 8 seconds someone dies from something related to

diabeteshttps://www.cdc.gov/diabetes/data/statistics-report/index.html. (accessed 4/1/23)

Youth-onset T2DM



The rise of Type 2 Diabetes among multiethnic youth in the U.S. from 2002 to 2016. (the rise continues)

Expected 400% increase within next 25 years

Adapted from Diabetes Care. 2023;46(3):490-499. doi:10.2337/dci22-0046

What types of diabetes are there?

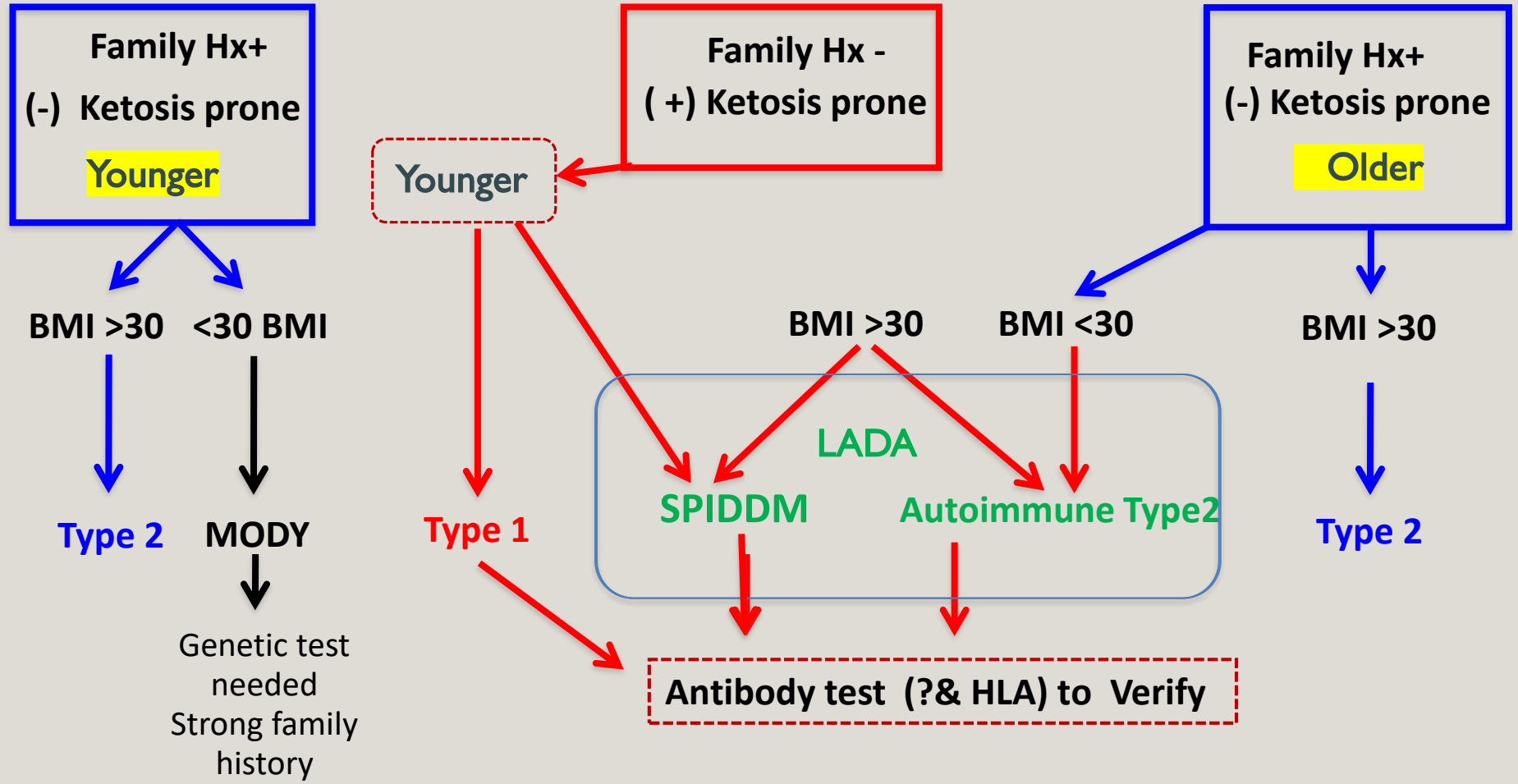
- **Autoimmune Type 1 (leads to absolute insulin deficiency)**
  - Type 1 diabetes (more rapid development)
  - Latent autoimmune diabetes in adults (LADA) (slow development)
  - An "event" will trigger the onset
- **Type 2 diabetes** (most common) (non-autoimmune)
  - progressive loss of β-cell function & relative insulin deficiency
  - Associated with IR and metabolic syndrome (now in younger pts)
- **Gestational diabetes**
  - Found in 2nd or 3rd trimester (unmasks underlying DM presence or risk)
- **MODY**
  - 4 main types (1-2% of those with DM—usually misdiagnosed)
  - HNF1-alpha; HNF1-beta; HNF4-alpha; glucokinase
- **Exocrine pancreas disease/impairment**
  - Pancreatitis, cystic fibrose, adiposity
  - Drug-induced– glucocorticoid use

Suspicions based on:
Family History (genes)
Age
Ketosis prone
BMI
Antibodies

Greater risk in those with underlying or family history of autoimmune disease

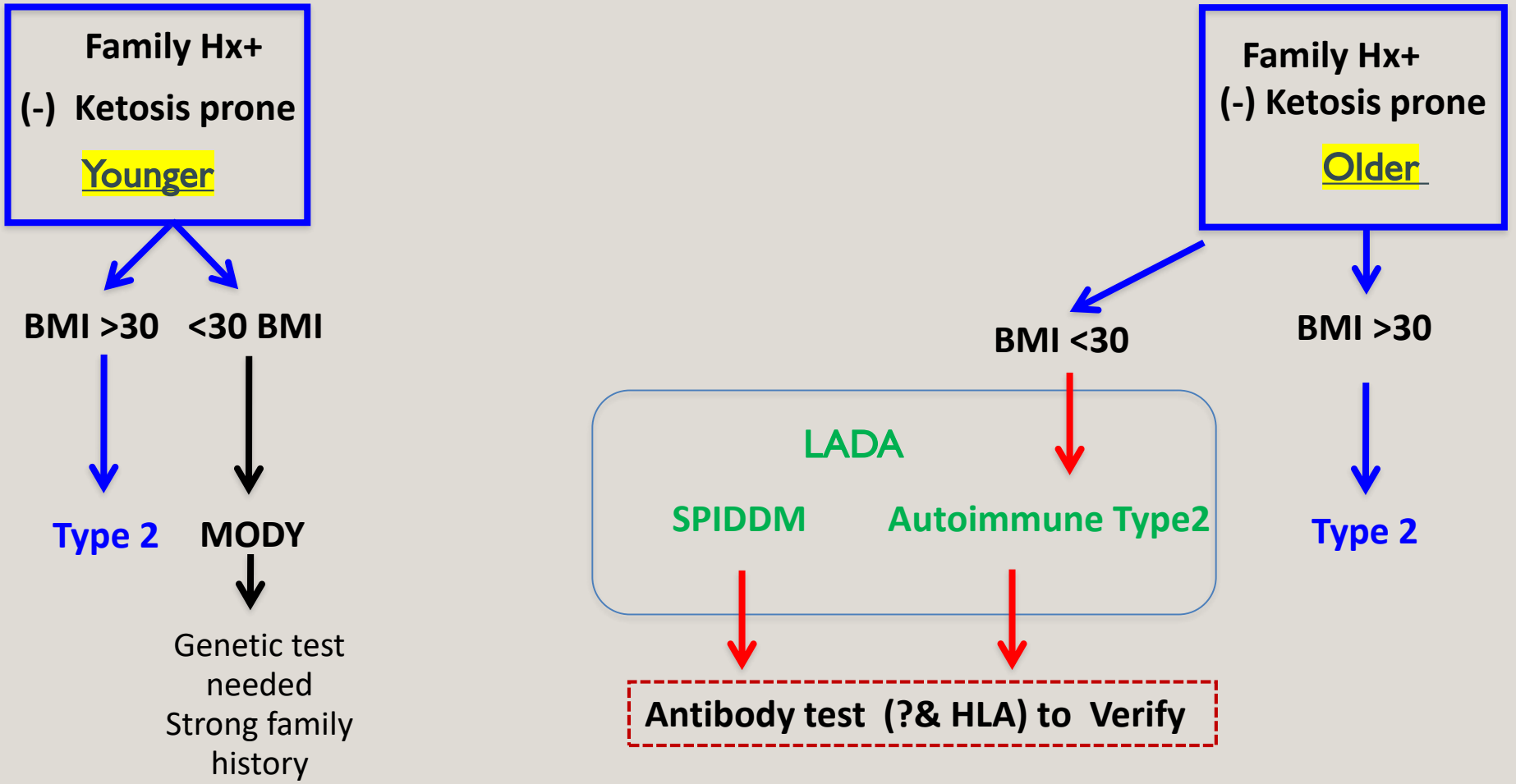
https://www.diabetesgenes.org/

TIPS TO TYPES OF DIABETES

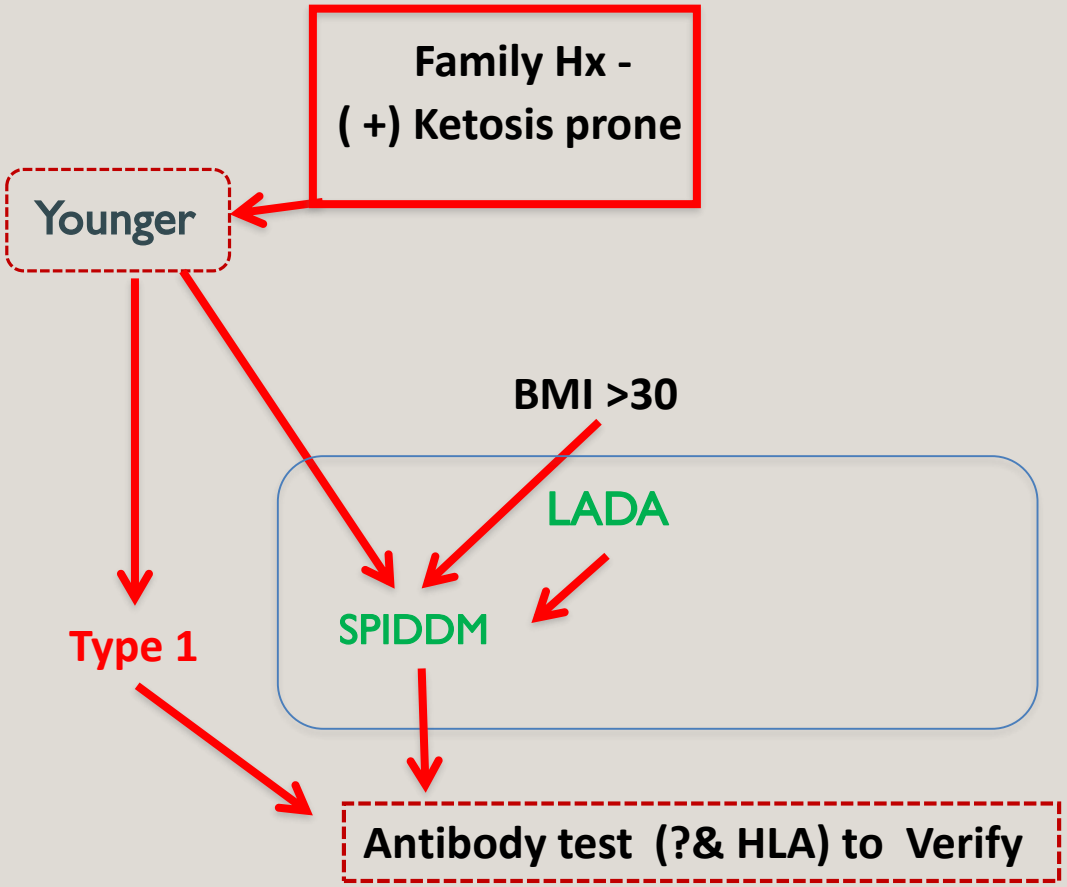


Adapted from : lecture by Stanley Schwartz MD, FACE, FACP, U of Pennsylvania

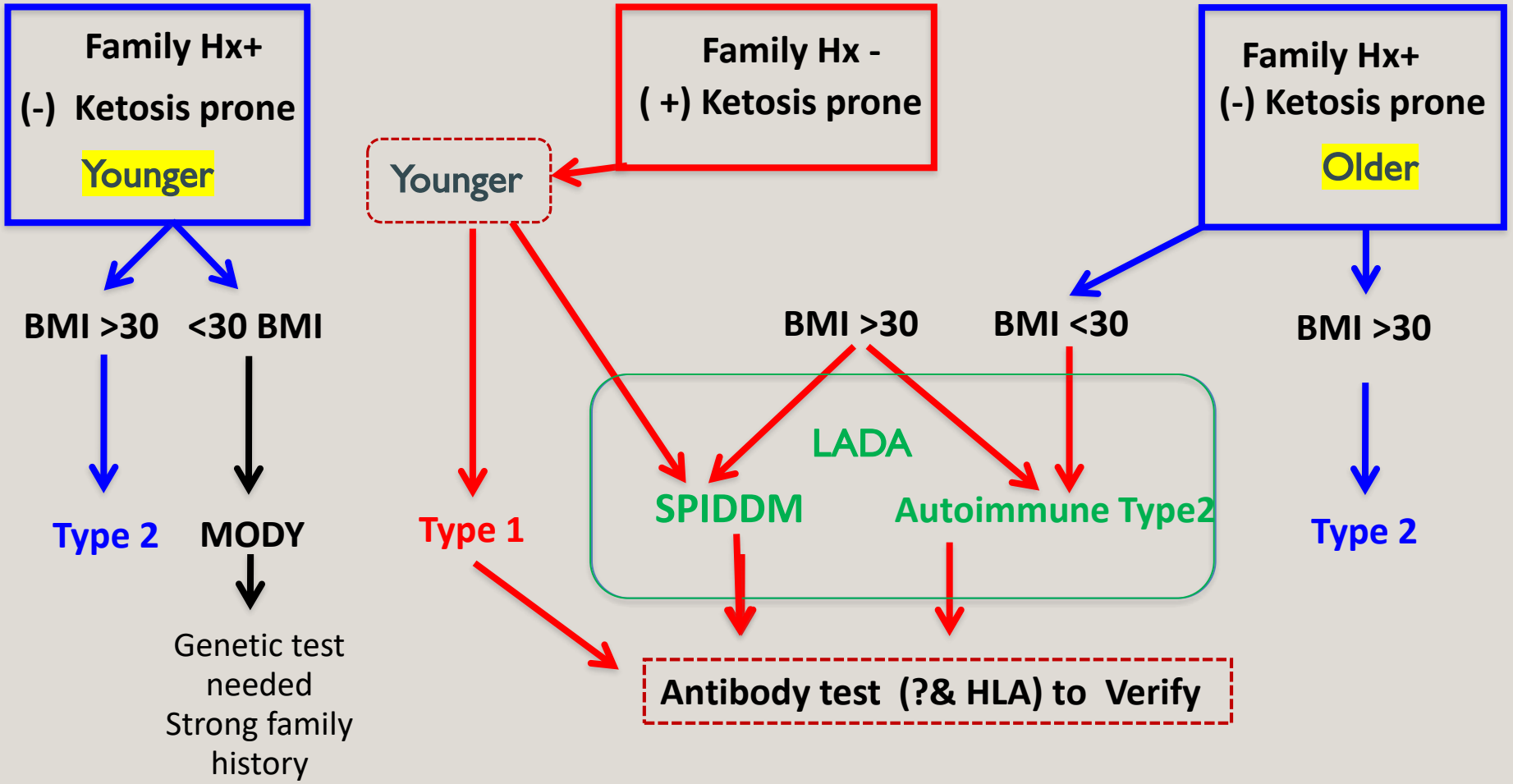
TIPS TO TYPE OF DIABETES



TIPS TO S OF DIABETES



TIPS TO TYPES OF DIABETES



Adapted from : lecture by Stanley Schwartz MD, FACE, FACP, U of Pennsylvania

Genetics-Environment-Biology

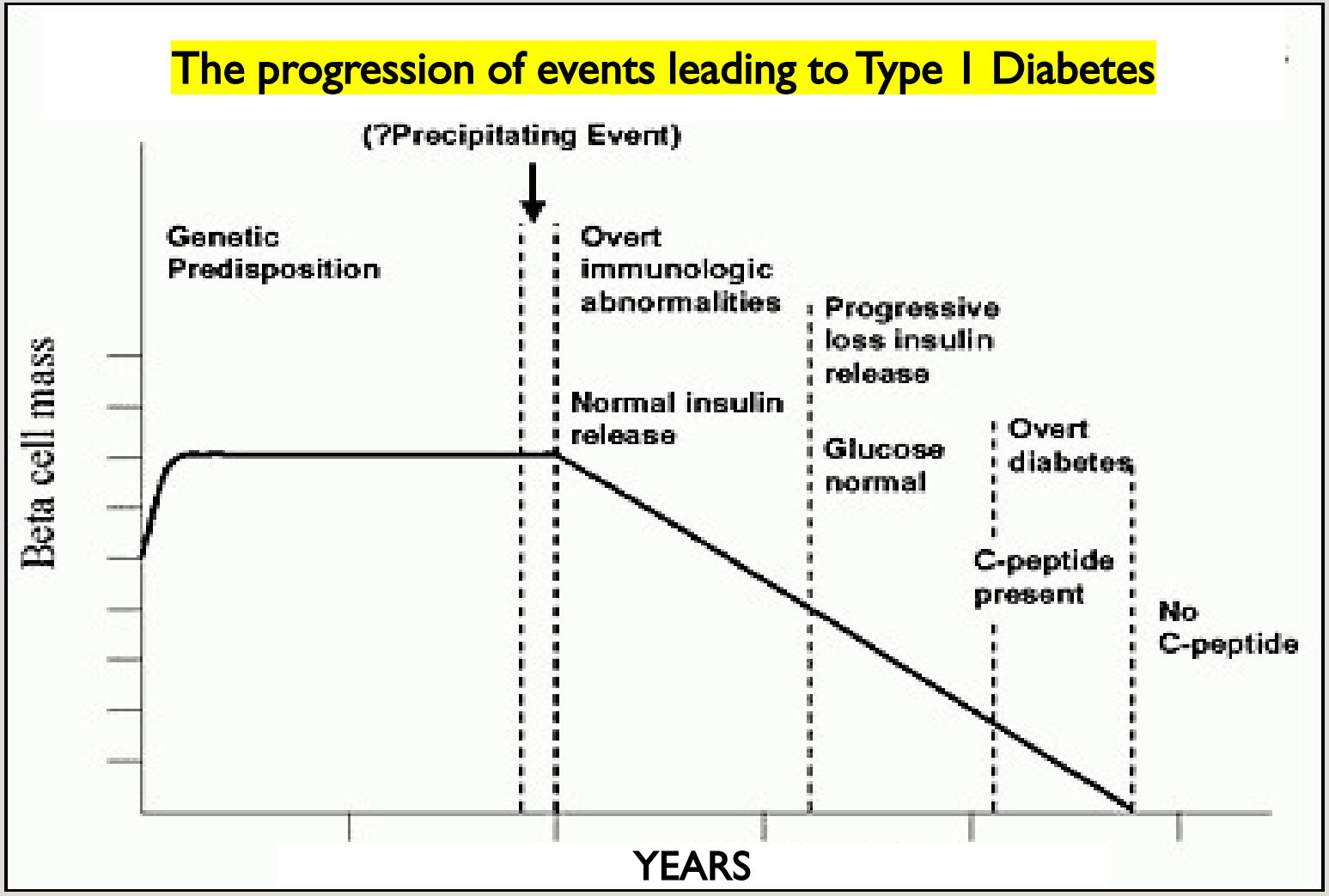


Image adapted by speaker

Examples of Triggers:

Endocrine disrupting chemical
Virus (esp norovirus,)
Certain foods (grains, bovine milk, etc
Vax reactions (yep)
Stress
PTSD
more

Michels A, Gottlieb P. Pathogenesis of Type 1A Diabetes. [Updated 2015 Mar 4]. In: Feingold KR, Anawalt B, Blackman MR, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-.

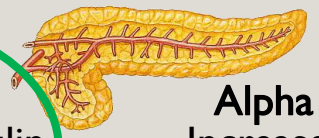
Type 1 Diabetes Stages

	Stage 1	Stage 2	Stage 3
Characteristics	• Autoimmunity	• Autoimmunity	• Autoimmunity
	• Normoglycemia	• Dysglycemia	• Overt hyperglycemia
	• Presymptomatic	• Presymptomatic	• Symptomatic
Diagnostic criteria	• Multiple islet autoantibodies • No IGT or IFG	• Islet autoantibodies (usually multiple) • Dysglycemia: *IFG and/or IGT* • FPG 100–125 mg/dL • 2-h PG 140–199 mg/dL • A1C 5.7–6.4% or ≥10% increase in A1C	• Autoantibodies may become absent • Diabetes by standard criteria

Diabetes Care 2023;46(Supplement_1):S19–S40
Diabetes 2017;66:241–255
BMJ Open 2019;9:e031586

PATHOGENESIS OF DIABETES
(INFLAMMATION & INSULIN RESISTANCE)

Pancreas



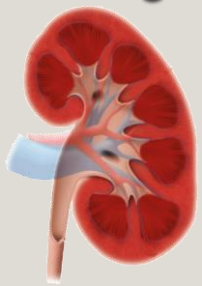
Beta cells
Decreased insulin secretion

Alpha cells
Increased glucagon secretion

Liver

Increased hepatic glucose production

Kidneys



Increased glucose reabsorption

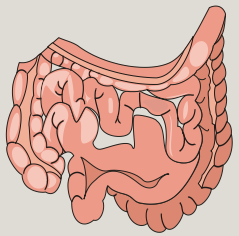
Hyperglycemia

Inflammation (cytokines)
Vascular insulin resistance

Adipose

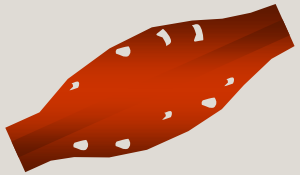
Increased lipolysis

Gut



Decreased incretins

Muscle

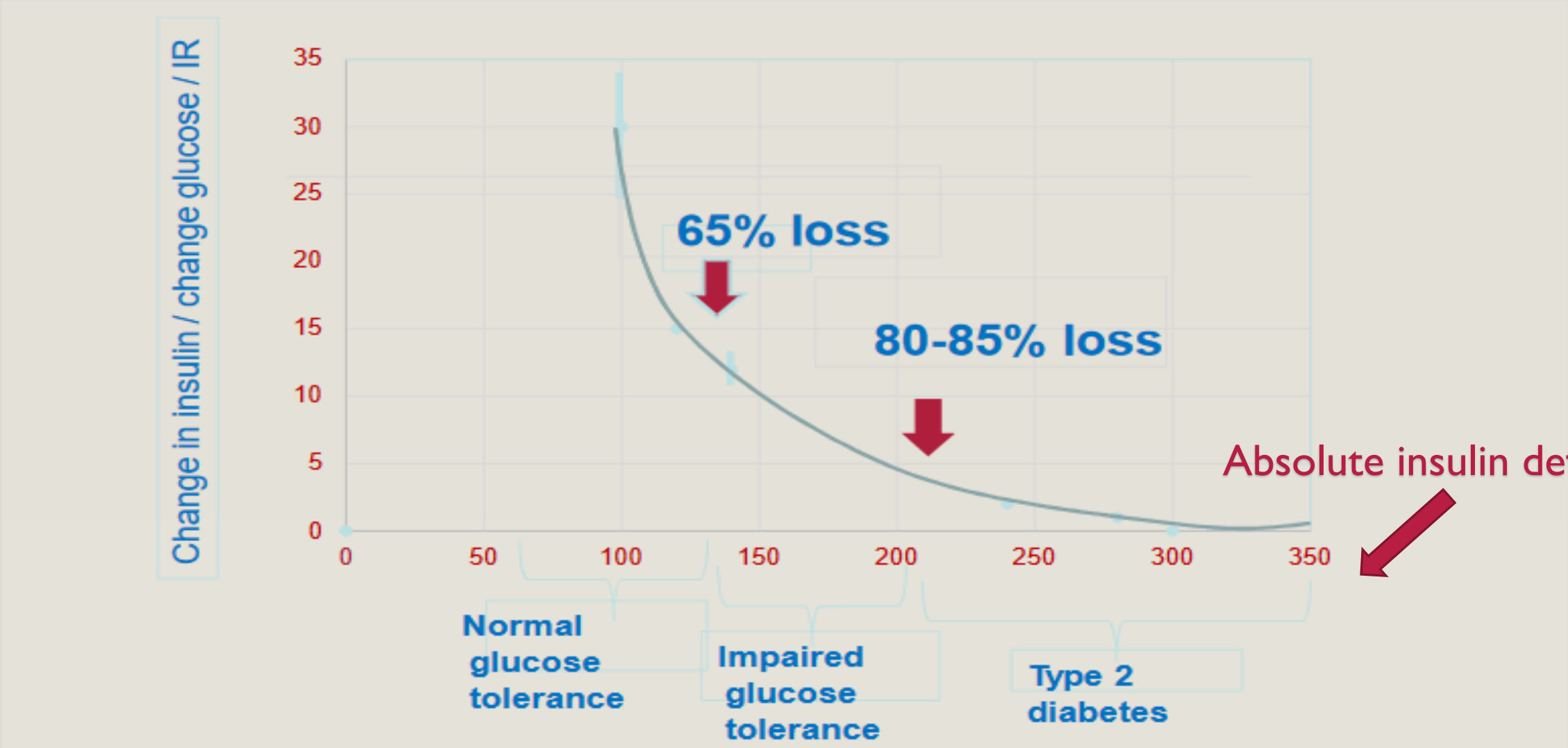


Decreased glucose uptake

Brain

Neurotransmitter dysfunction

BETA CELL FAILURE & INSULIN REDUCTION IN T2DM



Measure C-peptide

European Journal of Inflammation. 2023;21

WHO'S AT GREATER RISK FOR DIABETES?

- Family history
- Hx of Autoimmune disease (139 of these)
- Age
- Gender or ethnic influences (African American, Latino, Native American, Asian American, Pacific Islander)
- Gestational diabetes
- Hx of carpal tunnel or Duprey's contracture?
- Morbid obesity
- New onset hyperglycemia in acute care setting?

Diagnosing diabetes

	Normal	Pre Diabetes	Diabetes
Fasting	< 100	100-125	126+
Postprandial	<140	140-199	200+
HbA1c	<5.7	5.7-6.4	6.5+

ElSayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., ... & Gabbay, R. A. (2023). 2. Classification and Diagnosis of Diabetes: Standards of Care in Diabetes—2023. *Diabetes Care*, *46*(Supplement_1), S19-S40

Diagnosing diabetes

	Normal	Pre Diabetes	Diabetes
Fasting			+
Po			+
HbA1c	<5.7	5.7-6.4	6.5+

For diagnosis of Diabetes, must have TWO abnormal findings from the SAME sample (i.e, FBG and A1C)

ElSayed, N. A., Aleppo, G., Aroda, V. R., Bannuru, R. R., Brown, F. M., Bruemmer, D., ... & Gabbay, R. A. (2023). 2. Classification and Diagnosis of Diabetes: Standards of Care in Diabetes—2023. *Diabetes Care*, *46*(Supplement_1), S19-S40

POINTS ABOUT THE A1C

- Reflects AVERAGE blood glucose over a 3 month period
- It does not reflect blood glucose variations
- Its accuracy can be affected by the following:

False Increase:

Anemias (iron/Vit B12 deficiency)
Asplenia
Uremia
High triglycerides (>1750 mg/dl)
Chronic ETOH use
Chronic salicylate use
Chronic opioid use
HGB variants
Blood transfusion (high sugar in storage medium)
Vitamin C ingestion (depends on lab methods)

False Decrease:

Anemia (blood loss)
Splenomegaly
Pregnancy (1st & 2nd trimester)
Ribavirin & interferon-alpha
Vitamin E use
Blood transfusion (dilution effect)
Vitamin C ingestion (depends on lab methods)

Are there other options?

Radin MS. Pitfalls in hemoglobin A1c measurement: when results may be misleading. J Gen Intern Med. 2014 Feb;29(2):388-94.

MOST COMMON ANTIBODY TESTS FOR AUTOIMMUNE DIABETES

- **Positive rate in new-onset type 1 diabetes patients (combined analysis with 98% detection rate):**
- ✓ GAD-65 antibodies
- ✓ ICA 512 antibodies
- ✓ Insulin antibodies
- ✓ ZnT8 antibodies
- The higher the # of antibodies the higher the certainty of T1DM
- 2% of patients with T2DM have positive antibodies

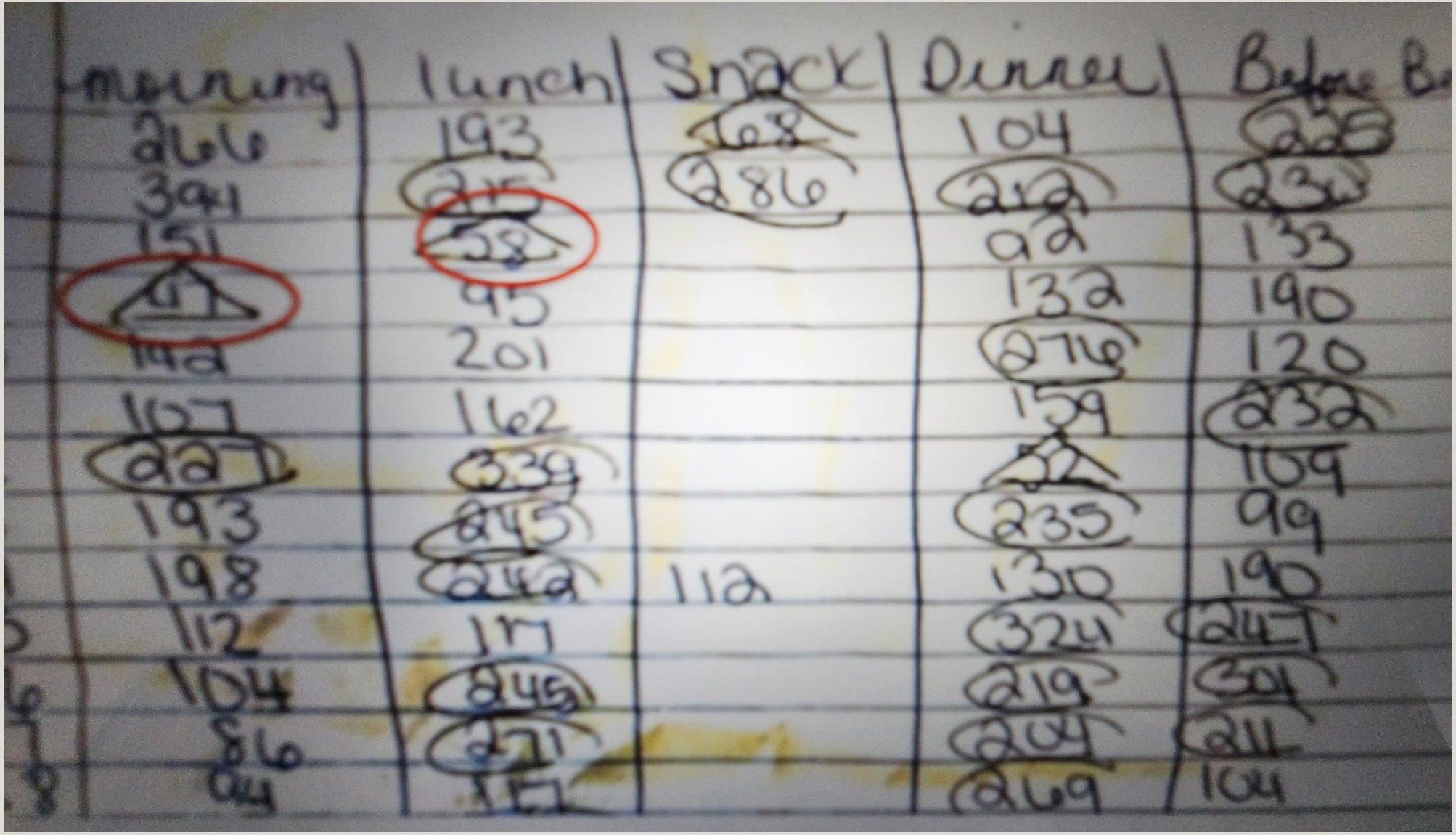
Blonde L, Umpierrez GE, Reddy SS, et al. American Association of Clinical Endocrinology clinical practice guideline: developing a diabetes mellitus comprehensive care plan-2022 update. Endocr Pract. 2022;28(10):923-1049.
Pieralice S, Pozzilli P. Latent autoimmune diabetes in adults: a review on clinical implications and management. Diabetes Metab J. 2018;42(6):451-464.

Self-monitoring blood glucose levels

Pixabay.com

Seeing is believing?

What I used to see all the time



Tips on how to use SMBG finger-sticks to get a picture of what is going on.

For the visit

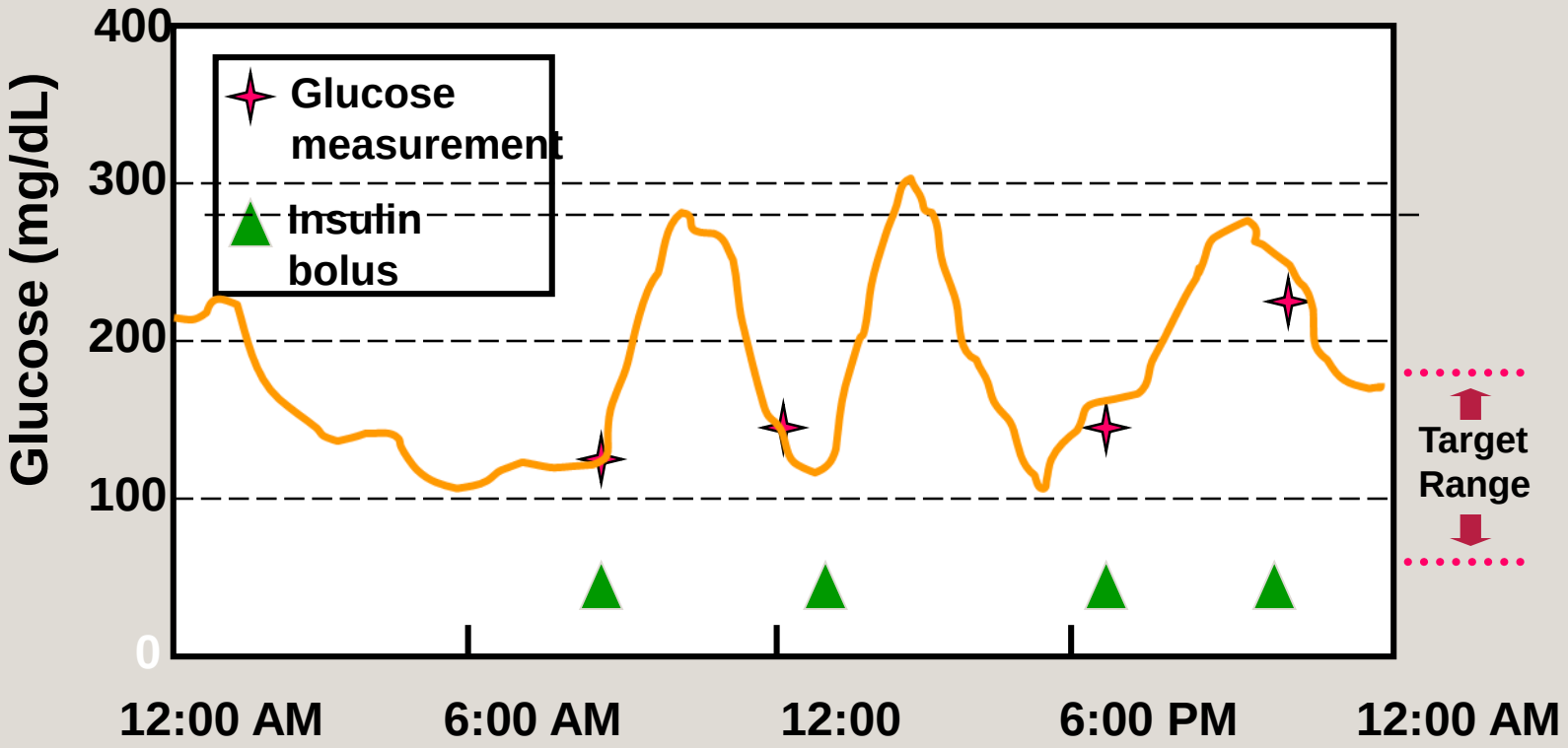
Paired tests—or 7 check in a week

	Fasting	Post Break-fast	Pre Lunch	Post Lunch	Pre Supper	Post Supper	Bed
Monday	X	X					
Tuesday							
Wed.			X	X			
Thurs.							
Friday					X	X	
Sat.							
Sunday							X

Testing 7 checks a week

	Fasting	Post Break-fast	Pre Lunch	Post Lunch	Pre Supper	Post Supper	Bed
Monday	X						
Tuesday		X					
Wed.			X				
Thurs.				X			
Friday					X		
Sat.						X	
Sunday							X

Fingerstick Blood Glucoses

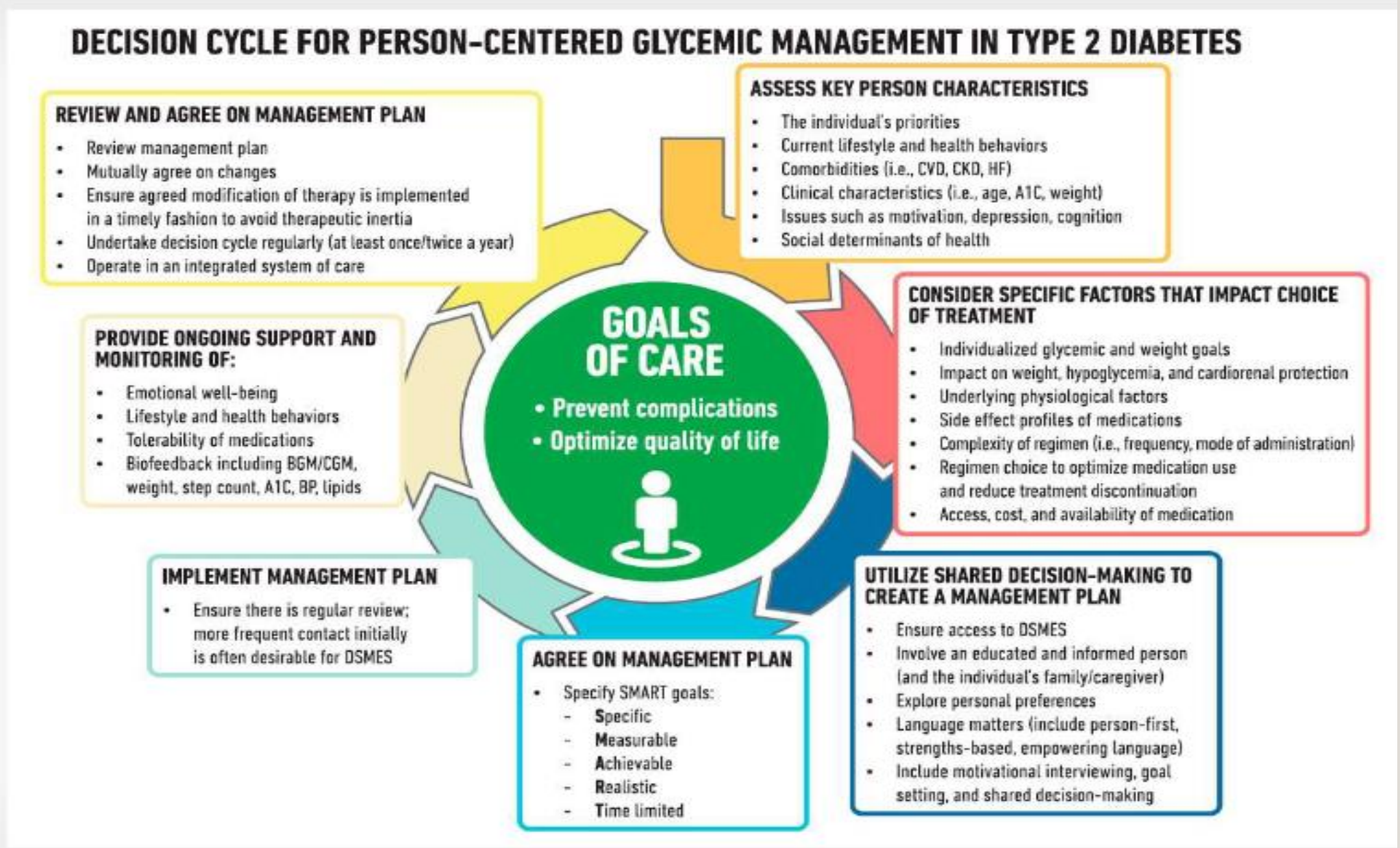


Diabetes Technology is here to STAY

diabetotech.com

It's time to medically manage the patient

What do the guidelines say?



American Diabetes Association. Standards of Care in Diabetes–2023. (Suppl. 1):S49-S670[Published: Jan 2023; Accessed: Apr 2023]

WHAT IS THE CURRENT FOCUS FOR DIABETES CARE?

- Improving glycemic control
- Preventing Beta Cell failure
- Cardiometabolic health *(macrovascular)*
  - Weight (adiposity) reduction
  - Reducing NAFLD
  - Lipid & BP stabilization
  - Monitor for PAD
  - Monitor for hypothyroidism & other CMD risk
- Screening for & treatment of the "opathies" *(microvascular)*
  - Retinopathy
  - Nephropathy
  - Neuropathy (peripheral & autonomic)

Real focus on lifestyle: dietary, activity, behaviors

Will better glycemic control help macro- & microvascular impairment?

GOALS FOR ADULTS WITH DIABETES

Risks	Goals	Less stringent goals
A1C	<7.0%	<8.0%
Blood Pressure	<140/90 mmHg	<140/90 mmHg
Cholesterol, non-HDL	<130 mg/dL	<160 mg/dL
Smoking, current	Nonsmoker	Nonsmoker
Percentage meeting all goals	**18.2 (14.6–22.5)**	**35.8 (31.7–40.2)**

Data source: 2015–2018 National Health and Nutrition Examination Survey.

GUIDELINES FOR THE "OPATHIES"

- **RETINOPATHY**
- Adults with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist within 5 years after the onset of diabetes.
- People with type 2 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist at the time of the diabetes diagnosis.
- If there is no evidence of retinopathy for one or more annual eye exams and glycemia is well controlled, then screening every 1–2 years may be considered

Diabetes Care 2023;46(Supplement_1):S203–S215

GUIDELINES FOR THE "OPATHIES"

- **Nephropathy**
- *DM & DKD doubles the risk of CV mortality*
- *DKD increases the risk of hypoglycemia*
- Annual urinary albumin (spot urinary albumin-to-creatinine ratio UACR) and eGFR assessed in T1DM ≥5 years and in all people with T2DM regardless of treatment.
- In patients with established kidney disease do the above 1-4 x annually

What are the obvious & not so obvious problems with impaired renal function in DM?

Diabetes Care 2023;46(Supplement_1):S191–S202

Monitor nephropathy risk & progression

CKD is classified based on: • Cause (C) • GFR (G) • Albuminuria (A)				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
GFR categories (mL/min/1.73 m^2) Description and range	G1	Normal to high	≥90	1 if CKD	Treat 1	Refer* 2
	G2	Mildly decreased	60-89	1 if CKD	Treat 1	Refer* 2
	G3a	Mildly to moderately decreased	45-59	Treat 1	Treat 2	Refer 3
	G3b	Moderately to severely decreased	30-44	Treat 2	Treat 3	Refer 3
	G4	Severely decreased	15-29	Refer* 3	Refer* 3	Refer 4+
	G5	Kidney failure	<15	Refer 4+	Refer 4+	Refer 4+

Diabetes Care 2023;46(Supplement_1):S191–S202

GUIDELINES FOR THE "OPATHIES"

- **Neuropathy**
- Everyone with DM should be assessed for peripheral neuropathy starting at diagnosis of T2DM & 5 years post diagnosis of T1DM and annually thereafter
- Assess for distal symmetric polyneuropathy: take careful history & assessment of either temperature or pinprick sensation (small-fiber function) and vibration sensation using a 128-Hz tuning fork (for large-fiber function).
- If NO sensation—monitor for foot ulcers and fall risk.
- Monitor for signs of autonomic neuropathy as this will indicated an increased risk CVD and mortalitiy

Diabetes Care 2023;46(Supplement_1):S203–S215

Tips for assessing peripheral neuropathy

Touch
Vibration
Temperature
Reflexes

COMPARING DISTAL DIABETES NEUROPATHIES

- **Large fiber**
- Deep seated pain
- Wasting & weakness
- Ataxia
- Numbness, tingling, pins & needles
- Impaired vibration sense
- Loss of proprioception
- Impaired nerve conduction, reflexes
- Risks of falls & injury

- **Small fiber**
- Superficial (C-type) pain
- Electric shocks, burning sensation
- Autonomic dysfunction
- Thermal imperception
- Normal strength & reflexes
- Highly symptomatic—miserable
- Associated with increased morbidity & mortality

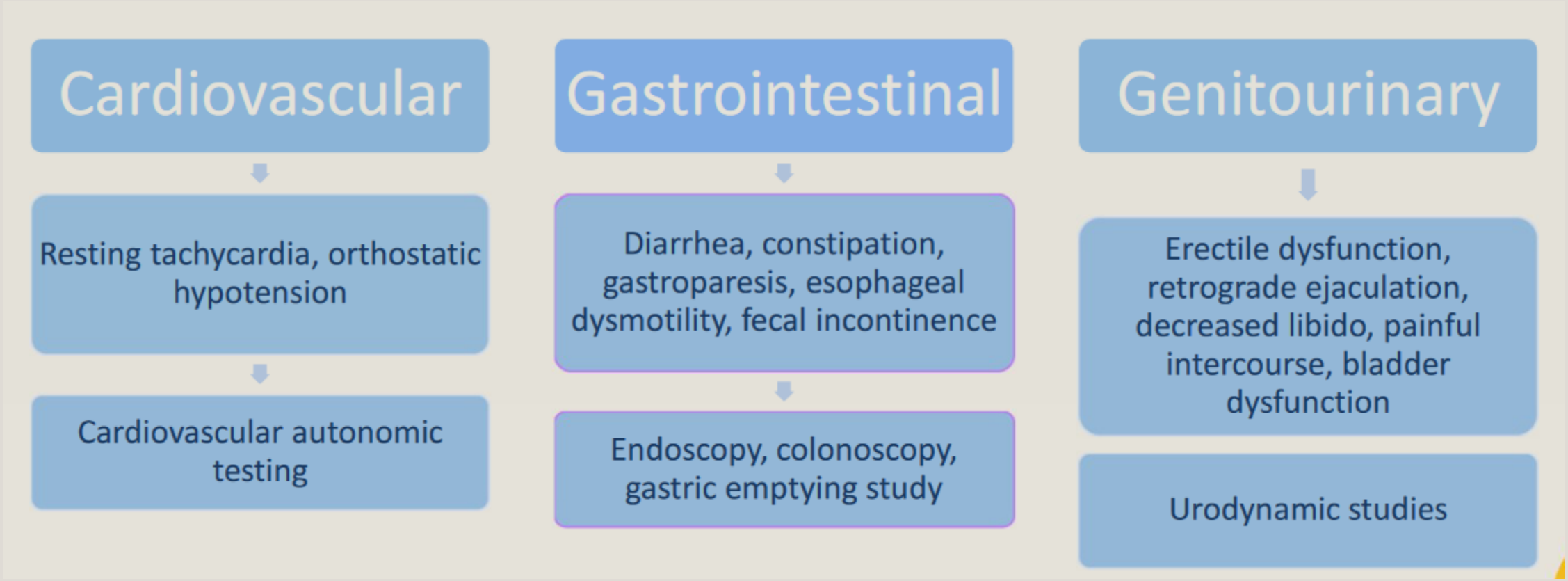
What's the worst finding?

Anandhanarayanan A, Teh K, Goonoo M, et al. Diabetic Neuropathies. [Updated 2022 Mar 15]. In: Feingold KR, Anawalt B, Blackman MR, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-.

Treatment options for peripheral neuropathy

Therapy Class	Drug Name	Precautions or contraindications
Gabapentinoids	Pregabalin, Gabapentin	Dizziness, somnolence, edema
Serotonin/Norepinephrine Reuptake Inhibitor	Duloxetine, Venlafaxine	Exacerbate restless leg syndrome, sexual dysfunction, dizziness, nausea, avoid with other serotonergic drugs
Central Acting Opioid Analgesics	Tapentadol & Tramadol	Beers Criteria,
Tricyclic Antidepressants	Amitriptyline, nortriptyline	Urinary retention, cardiac disease, avoid with other serotonergic drugs, Beers criteria
Sodium Channel Blockers	Lamotrigine, Lacosamide, Oxcarbazepine, Valproic acid	Blood dyscrasias, CNS effects, liver disease
Topical Analgesic	Capsaicin, Lidocaine patches	Local burning & irritation
Anti-seizure, antimanic	Carbamazepine, Oxcarbazepine	Liver disease, Beers criteria, Hematologic effects, cardiac disease
Nutritional Supplement, Antioxidant	Alpha Lipoic Acid	None listed

Autonomic Neuropathy– LOOK for it



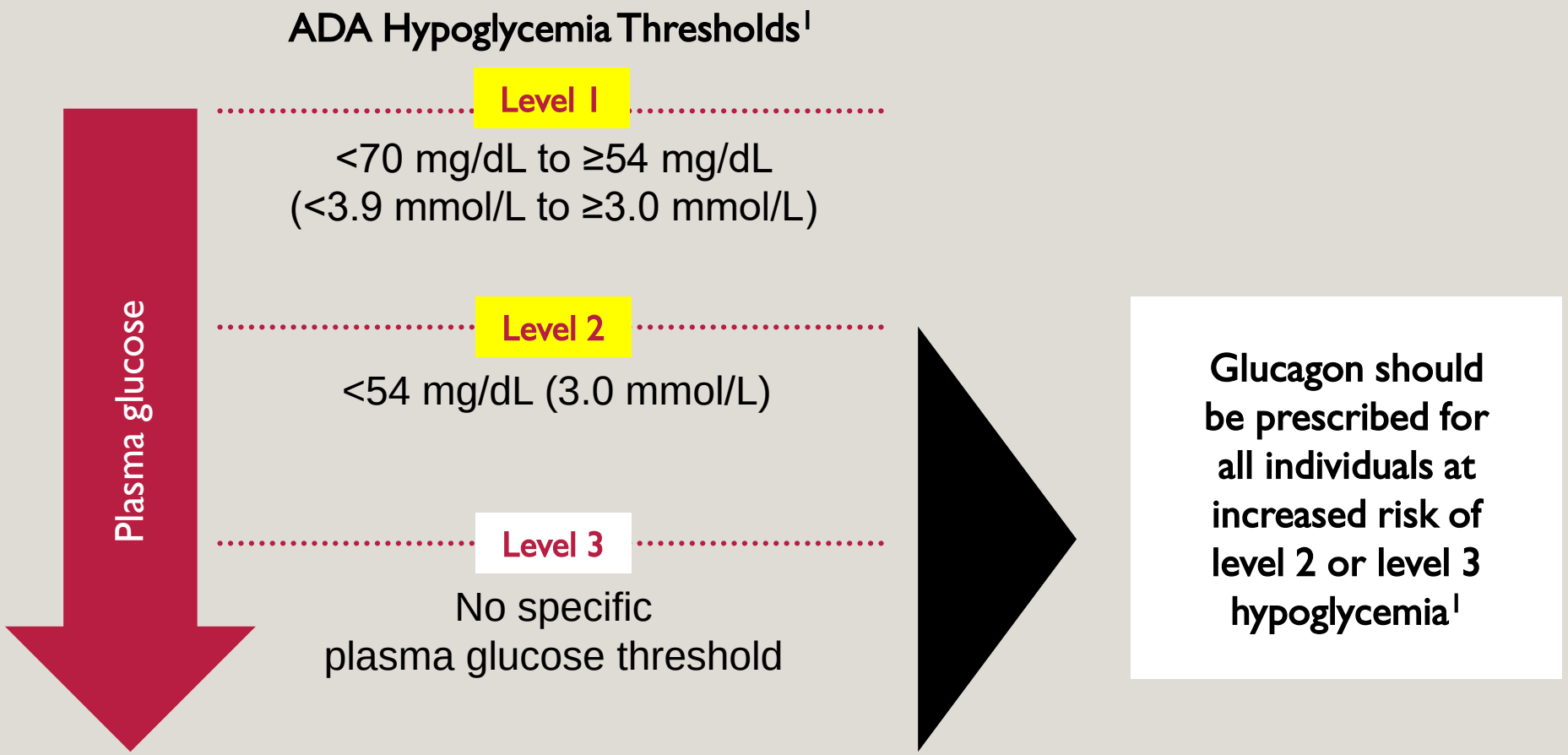
Diabetes Care 2023;46(Supplement_1):S203–S215

WHAT ABOUT HYPOGLYCEMIA RISK?

When sweet goes sour

Is your patient aware and prepared?

HYPOGLYCEMIA DIAGNOSTIC CRITERIA (PER ADA)



ADA = American Diabetes Association.1. American Diabetes Association. *Diabetes Care*. 2021;44(suppl 1):S73-S84

OCCURRENCES OF HYPOGLYCEMIA

T1DM: Pediatric incidence of symptomatic hypoglycemia (SH)

- Pediatric and adult patients receiving intensive insulin therapy have 3-fold higher risk
  - Pediatric pts average of 2 episodes of SH per week
  - 30% to 40% of adults experience SH, at an average of 1-3 episodes/year

T2DM adult patients:

- **21%** of adult patients on insulin experience **SH** once annually
  - 50% have mild/moderate episodes, with 23 events per person-year

Abraham et al. *Pediatr Diabetes*. 2018;19(Suppl. 27):178-192; 3. International Hypoglycaemia Study Group; *Diabetes Care*. 2015;38:1583-1591; 4. Edridge et al. *PloS ONE.* 2015:10:e0126427.

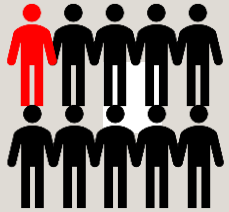
WHY IS HYPOGLYCEMIA BAD?!!

- **Hypoglycemia is associated with adverse cardiovascular outcomes:**
- Increased myocardial contractility, (increased O2 requirements)
- Prolonged QT interval with dysrhythmias *(due to a rapid drop in serum potassium from increased circulating epinephrine and norepinephrine?)*, Ischemic electrocardiogram changes and repolarization abnormalities,
- Angina, arrhythmias, increased inflammation, and sudden death
- Mechanisms for the poor outcome are not completely understood,
  - Likely d/ tincreases in *pro-inflammatory cytokines* (TNFα, IL-1β, IL-6, and IL-8), markers of lipid peroxidation,
  - And *acute endothelial dysfunction* with associated vasoconstriction, increased blood coagulability, cellular adhesion, and oxidative stress

Am Fam Physician. 2017 Nov 15;96(10):648-654.

THE SIGNIFICANCE OF SEVERE HYPOGLYCEMIA

Morbidity and mortality of SH are significant and can be barriers to adherence and intensification of diabetes treatments in patients with T1DM and T2DM.



Up to 1 out of every 10 **deaths** of patients with T1DM due to hypoglycemia[1]

"Dead-in-bed" syndrome (up to 6% of deaths in patients with T1DM <40 years of age)[4]

Up to 4x ↑ risk for falls

Additional clinical consequences

- Increased risk for cardiovascular events
- Loss of consciousness or coma
- Seizures
- Impaired cognitive function
- Increased risk for more SH episodes
- Fear, depression & quality of life impairment

SH=severe hypoglycemia; T1DM=Type 1 diabetes mellitus; T2DM=Type 2 diabetes mellitus.

1. Cryer. *Diabetes Care*. 2012;35:1814-1816; 2. Weston et al. *Diabetes Manage*. 2012;2:233-241; 3. Gagnum et al. *Diabet Med*. 2017;34:56-63; 4. Secrest et al. *Diabet Med*. 2011;28:293-300; 5. Lee et al. *Diabetes Care*. 2020;43:2060-2065; 6. Morales et al. *Am J Med*. 2014;127:S17-S24; 7. Cryer. *N Engl J Med 2013*; 369:362-372; 8. American Diabetes Association. 6-Glycemic Targets: Standards of Medical Care in Diabetes 2020. *Diabetes Care*. 2020;43(Suppl 1):S66–S76; 9. American Diabetes Association. 5-Facilitating behavior change and wellbeing to improve health outcomes: Standards of Medical Care in Diabetes 2020. *Diabetes Care*. 2020;43(Suppl 1):S48–S65; 10. Ross. *Am J Med*. 2013;126(9 Suppl 1):S38-S48.

HYPOGLYCEMIA RISK MEDICATIONS & CONDITIONS

- warfarin
- quinine
- salicylates
- fibrates
- Sulfonamides (including co-trimoxazole)
- monoamine oxidase inhibitors
- NSAIDs
- probenecid
- somatostatin analogues
- selective serotonin reuptake inhibitors.
- loss of counter-regulatory hormone function, (e.g., Addison's disease, growth hormone deficiency, hypothyroidism, or hypopituitarism.)

Am Fam Physician. 2017 Nov 15;96(10):648-654.

MANIFESTATIONS OF HYPOGLYCEMIA

- Feeling shaky
- Being nervous or anxious
- Sweating, chills and clamminess
- Irritability or impatience
- Confusion
- Fast heartbeat
- Feeling lightheaded or dizzy
- Hunger
- Nausea
- Color draining from the skin (pallor)

- Feeling sleepy
- Feeling weak or having no energy
- Blurred/impaired vision
- Tingling or numbness in the lips, tongue or cheeks
- Headaches
- Coordination problems, clumsiness
- Nightmares or crying out during sleep
- Seizures

TREATMENT OF OUTPATIENT HYPOGLYCEMIA

- Prevention!
- Quick recognition of symptoms (neuronal starvation)
- Rapid-acting carbohydrate
- Glucagon

CARBOHYDRATE TREATMENT

- **Patient must be conscious and able to swallow!!!**
- The *rule of 15* : Administer approximately 15 g (or 20 g) of rapid-acting carbohydrate and check BG 10-15 minutes later
  - Repeat dose as needed x 3.
  - If sugars still low---need glucagon

FAST-ACTING CARBOHYDRATE POINTERS

- **Forms of rapid-acting carbs**
  - Sucrose & glucose best (tabs, syrup, drinks)
  - Is orange juice best?
  - What about chocolate or milk?
- **Amount of carbohydrates is best?**
  - Which is the most effective…10g, 15 g, or 20 g?
  - Should it be weight-dosed?
- **Time to resolution of symptoms**
  - If not resolved quickly it will lead to an even slower response with next dose
  - How soon should you really wait to recheck sugars….5 minutes?,10 minutes? Longer?

GLUCAGON ADMINISTRATION

- Glucagon kits are reconstituted with the provided solution to a 1 mg/mL clear, particulate-free solution. The entire 1 mg (1 mL) is administered SC or IM
- Other formulations of glucagon (premixed injectable solutions and nasal sprays) have recently been developed
- **Reversal of hypoglycemia relies on sufficient hepatic glycogen stores and other factors. Patients normally respond within 15 minutes;**
- *Will Not work in those with alcohol toxicity (blunted glycogen response)*
- **ONLY USE ONCE—do not repeat (won't work)**
- **NEW glucagon pens and nasally-inhaled glucagon (*Zegalogue, Gvoke, BAQSIMI*)**

Am J Health Syst Pharm. 2015;72(19):1631-1641.
US Pharm. 2018;43(10):HS2-HS6

So what pills, pokes and potions do we have for diabetes treatment?

ORAL MEDICATIONS FOR DIABETES

Biguanides
*metformin

Sulfonylureas
*glipizide
*glyburide
*glimepiride

Thiazolidinediones (TZDs)
*pioglitazone (Actos)
rosiglitazone (Avandia)

GLP-1 agonists
semaglutide (Rybelsus)

DPP-4 Inhibitors
sitagliptin (Januvia)
saxagliptin (Onglyza)
linagliptin (Tradjenta)
alogliptin (Nesina)

SGLT 2 Inhibitors
dapagliflozin (Farxiga)
canagliflozin (Invokana)
empagliflozin (Jardiance)
ertugliflozin (Steglatro)
Bexagliflozin (Brenzavvy)

Meglinatides
*nateglinide (Starlix)
*repaglinide (Prandin)

Alpha-glucosidase inhibitors
*acarbose (Precose)
*miglitol (Glyset)

Bile acid sequestrants
*colesevelam (Welchol)

Dopamine agonist
bromocriptine (Cycloset ONLY)

* = generic available

INJECTABLE MEDICATIONS FOR DIABETES

GLP-1 agonist
liraglutide (Victoza)
dulaglutide (Trulicity)
exenatide ER (Bydureon, Bcise)
exenatide (Byetta)
Semaglutide (Ozempic)

GLP-1/GIP agonist
tirzapetide (Mounjaro)

Basal Insulin
insulin glargine u100*
(Lantus, Basaglar)
insulin detemir u100 (Levemir)
insulin glargine u300 (Toujeo)
insulin degludec u100 or u200
(Tresiba)

Rapid Acting Insulin
insulin glulisine (Apidra)
insulin lispro u100 or u200
(Humalog)
insulin lispro-aabc u100or u200
(Lyumjev)
insulin aspart (Novolog, Fiasp)
insulin human inhaled (Afrezza)

Regular Insulin
insulin regular human u100
(Humulin R, Novolin R, Relion R)
Insulin regular human u500
(Humulin R u500)

Intermediate Insulin
Human insulin isophane, aka NPH
(Humulin N, Novolin N,Relion N)

Split mixes
Humulin 70/30 (70% NPH, 30% regular)
Novolin 70/30 (70% NPH, 30% regular)
Relion 70/30 (70% NPH, 30% regular)
Humalog 50/50 (lispro /lispro protamine)
Humalog 75/25 (75% lispro protamine, 25% lispro

Mixed injectables – GLP1 and basal insulin
insulin degludec and liraglutide (Xultophy)
insulin glargine and lixisenatide (Soliqua)

Amylin mimetic
Pramlinitide (Symlin)

*Indicates units per mL:
u100 = 100 units/mL,
u300 = 300 units/mL, etc.

MORE ON WHY, HOW AND WHEN TO USE THESE MEDICATIONS LATER!

WHAT O-T-C SUPPLEMENTS OR FOOD MIGHT YOUR PATIENTS BE TAKING FOR DIABETES PREVENTION OR CONTROL?

Do they help?

- Cinnamon
- Chromium
- Vitamin B1
- Bitter Melon
- Alpha lipoic acid
- Aloe Vera
- Green tea
- Resveratrol
- Magnesium
- Others…..

Ahmad R, AlLehaibi LH, AlSuwaidan HN, Alghiryafi AF, Almubarak LS, AlKhalifah KN, AlMubarak HJ, Alkhathami MA. Evaluation of clinical trials for natural products used in diabetes: An evidence-based systemic literature review. Medicine (Baltimore). 2021 Apr 23;100(16):e25641
Deyno S, Eneyew K, Seyfe S, et al. Efficacy and safety of cinnamon in type 2 diabetes mellitus and pre-diabetes patients: A meta-analysis and meta-regression. Diabetes Res Clin Pract. 2019 Oct;156:107815

Can we cure diabetes?

References

- American Diabetes Association. Standards of Care in Diabetes–2023. [Published: Jan 2023; Accessed: Apr 2023]
- Wei Perng, Rebecca Conway, Elizabeth Mayer-Davis, Dana Dabelea; Youth-Onset Type 2 Diabetes: The Epidemiology of an Awakening Epidemic. Diabetes Care 1 March 2023; 46 (3): 490–499.
- Khin PP, Lee JH, Jun H-S. Pancreatic Beta-cell Dysfunction in Type 2 Diabetes. European Journal of Inflammation. 2023;21
- Anandhanarayanan A, Teh K, Goonoo M, et al. Diabetic Neuropathies. [Updated 2022 Mar 15]. In: Feingold KR, Anawalt B, Blackman MR, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-.
- Ahmad R, AlLehaibi LH, AlSuwaidan HN, Alghiryafi AF, Almubarak LS, AlKhalifah KN, AlMubarak HJ, Alkhathami MA. Evaluation of clinical trials for natural products used in diabetes: An evidence-based systemic literature review. Medicine (Baltimore). 2021 Apr 23;100(16):e25641
- Deyno S, Eneyew K, Seyfe S, et al. Efficacy and safety of cinnamon in type 2 diabetes mellitus and pre-diabetes patients: A meta-analysis and meta-regression. Diabetes Res Clin Pract. 2019 Oct;156:107815
- Sánchez M, González-Burgos E, Iglesias I, et al. Pharmacological Update Properties of Aloe Vera and its Major Active Constituents. Molecules. 2020 Mar 13;25(6):1324.
- Abraham et al. Pediatr Diabetes. 2018;19(Suppl. 27):178-192; 3. International Hypoglycaemia Study Group; Diabetes Care. 2015;38:1583-1591; 4. Edridge et al. PloS ONE. 2015:10:e0126427.

Time for a brain break

ckessler@maranatha.net