



How to Prevent Diabetes & Diabetes Complications [and...Protect Your Vision]

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Why Do We Want to Prevent Diabetes?

- #1 Cause of new blindness in Americans of working age (< 70)
- #1 cause of kidney failure in the US
- #1 cause of non-traumatic amputation in the US
- 2-4X the risk of heart attack and stroke
- Double the risk of dementia
- Managing diabetes in a pain in the  !!!

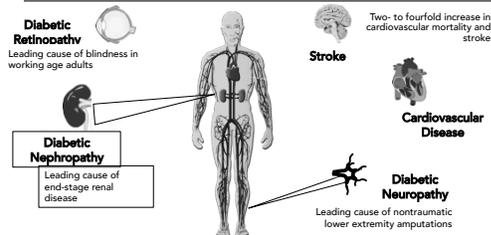
Eye Opening Stats

- **About 40 million Americans have diabetes**
- **>100 million Americans will have diabetes by 2050**
- **> 100 million have prediabetes and are likely to develop type 2 diabetes IF they live long enough**

We Need a Whole Lot of Prevention



DIABETES HEALTH IMPACT



Diabetes Complications

- Only occur in tissues containing:
- **Blood Vessels**
- **Nerves**
- **Proteins.....**



Two Main Types

- **Type 1 diabetes (T1D)** – the body’s immune system kills cells in the pancreas that make insulin
- **Type 2 diabetes (T2D)** – the body can’t use insulin properly and loses the ability to produce insulin over time

What Goes Wrong in DM?

Blood glucose levels become elevated secondary to:

Inadequate Insulin Production
(both T1DM and T2DM)

Insulin
Deficiency

and/or

Loss of Cellular Response to Insulin
AKA ‘Insulin Resistance’ (T2DM)

Insulin
Resistance

Let’s Dispense with Some ‘Silly’ Stuff First Common Misunderstandings

- Use of insulin means a person with type 2 DM now has type 1 DM
- Only overweight/obese people get type 2 diabetes
- type 2 diabetes is the ‘good kind’ of diabetes

Who Gets Diabetes?

- Transmission of type 2
 - If 1 parent with T2DM, then 20% risk
 - If 2 parents with T2DM, then 60% risk
 - 60-75% in identical twins
- Transmission of type 1
 - If father has T1DM, then 5-15% risk
 - If mother has T1DM, 1-5% risk
 - If both parents have T1DM, then 10-25%
 - 25-50% in identical twins



Rev Diabet Stud. 2015 Fall-Winter;12(3-4):233-42.

T2DM is Far More ‘Transmissible’ than T1DM!!

- After controlling for age, gender, BMI, BP, race, and socioeconomic status, patients with high familial diabetes risk (≥ 2 first order relatives or ≥ 1 first + ≥ 1 second order relative) are **5.5 times** more likely to develop T2DM than the population average
- Source: NHANES 163,000 US Adults

Diabetes Care. 2007 Oct;30(10):2517-22, Epub 2007 Jul 18
Public Health Genomics. 2010;13(6):353-9.

Misconception

- It is completely patients’ own fault if they develop type 2 diabetes due to poor lifestyle choices
- **FACT:** There are myriad environmental factors beyond individual control that increase the risk of T2DM

Nature/Nurture in T2DM

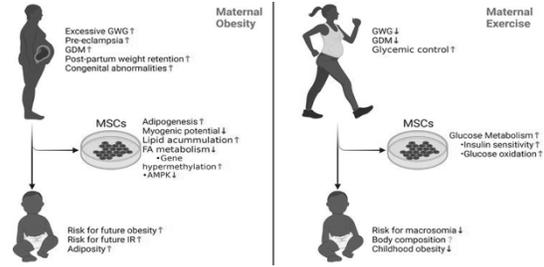
- **Analysis of MESA/NHANES (n = 89K) shows that excess weight is the SINGLE biggest contributor to T2DM onset in the US, accounting for 30-53% of total risk** J Am Heart Assoc. 2021 Feb 16;10(4):e018799.

BUT ...

- **Gene-wide associated studies (GWAS) show that T2DM is a polygenic disease with 30-70% heritability depending on specific phenotype**

Nutrients. 2022 Aug 4;14(15):3201.

Influence of Maternal Diabetes on Offspring



Nature/Nurture in T2DM

- ...about a fifth of the global T2DM burden is attributable to PM_{2.5} (fine particulate matter ≤ 2.5 microns diameter)



GBD 2019 Diabetes and Air Pollution Collaborators. Estimates, trends, and drivers of the global burden of type 2 diabetes attributable to PM_{2.5} air pollution, 1990-2019: an analysis of data from the Global Burden of Disease Study 2019. Lancet Planet Health. 2022 Jul;6(7):e586-e600.

Nature/Nurture in T2DM

- **Food insecurity** is associated with **DOUBLE** the risk of T2DM and diabetic retinopathy
- Food insecurity is **CAUSALLY** linked to T2DM and poor glucose control
- Food insecurity is associated with consumption of highly processed, cheap foods, elevated cortisol, obesity and insulin resistance

Diabetes Care 2021 Jun; 44(6): e131-e132
J Nutr. 2019 Jun 1;149(6):982-988.

What Causes Diabetes? --- Everything!



Source: A. Paul Chous, O.D.

Bottom Line

- **We have created a diabetogenic environment**
- **Obesity is not the only risk for T2DM**

Practical Tips To Avoid Diabetes

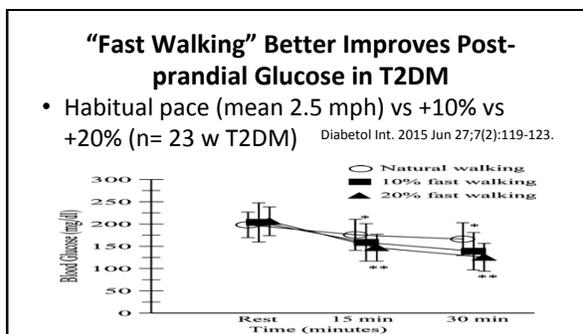
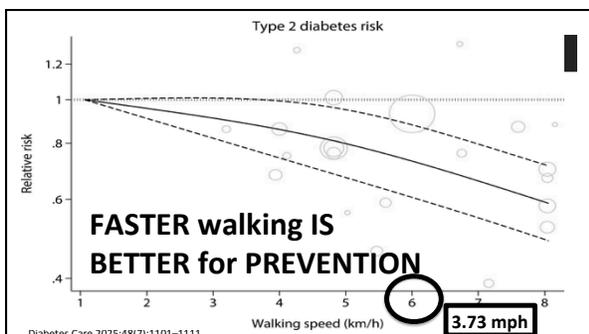
- Exercise 30 minutes each day (soon after waking)
- Eat a predominantly plant based diet including a variety of fruits and vegetables and more vegetables, including fermented foods
- Minimize processed meats
- Drink coffee or tea
- Sleep > 6 hours per night and < 9 hours
- Get your serum vitamin D > 40 ng/ml
- Don't smoke
- Live away from smog
- Breast Feed
- Turn down the thermostat
- Reduce Light at Night



Source: AP Chous

How Do We Prevent Diabetes?

- Find out if YOU are at risk
- Do you have prediabetes?
- www.dohaveprediabetes.org
- **About 40 million Americans have diabetes** (9 million don't know it) and another **100 million have prediabetes**



Eat a Mediterranean-Type Diet

- Significantly lowers the risk of type 2 diabetes (T2D) [50% lower risk in the PREDIMED trial]
- **Also significantly lowers the risk of AMD AND the risk of dry AMD becoming wet AMD**



Eat a Diet that Promotes a Healthy Gut Microbiome

- Avoid processed foods, saturated fats and added sugars, and artificial sweeteners like aspartame that increase diabetes risk
- Favor a plant-based diet with lots of fiber
- Eat fermented foods (pickles, sauerkraut, kimchi)
- **Abnormal microbiome has been linked to diabetes and AMD**



Eat a VARIETY of Foods Containing Flavonoids

- Berries
- Red grapes
- Black and Green Tea
- Citrus
- Kale
- Apples
- Onions
- Dark Chocolate



Recent research shows that higher VARIETY of flavonoid-rich foods reduces diabetes Risk by 20%

Nat Food 6, 668-680, (2025), <https://doi.org/10.1038/s43016-025-01176-1>

Get Adequate Sleep

- Short and long sleep (< 6 hrs or > 9 hrs) both increase the risk of diabetes
- Untreated sleep apnea increases the risk of diabetes
- Do NOT look at your phone or computer screen within an hour of going to bed

What Else Can Patients Do to Lower the Risk of Developing Diabetes... but are rarely told by their HCPs?

- **Drink coffee (NOT instant coffee!)**
- **Breast Feed Longer**
- **Avoid most artificial sweeteners**
- **Consider fasting**

Coffee is Protective

- Multiple studies show that caffeinated and decaffeinated coffee consumption reduces the risk of developing type 2 diabetes after all controls
- Not caused by lowering blood glucose
- Chlorogenic acid (CGA) reduces fatty liver disease, preserves functioning beta cells and activates Nrf2 – the master switch of antioxidant defense
 - **11% decreased risk per additional cup**



Koib H, Martin S, Kempf K. Coffee and Lower Risk of Type 2 Diabetes: Arguments for a Causal Relationship. *Nutrients*. 2021;13(4):1184. Published 2021 Mar 31. doi:10.3390/nu13041184
Eur J Clin Nutr (July 2015). Web. 30 July 2015.

Breast Feeding and DM Risk

- **Women who breast feed are 32% less likely to develop T2DM after all controls – each additional year reduces risk 9%**

Acta Paediatr. 2015 Jul 14.



I Did The Math....

- **Drinking 20 or more cups of coffee daily will lower diabetes risk 95%**
- **Breast Feeding your child until age 23 will reduce risk of diabetes by 98%**



Wear a CGM to Better Assess Your Blood Glucose Levels

- CGM = continuous glucose monitor
- Allows you to learn what foods affect your blood sugar and take corrective action
- OTC options can be purchased without a prescription
- **Easily the most beneficial diabetes technology of the last 20 years**



**OTC devices without
A prescription**

Consider Fasting

- Improves microbiome diversity → better blood sugar & blood pressure
- Can cause remission of type 2 diabetes
- Korean study found that intermittent fasting (skipping breakfast) reduced AMD

Preventing...



Good NEWS!!

- **Preventing diabetes complications includes EVERYTHING we have already discussed...**
- **PLUS, a few more things...**

KEY POINT

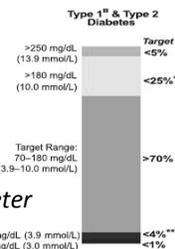
•Some tissue and cell types are insulin independent

- Retina
- Renal Glomeruli
- Aorta
- Neuronal microvessels

This makes these sites susceptible to hyperglycemic insult even in the total absence of insulin

Glucose Time-in-Range

Definition: The % of any given time period that blood glucose readings are in a relatively normal range (70-180 mg/dL)



*A1c test DOES NOT tell you this

*Home glucose readings on a meter DO NOT tell you this

Why Time-In-Range Matters

A 10% increase in Glucose TIR has been shown to reduce the risk of diabetic retinopathy incidence & worsening by > 40% in both Type 1 and Type 2 diabetes → INDEPENDENT of A1c..

→ Better TIR (> 70% vs < 50%) also linked to >30% reduced risk of MACE in T2DM (MI, stroke, bypass surgery)

Everett EM. Leveraging Continuous Glucose Monitors to Reduce the Risk of Diabetic Retinopathy. JAMA Netw Open. 2024;7(3):e240718.
Diabetes Technol Ther. 2023 Jun;25(6):378-383.

To Avoid Heart Disease & Stroke

- Get good blood sugar, pressure and lipid control as soon after diabetes diagnosis as possible (legacy effect)
- GOALS; A1c < 7%, TIR > 70%, BP < 135/85, LDL-cholesterol < 70

To Avoid Kidney Disease, Heart Disease and Vision Loss

- Take an ACE inhibitor or angiotensin receptor blocker drug if you have high blood pressure (a -pril or a -sartan)
- Ask your physician about the cardio-renal benefits of an SGLT2 inhibitor (like Jardiance or Farxiga)
- Consider a GLP-1 drug if you are above ideal body weight (**tirzepatide better than semaglutide**)



Ozempic Arm

Consider Fasting

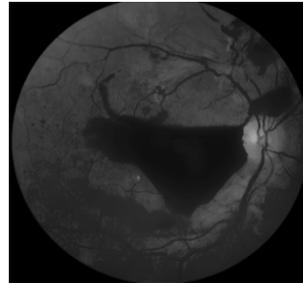
- Helps with weight loss
- Improves the gut microbiome
- Cheapest weight loss regimen

Get a Dilated Eye Exam Every Year if You Have Diabetes

- Visual symptoms occur LATE in the game
- Most patients have significant damage by the time they notice any symptoms
- Regular eye examinations are the BEST WAY to catch diabetes-related eye problems and treat them before vision is lost

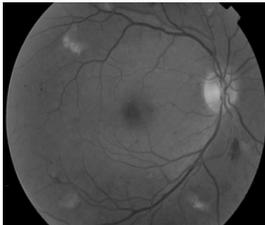
Critical Message for Diabetes Patients

Good Vision On an Eye Chart
or Daily Life
≠ Healthy Eyes



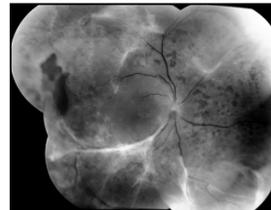
Many patients with diabetic retinopathy have good vision until The day they don't

The Last patient started Here



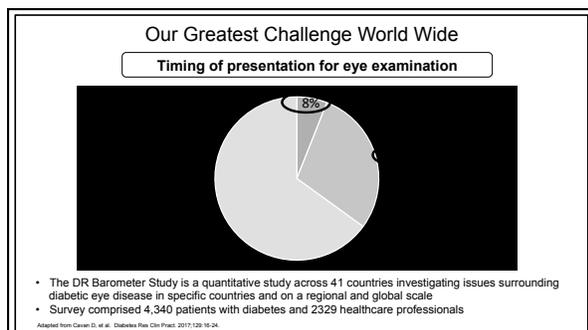
Early DR
20/20 Vision
NO SYMPTOMS

Became LTFU
(lost-to-followup)



Retinal Detachment from PDR
20/2000 Vision

THIS is what we are ALL Trying to PREVENT



In-Office Awareness

- Hypoglycemia versus Hyperglycemia
- **High blood sugar affects refractive error in phakic patients**
- **High blood sugar causes Diabetic Retinopathy and is linked to other major eye diseases:**
 - Cataract, corneal infection, glaucoma, retinal vascular occlusion, dry eye, cranial nerve palsy

Hypoglycemia

- **Low blood sugar accelerates diabetic retinopathy progression**
- **Low blood sugar can kill patients quickly if it is severe**
- **Symptoms: tremors, perspiration, mental confusion/mood change**
 - Occurs almost exclusively in patients who take external (exogenous) insulin



Important

- **Always have a fast-acting carbohydrate in the office for patients who experience hypoglycemia**

- **OJ or other fruit juice, non-diet soda**

Optometry's Role

- AOA clinical practice guidelines state that ALL ODs should have a rapid-acting CHO (fruit juice, sugar sweetened beverage) in-office to rescue hypoglycemic patients
- Check glucose in-office with patient's meter or CGM
- 15 grams of carbohydrate will raise blood sugar 30-40 mg/dl in 15 minutes (NOT IMMEDIATE -- DO NOT EXPECT Patient coherence to improve immediately!) - follow-up with re-test and protein

We are all in this
together



QUESTIONS?