Disclosures

- I have no disclosures
$245 BILLION

American DM ASSOC 2012 cost of Diabetes

Economic Costs of Diabetes in the U.S. in 2012

$245 billion, including $176 billion in direct medical costs and $69 billion in reduced productivity.
Every Single Day in the U.S.

- 5,205 new cases of diabetes are diagnosed
- 230 people have diabetes-related amputations
- 133 people progress to End Stage Renal Disease
- 55 people with Diabetes become BLIND

- Centers for Disease Control and Prevention 2011 National Diabetes Fact Sheets
Genes predispose us to Diabetes and OR obesity but we pull the trigger with our environment.
Goals when you leave my office

• Stop smoking! Number one risk factor for amputation
• Stop drinking sweet TASTING beverages (I don’t care if it is diet!) No fruit juice no soda, no artificially sweetened “water”
• Know your NUMBERS: A1C, Fasting, Post-prandial, LDL, Triglycerides, HDL
• Know Diabetes affects EVERYTHING! (arthritis, pancreatitis, carpal-tunnel)
“I just have Pre-Diabetes”

- Fasting Glucose: 100mg/dl – 125mg/dl
- A1C: 5.7% – 6.4%
- Glucose Tolerance: 140mg/dl – 199mg/dl

Reference: www.diabetes.org
The Ominous Octet

"New paradigm for pathophysiology of type 2 diabetes"

- Decreased Insulin Secretion
- Decreased Incretin Effect
- Increased body weight
- Increased Glucagon Secretion
- Increased HGP
- Satiety
- Decreased Glucose Uptake
- Increased Glucose Reabsorption

Hyperglycemia

Modified from DeFronzo., Diabetes. 2009
Diagnosing Diabetes

- Random glucose ≥ 200mg/dL
- Fasting glucose ≥ 126 mg/dL
- A1C ≥ 6.5%
- These require repeat testing A1C should not be used for Type 1 or Gestational and may be misleading in hemoglobinopathies (anemias, thalassemias etc)

*American Diabetes Association. Diabetes Care 2013 Jan; (suppl 1): s11-66
We Are Important!

- Diabetic Retinopathy is the leading cause of blindness in U.S. adults >50 years old
- The fear of blindness exceeds many patients’ fear of death
- The American Association of Clinical Endocrinologist recommends any person with ANY retinopathy have a dilated retinal exam at least every 6 months
- Primary care doctors will hear we are talking to our patients and they WANT OUR HELP (and dilation reports)
Why is it so Complicated??

Hyperglycemia in Type 2 Diabetes

- Neurotransmitter dysfunction
  - GLP-1 receptor agonists
  - Amylin
  - Bromocriptine

- Increased lipolysis and reduced glucose uptake
  - Thiazolidinediones

- Impaired insulin secretion
  - Sulfonylurea
  - Meglitinide
  - GLP-1 receptor agonists
  - DPP-4 inhibitors

- Increased glucagon secretion
  - GLP-1 receptor agonists
  - DPP-4 inhibitors
  - Amylin

- Increased hepatic glucose production
  - Metformin
  - Insulin
  - Thiazolidinediones

- Decreased glucose uptake
  - Metformin
  - α-Glucosidase inhibitors
  - Colesevelam

DeFronzo RA, Tahrani AA, et al.
Most important thing to discuss with our “captive” patients

<table>
<thead>
<tr>
<th>Test</th>
<th>Level for people without diabetes</th>
<th>Goals for people with diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood sugar before meals</td>
<td>&lt;100 mg/dL</td>
<td>American Diabetes Association¹</td>
</tr>
<tr>
<td>Blood sugar after meals</td>
<td>&lt;110 mg/dL (2 hr post meal)</td>
<td>70-130 mg/dL</td>
</tr>
<tr>
<td>A1C¹</td>
<td>&lt;8%</td>
<td>&lt;7% (patients in general)</td>
</tr>
</tbody>
</table>

¹ Do not use these values if you are pregnant. Work with your healthcare provider to determine your target values.

² A1C test values may be different for different test labs. The values used in this chart refer to a range of 4-6% for people without diabetes (mean 5%, standard deviation 0.5%).

Reference: www.lillydiabetes.com
Discuss Dietary and Medication Compliance

<table>
<thead>
<tr>
<th>Treatment Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1C</strong>&lt;br&gt;&lt;6.5&lt;br&gt;&lt;7.0 (&lt;i&gt;&lt;6.0 if safe&lt;/i&gt;)</td>
</tr>
<tr>
<td><strong>Fasting/pre meal BG (mg/dL)</strong>&lt;br&gt;&lt;110&lt;br&gt;70-130</td>
</tr>
<tr>
<td><strong>Postprandial (mg/dL)</strong>&lt;br&gt;&lt;140**&lt;br&gt;&lt;180*</td>
</tr>
<tr>
<td><strong>Blood pressure (mm Hg)</strong>&lt;br&gt;&lt;130/80&lt;br&gt;&lt;130/80</td>
</tr>
<tr>
<td><strong>LDL Cholesterol (mg/dL)</strong>&lt;br&gt;&lt;100 (&lt;i&gt;&lt;70***&lt;/i&gt;)&lt;br&gt;&lt;100</td>
</tr>
<tr>
<td><strong>HDL Cholesterol (mg/dL)</strong>&lt;br&gt;&gt;40&lt;br&gt;&gt;40</td>
</tr>
<tr>
<td><strong>Triglycerides (mg/dL)</strong>&lt;br&gt;&lt;150&lt;br&gt;&lt;150</td>
</tr>
</tbody>
</table>

*Peak<br>**2 hours postmeal<br>***Lower goals recommended for high-risk / CVD

BG = blood glucose; CVD = cardiovascular disease; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol

## A1c Targets

### Treating the ABCs Reduces Diabetic Complications

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Complication</th>
<th>Reduction of Complication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blood glucose control</strong></td>
<td>Myocardial infarction</td>
<td>↓ 16%&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Cardiovascular disease</td>
<td>↓ 51%&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Heart failure</td>
<td>↓ 56%&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Stroke</td>
<td>↓ 44%&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Diabetes-related deaths</td>
<td>↓ 32%&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Blood pressure control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coronary heart disease mortality</td>
<td>↓ 35%&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Major coronary heart disease event</td>
<td>↓ 55%&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Any atherosclerotic event</td>
<td>↓ 37%&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Cerebrovascular disease event</td>
<td>↓ 53%&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Medication Options

- Biguanides
- GLP-1 RA
- Sulfonylureas
- Meglitinides
- Thiazolidinediones
- DPP-4 inhibitors
- SGLT2 Inhibitors
- Alpha-glucosidase inhibitors
- Bromocriptine
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  - Colesevelam
- Increased lipolysis and reduced glucose uptake
  - Thiazolidinediones
- Increased glucose reabsorption

DeFronzo RA, et al. [20]
Tahrani AA, et al. [25]
Biguanides
(Muscle & Liver)

- METFORMIN (Glucophage)
- Slows glucose release from the liver
- Affects FASTING glucose
- Is weight NEUTRAL
- Interacts with Tagamet (Tagamet prevents excretion and can increase amount of metformin in system by 40%)
- Contraindicated in severe renal and liver impairment; rare S.E. lactic acidosis 1:30,000
What the heck is GLP-1?
(Brain & Small Intestines)

• INJECTABLE
• Glucagon like peptide (incretin)
• Secreted by cells in the intestinal wall
• Delays gastric emptying, decreases glucagon from the liver, prevents Beta apoptosis
• Stimulates the release of insulin
Incretin mimetics: Byetta, Victoza, Bydureon

- Glucagon-Like Peptide Receptor Analogs
- Target Incretin (incretin mimetic)- people with DM are low on this hormone
- Injectable: b.i.d, q daily, q weekly
- Assists with weight loss, does not cause hypoglycemia, contraindicated with pancreatitis, controversy on pancreatic cancer studies
- S.E. nausea-dissipates with time
DPP4 Inhibitors: “gliptins” Onglyza, Januvia

- DPP4 breaks down GLP-1 (half life 2 min)
- Oral
- Weight neutral, act only on demand
- Controversial in patients with previous pancreatitis or thyroid issues
- May be safer in older adults because of less effect on appetite
Alpha Glucosidase Inhibitors: acarbose, miglitol
(Intestines)

- Slow down the digestion of complex carbs like bread and pasta
- Do NOT affect simple sugars like milk or fruit
- GI disturbances and be helped by tapering medication up
- Weight NEUTRAL, will not cause hypoglycemia on it’s own
- If low occurs due to other medications, do not use Soda to try to bring sugar back up
- Take with first bite of food
Are you ready to go on the Donkey Diet yet?
Why is it so Complicated?

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- Increased glucose reabsorption
SGLT-2 Inhibitors: the FLOzins (Kidneys)

• Sodium Glucose co-transporter-protein that reabsorbs glucose in the kidney
• “Doc, I have a new medicine to pee out my sugar”
• Helps with weight loss
• Vaginal yeast infection and UTI
Bromocriptine—what the heck?
(Brain)

• Ergot alkaloid-mycotoxin from fungus
• Helps with abnormal milk discharge (think pituitary problems), infertility, Parkinson’s
• Affects circadian rhythms in the hypothalamus driving cravings for sugar and high triglyceride foods
• Weight neutral and only has MILD GI side effects
Sulfonylureas: glipizide, Glyburide
(Pancreas)

• Becoming a last resort
• Increase Insulin release from the Beta Cells
• Cause weight GAIN
• Cause moderate to severe HYPOGLYCEMIA
• Aspirin can make hypoglycemia worse
• Contraindicated in renal insufficiency and severe liver disease
Thioglitzones: Actos, Avandia (Liver)

- Reduce insulin resistance in the liver and peripheral tissues
- Reduces the amount of glucose withdrawn from the liver—FASTING
- Can cause bone fractures in hands and feet (moderate bone loss)
- Causes fluid retention (macular edema, worsening of CHF, respiratory infection)
- Weight gain (fluid retention)
- Bladder cancer studies have not supported causal relationship
Meglitinides: Prandin, Starlix, Glufast (Pancreas)

- Act on the beta cells
- Increases insulin therefore causes weight gain and potentiates hypoglycemia
- Rat studies have shown increase in benign tumors of thyroid and liver
Switching Gears

• Post-prandial glucose is an independent risk factor for mortality.
• DECODE study followed 25,000 people for a little over 7 years found increased mortality risk was much more closely associated with 2-h post–glucose load than with fasting glucose.
• More recent studies have demonstrated that even moderate postprandial hyperglycemia (148–199 mg/dl) is not only more indicative of atherosclerosis than is fasting glucose, but also may have direct adverse effects on the endothelium.


Discuss Dangers of Hypoglycemia

- Is it really hypoglycemia (less than 70mg/dL)?
- Loss of hypoglycemia awareness with repeated episodes
- Appropriate ways to address lows
- Dead In Bed Syndrome
Discuss Side Effects

- Nausea is NOT not finishing your plate
- GI disturbances contributed to by sick gut/ unhealthy diet
- (diarrhea)
- Need to incorporate more whole, raw foods
Why is this important to EVERYONE in this room?

A 23 year-old patient with type 1 diabetes visits her endocrinologist every three months. Which of the following in the most appropriate recommendation for this patient to maintain healthy vision?

A. The endocrinologist should visually inspect the patient’s eyes at each visit.
B. An ophthalmologist should perform a dilated eye exam annually.
C. An optometrist should evaluate the patient for corrective lenses every three years.
D. The endocrinologist should physically examine the patient’s eyes twice yearly.
A 41 year-old man with recently diagnosed type-2 diabetes presents for diabetes education. He complains of blurry vision and states that he cannot read the newspaper print. He does not wear corrective lenses and his last eye exam was five years ago. What is the most appropriate recommendation?

A. Referral to an Optometrist for a vision screening.
B. Referral to an Ophthalmologist for a comprehensive dilated eye exam.
C. Purchase reading glasses.
D. Wait three months to see if vision improves.
Team Approach:
Partner with Other HCPs

- Patient
- Physician
- Nurse practitioner
- Physician assistant
- Endocrinologist
- Ophthalmologist
- Podiatrist
- Nephrologist
- Dentist
- Community health worker
- Certified Diabetes Educator (CDE)
- Registered nurse
- Registered dietitian
- Pharmacist
- Medical Assistant
- Exercise Trainer
- Psychologist
- Social worker

HCP = Health Care Professional

Funnell, MM et al. Diabetes Care; Jan. 26(10);33(S1):pS95-S96.
Thank You!