Diabetes Update 2014

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What is Diabetes?

Diabetes mellitus is a metabolic disease characterized by hyperglycemia. This is a result of inadequate insulin secretion, insulin action, or both.*

PATHOPHYSIOLOGY OF GLUCOSE REGULATION
Normal Blood Glucose Control

In people without diabetes, glucose stays in a healthy range because...

Insulin is released at the right times and in the right amounts.

Insulin helps glucose enter cells.
In diabetes, blood glucose builds up for several possible reasons...

- Too little insulin is made
- Liver releases too much glucose
- Cells can't use insulin well
# Diagnosing Diabetes

## Blood Sugar Levels

<table>
<thead>
<tr>
<th></th>
<th>No Diabetes</th>
<th>Pre-Diabetes</th>
<th>Diabetes Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting</strong></td>
<td>70 - 99</td>
<td>100 – 125</td>
<td>126 or higher</td>
</tr>
<tr>
<td><strong>2 hour Oral Glucose Tolerance test</strong></td>
<td>70 - 145</td>
<td>146 - 199</td>
<td>200 or higher</td>
</tr>
<tr>
<td><strong>A1c</strong></td>
<td>5.6% or lower</td>
<td>5.7% – 6.4%</td>
<td>6.5% or higher</td>
</tr>
</tbody>
</table>
Symptoms of Diabetes

Are due to high blood sugars

- Excessive thirst
- Frequent urination
- Blurry vision
- Numbness or tingling in hands or feet
- Feeling tired most of the time, especially after eating
- More infections than usual
- Wounds that are slow to heal
Two Main Types of Diabetes

Type 1 Diabetes
- Pancreas makes too little or no insulin

Type 2 Diabetes
- Cells do not use insulin well (insulin resistance)
- Ability for pancreas to make insulin decreases over time
Type 1 Diabetes

- 1 in 10 people with diabetes have type 1
- Most people are under age 20 when diagnosed
- Body can no longer make insulin

Insulin is always needed for treatment
9 in 10 people with diabetes have type 2

Most people are over age 40 when diagnosed, but Type 2 is becoming more common in children and teens

Type 2 is more likely in people who:
- Are overweight
- Belong to certain ethnic groups
- Have a family history of type 2 diabetes
Diabetes in the US

Persons With Diagnosed Diabetes (millions)

Year


16 14 12 10 8 6 4 2 0

18,000,000


29 million (9.3%) - 2012
20 million in 2006
Diabetes in New Mexico*
2010

- 130,000 New Mexicans diagnosed
  - 1 in 11 adults (8.1%)
  - 1700 children (type 1 and type 2)
- 4% of non-Hispanic Whites
- 6% of Hispanics
- 9% of Native Americans

*The Behavioral Risk Factor Surveillance System (BRFSS), 2000 Updated 2010
Pre-Diabetes 2010

- 86 million US adults
- 106,310 NM adults (7%)
- 15-30% will develop diabetes within 5 years
Diabetes Is...

**Common**
Affects 1 in every 16 people

**Chronic**
A lifelong condition

**Controllable**
Good management depends on YOU!
True or False?

Diabetes is a fairly easy disease to manage.
Diabetes Treatment Plan
What the patient is told:

- Diet
- Activity
- Medications
- Monitoring
- Managing stress

Simple, right?
No white foods - bread, tortillas, rice, potatoes, all my favorite foods!!!!! And there are 4 birthday parties this month

Exercise - UGH, I haven’t been to the gym in years, and who can afford it???

100 pills, stick myself with insulin?? Oh my gosh, how will I do this???

Check my blood sugar? Its 200, what does that mean, am I going to DIE???
Diabetes is a Self-Managed Disease

But... “many hands make light work”
~John Heywood
The Team Approach to Diabetes Care

- Patient
- Family/ Support System
- Community/ Community Health Workers
- Provider (doctor, PA, nurse practitioner)
- Medical Home Team
- Diabetes Educator/ Dietitian
- Dentist, Optometrist, Foot Doctor, Psychologist, and others
Diabetes Self-Management Education (DSME)

“Diabetes education focuses on seven self-care behaviors that are essential for improved health status and greater quality of life.”

http://www.diabeteseducator.org/DiabetesEducation/Definitions.html
The AADE 7™ Self-Management Behaviors

* Healthy eating
* Being active
* Monitoring
* Taking medication
* Problem solving
* Healthy coping
* Reducing risks

http://www.diabeteseducator.org/DiabetesEducation/Definitions.html
Major Targeted Sites of Oral Drug Classes

- Pancreas
  - Beta-cell dysfunction
  - Sulfonylureas
  - Meglitinides
  - DPP-4 inhibitors

- Liver
  - Hepatic glucose overproduction
    - Biguanides
    - TZDs
    - DPP-4 inhibitors

- Muscle and fat
  - Insulin resistance
    - TZDs
    - Biguanides

- Gut
  - Glucose absorption
    - Alpha-glucosidase inhibitors
    - Biguanides

DPP-4=dipeptidyl peptidase-4; TZDs=thiazolidinediones.
Diabetes Pills

**Name**
- Metformin/ Glucophage
- Glyburide/ Glipizide/ Glimiperide
- Actos/ Avandia
- Januvia/ Onglyza

**Primary Action**
- Decrease liver sugar output
- Increase insulin production
- Increase insulin sensitivity in muscle
- Improves after-meal blood glucose disposal
Combination Medications

- Glucovance
  - Glucophage
  - Glucotrol
- Metaglip
  - Metformin
  - Glipizide
- Janumet
  - Januvia
  - Metformin
INJECTABLE
Diabetes Medications

Class
- Incretin mimetics
- Synthetic Amylin analogs
- Insulins
  - Rapid/Short Acting
  - Intermediate Acting
  - Long Acting

Primary Action
- Improve post-meal blood glucose disposal, improve satiety
- Provide additional insulin to transport glucose from blood into muscles and cells
Incretin Mimetics

- **Exenatide**
  - Byetta- twice a day
  - Bydureon- weekly

- **Liraglutide**
  - Victoza- once a day

- Type 2 Diabetes
- Injection- variable dose schedules
- Improves beta cell function
- Improves satiety
- Improves post-meal glucose levels
- S/E: nausea, weight loss

GLP-1 secreted upon the ingestion of food

- **Beta-cell response**
  - Enhances glucose-dependent insulin secretion

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

- **Alpha cells:**
  - Postprandial glucagon secretion

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

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

- **Promotes satiety and reduces appetite**

- **↓ Beta-cell workload**

Adapted from Larsson H, et al. *Acta Physiol Scand.* 1997;160:413-422
Adapted from Drucker DJ. *Diabetes.* 1998;47:159-169
Insulins

- Rapid acting
  - Lispro (Humalog)
  - Insulin Aspart (NovoLog)
  - Glulisine (Apidra)
- Short acting
  - Regular
- Intermediate acting
  - NPH

- Long acting
  - Glargine (Lantus)
  - Detemir (Levemir)

- Combinations
  - 70/30
  - 75/25
  - 50/50
Rapid-Acting Insulins

Starts lowering blood glucose within 10 – 15 minutes after injection

Lispro (Humalog), aspart (Novalog), and glulisine (Apidra):

- Should be taken immediately before eating
- Reduce blood glucose after eating
Short-Acting Insulins

Most effective at 2 – 4 hours after injection

Regular insulin (Humulin R and Novolin R):
- Should be taken 30 – 60 minutes before eating
- Reduces blood glucose after eating
Intermediate-Acting Insulins

Greatest effect at 6 – 10 hours

NPH (Humulin N, Novolin N) and Lente (Humulin L, Novolin L):

- Usually taken before breakfast, dinner, or bedtime
- Usually used with rapid- or short-acting insulins
Long-Acting compared to the other insulins
<table>
<thead>
<tr>
<th>Test</th>
<th>Suggested Ranges for People with Diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood glucose before meals</td>
<td>90 – 130 mg/dL</td>
</tr>
<tr>
<td>Blood glucose after meals</td>
<td>Less than 180 mg/dL</td>
</tr>
<tr>
<td>A1C</td>
<td>Less than 7%</td>
</tr>
</tbody>
</table>
HbA1c
(also known as A1c)

- A test that measures the amount of glucose bound to red blood cells
- Represents 3 month average blood sugar, based on the lifecycle of the red blood cell
- Goal of 7% is equal to average estimated glucose of 154 mg/dl
- A very high HbA1c represents poor control and higher risk of diabetes complications
## A1c / Average Blood Sugar Comparison

<table>
<thead>
<tr>
<th>A1C (%)</th>
<th>Avg. Blood Sugar (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>6</td>
<td>120</td>
</tr>
<tr>
<td>7</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>180</td>
</tr>
<tr>
<td>9</td>
<td>210</td>
</tr>
<tr>
<td>10</td>
<td>240</td>
</tr>
<tr>
<td>11</td>
<td>270</td>
</tr>
<tr>
<td>12</td>
<td>300</td>
</tr>
</tbody>
</table>
Blood Sugar Testing: Using Results

<table>
<thead>
<tr>
<th></th>
<th>Before Breakfast</th>
<th>After Breakfast</th>
<th>Before Lunch</th>
<th>After Lunch</th>
<th>Before Dinner</th>
<th>After Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>130</td>
<td>65</td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td>120</td>
<td>75</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td>110</td>
<td>60</td>
<td>115</td>
<td></td>
<td></td>
<td></td>
</tr>
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<th>Before Dinner</th>
<th>After Dinner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>120</td>
<td></td>
<td>215</td>
<td></td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>Day 2</td>
<td>130</td>
<td>120</td>
<td>225</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td>110</td>
<td></td>
<td></td>
<td>125</td>
<td>285</td>
<td></td>
</tr>
</tbody>
</table>
Diabetes and Illness

- Illness can make blood sugars go up and be more difficult to control
- High blood sugars can make any illness last longer, delay wound healing, or make infections harder to treat
- High blood sugars can lead to a medical emergency called DKA or Diabetic Ketoacidosis
  - Signs: Throwing up, can’t keep food or drink down, stomach pain, very weak, can go into a coma
Sick Day Management

- Have a plan before it is needed
- Continue diabetes medications
- Drink plenty of fluids
- Consume carbohydrates: solid or liquid
- Test blood sugar and urine ketones often
- Know when to call the doctor or seek help
Sick Day Foods
(Equal to 15 gms carbohydrate)

- 4 oz juice or regular soda
- 8 oz Gatorade™ or Pedialyte™
- ½ cup regular gelatin
- ½ cup unsweetened applesauce
- ½ cup mashed potatoes
- 1/3 cup rice
- 6 saltine crackers
- 1 cup soup
- 1 popsicle or ½ cup ice cream or sherbet
- 3 graham cracker squares
Sick Day Management: When to Call the Doctor

- Blood sugar higher than 240 with treatment for 8 hours or higher than 400 for 4 hours
- Fever of 101 or higher
- Sick for 24 hours with no improvement
- Nausea, vomiting or diarrhea for more than 4-6 hours
- Symptoms of dehydration
- Symptoms of DKA - can lead to coma if not treated
  - Difficulty breathing
  - Moderate or Large urine ketones
  - Abdominal pain and vomiting
Hypoglycemia
(low blood sugar)

Signs

Symptoms

Treatment
Hypoglycemia: Signs

- **Blood Sugar 70 or lower**
  - Mild
  - Moderate
  - Severe

- **Causes**
  - Too much insulin
  - Not enough food
  - Exercise

- **Increased Risk**
  - Elderly
  - Poor nutrition/chronic illness
  - New to meds
Hypoglycemia: Symptoms

- Headache
- Hunger or nausea
- Weak
- Dizzy
- Shaky
- Anxious
- Sweaty
- Irritable/ mood changes
- Combative
- Difficulty concentrating
- Slurred speech
- Unconsciousness
Hypoglycemia: Treatment

- 15-20 gm fast-acting carbohydrate (sugar)
- Re-test blood sugar in 15 minutes, if still low, repeat the treatment
- **Do not over-treat**
- Identify and treat cause
- Monitor blood sugar frequently
Hypoglycemia: Treatment

15-20 gm Carbohydrate =

- 4 - 6 oz. fruit juice
- 1 small piece of fruit
- 5 pieces of hard candy
- 8 oz. fat-free milk
- 4 oz. Regular soda
- 4 glucose tablets
- 1 tablespoon jelly
- 1 tablespoon honey
Glucagon Emergency Kit
Hypoglycemia: Patient Education

- Recognize signs
- Appropriate treatment procedure
- Always carry something for hypoglycemia
- Educate family members
- Monitor trends
- Safety issues
- Prevention measures
P.S. There is no “diabetic diet”
Myths and Facts about Diabetes

- Eating too much sugar causes diabetes
- People with diabetes can’t eat sweets or chocolate
- A low carb diet is the best for people with diabetes
- Your body needs carbohydrates for energy
- Fruit is healthy, so is it OK to eat as much as you want.
- You are in charge of managing your diabetes
What Happens When We Eat?

After eating, most food is turned into blood glucose, the body's main source of energy.
Total Carbohydrates Count

Carbohydrates give energy

But too much carbohydrate can raise blood glucose above your target range

Ask your care team: How much carbohydrate is right for you?
Where Carbs are Found

**Starchy vegetables** - let's name 'em
What about beans?

**Dairy products** - let name 'em
What about cheese?

**Grains/ breads** - let’s name ‘em
Snack foods?

**Fruits** - All fruits have some sugar/energy
with various amounts of fiber

**Others?** - let’s name ‘em
Carb Counting/Management

- **Portion** is a measure
  15 grams = 1 Carb Portion (CHO)

- **Serving** is an amount determined by manufacturer (or your Aunt)
  - Is term used from food groups at USDA
  - Is labeled by weight

- **Exchange** is an ADA method of carb counting very last century
Control Portion Sizes

1 serving of raw vegetables
1 serving of meat
1 serving of cooked vegetables
1 serving of cheese
1 serving of pasta
# Using a Food Label

<table>
<thead>
<tr>
<th>Nutrition Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving Size: 1 Cup (239g)</td>
</tr>
<tr>
<td>Servings Per Container: About 2</td>
</tr>
<tr>
<td>Amount Per Serving</td>
</tr>
<tr>
<td>Calories: 150</td>
</tr>
<tr>
<td>% Daily Value*</td>
</tr>
<tr>
<td>Total Fat: 6g</td>
</tr>
<tr>
<td>Saturated Fat: 1.5g</td>
</tr>
<tr>
<td>Trans Fat: 0g</td>
</tr>
<tr>
<td>Polyunsaturated Fat: 1.5g</td>
</tr>
<tr>
<td>Monounsaturated Fat: 2.5g</td>
</tr>
<tr>
<td>Cholesterol: Less than 5mg</td>
</tr>
<tr>
<td>Sodium: 250mg</td>
</tr>
<tr>
<td>Total Carbohydrate: 19g</td>
</tr>
<tr>
<td>Dietary Fiber: Less than 1g</td>
</tr>
<tr>
<td>Sugars: 0g</td>
</tr>
<tr>
<td>Protein: 3g</td>
</tr>
<tr>
<td>Vitamin A: 0%</td>
</tr>
<tr>
<td>Calcium: 2%</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet
Cut Down on Fat and Cholesterol

High Calories → Weight Gain

High Cholesterol & Saturated Fat → Heart Attack Risk
Messaging to the Patient

- Deciding to improve
  - one meal at a time
  - one event at a time
  - one day at a time
- Defining an achievable goal
- Self-recognition for goals met
How You Can Help

- Teaching not telling
- Helping them start
- Food for thought
- Small changes big rewards
Healthy Food Choices Help Keep Blood Glucose on Target

Less healthful choices → HIGH → TARGET RANGE → More healthful choices
Make Healthier Food Choices

Instead of this:

Try this:

- Donut
- Hot dog with chips
- Ice cream cone

- Glass of milk
- Bowl of cereal
- Plate with sandwich and carrots
Tips for Healthier Eating at Home

Try:

- New recipes low in fat and high in fiber
- Low-fat or fat-free foods (but check carbohydrate content)
- Fresh fruits and vegetables
Tips for Healthier Eating Dining Out

Order:
- An appetizer as an entrée
- Sauces and dressings on the side
- Half-size portions
Cultural Culprits: Our Fast Food Nation

Large Soda (32 oz.):
- 300 calories
- 19 tsp. sugar

Large Fries:
- 520 calories
- 25 g fat
- 4.5 g saturated fat

Double Cheeseburger:
- 770 calories
- 47 g fat
- 20 g saturated fat

Apple Pie:
- 260 calories
- 13 g fat
- 3.5 g saturated fat

The average fast-food meal has close to a full day’s calories.
## McDonald’s™ Burger/Fries

<table>
<thead>
<tr>
<th></th>
<th>Calories (+/- cheese)</th>
<th>Fat gm</th>
<th>Carb gm/CHO port.</th>
<th>Sodium gm/+- cheese (no salt)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Big Mac Burger</strong></td>
<td>540</td>
<td>29</td>
<td>45 gm/3</td>
<td>1040</td>
</tr>
<tr>
<td><strong>¼ pound Burger</strong></td>
<td>510 (410)</td>
<td>26 (19)</td>
<td>40 (37)/2.5</td>
<td>1190/730</td>
</tr>
<tr>
<td><strong>Value Burger (99c)</strong></td>
<td>300 (250)</td>
<td>12 (9)</td>
<td>33 (31)/2</td>
<td>750/520</td>
</tr>
<tr>
<td><strong>Medium Fry</strong></td>
<td>380</td>
<td>19</td>
<td>48/3</td>
<td>270 (175)</td>
</tr>
<tr>
<td><strong>Small Fry</strong></td>
<td>230</td>
<td>11</td>
<td>29/2</td>
<td>160 (101)</td>
</tr>
<tr>
<td>Tortilla</td>
<td>Calories</td>
<td>Fat gm</td>
<td>Carb gm/ carb portion</td>
<td>Fiber gm</td>
</tr>
<tr>
<td>---------------</td>
<td>----------</td>
<td>--------</td>
<td>------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>6” Corn</td>
<td>56</td>
<td>1</td>
<td>9 gm/ 0.5</td>
<td>1</td>
</tr>
<tr>
<td>6” Flour</td>
<td>100</td>
<td>2.5</td>
<td>16 gm/ 1</td>
<td>1</td>
</tr>
<tr>
<td>7” Multi-grain</td>
<td>150</td>
<td>4.5</td>
<td>23 gm/ 1.5</td>
<td>5</td>
</tr>
<tr>
<td>7” Flour (homestyle)</td>
<td>180</td>
<td>4</td>
<td>31 gm/ 2</td>
<td>3</td>
</tr>
<tr>
<td>7” Whole Wheat</td>
<td>139</td>
<td>2.5</td>
<td>25 gm/ 1.5</td>
<td>4</td>
</tr>
<tr>
<td>10” Flour (burrito)</td>
<td>210</td>
<td>5</td>
<td>36 gm/ 2.5</td>
<td>1</td>
</tr>
<tr>
<td>11” Multi-grain</td>
<td>210</td>
<td>6</td>
<td>32 gm/ 2</td>
<td>7</td>
</tr>
</tbody>
</table>
Tips to Remember

- Decide to investigate menu at a given restaurant
- Decide on weekly menu at home then make shopping list
- Decide to pay attention to one thing and build on it
- Define success and practice new rewards
Diabetes Increases the Risk of Large Blood Vessel Damage

Macrovascular complications:

Stroke
Heart attack
Poor circulation

Over time, fatty deposits can clog large blood vessels
Hyperglycemia Can Cause Serious Long-Term Problems

Chronic complications of diabetes

- Blindness
- Kidney disease
- Nerve damage
- Cardiovascular disease:
  - Stroke
  - Heart attack
  - Loss of circulation in arms and legs
- Amputation
Good News for Type 2 Diabetes

Keeping A1C in target range reduces:

- Heart attack as much as 16%
- Eye damage as much as 21%
- Kidney disease as much as 34%

United Kingdom Prospective Diabetes Study
Co-morbidity Management

- Blood pressure control
- Cholesterol control
- Complication screening and prevention
  - Yearly eye exam
  - Yearly foot exam and daily foot care
  - Yearly blood and kidney tests
  - Vaccines
  - Medic alert
  - Regular dental care
  - Education
Cholesterol and Diabetes

- LDL or “bad cholesterol” should be lower than 100
- HDL or “good cholesterol” should be higher than 45
- Triglyceride level should be lower than 150
- Diet and exercise can help improve cholesterol
High Blood Pressure and Diabetes

- Goal blood pressure
  - Lower than 130/80
- Medications recommended because they also can protect kidneys
- Many people need 2 or 3 medications to reach goal
- Diet and exercise can help improve blood pressure
The Good News About Diabetes

Avoid diabetes complications by:

- Keeping blood glucose as near normal as possible
- Learning self-care skills
- Getting support from family and diabetes care team
- Taking medication, as needed

People with diabetes can lead full, productive lives!
On the Horizon

- New medications
- “Smart” insulin pumps
- Continuous glucose monitoring
- “Artificial Pancreas” technology
- Pancreas transplants
- Gastric bypass surgery
On the Horizon: Medications

- **Insulin Degludec**
  - ultra long-acting
  - 42 h effective duration
  - Launch in early 2013

- **SGLT2 Inhibitors**
  - Decrease renal glucose reabsorption
  - Increase glucosuria
  - Secondary wt loss due to increased calorie excretion (glucose)
  - May increase risk of UTI/bladder infections
Some Available Pumps

- Animus with “Ping”
- Omni Pod with PDM
- Medtronic with CGM
- t:slim (touch simplicity)
Postprandial Excursions

Glucose - mg/dL

3:00 AM  6:00 AM  9:00 AM  12:00 PM  3:00 PM  6:00 PM  9:00 PM
Time Of Day

Food

120
100
80

Food

0