Diabetes: The Basics

Understanding and Managing Diabetes (Part 1 of 3)

Satellite Conference
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Program Objectives

- **Understanding and managing diabetes**
- **Self-testing**
- **Diabetes and medications**

Introducing the Problem

- **Type 1**
- **Type 2**
- **Who gets it?**
- **What causes it?**
- **How can it be treated?**

Minorities at Greater Risk of Having Type 2 Diabetes

- **African Americans are 2 times as likely to have diabetes as the general population**
  - **An estimated 2.8 million or 13.0%**
- **Hispanics/Latinos are 1.9 times as likely to have diabetes as the general population**
  - **An estimated 2.0 million or 10.2%**
- **15.1% of Native Americans have type 2 diabetes**

Diabetes is a Silent Killer

- **People with diabetes are**
  - **2 - 4 times more likely to have heart disease**
  - **2 - 4 times more likely to suffer a stroke**
- **Diabetes is the leading cause of new cases of blindness in people ages 20 - 74**
  - **12,000 - 24,000 people lose their sight each year**

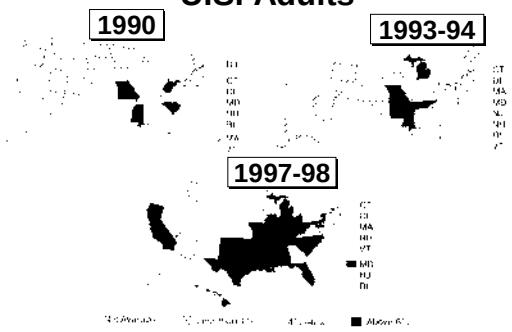
Diabetes is a Silent Killer

- Diabetes is the leading cause of kidney failure
  - accounts for 43% of new cases
  - in 1999, 114,478 people with diabetes on dialysis

Diabetes is a Silent Killer

- Diabetes is the most frequent cause of non-traumatic lower limb amputation
  - 60 - 70 percent of people with diabetes have mild to severe forms of diabetic nerve damage
  - the risk of leg amputation is 15 - 40 times greater for a person with diabetes

Prevalence of Diabetes Among U.S. Adults



If you took all of the people in Alabama with diagnosed Diabetes Mellitus and brought them to Bryant-Denny Stadium or Jordan-Hare Stadium, how close to filling the stadium would you be?

Figure that the stadium could hold 90,000 people or so.

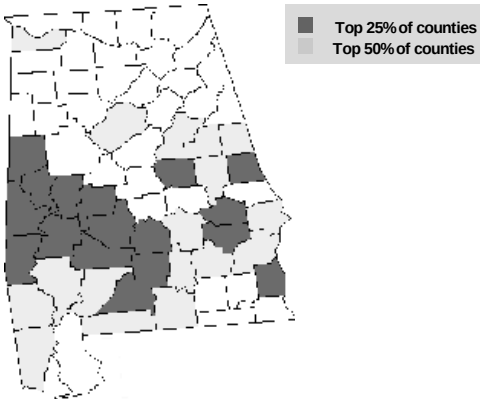
Now if you took just the people in Alabama who have Diabetes Mellitus but do not know it yet, and brought them to Bryant-Denny Stadium or Jordan-Hare Stadium, how close to filling the stadium would you be?

If you took just the people in Alabama who have Pre-Diabetes Mellitus, and brought them to Bryant-Denny Stadium or Jordan-Hare Stadium, how close to filling the stadium would you be?

How many people in Alabama have Diabetes Mellitus (DM)?

- 450,000 diagnosed
- 200,000 un-diagnosed
- 800,000 pre-diabetes

Does the incidence of Diabetes Mellitus in certain areas of Alabama reflect the African-American population in those areas?



Diabetes incidence has increased 49% from 1991 to 2000 in Alabama.

Why so much?

When you eat more calories than you use each day, you gain weight.

Americans eat more food than they used to and they burn fewer calories than they used to.

Plentiful food + the money to pay for it + fewer calories burned = the perfect recipe for weight gain

Risk Factors You Can Change

- Inactive lifestyle
- Overweight

The Automobile Analogy:

- Your body is like a car.
- It runs on fuel, like a car.
- Your body's fuel is food.
- You burn more fuel when you move, like a moving car uses more gasoline.
- You burn less fuel when you sit in one place, like a parked car that is turned on, but not moving, uses less gasoline.

When you refuel with gasoline, you must use more gasoline if the car was moving, and less gasoline if the car was parked.

If you put in more gasoline than you used up, what will happen?

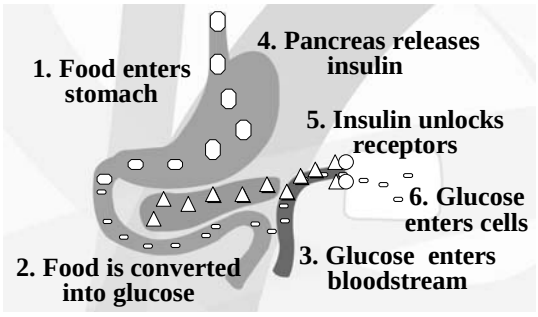
(The tank overflows)

When you refuel with food at meals three times a day, you tend to eat the same, whether you moved or not.

If you haven't moved much all day, and you put in more food fuel than you used up, what will happen?

(The stomach expands)

How Food is Digested



The Central Air Conditioner Analogy

- **Your body needs glucose to live.**
- **That is why we eat food.**
- **Your body tries to keep the glucose level in the blood between 80-120 mg/dL automatically.**
- **The blood glucose level wants to go up after we eat. It wants to go down between meals and while we sleep.**

The body has a system to keep the blood glucose level steady, like a central heating & air-conditioner keeps a house at a comfortable temperature, even when it is cold or hot outside.

The body has a system to keep the blood glucose level from getting too high after a meal or too low between meals.

The body secretes a little insulin all day long and secretes more insulin whenever you eat.

The insulin lowers the blood glucose level, like an air conditioner lowers the temperature.

The body secretes glucagon and adrenaline all day long. It secretes more glucagon when the blood glucose level falls. It secretes more adrenaline when it senses a stressful situation.

Glucagon and adrenaline increase the blood glucose level, like a heater raises the temperature in a house.

We sometimes eat too much food, more than we need. This will make the blood glucose level increase. The body will secrete more insulin than usual. If we do that over and over, we eventually will not be able to make enough insulin. Then we will have high blood sugars (diabetes).

An air conditioner can break, all at once, or it can gradually lose its cooling power.

Diabetes Type 1 is like a sudden breakdown of our air conditioner (insulin production).

Diabetes Type 2 is like a gradual breakdown of our air conditioner. We don't even notice it at first.

A house with a broken air-conditioner will get very hot.

A person with Type 1 diabetes cannot make insulin, and will get very, very high blood glucose levels.

They must be given insulin to lower their blood glucose.

Taking a shot of insulin every few hours to keep your blood glucose near normal is like turning on a room air-conditioner unit for a few hours to cool a whole house.

It is very difficult to keep the blood glucose near 80-120 mg/dL all the time, day and night, using insulin injections.

Remember, insulin is used to lower the glucose level in the blood.

Type 1 diabetes is like having a broken air-conditioner. Failure to take insulin will cause the blood glucose level to get too high.

Taking too much insulin will cause the the blood glucose level to get too low.

Type 2 diabetes is different. It is much more common.

It is like having an air-conditioning unit that is running all the time, but it is wearing out, so it cannot keep the house cool.

Patients with Type 2 Diabetes Mellitus cannot keep their blood glucose levels in the normal range.

They still make insulin, but it is not effective.

An air-conditioner that runs all the time will eventually break and stop running.

In a person with Type 2 Diabetes, eventually the body will be unable to make more insulin.

These patients have high blood glucose levels, especially after a big meal and during times of stress, because stress also makes the blood glucose level increase.

Like an air conditioner that is gradually failing, a person with Type 2 Diabetes will experience worsening blood glucose control as the disease progresses.

This is a normal process and it is not caused by poor compliance by the patient.

At the earliest stages of the disease, oral medicines will make the blood glucose levels improve.

As the disease progresses, insulin will be required to maintain good control of blood glucose levels.

You may be wondering if your family members are at risk for getting diabetes.

Risk Factors for Type 2 DM

- **Pre-Diabetes:**
  - **Impaired glucose tolerance**
  - **Impaired fasting glucose**
- **Gestational diabetes (high blood glucose during pregnancy)**
  - **Physical inactivity**
  - **Race/ethnicity**
  - **Obesity**

Does DM Affect More African American Women Than Men?

African Americans Aged 50+

Males: 19% have diabetes

Females: 28% have diabetes

Has the Incidence of Type 2 DM in Children Increased?

- **Ratio of teenagers with Type 2 DM/Type 1 DM**
  - **1992 0/100**
  - **2002 50/100**

What Schools Have Done Differently

- **Eliminated physical education classes**
- **Served high-fat lunches and fast food**
- **Provided soda and snack machines**

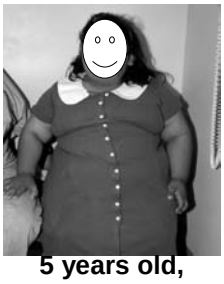
Net Result: More Obesity

Case Study

Age : 17y 4m
Weight 167.8 kg Height 160.7 cm
BMI 65 kg/m^2
PCOS/hyperinsulinemia
Morbid obesity
Obstructive sleep apnea
Orthopedic complaints
Mild depression
Failed aggressive medical management over 4 years of follow up

Obstructive Sleep Apnea: Possible Signs/Symptoms

- **Obesity**
- **Snoring**
- **Restless nighttime sleep**
- **Daytime sleepiness (falls asleep in car on short rides)**
- **Bedwetting**
- **Morning headaches**
- **Difficult behavior**
- **Poor school performance**



5 years old, 150 pounds

Monitor Your Blood Glucose Frequently

- **Gain immediate information about how you are doing**
- **Monitor the effect of changes in lifestyle and medication adjustments**
- **Relate symptoms of high and low blood glucose with blood glucose test results**

Hyperglycemia

Hyperglycemia = High Blood Sugar

- **Symptoms**
  - **Extreme thirst**
  - **Frequent urination**
  - **Hunger**
  - **Fatigue, no energy**
  - **Blurry vision**
  - **Dry, itchy skin**
  - **Slow to heal cuts or more frequent vaginal yeast infections**

Hyperglycemia

- Causes
  - Too much food – especially foods high in carbohydrates
  - Not enough exercise
  - Illness
  - Stress
- What to do:
  - Drink extra water
  - If over 240 mg/dL, check 4 - 5 times that day
  - If blood sugar stays over 240 mg/dL, call your doctor

Hypoglycemia – Low Blood Sugar

- Symptoms
  - Hungry
  - Cold sweat
  - Shaking
  - Fast heart rate
  - Anxiety
  - Dizzy
  - Nausea
  - Irritability
  - Can pass out

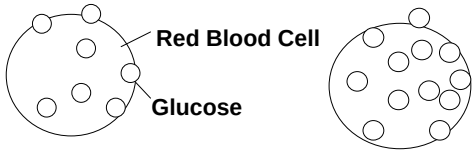
Hypoglycemia

- Causes
  - Skipped a meal or ate too little
  - Extra physical activity
  - Too much medication
- What to do
  - Check your blood sugar
  - If below 80, drink 4 ounces of juice or eat several hard candies or glucose tablets
  - Follow with a snack or your next meal

Key Numbers in Diabetes Control

- Daily blood glucose
- A1C (2-3 month glucose levels)
- Lipids (blood fats)
- Blood Pressure (hypertension)
- Urine Protein (microalbuminuria)

Hemoglobin A1C Measures Glucose Levels Over a 2-3 Month Period



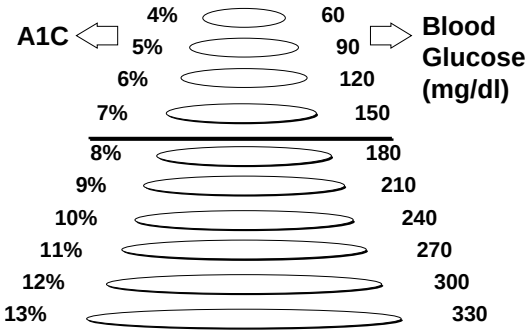
Normal Blood Glucose

HbA1c = 5%

High Blood Glucose

HbA1c = 10%

A1C and Self-Monitoring Results



The story has changed . . .

Diabetes in the 1920's

Diabetes in the 21st century

Medications

• Insulin	⇨	• Supplements body's own insulin
• Secretagogues (glyburide/ glucotrol)	⇨	• Pancreas -- stimulates insulin production
• Metformin (Glucophage)	⇨	• Liver - decreases glucose release Fat/Muscle -- increases insulin sensitivity
• Thiazolidinedione (Actose/avandia/ amaryl)	⇨	• Fat/Muscle - increases insulin sensitivity
• Alpha-glucosidase inhibitors	⇨	• Intestine -- slows carbohydrate metabolism

Insulins

Types	Examples
Rapid-acting	Insulin lispro, Aspart
Short-acting	Regular
Intermediate-acting	NPH, Lente, NPL
Long-acting	Ultralente, Glargine
NPH/Regular Pre-mixed	70/30, 50/50
Lispro/NPL Pre-mixed	75/25

Treating Type 1 Diabetes

Yesterday:

Two shots a day of
Regular and NPH insulin
either pre-mixed or mixed
by the patient

Treating Type 1 Diabetes

Today:

Many options available
One approach:
Three shots a day of Rapid-acting insulin plus one shot of glargine insulin

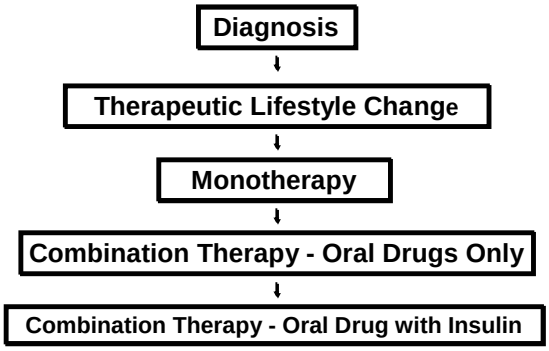
Another approach:
An insulin pump

Treating Type 1 Diabetes

Tomorrow: Many, many options!

Three or more puffs or nosedrops a day
plus one shot of glargine
or
An insulin pump
or
Transplanted islet cells
or
Transdermal insulin
or
Oral insulin

Treatment of Type 2 Diabetes



Medications

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Alpha-glucosidase inhibitors	⇨	Intestine -- slows carbohydrate metabolism

With all these oral drugs, and insulin, to choose from, what is the best way to treat Type 2 Diabetes Mellitus?

There is no single best way

Type 2 diabetes mellitus is a progressive disease.

Pancreatic function is impaired initially and worsens as the disease progresses.

More than one drug is needed to optimize glycemic control.

Exercise and diet are also critical.

Strategies to Improve Glycemic Control: Type 2 Diabetes

- **Monitor glycemic targets – Fasting and postprandial glucose, HbA_{1c}**
- **Self-monitoring of blood glucose is essential**
- **Nutrition and activity are cornerstones of therapy**
- **Combinations of pharmacologic agents are often necessary to achieve glycemic target values**