Advancements in the Management of Diabetes

A Continuing Nurse Education Activity

Presented by: Laura M. Abbey RN, BSN, MA, CDE, Diabetes Center Program Coordinator for St. David’s Medical Center Austin, TX
Objectives

At the end of this presentation you will be able to:

1. Discuss the demographic of diabetes among adults in the US.

2. Identify complications associated with diabetes.

3. Describe the classifications for diabetes.
Objectives

4. List the methods used for diagnosing diabetes.

5. Explain the risk factors associated with Metabolic Syndrome.

6. Discuss updates in oral and injectable medications used for managing diabetes.

7. Describe advances in the treatment and management of diabetes.
National Statistics Comparisons*

Diabetes Statistics Shown in Millions

7% of total population are diagnosed with Diabetes

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Diagnosed</th>
<th>Undiagnosed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>18.2</td>
<td>13</td>
<td>5.2</td>
</tr>
<tr>
<td>2005</td>
<td>20.8</td>
<td>14.6</td>
<td>6.2</td>
</tr>
<tr>
<td>2007</td>
<td>23.6</td>
<td>17.9</td>
<td>5.7</td>
</tr>
</tbody>
</table>

*Centers of Disease Control & Prevention
National Statistics (2007)

❖ People younger than 20 years old
  Total of 186,300 people with diabetes (Type 1 or 2)
  .2% of all people in this age group

❖ People older than 20 years old with diabetes
  Total of 23.5 million people –
  10.7% of all people in this age group

❖ People 60 years and older with diabetes
  Total of 12.2 million people
  23.1% of all people in this age group
Demographic of Adults with DM

- **Total (direct and indirect):** $174 billion
- **Direct medical costs:** $116 billion
- **Indirect costs:** $58 billion (disability/work loss/premature mortality)

![Pie chart showing the percentage of direct and indirect medical costs. Direct costs account for 66% and indirect costs account for 34%.]
Long-term Complications

Blindness:
- Diabetes is the leading cause of new cases of blindness among adults 20-74 years old.
- Diabetes causes 12,000 to 24,000 new cases of blindness each year.

Kidney Disease:
- Diabetes is the leading cause of treated end-stage renal disease, accounting for 44% new cases in 2005.
Long-term Complications

Stroke:
- The risk for stroke is 2 to 4 times higher among people with diabetes

Nervous System Diseases:
- 60% to 70% of people with diabetes have mild to severe forms of nerve damage

Microvascular Complications:
- It is thought that at diagnosis 50% of all patients have some sort of microvascular complication
Deaths Among People with Diabetes

- Diabetes was the 7th leading cause of death nationally in 2006
- Diabetes is likely to be under reported as a cause of death
- Risk of death is approximately 2 times that of people without diabetes of similar age.
Diabetes Classifications

- Type 1 - previously referred to as juvenile onset diabetes or insulin dependent diabetes

- Type 2 - previously referred to as adult onset diabetes and non-insulin dependent diabetes

- Gestational Diabetes

- Other types
Diagnosis of Type 2 Diabetes

There are 3 ways to diagnose diabetes:

1. Symptoms of diabetes along with a casual plasma glucose $\geq 200\text{mg/dl}$
2. Fasting Plasma Glucose $\geq 126\text{mg/dl}$ (at least an 8 hour fast)
3. 2-h postload glucose $\geq 200\text{mg/dl}$ during an OGTT (using a 75-g glucose load)

NOTE: Each must be confirmed on a subsequent day unless unequivocal symptoms of hyperglycemia are present

*Diabetes Care, Vol. 30, supplement 1, January 2007*
Diagnosis of Type 2 Diabetes

ADA recommendations for diagnosis:

- FPG is the preferred test because of: ease of use, acceptability to patients and lower cost
- HgA1C is not recommended to diagnose diabetes

Diabetes Care, Vol. 30, supplement 1, January 2007
Impaired Glucose Classifications

Impaired Fasting Glucose:
The fasting blood glucose level is 100 – 125 mg/dL after an overnight fast.

Impaired Glucose Tolerance:
The blood glucose level is 140 – 199 mg/dL after a 2-hour oral glucose tolerance test.

These levels are higher than normal but not high enough to be classified as diabetes.
IFG

\[ \geq 126 \]
\[ <126 \]
\[ \geq 100 \]
\[ <100 \]

DIABETES

\[ \geq 200 \]
\[ <200 \]
\[ \geq 140 \]
\[ <140 \]

PREDIABETES

NORMAL

FPG (mg/dL)

2-hour glucose (mg/dL)
Additional Classifications

- Prediabetes, Metabolic Syndrome or Insulin Resistance

- Type 1A, Type 1.5 or LADA
  (Latent Autoimmune Diabetes in Adults)
American Heart Association’s Diagnosis of Metabolic Syndrome
(Any 3 of the following risk factors, also see next slide)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Defining Level</th>
</tr>
</thead>
</table>
| Elevated waist circumference* | ≥40 inches men
                              | ≥35 inches women                                                                |
| Elevated triglycerides        | >150 mg/dL or on drug treatment for elevated triglycerides                   |
| Reduced HDL-C                 | < 40mg/dL in men                                                             |
|                               | < 50mg/dL in women OR on drug treatment for reduced HDL-C                    |

* Lower waist circumference seems to be appropriate for Asian Americans (≥35 inches in men and ≥31 inches in women)
American Heart Association’s Diagnosis of Metabolic Syndrome
(Any 3 of the following risk factors, *see previous slide*)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Defining Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated blood pressure</td>
<td>$\geq 130\text{mm Hg systolic OR}$</td>
</tr>
<tr>
<td></td>
<td>$\geq 85\text{mm Hg diastolic OR on antihypertensive drug treatment}$</td>
</tr>
<tr>
<td>Elevated fasting glucose</td>
<td>$\geq 100\text{mg/dL OR on drug treatment for elevated glucose}$</td>
</tr>
</tbody>
</table>

*Circulation 112: 2735-2752, 2005*
Obesity

66% U.S. adults and 17% ages 2-19 are overweight or obese (National Health and Nutrition Examination Survey 2004)

BMI
- 25 - 29.9 = overweight
- ≥ 30 = obesity
- ≥ 40 = extreme obesity
# Oral Medication Classifications

<table>
<thead>
<tr>
<th>Drug</th>
<th>FDA approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfonylureas</td>
<td>1958</td>
</tr>
<tr>
<td>Biguanides</td>
<td>1995</td>
</tr>
<tr>
<td>alpha-Glucosidase Inhibitors</td>
<td>1995</td>
</tr>
<tr>
<td>Meglitinides</td>
<td>1997</td>
</tr>
<tr>
<td>Thiazolidinediones (TZDs)</td>
<td>1999</td>
</tr>
<tr>
<td>DPP-4 Inhibitor</td>
<td>2006</td>
</tr>
</tbody>
</table>
Avandia (TZD)

In 2007, the FDA evaluation of Avandia confirmed the heart risks reported and suggested that as many as 60,000 to 100,000 heart attacks might be linked to its use since it came on the market eight years prior.

Avandia received a Black Box Warning. The strongest warning FDA can make.

The FDA will present a summary of any new observational studies of Avandia safety in July '10
DPP-4 Inhibitors

**Action:** Prevents breakdown of incretin hormones referred to as GLP-1. The incretin effect implies the food ingestion causes the gut to release substances that enhance insulin secretion beyond the release caused by the rise in glucose secondary to absorption of digestive nutrients.

**Benefits:**
- Improved glycemic control (↓ A1C)
- Enhanced insulin action
DPP-4 Inhibitors

- Januvia (Sitagliptin)
  - FDA approved 2006
- Onglyza (Saxagliptin)
  - FDA approved July 2009
- Galvus (vildagliptin)
  - Approved in Europe 2009

At last count there were >37 DPP4-Inhibitor in research
Combination Drugs

Actoplus Met - Actos and Metformin
Advandamet - Avandia and Metformin
Avandaryl - Avandia and Amaryl
Duetact - Amaryl and Actos
Glucovance - Diabeta and Metformin
Metaglip - Metformin and Glipizide
Janumet - Januvia and Metformin
Medications Not Primary for DM

Welchol (Colesevelam) - lowers cholesterol levels in the blood. It also improves control of blood sugar in type 2 diabetes, mechanism of improving blood sugar is unknown. Is used in combination with other drugs for treating type 2 diabetes
Injectables Not Classified As Insulin

**Incretin mimetics**
- **BYETTA (Exenatide)** Approved in 2005
  - Twice a day injectable suspension
- **BYDUREON (Exenatide)** Approved in March 2010
  - Once a week extended-release injectable suspension
- **Victoza (Liraglutide)** Approved in 2010
  - Once-Daily injectable suspension

**Amylin-analog**
- **SYMLIN (Pramlintide)** Approved in 2005
  - Taken before meals (>30 carbs) with insulin
Incretin Mimetics

Incretin hormones: hormones secreted by specialized cells in GI tract which stimulate insulin secretion.

Target population: Patients with type 2 diabetes not yet requiring insulin, but unable to achieve adequate glycemic control despite lifestyle intervention and treatment with Metformin and/or sulfonylureas.
Incretin Mimetics

Benefits:

- Improves glycemic control
  - Reduces fasting glucose levels and reduces postprandial glucose excursions.
- Progressive weight loss
  - Slows gastric emptying and promotes satiety.
- Appears to B-cell proliferation and promote B-cell survival
**Incretin Mimetics**

- Special considerations:
  - Mild-to-moderate nausea (diminishes with continued use)
  - Risk of hypoglycemia is significantly increased in patients using **both** an incretin mimetic and a sulfonylurea
Incretin Mimetics

These may slow the rate and extent of absorption of other drugs due to gastric emptying effects, especially contraceptives and antibiotics. Therefore these drugs should be given one hour before the injection dose.
Incretin Mimetics

Exenatide warns patients that “serious side effects can happen in people who take BYETTA, including pancreatitis which may be severe and lead to death.”

In clinical trials, there were more cases of pancreatitis with Victoza than with Exenatide. Victoza has not been studied sufficiently in patients with a history of pancreatitis to determine whether these patients are at increased risk for pancreatitis while using Victoza.
Victoza

Victoza (Liraglutide) Approved in Jan, 2010

Administered once daily at any time of day, independently of meals

Received a Black Box Warning:

Has an uncertain relevance of the rodent thyroid C-cell tumor findings to humans, prescribe Victoza only to patients for whom the potential benefits are considered to outweigh the potential risk.
SYMLIN: an Amylin-analog

Amylin is a naturally occurring hormone co-secreted with insulin by islet B-cells.

- People who do not produce enough insulin at mealtimes typically do not produce enough Amylin.
- Amylin and insulin work together with glucagon to maintain normal glucose concentrations.
SYMLIN

Candidates: Patients with Type 1 or Type 2 diabetes who are on insulin therapy but have failed to achieve adequate glycemic control

Side-effects:
- N/V, insulin-induced hypoglycemia (Reduce prandial insulin dosage by 50% to minimize the risk of hypoglycemia)
Diabetes Advancements

Continuous Glucose Monitoring System
HumaPen Luxura HD

Reusable insulin pen that doses in half-units increments from 1-30 units
HumaPen MEMOIR

Records date, time and amount of last 16 doses

The first insulin pen with a memory
Injection Port

i-port: a medication delivery channel directly into the subcutaneous tissue
Gastric Electrical Stimulation

Gastric electrical stimulation uses mild electrical stimulation of the lower stomach to reduce chronic intractable (drug refractory) nausea and vomiting secondary to gastroparesis of diabetic or idiopathic origin.
Gastric Electrical Stimulation
Gastric Electrical Stimulation

The Medtronic Enterra neurostimulator received humanitarian device exemption (HDE) approval from the FDA in 2000. HDE status are specially designated for use in treatment of rare medical conditions with an incidence of less than 4,000 patients per year. However, the effectiveness of gastric electrical stimulation for this use has not been demonstrated. Because of the HDE status, the system must be implanted in a medical center whose institutional review board has approved use of the device.
Gastric Electrical Stimulation

May Be Effective Against Morbid Obesity

Although weight loss is less rapid than with gastric bypass or laparoscopic banding, selected patients can expect to lose 30-40% of excess weight over a period of 24 months
Continuous Subq Insulin Pump: OmniPod

With *just two user-friendly parts*, the OmniPod System makes diabetes a much smaller part of your life.
Continuous Subq Insulin Pump: Solo MicroPump
Bariatric Surgeries

Previous observational studies estimate that 60 to 90% of bariatric surgery patients who were obese and had type 2 diabetes were later able to maintain normal blood glucose levels without medication.

84% of patients immediately resolve their type 2 diabetes with gastric bypass surgery, a phenomenon found to occur as a primary, specific, and direct effect of this surgery -- not secondary to the weight loss.
Adjustable Gastric Banding
Gastric Bypass Surgery
Noninvasive Delivery Systems in Development

Ora-lyn and Oralgen Oral Spray: The device delivers prandial insulin for buccal mucosa and orapharynx region absorption with no lung deposition
Noninvasive Delivery Systems in Development

Nanopump: tiny pump mounted on a disposable skin patch to provide continues insulin infusion
Noninvasive Treatments in Development

Gastrointestinal Liner – *EndoBarrier* offers *metabolic control* by influencing how food *moves through the digestive system*, similar to *the effect of gastric bypass surgery*.
Treatment Research

- Use of adult stem cells to reverse Type 1 Diabetes
- Transfusions of young patient’s own cord blood to slow the disease’s progression
- Human trials of a vaccine treatment for Type 1 Diabetes could start as early as next year
Pancreatic Transplant

Several approaches to pancreatic transplantation are currently being studied, including the whole pancreas and isolated islet cells (these groups of cells contain beta cells that are responsible for insulin production). Data available from 1995 indicates that almost 8,000 patients underwent pancreatic transplantation. Most patients undergo pancreatic transplantation at the time of kidney transplantation for diabetic kidney disease.
Take Home Message

A - A1c
B - Blood Pressure
C — Cholesterol

Talk to your patients every chance you get about the ABC’s of Diabetes Management and the Prevention of Long-Term Complications!!
Diabetes Resources

- **Diabetes Tool Kit (Texas Diabetes Council)**
  Can be downloaded from website at no charge
  www.dshs.state.tx.us/diabetes.org

- **American Diabetes Association**
  www.diabetes.org
  1-800-DIABETES (1-800-342-2383)

- **American Dietetic Association**
  www.eatright.org
  1-800-877-1600
Diabetes Resources

- Centers for Disease Control and Prevention
  www.cdc.gov/diabetes
  1-800-CDC-INFO (1-800-232-4636)

- MerckMedicus™
  www.merckmedicus.com
  1-800-489-5119

- National Diabetes Education Program
  www.ndep.nih.gov
  1-800-438-5383
Diabetes Resources

- National Diabetes Information Clearinghouse
  www.diabetes.niddk.nih.gov
  1-800-860-8747

- American Heart Association
  www.americanheart.org
  1-800-AHA-USA1 (1-800-242-8721)