The Diabetes Pandemic

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Learning Objectives

- To learn the pathophysiology and types of diabetes
- To learn the global burden of diabetes and its role as a leading cause of death worldwide
- To learn the risk factors of diabetes
- To learn why diabetes has become a pandemic
- To clarify some of the myths about diabetes
What is Diabetes?
Pathophysiology of Diabetes

When you eat, your body breaks food down into glucose. Glucose is a type of sugar that is the body’s main source of energy.
Pathophysiology of Diabetes

As blood glucose rises, the body sends a signal to the pancreas, which releases insulin.
Acting as a key, insulin binds to a place on the cell wall (an insulin receptor), unlocking the cell so glucose can pass into it. There, most of the glucose is used for energy right away.
Blood glucose goes up and down throughout the day:

- As your blood glucose **rises** (after a meal), the pancreas releases insulin.
What goes wrong in diabetes?

Normal situation

Type 1 diabetes

Type 2 diabetes

Gestational diabetes

Diagnosing Diabetes and Prediabetes

- **A1C**
  - Measures the average blood glucose for the past 2-3 months.
  - Does not require fasting.

- **FPG**
  - Fasting plasma Glucose.
  - Requires fasting for at least 8 hours.

- **OGTT**
  - Oral Glucose Tolerance Test.
  - Tests blood glucose level before and after a special sweet drink.
  - Tests how the body processes glucose.

Type 1 diabetes

• Accounts for only a minority of the total burden of diabetes in a population (5-10%).

• Caused by an autoimmune reaction, where the body’s defense system attacks the insulin-producing beta cells in the pancreas. As a result, the body can no longer produce the insulin it needs. Why this occurs is not fully understood.

• Has a sudden onset, and can affect people of any age, but usually occurs in children or young adults.
Type 2 diabetes

- Accounts for 85% to 95% of all cases of diabetes.
- In type 2 diabetes, the body is able to produce insulin but either this is not sufficient or the body is unable to respond to its effects (also known as insulin resistance), leading to a build-up of glucose in the blood.
- The number of people with type 2 diabetes is growing rapidly worldwide. This rise is associated with economic development, ageing populations, increasing urbanization, dietary changes, reduced physical activity, and changes in other lifestyle patterns.
Gestational diabetes

- Occurs in about 2–10% of all pregnancies.
- Tends to occur around the 24th week of pregnancy. The condition arises because the action of insulin is blocked, probably by hormones produced by the placenta.
- Gestational diabetes in mothers normally disappears after birth. However, after pregnancy approximately 5–10% of women with gestational diabetes develop diabetes mellitus, most commonly type 2.
- Babies born to mothers with gestational diabetes also have a higher lifetime risk of obesity and developing type 2 diabetes.
- Not the same as “diabetes in pregnancy”.

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Diabetes: Complications

**Macrovascular**
- Stroke
- Heart disease and hypertension
- Peripheral vascular disease
- Foot problems

**Microvascular**
- Diabetic eye disease (retinopathy and cataracts)
- Renal disease (nephropathy)
- Neuropathy
- Foot problems
Is Diabetes a Genetic Disease?

• Type 1 and type 2 diabetes have different causes. Yet two factors are important in both. The patient inherits a predisposition to the disease then something in his/her environment triggers it.

• Genes alone are not enough. One proof of this is identical twins. Identical twins have identical genes. Yet when one twin has type 1 diabetes, the other gets the disease at most only half the time.

• When one twin has type 2 diabetes, the other's risk is at most 3 in 4.
Global Diabetes Statistics

- Since 1980, the number of adults with diabetes worldwide has doubled. (1)
- Since 1980, the rate of obesity has nearly doubled worldwide. (2)
- There will be an estimated 70% increase in the number of adults with diabetes in the developing world, and a 20% increase in the developed world between 2010 and 2030. (3)
- Currently, there are 382 million people living with diabetes, and further 316 million with impaired glucose tolerance. (4)
- Globally, 46% of people who have diabetes are undiagnosed. (4)
- The majority of people with diabetes are aged between 40 and 59, and 80% of them live in low- and middle-income countries. (4)

Diabetes is the fourth or fifth leading cause of death in most high-income countries.
Prevalence (%) of diabetes in (20-79 years), 2011

80% of people with diabetes live in low-and middle-income countries

http://www.idf.org/diabetesatlas/5e/diabetes
Diabetes is not a disease of the rich…

Proportion of cases of diabetes (20-79 years) that are undiagnosed, 2013

- Africa: 27%
- Europe: 36%
- Middle East and North Africa: 48%
- North America and Caribbean: 49%
- South and Central America: 62%
- South-East Asia: 54%
- Western Pacific: 4%
Diabetes is a Worldwide Epidemic

In 2011, there were an estimated 366 million people with diabetes (8.3% of the world’s population)
By 2035, the prevalence is projected to rise to 592 million (10%)

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total world population (billions)</td>
<td>7.2</td>
<td>8.7</td>
</tr>
<tr>
<td>Adult population (20–79 years, billions)</td>
<td>4.6</td>
<td>5.9</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td></td>
<td></td>
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<tr>
<td>Global prevalence (%)</td>
<td>8.3</td>
<td>10.1</td>
</tr>
<tr>
<td>Number of people with diabetes (millions)</td>
<td>382</td>
<td>592</td>
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<tr>
<td><strong>Impaired Glucose Tolerance (IGT)</strong></td>
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<td></td>
</tr>
<tr>
<td>Global prevalence (%)</td>
<td>6.9</td>
<td>8.0</td>
</tr>
<tr>
<td>Number of people with IGT (millions)</td>
<td>316</td>
<td>471</td>
</tr>
</tbody>
</table>

# Prevalence of Diabetes: Top 10 Countries

<table>
<thead>
<tr>
<th>Country/territory</th>
<th>Prevalence of diabetes (%)</th>
<th>Country/territory</th>
<th>Prevalence of diabetes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tokelau</td>
<td>37.5</td>
<td>Tokelau</td>
<td>37.9</td>
</tr>
<tr>
<td>Federal States of Micronesia</td>
<td>35</td>
<td>Federal States of Micronesia</td>
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<tr>
<td>Marshall Islands</td>
<td>34.9</td>
<td>Kuwait</td>
<td>35</td>
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<tr>
<td>Kiribati</td>
<td>28.8</td>
<td>Kiribati</td>
<td>28.9</td>
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<tr>
<td>Cook Islands</td>
<td>25.7</td>
<td>Cook Islands</td>
<td>25.7</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>24</td>
<td>Saudi Arabia</td>
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<td>Nauru</td>
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<td>Kuwait</td>
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<td>Kuwait</td>
<td>23.2</td>
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<tr>
<td>Qatar</td>
<td>22.9</td>
<td>Qatar</td>
<td>22.8</td>
</tr>
</tbody>
</table>

Major Risk Factors for Diabetes

- Increase in population size
- Aging
- Obesity
- Physical inactivity
- Urbanization
- Dietary factors
- Prior gestational diabetes
- Family history: having a parent or sibling with type 2 diabetes
Figure 8. Age-standardized prevalence of diabetes in adults aged 25+ years, by WHO Region and World Bank income group, comparable estimates, 2008
Figure 16. Age-standardized prevalence of obesity in adults aged 20+ years, by WHO Region and World Bank income group, comparable estimates, 2008

http://www.who.int/nmh/publications/ncd_report_chapter1.pdf?ua=1
Figure 10. Age-standardized prevalence of insufficient physical activity in adults aged 15+ years, by WHO Region and World Bank income group, comparable estimates, 2008

http://www.who.int/nmh/publications/ncd_report_chapter1.pdf?ua=1
Figure 12. Availability of total fat and saturated fatty acids (SFA) (as % dietary energy supply) for 2005–7, by WHO Region and World Bank income group.

http://www.who.int/nmh/publications/ncd_report_chapter1.pdf?ua=1

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Why has the burden of diabetes been increasing globally?
YOUNG CHILDREN AND OLDER PEOPLE AS A PERCENTAGE OF GLOBAL POPULATION

PROJECTED INCREASE IN GLOBAL POPULATION BETWEEN 2005 AND 2030, BY AGE

Global Prevalence of obesity (BMI ≥ 30 kg/m²) in 1980 and 2008

**US Adults** Met-hours Per Week of All Physical Activity, and Hours/Week of Time in Sedentary Behavior: Measured for 1965-2009 and Forecasted for 2010-2030

UK Adults Met-hours per Week of Physical Activity and Hours/Week of Time in Sedentary Behavior: Measured for 1961-2005 and Forecasted for 2006-2030

Chinese Adults Met-hours per Week of Physical Activity & Hours/Week of Time in Sedentary Behavior: Measured for 1991-2009 and Forecasted for 2010-2030

![Graph showing changes in physical activity and sedentary time from 1991 to 2030.](image)

- **1991**: 399 MET-hr/week
- **2009**: 213 MET-hr/week
- **2020**: 200 MET-hr/week
- **2030**: 188 MET-hr/week

**Brazilian Adults** Met-hours per Week Of Physical Activity & Hours/Week Of Time In Sedentary Behavior: Measured For 2002-2008 And Forecasted For 2009-2030

**Indian Adults** Met-hours per Week of Physical Activity & Hours/Week of Time in Sedentary Behavior: Measured for 2000-2005 and Forecasted for 2006-2030

- **Active Leisure PA**
- **Travel PA**
- **Domestic PA**
- **Occupational PA**
- **Sedentary Time (hrs/week)**

By 2005: 239 MET-hr/week

By 2020: 225 MET-hr/week

By 2030: 212 MET-hr/week

The proportion of the population living in urban settings for the seven developing countries with the highest total populations

- **Nigeria**
- **Bangladesh**
- **Pakistan**
- **Brazil**
- **Indonesia**
- **India**
- **China**

![Bar chart showing urban population percentages for each country in 2000 and 2025.]
Trends in the Prevalence of Gestational Diabetes

USA

1989-2000
1.90%

2003-2004
4.20%

Thailand

1987-1989
2%

2001-2002
3%

China (Hong Kong)

1986
7.40%

1998-2001
10.40%

Hirst et al. Journal of Diabetology, October 2012; 3:4
Some Myths About Diabetes
Myths #1: Diabetes Is Caused by Eating Carbohydrates

Diabetes is least common in the population groups whose diets emphasize carbohydrates. Take Japan, where rice is a traditional staple. Prior to 1980, fewer than 5% of the adult population there had diabetes. But once fast food and meat started to displace rice, diabetes became much more prevalent. By 1990 the prevalence of diabetes in Japan had doubled.

In the US, the risk for type 2 diabetes is highest among frequent meat-eaters. Vegans have the lowest risk, and other groups (semi-vegetarians, fish-eaters) are in between.

Bottom Line is:
The real problem seems to be not carbohydrates, but fatty foods.
Myth # 2: Diabetes Doesn't Run in My Family, So I'm Safe

Many people develop diabetes despite the fact that they have no family history of the disease. Heredity certainly plays a role, but studies involving identical twins show it is not the only factor. When one twin has type 1 diabetes, the other has a 50-50 chance of having it, too. For type 2 diabetes, twins are more likely to share the diagnosis - the odds of the second twin having it can be as high as 75%. But even then, the reason may be that their diets and weight gain are similar.

Bottom Line is:
To minimize your risk for diabetes, you need to exercise and watch what you eat no matter what your family history is.
Myth #3: I'm Not Fat, So I Won't Get Diabetes

Staying slim cuts the risk dramatically, but thin people can certainly develop diabetes.

Similarly, being overweight or obese increases risk, but does not necessarily mean that one will develop diabetes.
Myth #4: Diet Has Nothing to Do with Type 1 Diabetes

- Type 1 diabetes is caused by antibodies—that under normal circumstances are produced by the body to fight invading bacteria and viruses. Diabetes results when, in the body's version of "friendly fire," antibodies attack the insulin-producing cells of the pancreas.

- What turns antibodies against the pancreas? One theory is that certain viral infections are to blame. But another possible culprit is cow's milk.
And the list of myths goes on.....

• Only adults get type 2 diabetes.
• People with diabetes can feel when their blood glucose level goes too low.
• It's possible to have "just a touch" or "a little" diabetes.
• If you are overweight or obese, you will eventually develop type 2 diabetes.
• You have to lose a lot of weight for your diabetes to improve.
• People who use insulin are unsafe drivers.
• People with diabetes can't get tattoos.
Thank you