Diabetes

Gojka Roglic
What is diabetes?

Diabetes mellitus is a metabolic disorder of multiple aetiology, characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both.

WHO, 1999
Three major types of diabetes

- Type 1 (5-15%)
- Type 2 (85-95%)
- Gestational diabetes

WHO, 1999
Causes of diabetes

Largely unknown...........
Causes of diabetes

Genetic susceptibility + Environmental factors
Apparent Epidemic of Insulin-Dependent Diabetes Mellitus in Midwestern Poland

Increasing trend in Type 1 (insulin-dependent) diabetes mellitus in childhood in Finland

Secondary Attack Rate of Type 1 Diabetes in Colorado Families

OBJECTIVE — To examine a possible relationship between the prevalence of Type 1 diabetes in children and the frequency of Type 1 diabetes in their family members.

RESEARCH DESIGN AND METHODS — We performed a retrospective analysis of medical records of children with Type 1 diabetes diagnosed between 1970 and 1989. The prevalence of Type 1 diabetes in the family of each child was determined by reviewing the medical records of all family members of that child. The prevalence of Type 1 diabetes in the family of each child was compared to the prevalence of Type 1 diabetes in the general population of the same age and sex.

RESULTS — We found a significant association between the prevalence of Type 1 diabetes in the family of the child and the prevalence of Type 1 diabetes in the general population. The prevalence of Type 1 diabetes in the family of the child was 4.5 times higher than the prevalence in the general population.

CONCLUSIONS — Our findings suggest that the prevalence of Type 1 diabetes in children is not only determined by environmental factors, but also by the genetic susceptibility of the family members.
Type 1 diabetes risk factors:

- Viral infections?
- Maternal nutrition in pregnancy?
- Infant nutrition?
- Environmental toxins?
- Protective effect of intestinal parasites?

No known means for prevention
Type 2 risk factors:

- Overweight, obesity
- Physical inactivity
- Smoking?

Potentially preventable
Number of persons with diabetes in the world 2010 (IDF Atlas, 4th ed)

- 285 million in 2010 (0.5 million type 1)
- 438 million in 2030
Age distribution of persons with diabetes in Europe, 2010 (IDF Atlas, 4th ed)
Age distribution of persons with diabetes in South-East Asia, 2010  (IDF Atlas, 4th ed)
Deaths attributed to 19 leading factors, by country income level, 2004

- High blood pressure
- Tobacco use
- High blood glucose
- Physical inactivity
- Overweight and obesity
- High cholesterol
- Unsafe sex
- Alcohol use
- Childhood underweight
- Indoor smoke from solid fuels
- Unsafe water, sanitation, hygiene
- Low fruit and vegetable intake
- Suboptimal breastfeeding
- Urban outdoor air pollution
- Occupational risks
- Vitamin A deficiency
- Zinc deficiency
- Unsafe health-care injections
- Iron deficiency

Mortality in thousands (total: 58.8 million)

- High income
- Middle income
- Low income
The rising global prevalence of diabetes (millions)
RISING PREVALENCE OF DIABETES IN URBAN INDIA

(Mohan, 2006)

Within a span of 14 years, the prevalence of diabetes increased by 72.3%
Is there a diabetes epidemic?
Possible causes of increasing type 2 diabetes prevalence

- Ageing of the population
- Younger age at onset
- Decreasing mortality
- Increasing incidence
Possible causes of increasing type 2 diabetes prevalence (Colagiuri et al, 2005)

- Ageing of the population
- Younger age at onset
- Decreasing mortality

Explain only 20-25% increase in prevalence
Possible causes of increasing type 2 diabetes prevalence (from Colagiuri et al, 2005)

- Ageing of the population
- Younger age at onset
- Decreasing mortality

\[ \text{Explain only 20-25\% increase in prevalence} \]

- Increasing incidence!
WHO Global Strategy for the Prevention and Control of Noncommunicable Diseases, 2000

### Four diseases and four risk factors

<table>
<thead>
<tr>
<th></th>
<th>Tobacco Use</th>
<th>Unhealthy diets</th>
<th>Physical Inactivity</th>
<th>Harmful Use of Alcohol</th>
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<tbody>
<tr>
<td>Cardiovascular</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Diabetes</td>
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<tr>
<td>Cancer</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Chronic Respiratory</td>
<td>✔</td>
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Determinants outside the health sector, including:
- Ministries of Finance, Trade, Education, Social Affairs
- Development donors
- International Financial Institutions
- Intergovernmental Organizations
Prevalence of overweight and obesity in 10 year old boys and girls in selected countries (IOTF, 2005)
“Remember when we used to have to fatten the kids up first?”
Is type 2 diabetes preventable.....

- In the population?
- In people at high risk?
Primary prevention of type 2 diabetes in the population

• Intuitively appealing, but few tries and little evidence
  – Finnish Diabetes Programme
  – Singapore National Healthy Lifestyle Programme (Bhalla, 2006)
  – (Un)natural experiments
    • Japan (Goto, 1958)
    • Netherlands (Hermanides, 2008)
    • Cuba (Franco, 2007)
    • Paris (anecdotal)
    • England (anecdotal)
Primary prevention of type 2 diabetes in the population

- Economic crisis in Cuba, 1990's (Franco, 2007)
  - CHD mortality reduced
  - Diabetes mortality levels off
Prevention of diabetes in people at high risk, by lifestyle modification

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>IGT Pop</th>
<th>Age</th>
<th>FU Yrs</th>
<th>FU %</th>
<th>Rx</th>
<th>RRR</th>
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<tbody>
<tr>
<td>Finnish DPS</td>
<td>522</td>
<td>BMI &gt; 25</td>
<td>55</td>
<td>3.2</td>
<td>92</td>
<td>Diet/Ex</td>
<td>58%</td>
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<tr>
<td>DPP</td>
<td>2161</td>
<td>BMI &gt; 24, FPG &gt; 5.3</td>
<td>51</td>
<td>3</td>
<td>93</td>
<td>Diet/Ex</td>
<td>58%</td>
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<td>DaQing</td>
<td>259</td>
<td>Groups</td>
<td>45</td>
<td>6</td>
<td>92</td>
<td>Diet/Ex</td>
<td>38%</td>
</tr>
<tr>
<td>Kosaka</td>
<td>458</td>
<td>Men; BMI = 24</td>
<td>~55</td>
<td>4</td>
<td>92</td>
<td>Diet/Ex</td>
<td>67%</td>
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<tr>
<td>India DPP</td>
<td>269</td>
<td>Any IGT</td>
<td>46</td>
<td>2.5</td>
<td>95</td>
<td>Diet/Ex</td>
<td>29%</td>
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</table>
Cumulative incidence of diabetes in Da Qing Follow-up Study (Li et al, Lancet 2008)
Can complications of diabetes be prevented/delayed?

- Yes, convincing evidence from rigorous trials
- However, great inequities in access to quality treatment
Working in partnership to prevent and control the 4 noncommunicable diseases – cardiovascular disease, diabetes, cancer and chronic respiratory disease and the 4 shared risk factors – tobacco use, physical inactivity, unhealthy diets and the harmful use of alcohol.

2008-2013 Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases

Department of Chronic Diseases and Health Promotion
Proposed actions for:

• Member States

• WHO Secretariat
  – WHO Headquarters
  – WHO Regional Office for Africa (AFRO)
  – WHO Regional Office for the Americas (AMRO)
  – WHO Regional Office for the Eastern Mediterranean (EMRO)
  – WHO Regional Office for Europe (EURO)
  – WHO Regional Office for South-East Asia (SEARO)
  – WHO Regional Office for the Western Pacific (WPRO)

• International partners
Objectives 2 and 3 – Technical support for national policies and plans

Reducing the level of exposure of individuals and populations to unhealthy diet and physical inactivity:

- Population salt reduction platforms & strategies
  - Population prevention strategies for childhood obesity
  - Recommendations on the marketing of foods and non-alcoholic beverages to children
  - Global Recommendations on physical activity and health
- NCD Prevention through Diet and Physical Activity in Schools and Worksites
  - The WHO STEPwise Approach to Chronic Disease Risk Factor Surveillance (STEPS)
  - From Surveillance-to-Policy workshops
  - Technical support package (next slide)
WHO technical support package of essential interventions to promote healthy diet and physical activity:

- Population prevention strategies for childhood obesity
- Population salt reduction platforms and strategies
- Recommendations on the marketing of foods and non-alcoholic beverages to children
- Global recommendations on physical activity and health
Strengthening health care for people with noncommunicable diseases:

- WHO technical support package of essential interventions to integrate NCD prevention and control into primary care
"…….there are now indications of a rapid increase in the disease that are in complete accord with the recognized clinical association between diabetes and increased food consumption, reduced physical exertion and obesity….. "