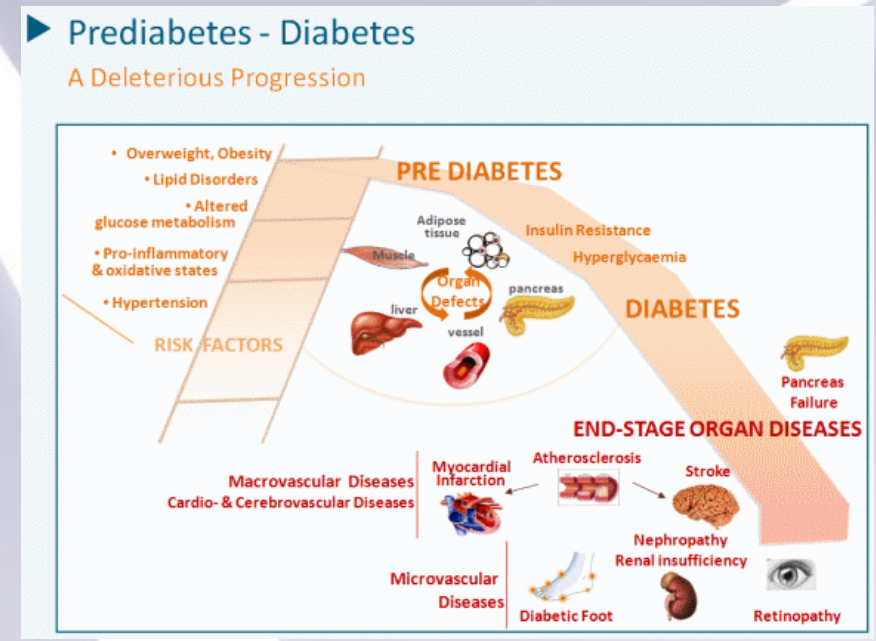

Prevent development of diabetes in high risk subjects

Henk Bilo

Cardiology and Vascular Medicine 2011 Congress

De Doelen, Rotterdam, 23 may, 2011

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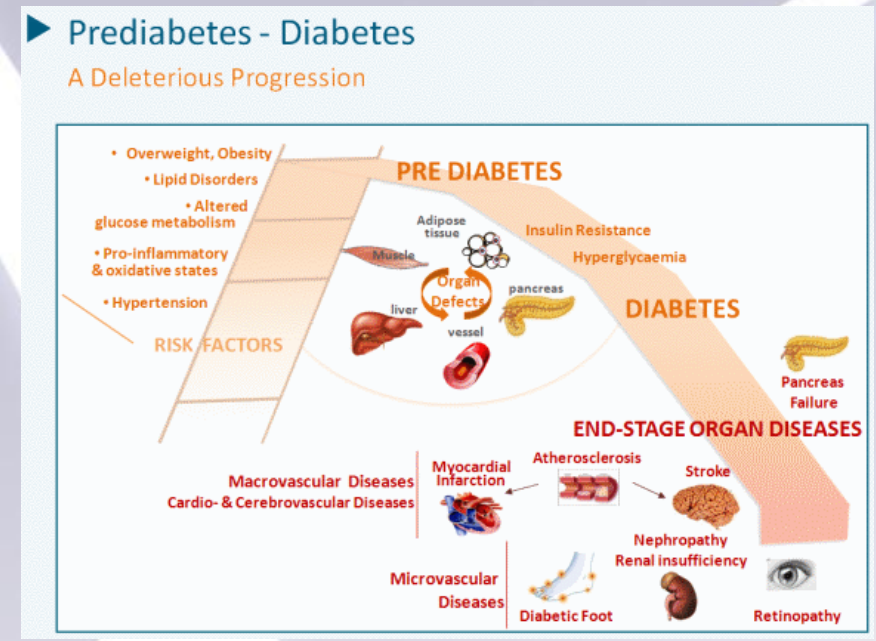

Prevent development of **type 2 diabetes** in high risk subjects

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T2DM: Heterogenic disease

- Predominantly insulin resistance with relative insulin deficiency
- predominantly secretory defect with insulin resistance
- Predominantly beta cell failure without complete loss of insulin secretory capacity
- Gestational diabetes

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Complications in T2DM

- Microvascular complications
  - nephropathy
  - retinopathy
  - neuropathy
- macrovascular complications
  - CHD
  - CVD
  - Peripheral vascular disease

Mortality
Macro/micro:
70 : 1

Morbidity
Macro/micro:
4 : 1

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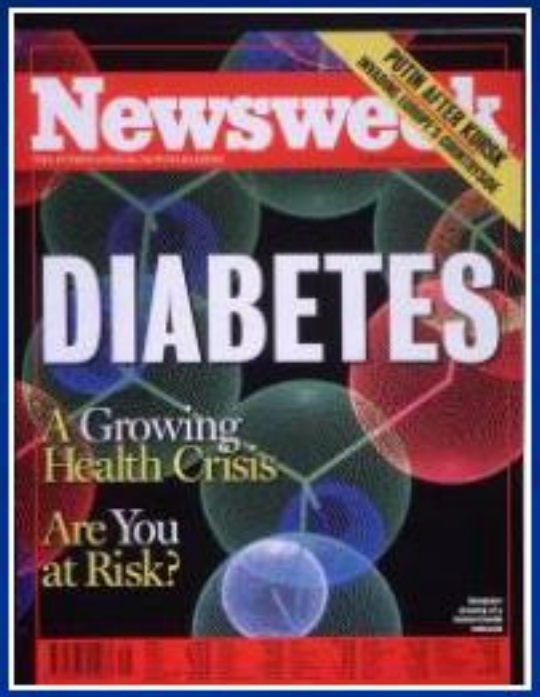
Diabetes Facts 2002

- Facts
  - 194 million people worldwide*
  - 330 million by 2025*
  - Fourth cause of death in developed countries**
  - 3.2 million deaths every year**
- US prevalence
  - 1.5-2.0 million insulin dependent type 1
  - 16-19 million people with type 2
- Cost
  - 5-10% world's healthcare budget is spent on diabetes*
  - $132B / year in US (predominantly due to complications)
  - $10,000 /year/patient with diabetes



*International Diabetes Foundation
** World Health Organization

2006

Prevalence

Approximately 246 million people worldwide are currently estimated to have diabetes, a global prevalence of 5.9% (IDF, 2006). This is expected to rise to 380 million people and a global prevalence of 7.1% by 2025 (King et al, 1998). Type 2 diabetes is the most common form of diabetes and accounts for 85-95% of all diabetes in developed countries and an even higher proportion in developing countries (IDF, 2006). It is now epidemic within many developing and newly industrialised countries (Wild et al, 2004).

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Prevalence DM 2010-2030

	2010	2030
World population (billions)	7.0	8.4
Adults (20-79 jaar)	4.3	5.6
Diabetes prevalence (%)	6.6	7.8
Total (millions)	285	438
IGT prevalence (%)	7.9	8.4
Total (millions)	344	472

Source: IDF

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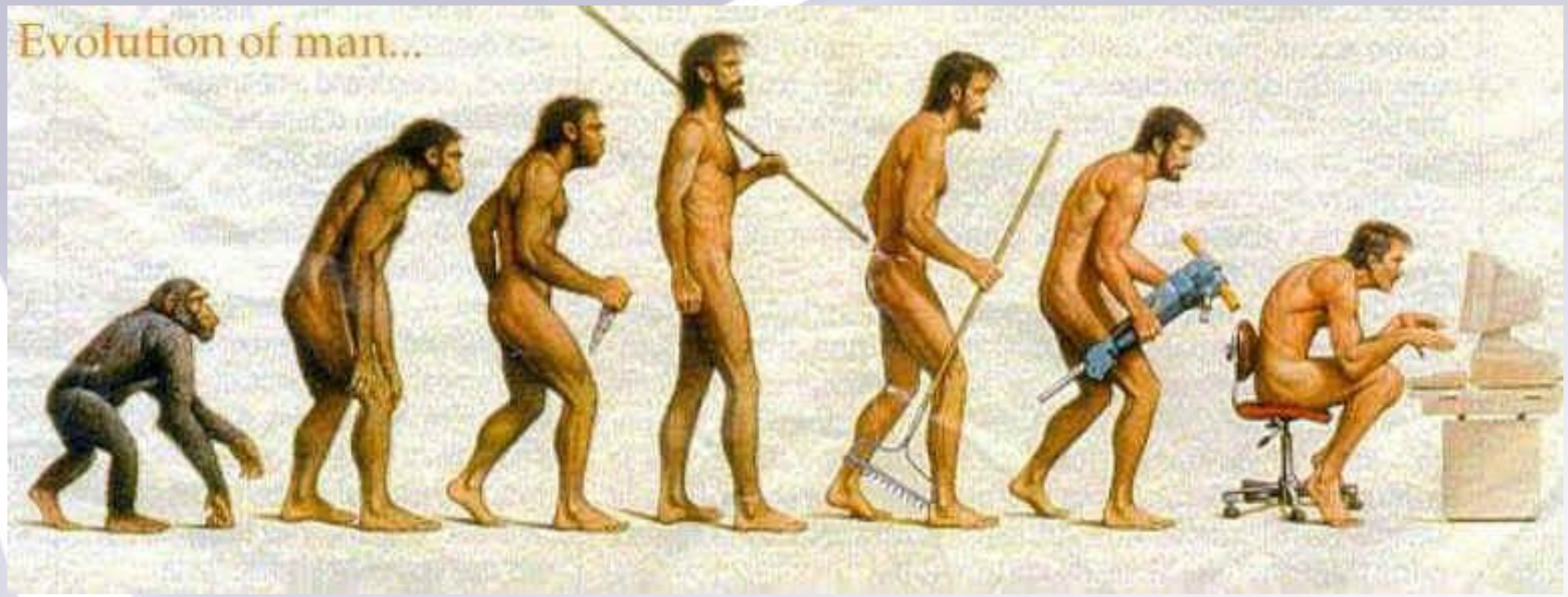

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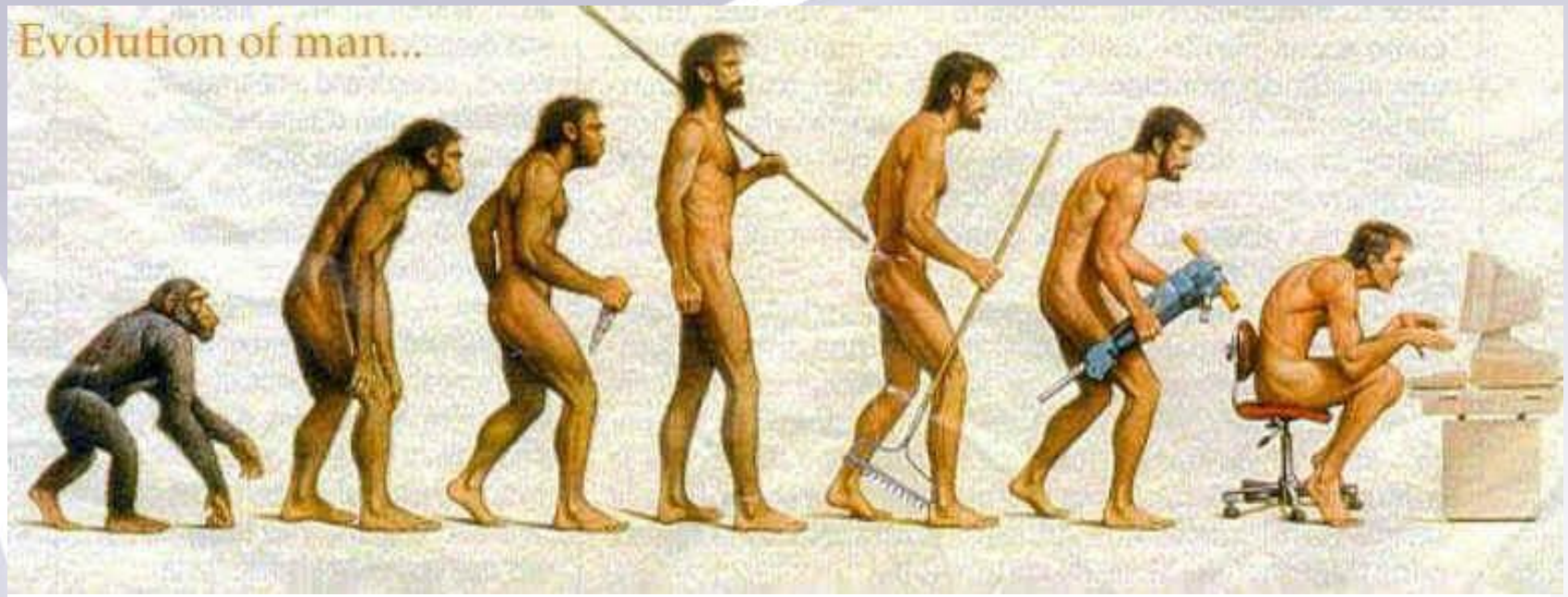
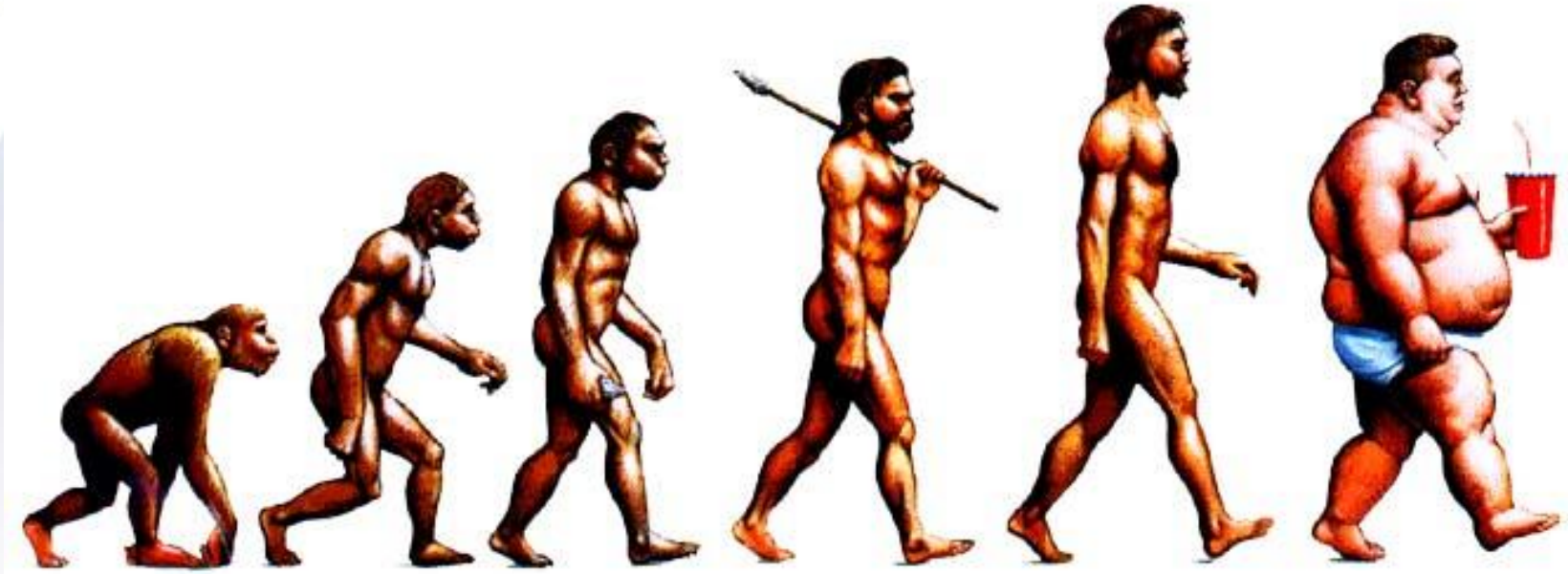
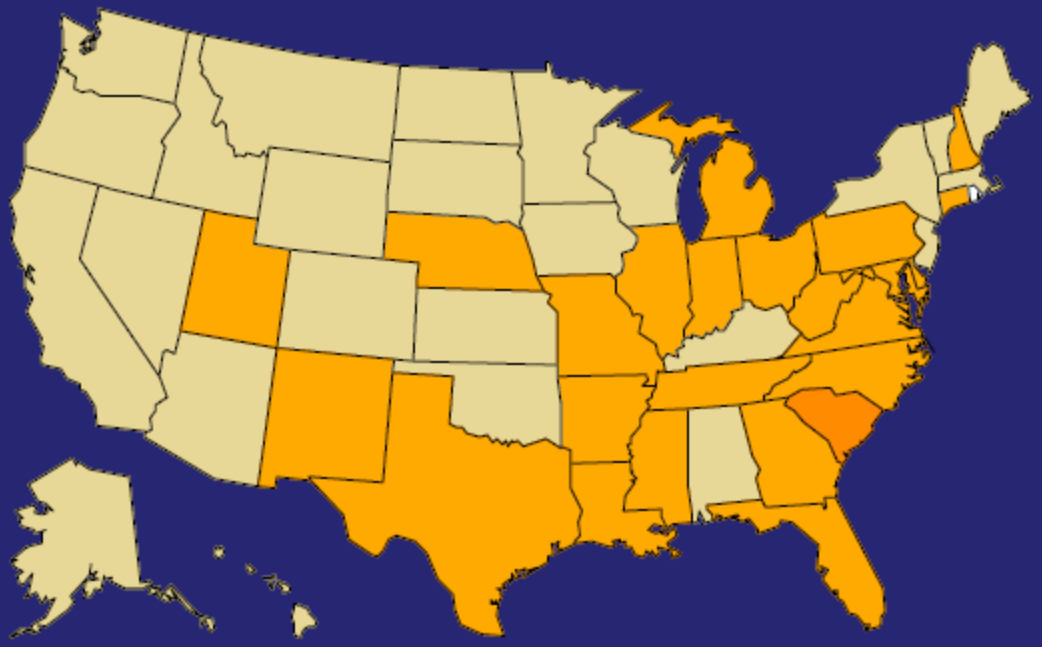

Evolution of man...



Age-adjusted Percentage of U.S. Adults Who Had Diagnosed Diabetes

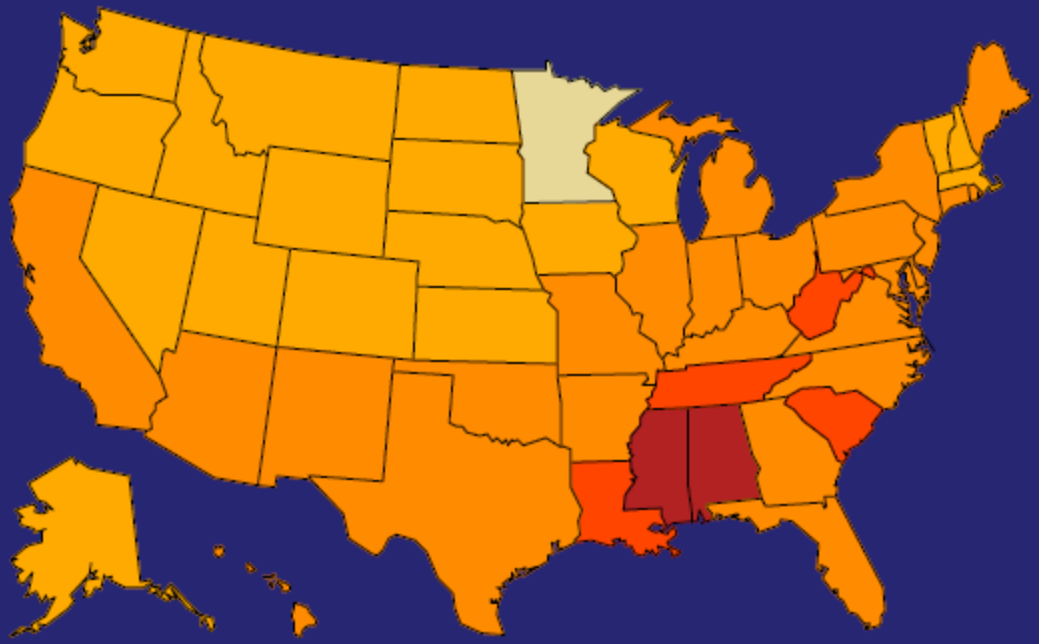
1994



CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

Age-adjusted Percentage of U.S. Adults Who Had Diagnosed Diabetes

2001

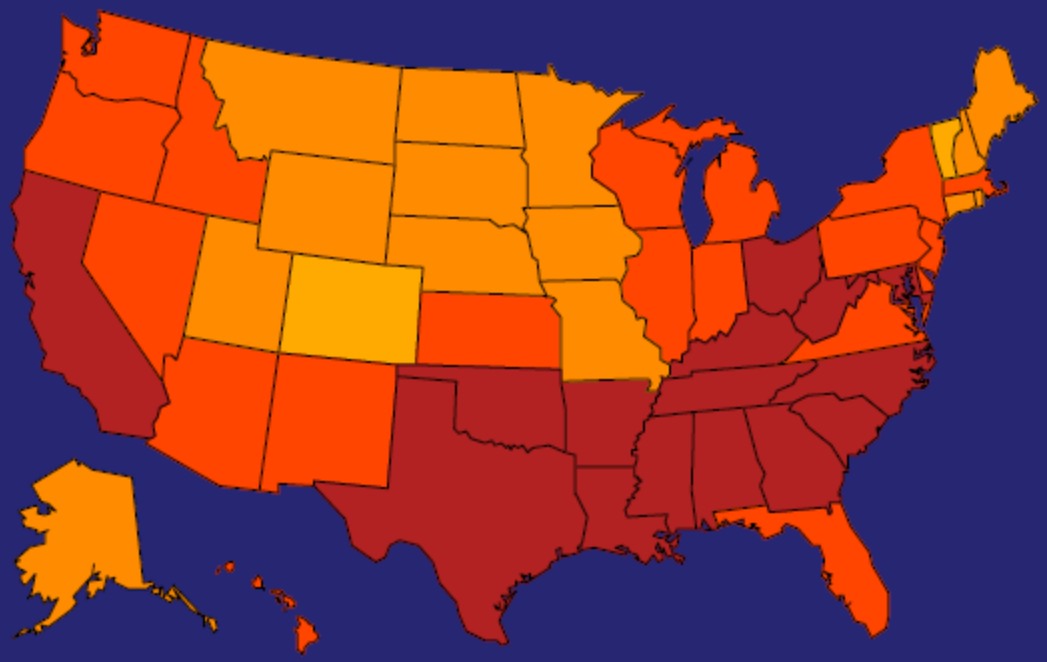


Missing data	<4.5%
4.5 - 5.9%	6.0 - 7.4%
7.5 - 8.9%	≥9.0%

CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

Age-adjusted Percentage of U.S. Adults Who Had Diagnosed Diabetes

2009

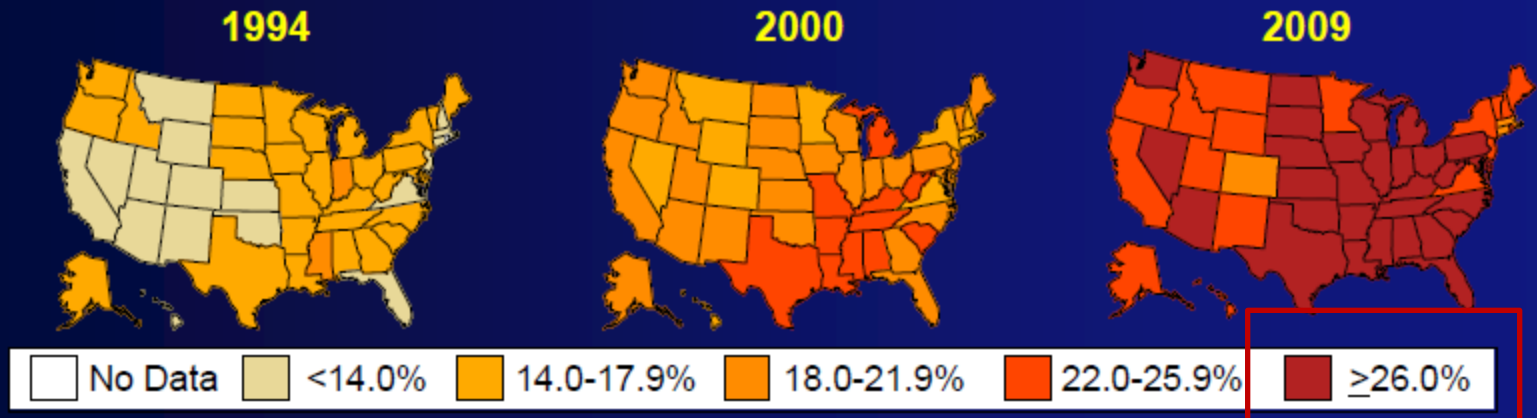


Missing data	<4.5%
4.5 - 5.9%	6.0 - 7.4%
7.5 - 8.9%	≥9.0%

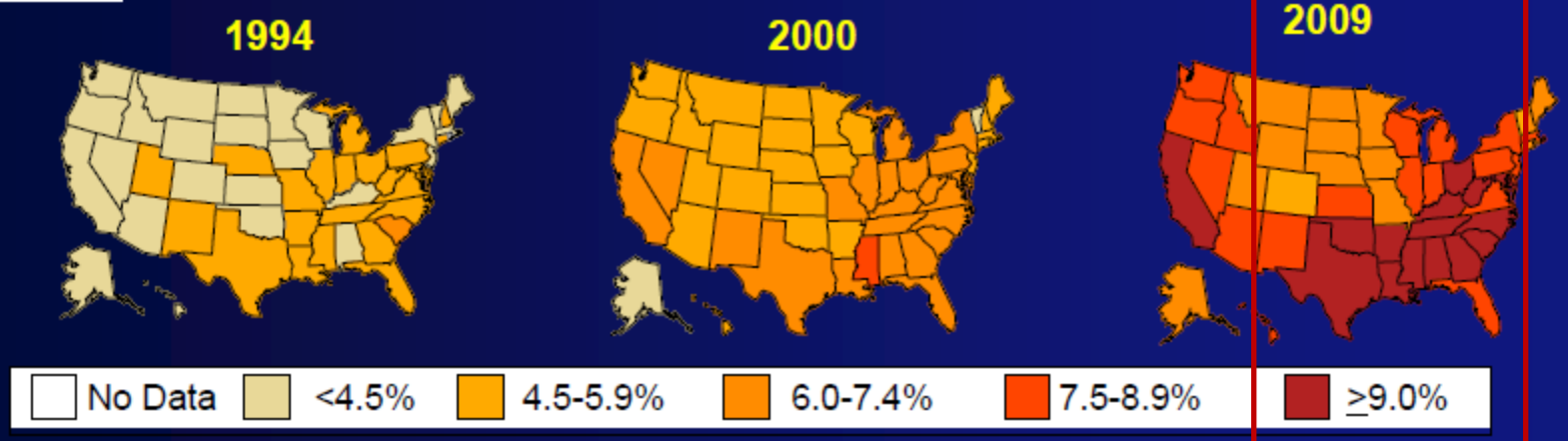
CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

Age-adjusted Percentage of U.S. Adults Who Were Obese or Who Had Diagnosed Diabetes

Obesity (BMI ≥30 kg/m²)

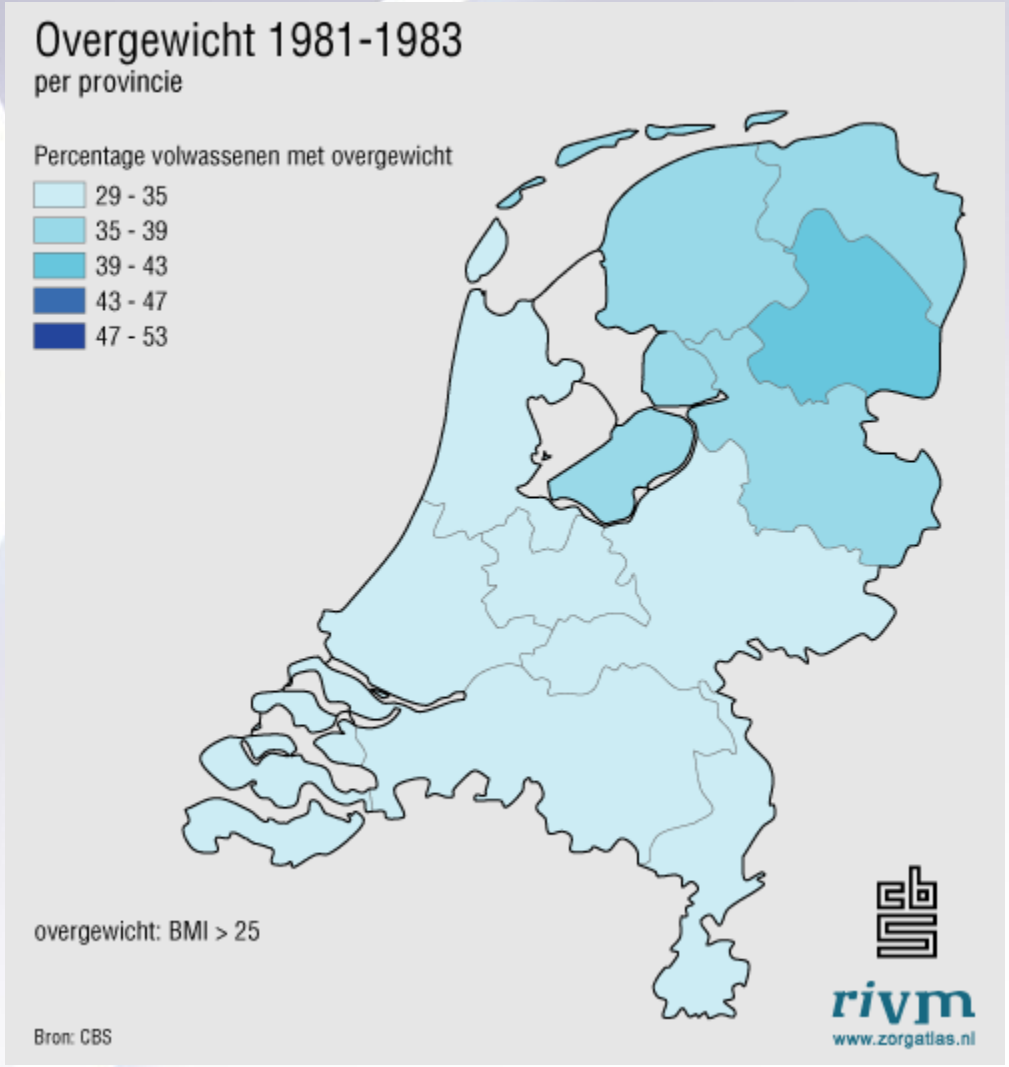


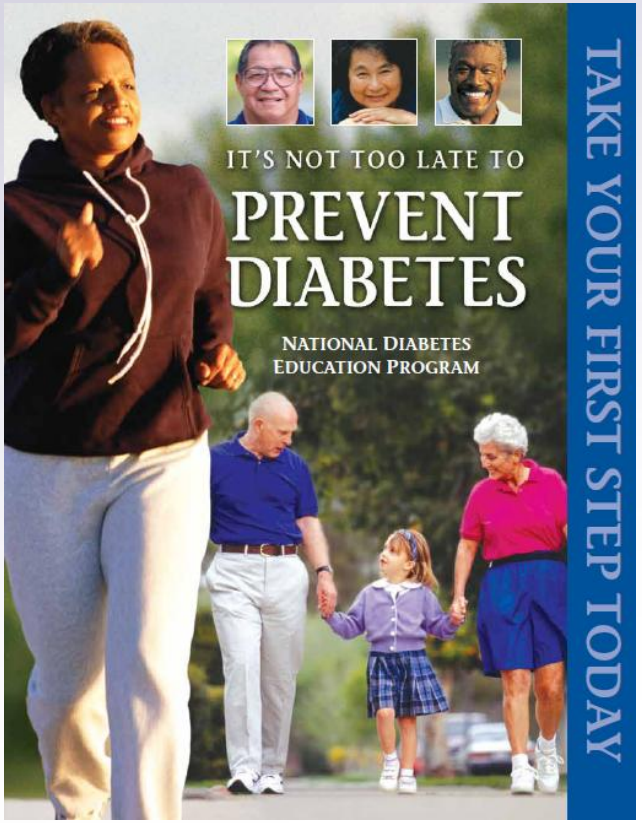
Diabetes



CDC's Division of Diabetes Translation. National Diabetes Surveillance System available at http://www.cdc.gov/diabetes/statistics

BMI > 25 kg/m² in The Netherlands





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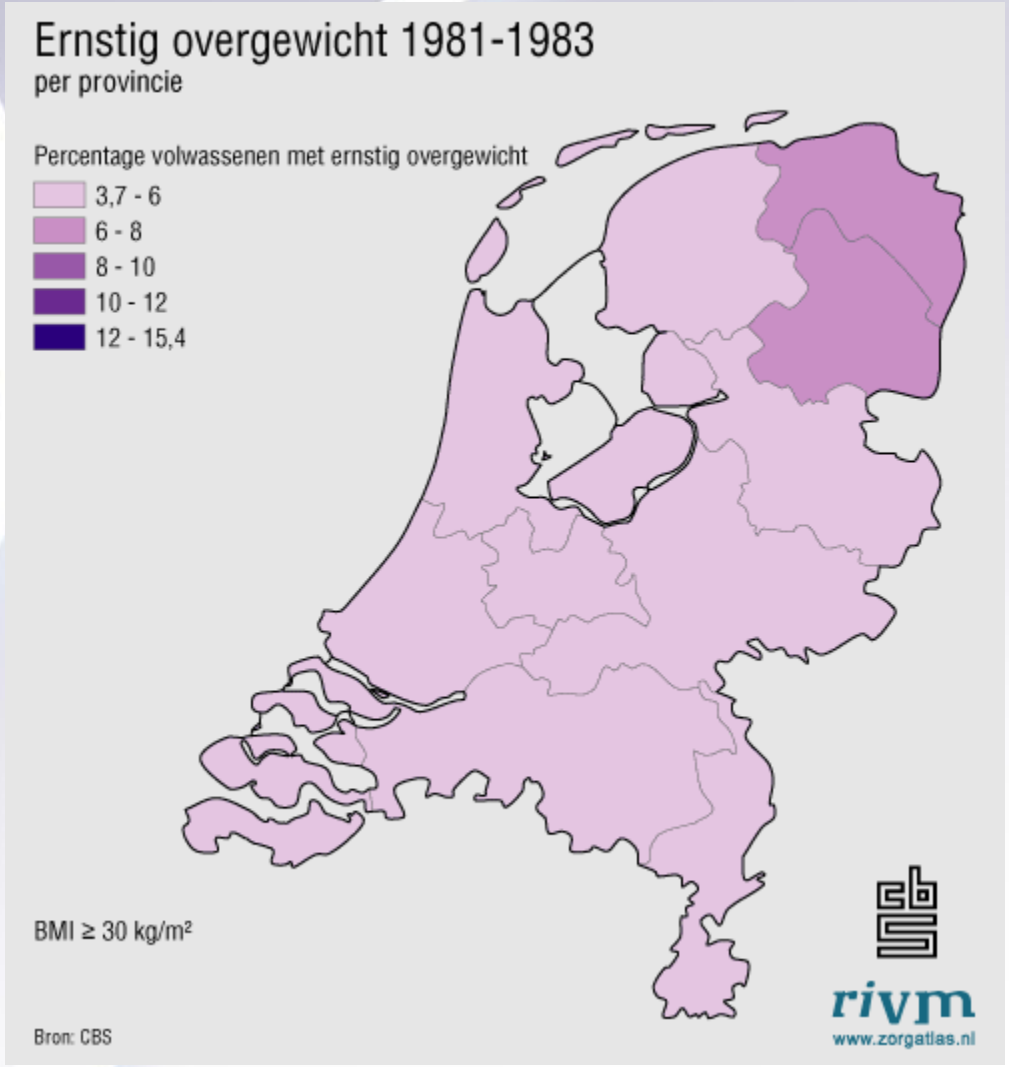
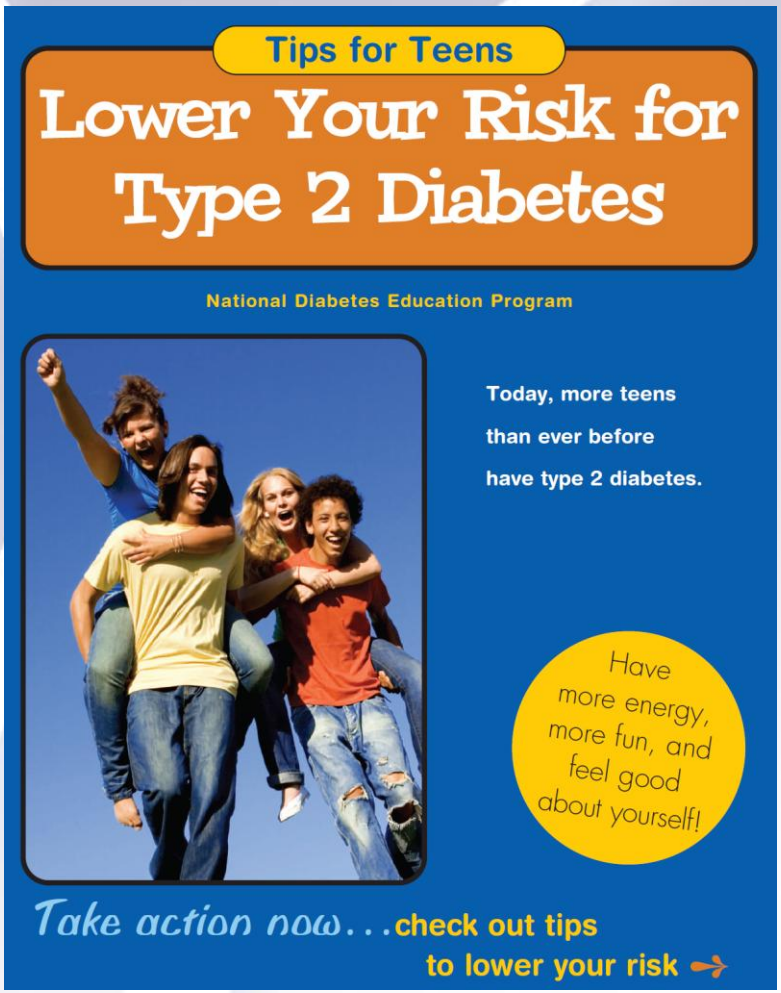
BMI ≥ 30 kg/m² in The Netherlands

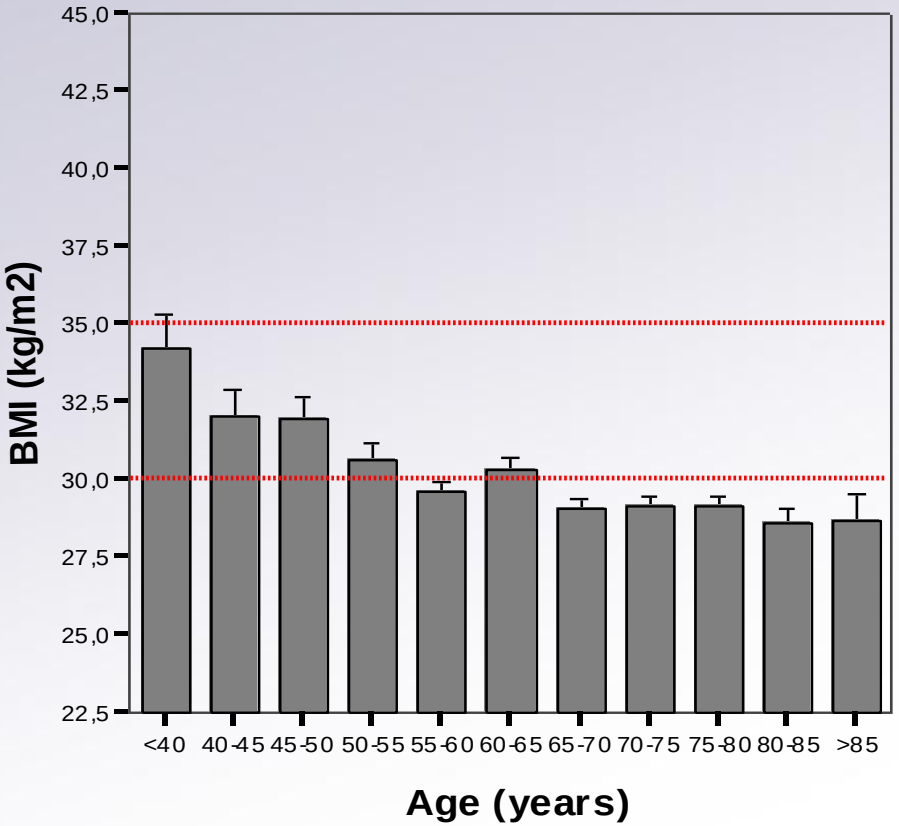


IF YOU ARE ASIAN AMERICAN AT RISK BMI ≥ 23		IF YOU ARE PACIFIC ISLANDER AT RISK BMI ≥ 26		IF YOU ARE NOT ASIAN AMERICAN OR PACIFIC ISLANDER AT RISK BMI ≥ 25	
HEIGHT	WEIGHT	HEIGHT	WEIGHT	HEIGHT	WEIGHT
4'10"	110	4'10"	124	4'10"	119
4'11"	114	4'11"	128	4'11"	124
5'0"	118	5'0"	133	5'0"	128
5'1"	122	5'1"	137	5'1"	132
5'2"	126	5'2"	142	5'2"	136
5'3"	130	5'3"	146	5'3"	141
5'4"	134	5'4"	151	5'4"	145
5'5"	138	5'5"	156	5'5"	150
5'6"	142	5'6"	161	5'6"	155
5'7"	146	5'7"	166	5'7"	159
5'8"	151	5'8"	171	5'8"	164
5'9"	155	5'9"	176	5'9"	169
5'10"	160	5'10"	181	5'10"	174
5'11"	165	5'11"	186	5'11"	179
6'0"	169	6'0"	191	6'0"	184
6'1"	174	6'1"	197	6'1"	189
6'2"	179	6'2"	202	6'2"	194
6'3"	184	6'3"	208	6'3"	200
6'4"	189	6'4"	213	6'4"	205

Source: Adapted from *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*

T2DM incidence and BMI





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Diabeteszorgbeter cohort 2006

Table 4 Top 10: Number of people with diabetes (20-79 age group), 2010 and 2030

	2010			2030	
	COUNTRY	PERSONS (MILLIONS)		COUNTRY	PERSONS (MILLIONS)
1	India	50.8	1	India	87.0
2	China	43.2	2	China	62.6
3	United States of America	26.8	3	United States of America	36.0
4	Russian Federation	9.6	4	Pakistan	13.8
5	Brazil	7.6	5	Brazil	12.7
6	Germany	7.5	6	Indonesia	12.0
7	Pakistan	7.1	7	Mexico	11.9
8	Japan	7.1	8	Bangladesh	10.4
9	Indonesia	7.0	9	Russian Federation	10.3
10	Mexico	6.8	10	Egypt	8.6

Table 6 Top 10: Number of people with impaired glucose tolerance (20-79 age group), 2010 and 2030

	2010			2030	
	COUNTRY	PERSONS (MILLIONS)		COUNTRY	PERSONS (MILLIONS)
1	China	67.0	1	China	81.7
2	India	39.5	2	India	64.1
3	United States of America	27.3	3	United States of America	35.2
4	Russian Federation	17.9	4	Indonesia	23.4
5	Indonesia	16.3	5	Russian Federation	17.6
6	Japan	13.0	6	Brazil	13.3
7	Brazil	9.0	7	Pakistan	12.6
8	Pakistan	7.2	8	Japan	12.1
9	Bangladesh	6.7	9	Bangladesh	9.1
10	Ukraine	6.0	10	Philippines	8.7

Table 4 Top 10: Number of people with diabetes (20-79 age group), 2010 and 2030

	COUNTRY	2010 PERSONS (MILLIONS)		COUNTRY	2030 PERSONS (MILLIONS)
1	India	50.8	1	India	87.0
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3	United States of America	26.8	3	United States of America	36.0
4	Russian Federation	9.6	4	Pakistan	13.8
5	Brazil	7.6	5	Brazil	12.7
6	Germany	7.5	6	Indonesia	12.0
7	Pakistan	7.1	7	Mexico	11.9
8	Japan	7.1	8	Bangladesh	10.4
9	Indonesia	7.0	9	Russian Federation	10.3
10	Mexico	6.8	10	Egypt	8.6

Table 3 Top 10: Prevalence of diabetes* (20-79 age group), 2010 and 2030

	COUNTRY	2010 PREVALENCE (%)		COUNTRY	2030 PREVALENCE (%)
1	Nauru	30.9%	1	Nauru	33.4%
2	United Arab Emirates	18.7%	2	United Arab Emirates	21.4%
3	Saudi Arabia	16.8%	3	Mauritius	19.8%
4	Mauritius	16.2%	4	Saudi Arabia	18.9%
5	Bahrain	15.4%	5	Réunion	18.1%
6	Réunion	15.3%	6	Bahrain	17.3%
7	Kuwait	14.6%	7	Kuwait	16.9%
8	Oman	13.4%	8	Tonga	15.7%
9	Tonga	13.4%	9	Oman	14.9%
10	Malaysia	11.6%	10	Malaysia	13.8%

Disparities in healthcare spending

There is a large disparity in healthcare spending on diabetes between regions and countries. More than 80% of the estimated global expenditures on diabetes are made in the world's economically richest countries, not in the low- and middle-income countries where over 70% of people with diabetes live.

One country, the United States of America, is projected to spend **USD198 billion** or 52.7% of global expenditure in 2010, while India, the country with the largest population of people living with diabetes, is expected to spend an estimated **USD2.8 billion**, or less than 1% of the global total. An estimated average of USD7,383 per person with diabetes is expected to be spent on diabetes-related care in the USA but less than USD10 per person will be spent in Burundi, Côte d'Ivoire and Myanmar in 2010.

Net losses in national income

Country	US dollars (billion)
USA 2007	58.0
DM and CV disease 2005-2015	
China	557.7
Russia	303.2
India	236.6
Brazil	49.2
Tanzania	2.5

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Risk factors and associated disorders

Table 1 Modifiable and non-modifiable risk factors and associated disorders for Type 2 diabetes

Modifiable risk factors	Non-modifiable risk factors
Overweight* and obesity† (central and total)	Ethnicity
Sedentary lifestyle	Family history of Type 2 diabetes
Previously identified glucose intolerance (IGT and/or IFG)	Age
Metabolic syndrome:	Gender
Hypertension	History of gestational diabetes
Decreased HDL cholesterol	Polycystic ovary syndrome
Increased trigylcerides	
Dietary factors	
Intrauterine environment	
Inflammation	

*World Health Organization (WHO) criteria define overweight as a BMI ≥ 25 kg/m^2 [50].
†WHO criteria define obesity as a BMI ≥ 30 kg/m^2 [50]. For country/ethnic specific values for waist circumference as a measure of central obesity see table 4.
HDL, high-density lipoprotein; IFG, impaired fasting glucose; IGT, impaired glucose tolerance.

Diabetic Medicine 2007, IDF consensus

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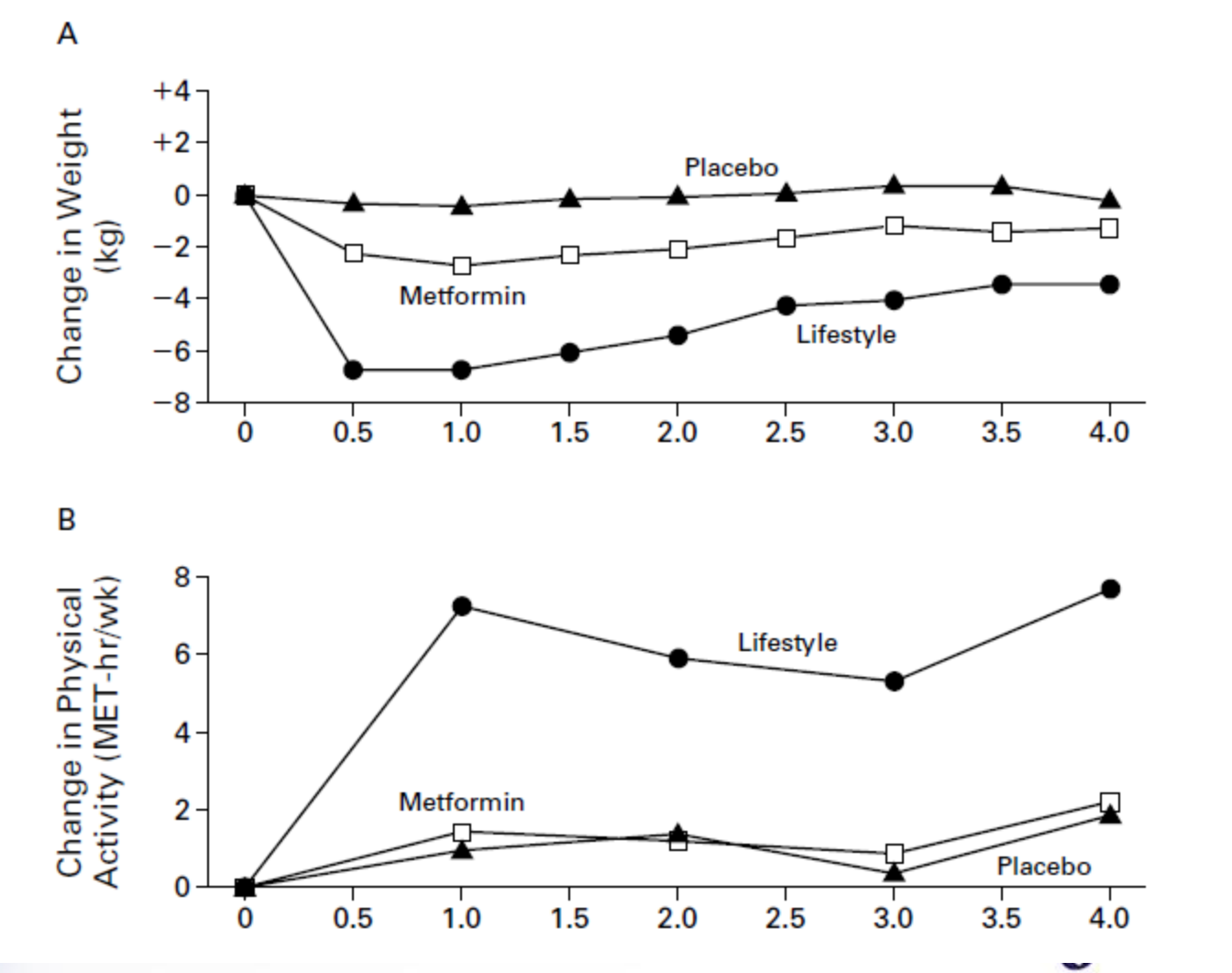
DPP, NEJM 2002



DPP, NEJM 2002

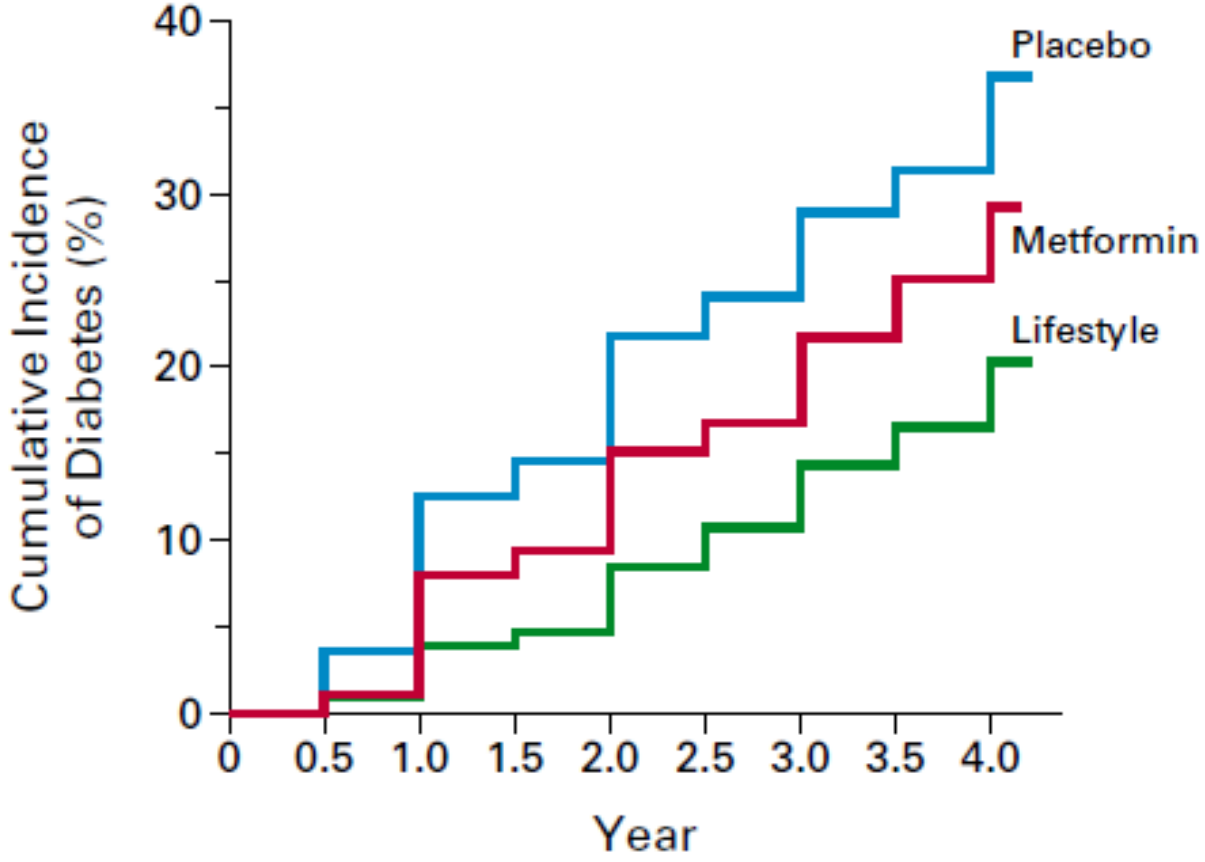


Figure 2. Cumulative Incidence of Diabetes According to Study Group.

DPS, Lancet 2006

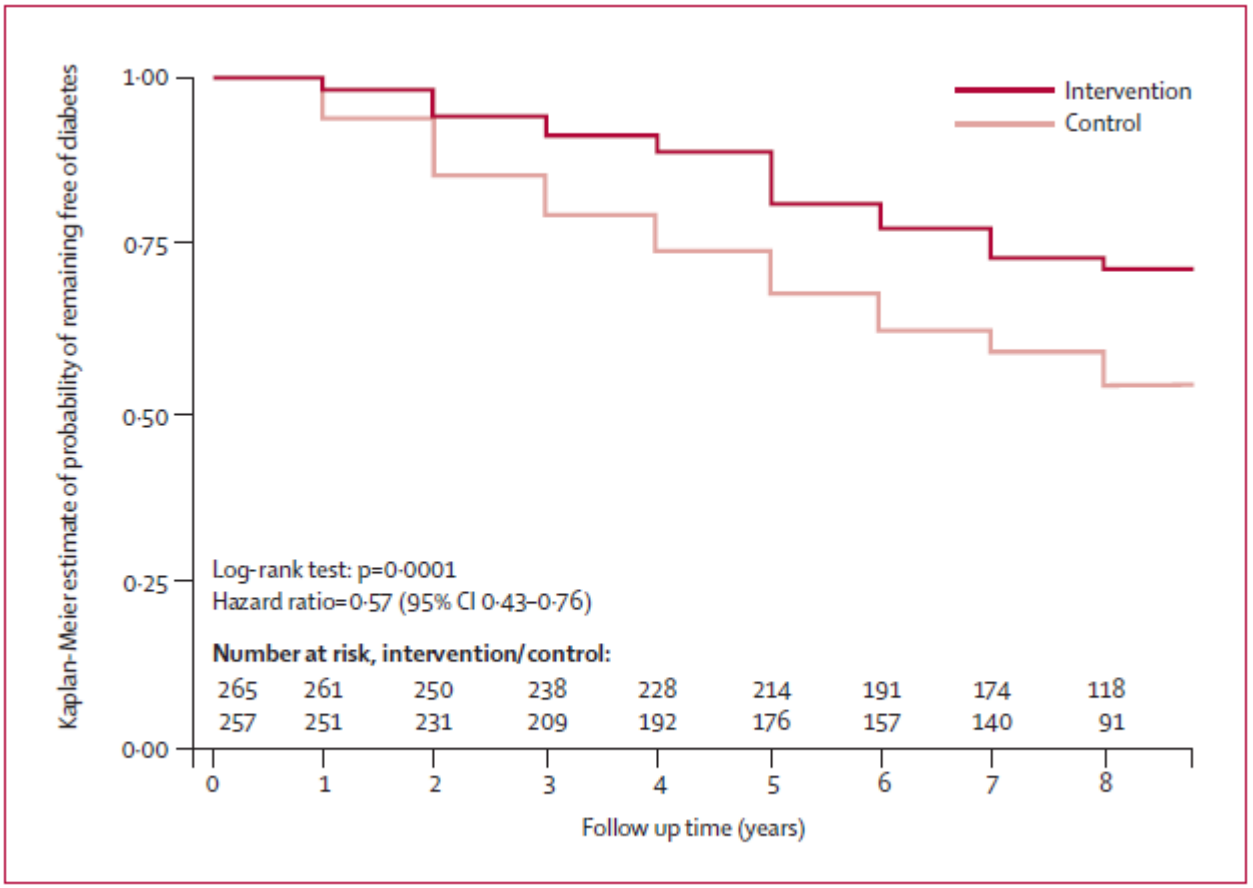


Figure 2: **Diabetes by treatment group**

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DPS, Lancet 2006

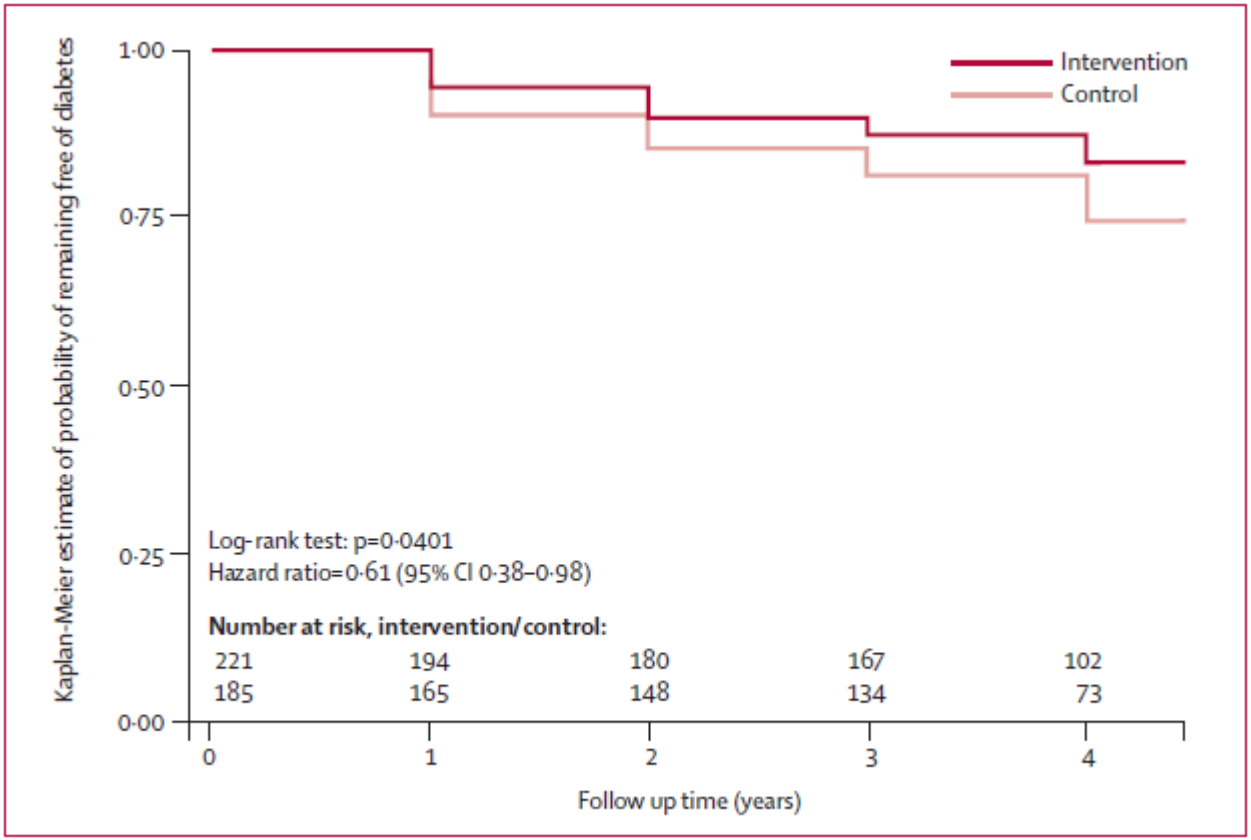

Figure 3: Diabetes by treatment group during the post-intervention follow-up period

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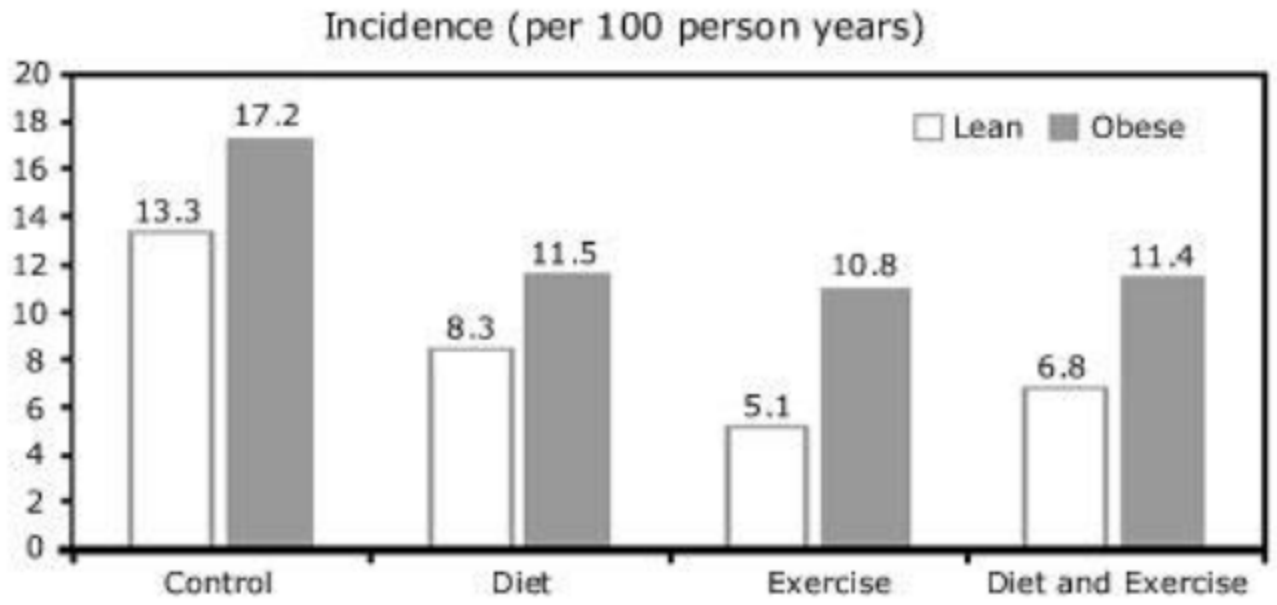
Da Qing, Diabetes Care 1997

Incidence of type 2 diabetes at or before the six year follow-up in the Da Qing study



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Da Qing, Lancet 2009

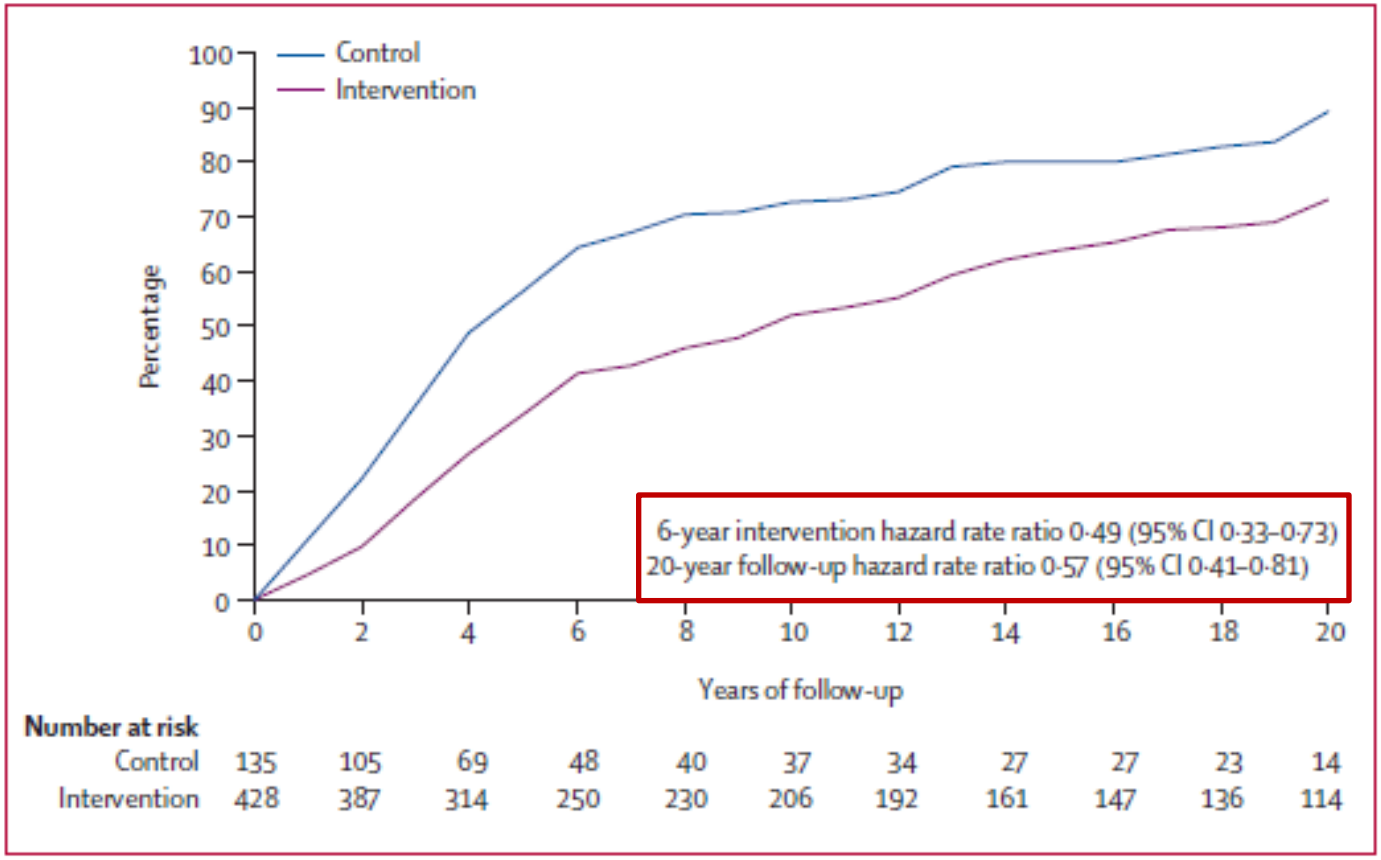
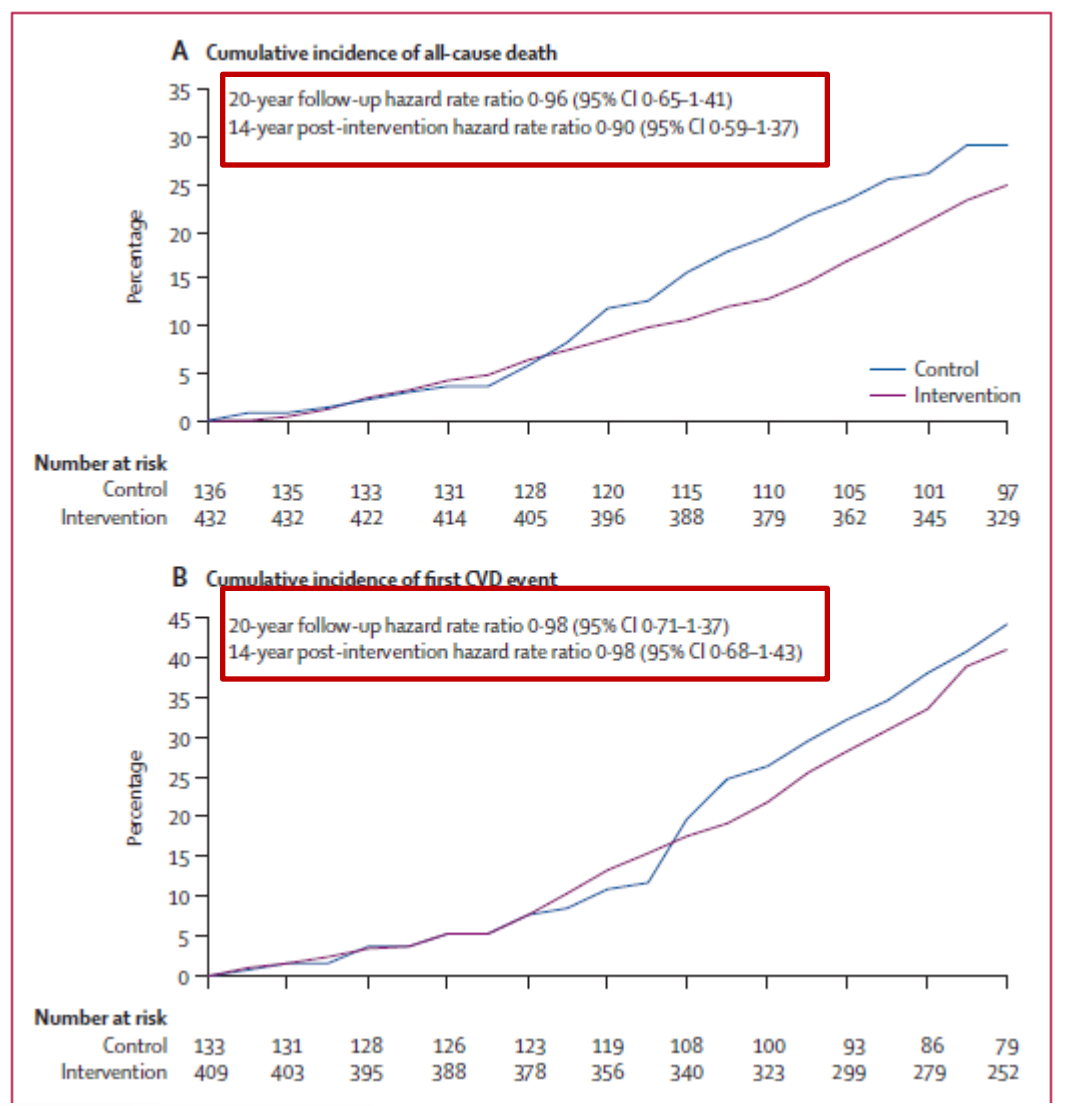
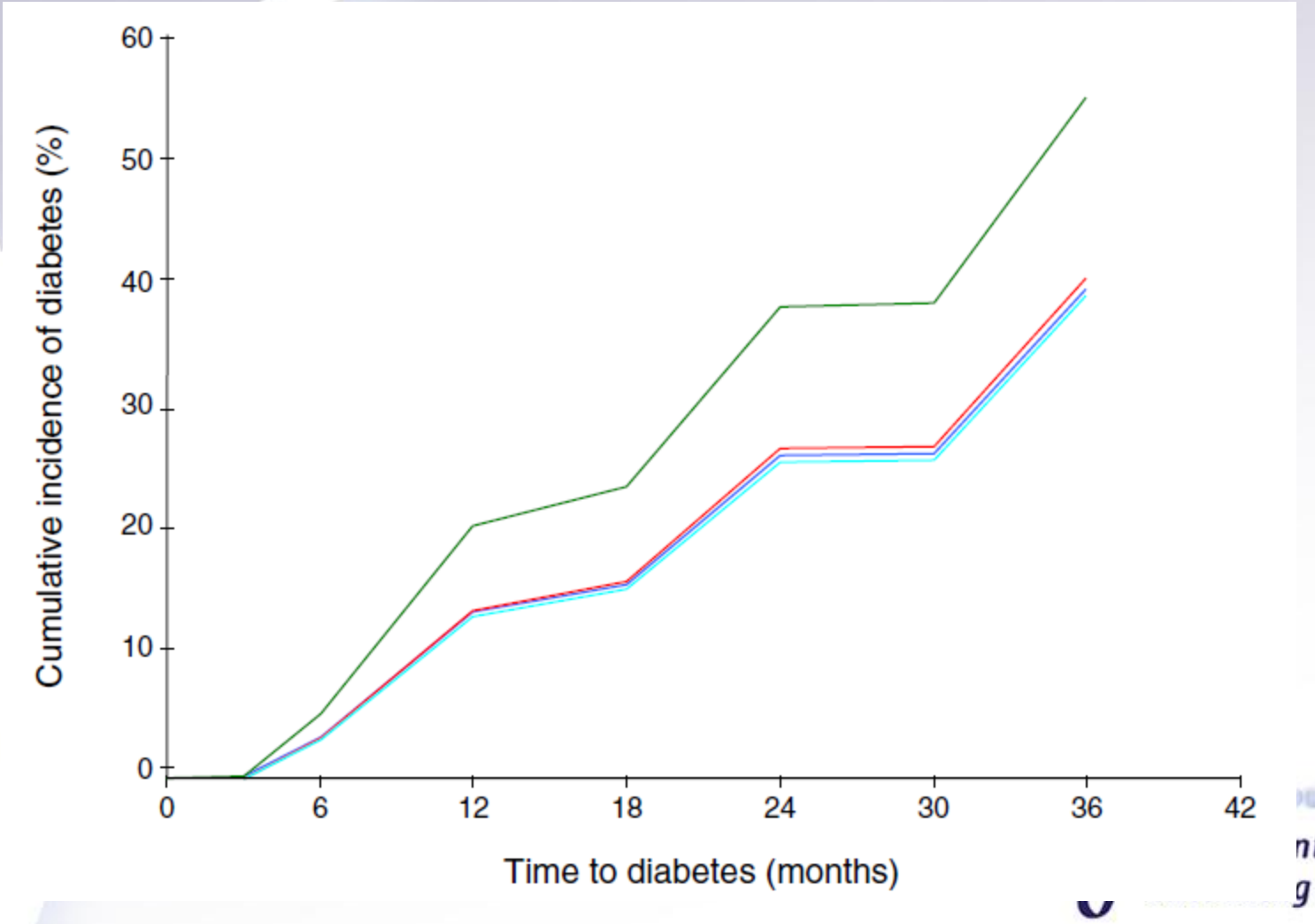


Figure 2: Cumulative incidence of diabetes mellitus during follow-up in China Da Qing Diabetes Prevention Outcome Study

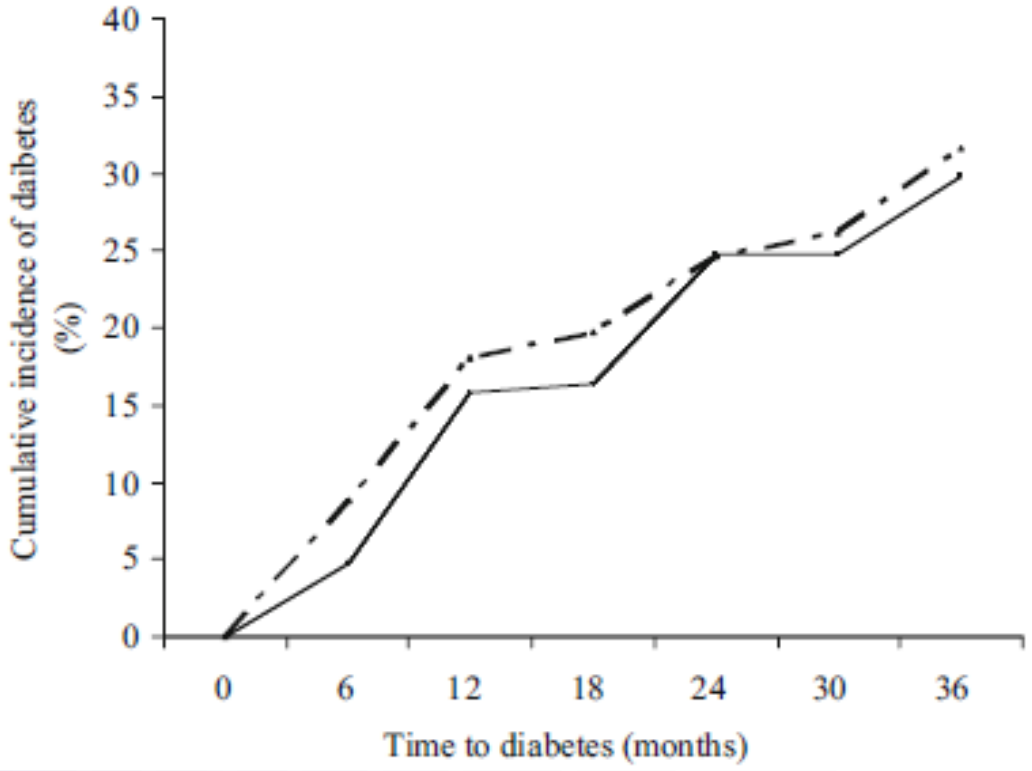
Da Qing, Lancet 2009



IDPP-1, Diabetologia 2006



IDPP-2, Diabetologia 2009



Pioglitazone vs placebo

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Major diabetes prevention studies

Table 3 Summary of major diabetes intervention studies

Study	Intervention	*n*	Relative risk reduction of T2DM vs. placebo (%)	Duration (years)
Malmö [23]	Lifestyle	181	63	6
Da Qing [24]	Lifestyle	577	42	6
DPS [17,25]	Lifestyle	522	58	3
DPP [18]	Lifestyle	3234	58	3
Japanese study [54]	Lifestyle	458	67	4
Indian study [28]	Lifestyle	531	28	3
DPP [18]	Metformin	3234	31	3
Indian study [28]	Metformin	531	26	3
Indian study [28]	Metformin + lifestyle	531	28	3
TRIPOD [31]	Troglitazone	266	55	2.5
DPP [18]	Troglitazone	3234	75	1
STOP-NIDDM [29]	Acarbose	1429	25	3
XENDOS [34]	Orlistat	3305	37	4
DREAM [32]	Rosiglitazone	5269	60	3

DPP, Diabetes Prevention Program; DPS, Diabetes Prevention Study; STOP-NIDDM, Study to Prevent Non-Insulin-Dependent Diabetes Mellitus; T2DM, Type 2 diabetes mellitus; TRIPOD, Troglitazone in Prevention of Diabetes; XENDOS, XENical in the Prevention of Diabetes in Obese Subjects.

Diabetic Medicine 2007, IDF consensus

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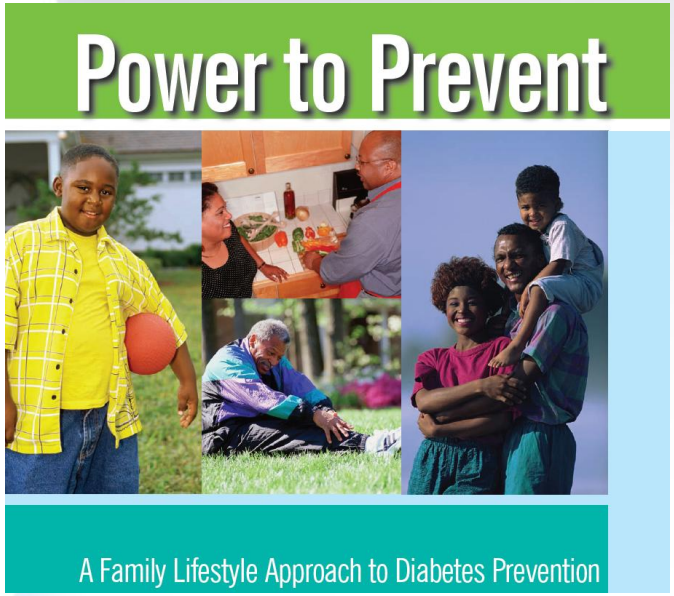
Screening tools

Might be different from country to country, and from population to population

Prevention strategies

- General
- Indicated



Finnish Diabetes Association

TYPE 2 DIABETES RISK ASSESSMENT FORM

Circle the right alternative and add up your points.

1. Age

0 p.	Under 45 years
2 p.	45–54 years
3 p.	55–64 years
4 p.	Over 64 years

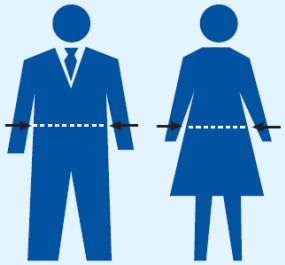
2. Body-mass index

(See reverse of form)

0 p.	Lower than 25 kg/m²
1 p.	25–30 kg/m²
3 p.	Higher than 30 kg/m²

3. Waist circumference measured below the ribs (usually at the level of the navel)

	MEN	WOMEN
0 p.	Less than 94 cm	Less than 80 cm
3 p.	94–102 cm	80–88 cm
4 p.	More than 102 cm	More than 88 cm



4. Do you usually have daily at least 30 minutes of physical activity at work and/or during leisure time (including normal daily activity)?

0 p.	Yes
2 p.	No

5. How often do you eat vegetables, fruit or berries?

0 p.	Every day
1 p.	Not every day

6. Have you ever taken medication for high blood pressure on regular basis?

0 p.	No
2 p.	Yes

7. Have you ever been found to have high blood glucose (eg in a health examination, during an illness, during pregnancy)?

0 p.	No
5 p.	Yes

8. Have any of the members of your immediate family or other relatives been diagnosed with diabetes (type 1 or type 2)?

0 p.	No
3 p.	Yes: grandparent, aunt, uncle or first cousin (but no own parent, brother, sister or child)
5 p.	Yes: parent, brother, sister or own child

Total Risk Score

The risk of developing type 2 diabetes within 10 years is

Lower than 7	Low: estimated 1 in 100 will develop disease
7–11	Slightly elevated: estimated 1 in 25 will develop disease
12–14	Moderate: estimated 1 in 6 will develop disease
15–20	High: estimated 1 in 3 will develop disease
Higher than 20	Very high: estimated 1 in 2 will develop disease

Please turn over

Test designed by Professor Jaakko Tuomilehto, Department of Public Health, University of Helsinki, and Jaana Lindström, MFS, National Public Health Institute.

Table 1: The new International Diabetes Federation (IDF) definition

According to the new IDF definition, for a person to be defined as having the metabolic syndrome they must have:

Central obesity *(defined as waist circumference* ≥ 94cm for Europid men and ≥ 80cm for Europid women, *with ethnicity specific values for other groups)*

plus any two of the following four factors:

- ***raised TG level*****:** ≥ 150 mg/dL (1.7 mmol/L), *or* ***specific treatment for this lipid abnormality***
- ***reduced HDL cholesterol***: < 40 mg/dL (1.03 mmol/L*) in males and < 50 mg/dL (1.29 mmol/L*) in females, ***or specific treatment for this lipid abnormality***
- ***raised blood pressure:*** systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg, ***or treatment of previously diagnosed hypertension***
- ***raised fasting plasma glucose*** (FPG) ≥ 100 mg/dL (5.6 mmol/L), ***or previously diagnosed type 2 diabetes***
  If above 5.6 mmol/L or 100 mg/dL, OGTT is strongly recommended but is not necessary to define presence of the syndrome.

* These values have been updated from those originally presented to ensure consistency with ATP III cut-points

Country/Ethnic group		Waist circumference
Europids*	Male	≥ 94 cm
In the USA, the ATP III values (102 cm male; 88 cm female) are likely to continue to be used for clinical purposes	Female	≥ 80 cm
South Asians *Based on a Chinese, Malay and Asian-Indian population*	Male	≥ 90 cm
	Female	≥ 80 cm
Chinese	Male	≥ 90 cm
	Female	≥ 80 cm
Japanese**	Male	≥ 90 cm
	Female	≥ 80 cm
Ethnic South and Central Americans	*Use South Asian recommendations until more specific data are available*	
Sub-Saharan Africans	*Use European data until more specific data are available*	
Eastern Mediterranean and Middle East (Arab) populations	*Use European data until more specific data are available*	

Ethnic groups and environment

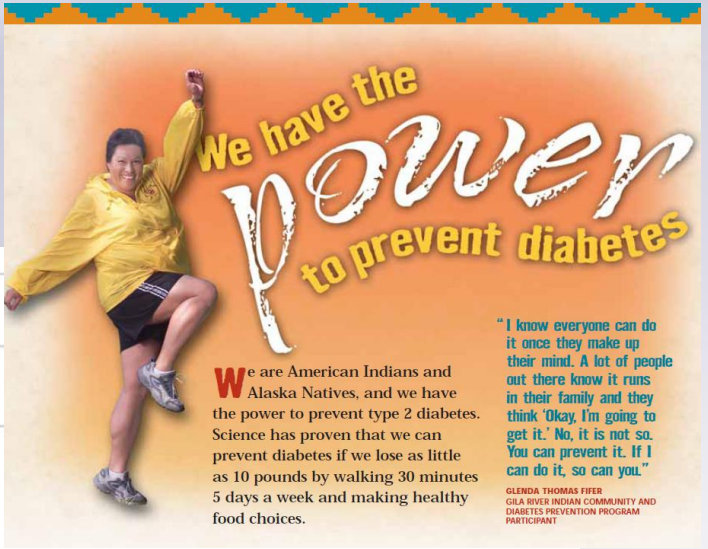
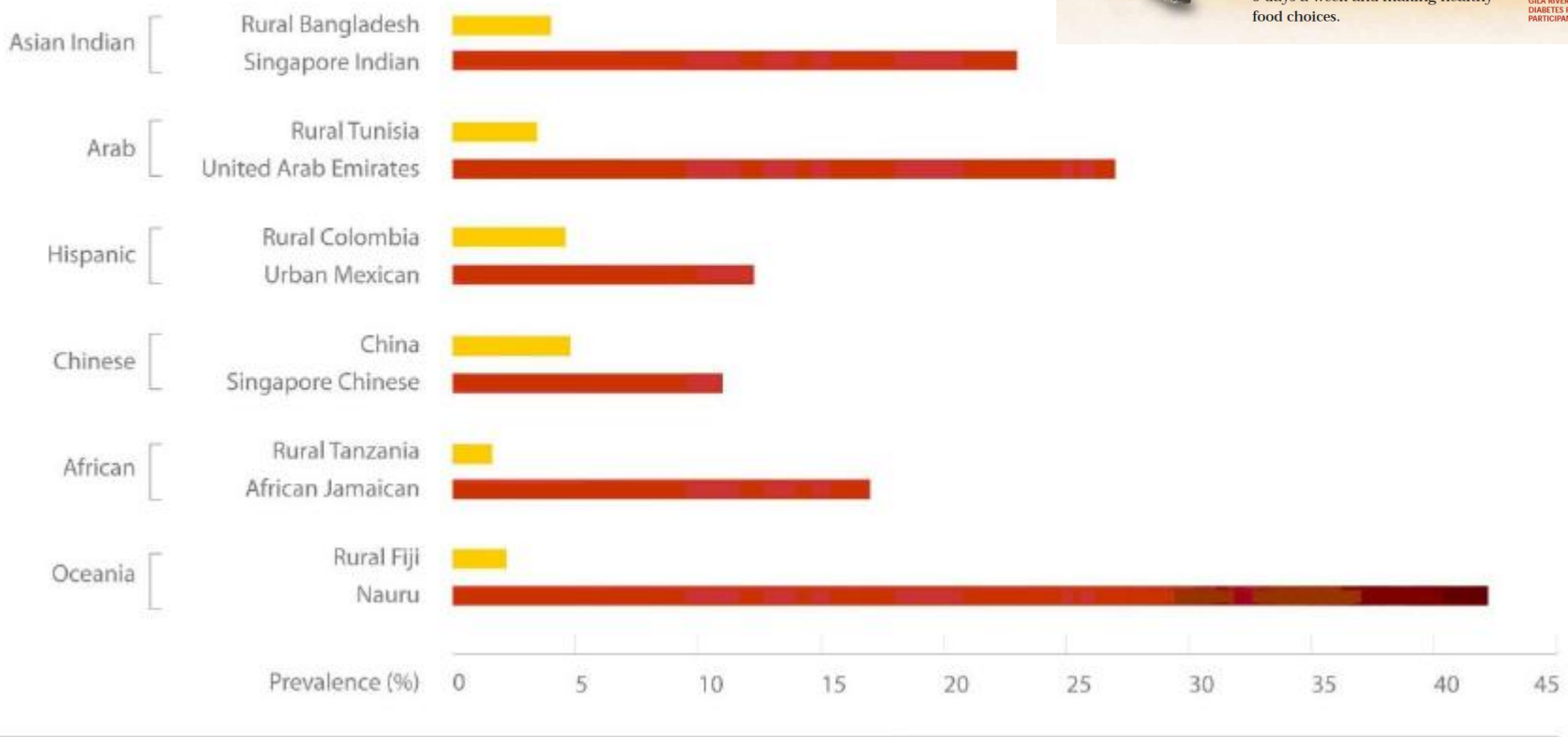


FIGURE 1

Differences in the prevalence of type 2 diabetes among selected ethnic groups, 2007



Prevalence rates are age standardized to Segi's World Population for ages 30-64 year

Pharmacological interventions

<u>at present:</u>

Metformin

TZD's

Acarbose

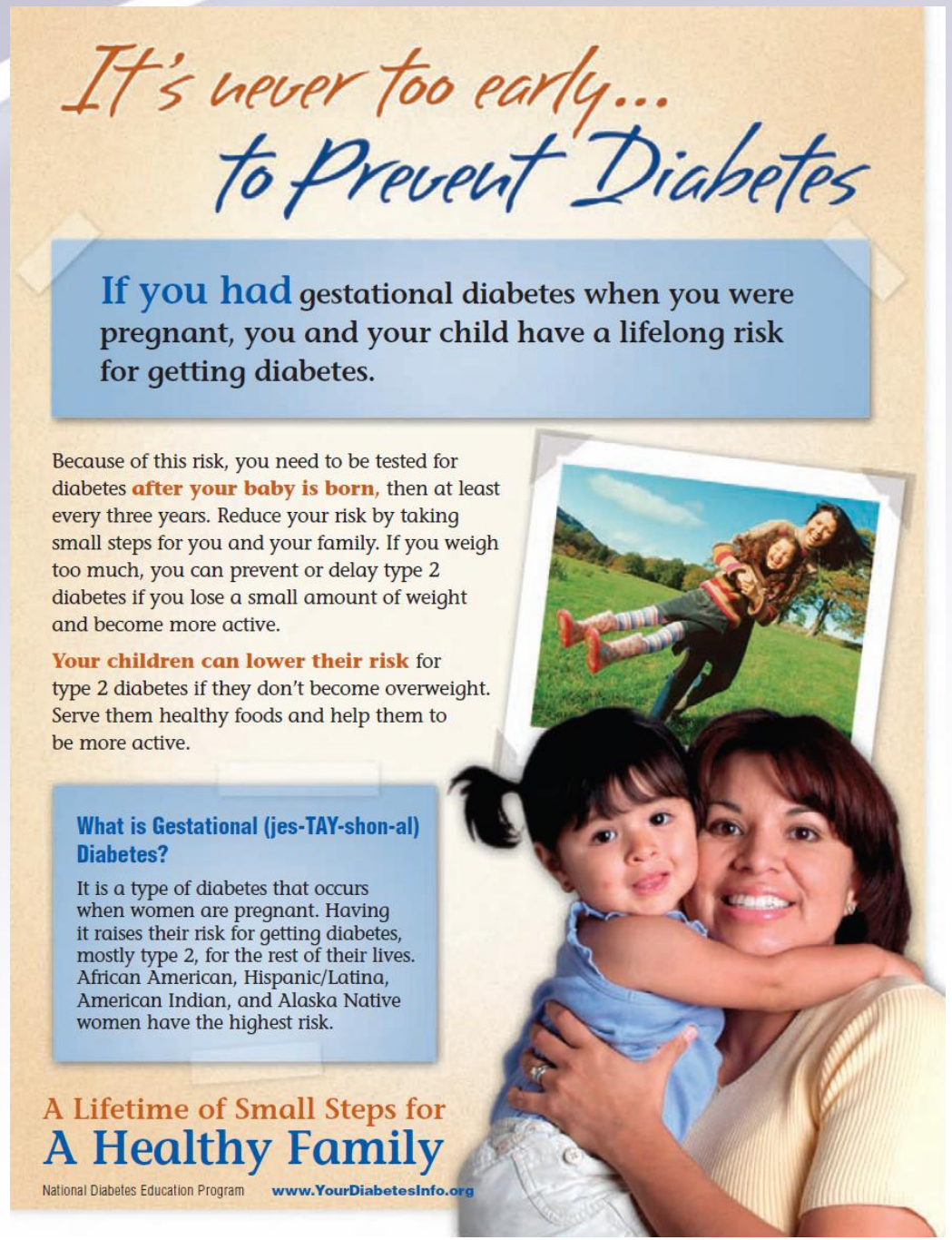
ACE-inhibitors?

AIIA's?

<u>(near) future:</u>

Weight loss enhancers

Gut hormones (GLP-1 analogues)



Non-pharmacological interventions

Prevent overweight

Keep active from young age

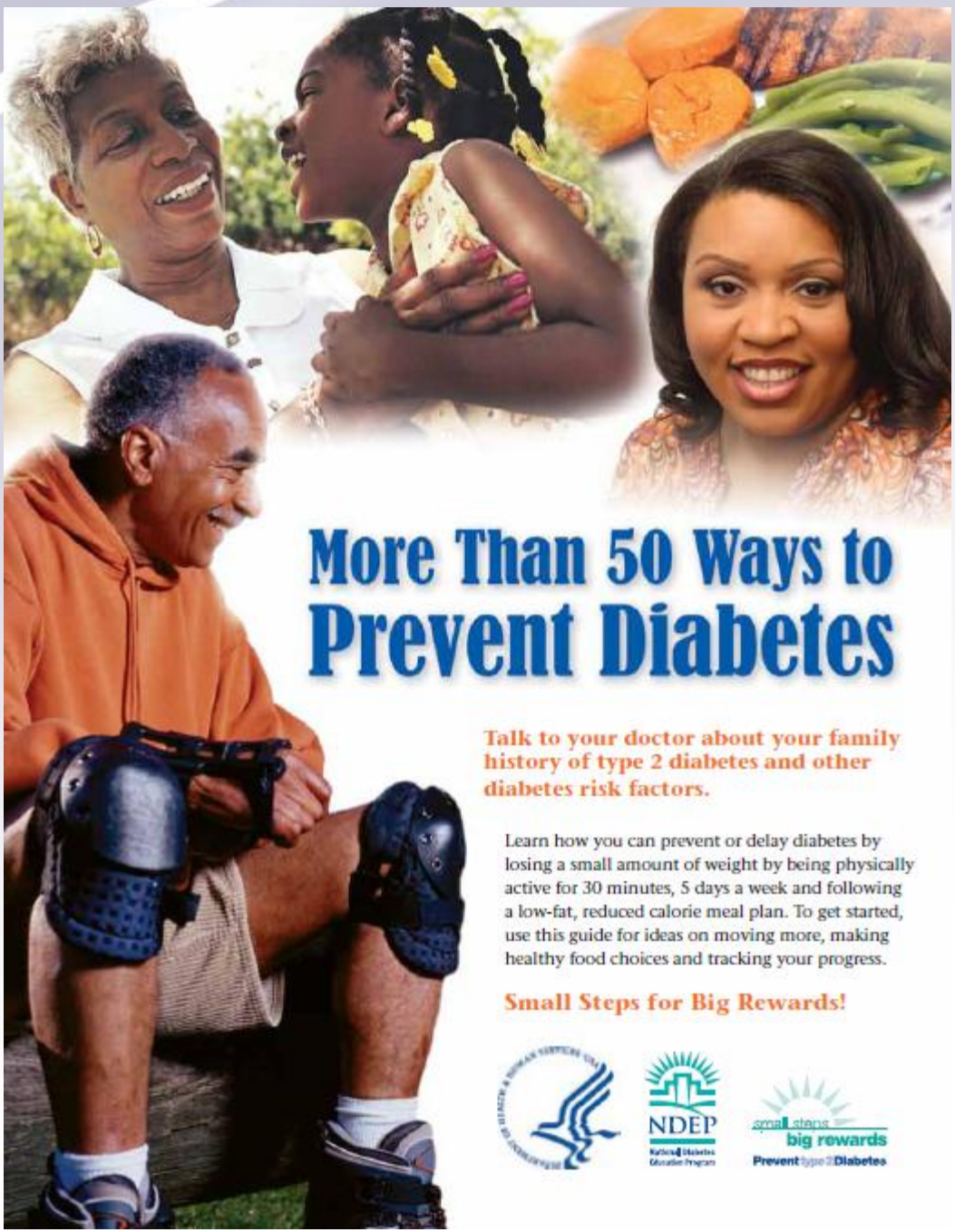
Eat healthy

Combat overweight

Start exercising

(Stop fast food, avoid softdrinks)

Maintain the gain



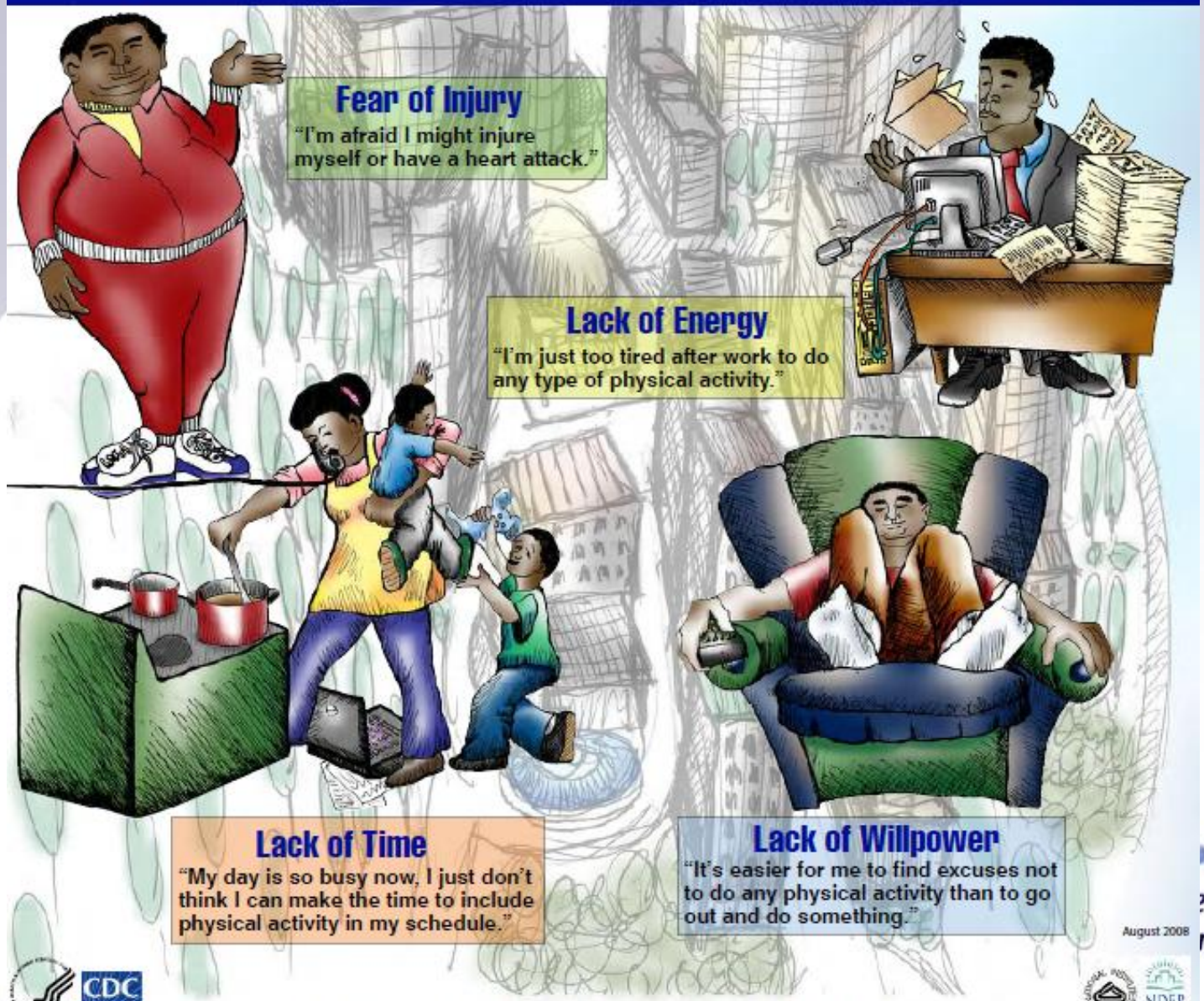
NICE public health guidance 35

- To achieve general health benefits: accumulate at least 30 minutes of at least moderate-intensity physical activity on 5 or more days of the week[10].
- To lose weight: most people may need to do 45–60 minutes of moderate-intensity activity a day, particularly if they do not reduce their energy intake[11].
- People who have been obese and have lost weight may need to do 60–90 minutes of activity a day to avoid regaining weight[11].

Kenniscentrum Ketenzorg

WELCOME TO THE CITY OF EXCUSES!

Where Healthy Living Is a Second Priority



GET REAL!

YOU DON'T HAVE TO KNOCK YOURSELF OUT TO PREVENT DIABETES!