



**MRC**

Epidemiology Unit

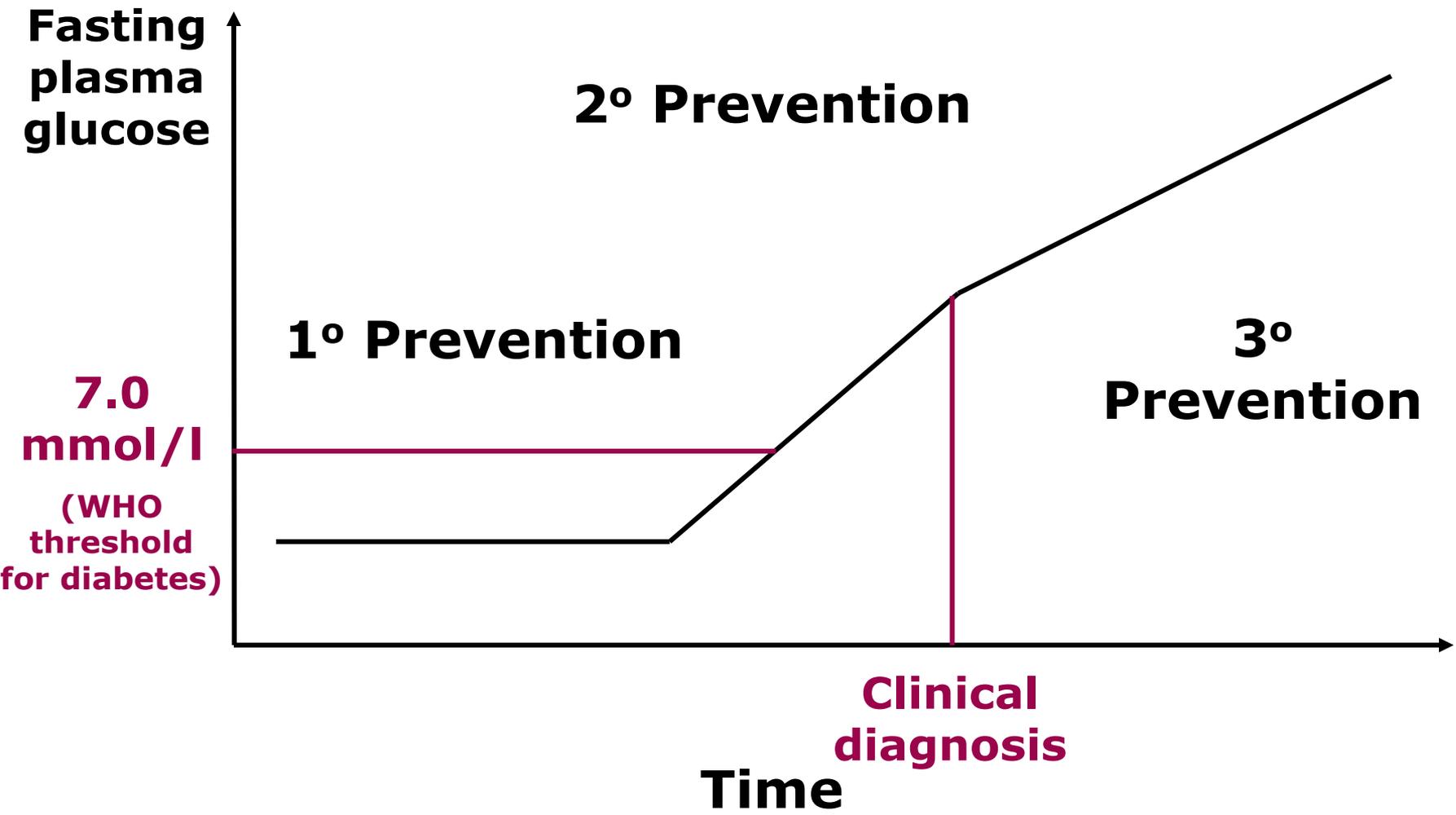
*investigating the causes and prevention of  
diabetes and obesity*

# **Screening for Diabetes – who, when, how and if?**

**Simon Griffin**

**Association of British Clinical Diabetologists  
Autumn Meeting  
London  
2<sup>nd</sup> Nov 2006**

# Reducing the growing burden of diabetes



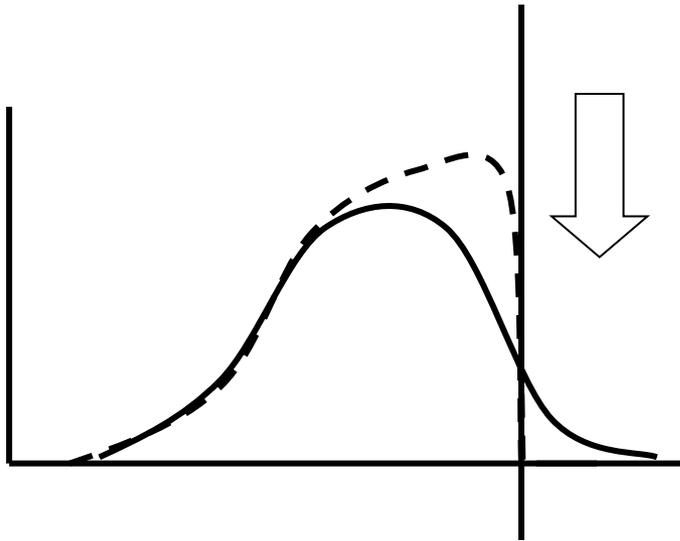
**Sick individuals**

**High risk groups**

**Populations**

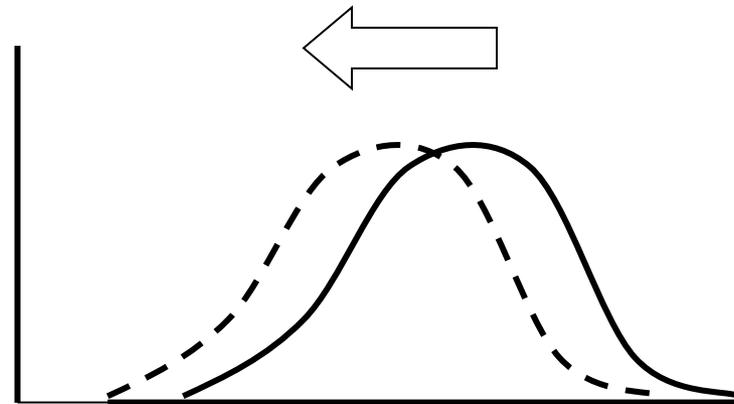
**Societies**

# Population or High Risk Approach



## Identify and treat those beyond a threshold for risk factor

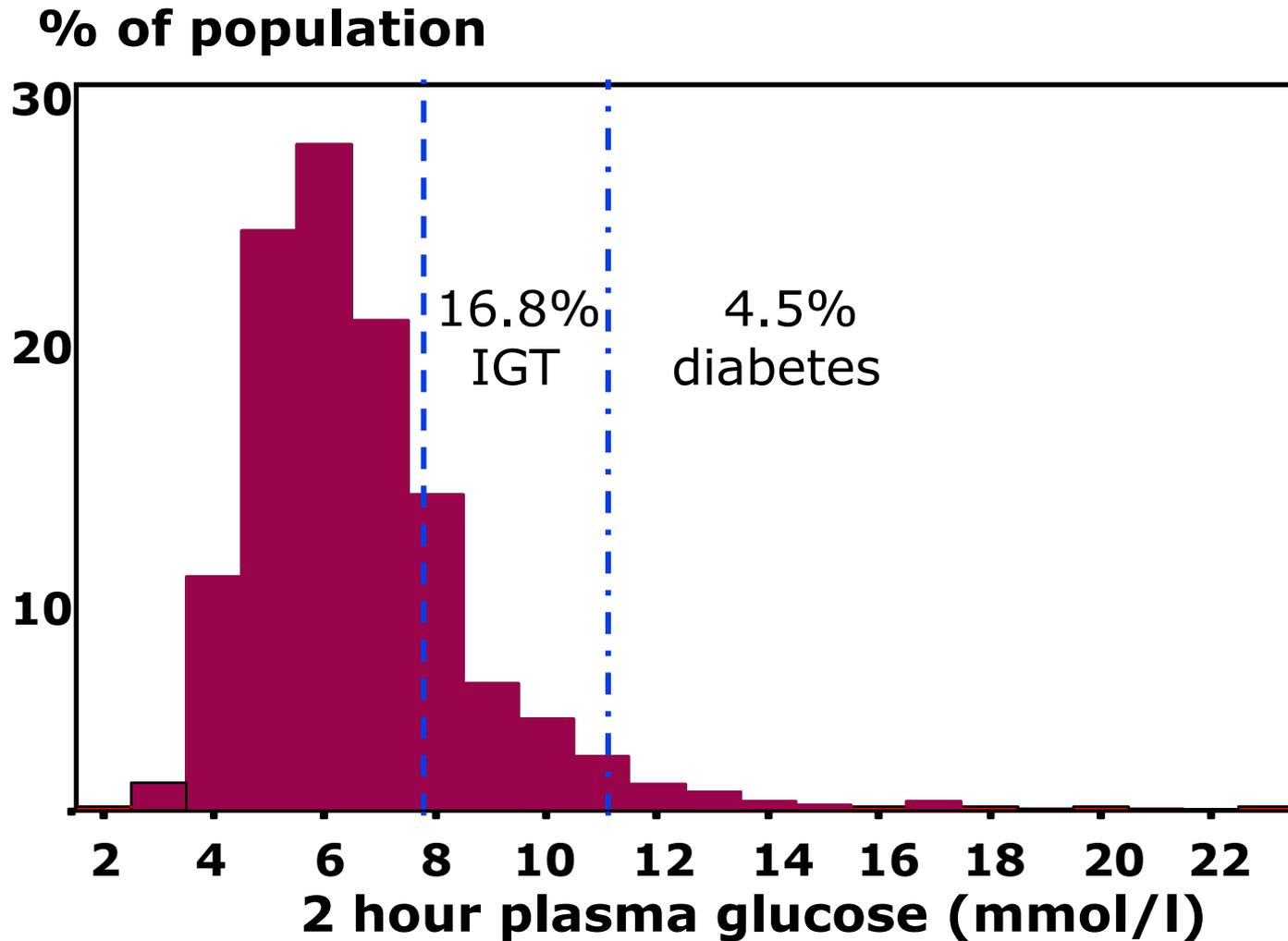
- Resource intensive
- Provable in RCT
- Large effect in small number of people
- High ARR / low NNT



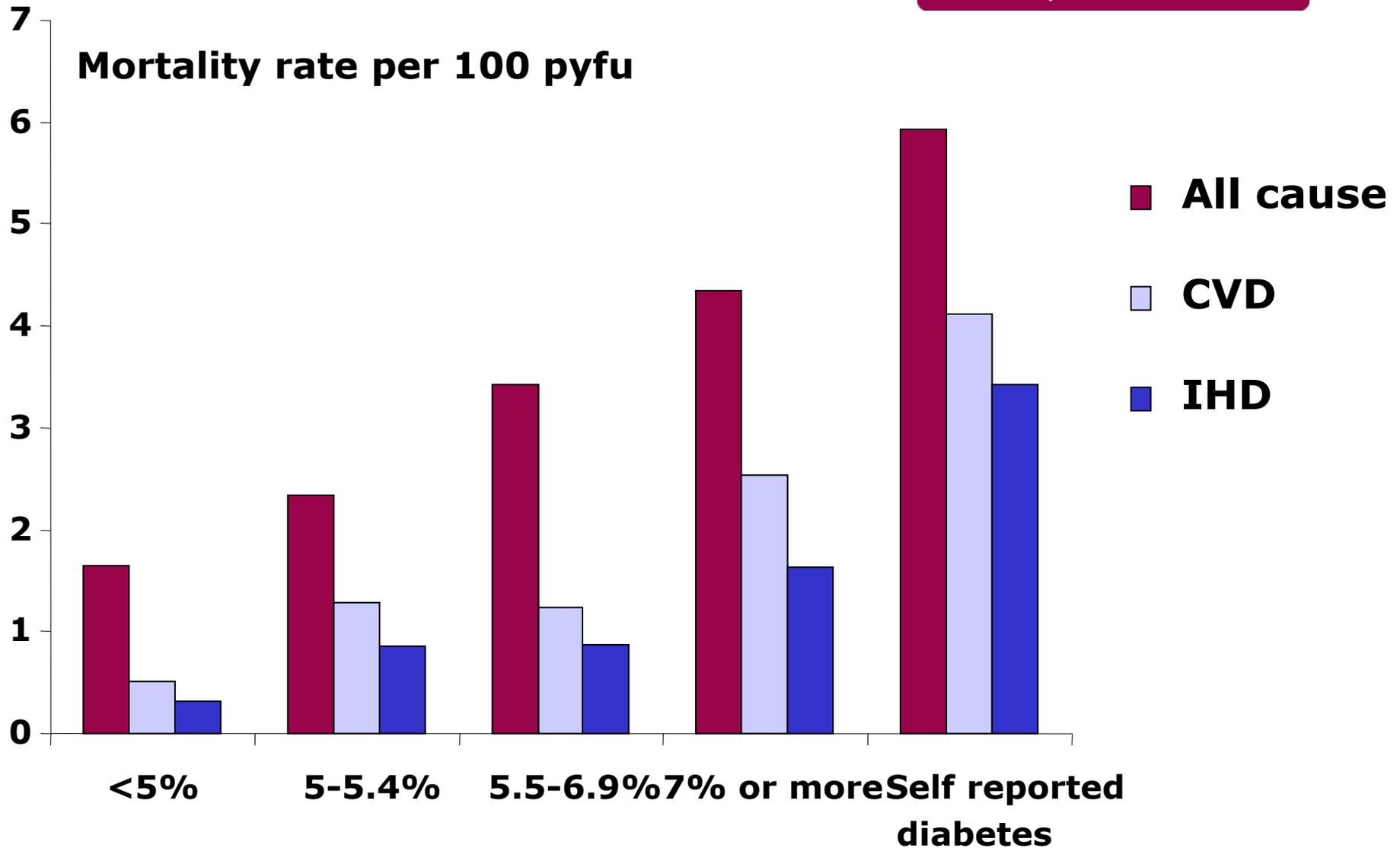
## Shift the whole population distribution of risk factor

- ? Less resource intensive
- Less amenable to RCT
- Small effect in large number of people
- High PAR

# Population Distribution for 2 Hour Glucose in a Previously Unscreened Population: Ely Study



# The Association Between HbA<sub>1c</sub> Diabetes and Mortality



# The strategy of prevention

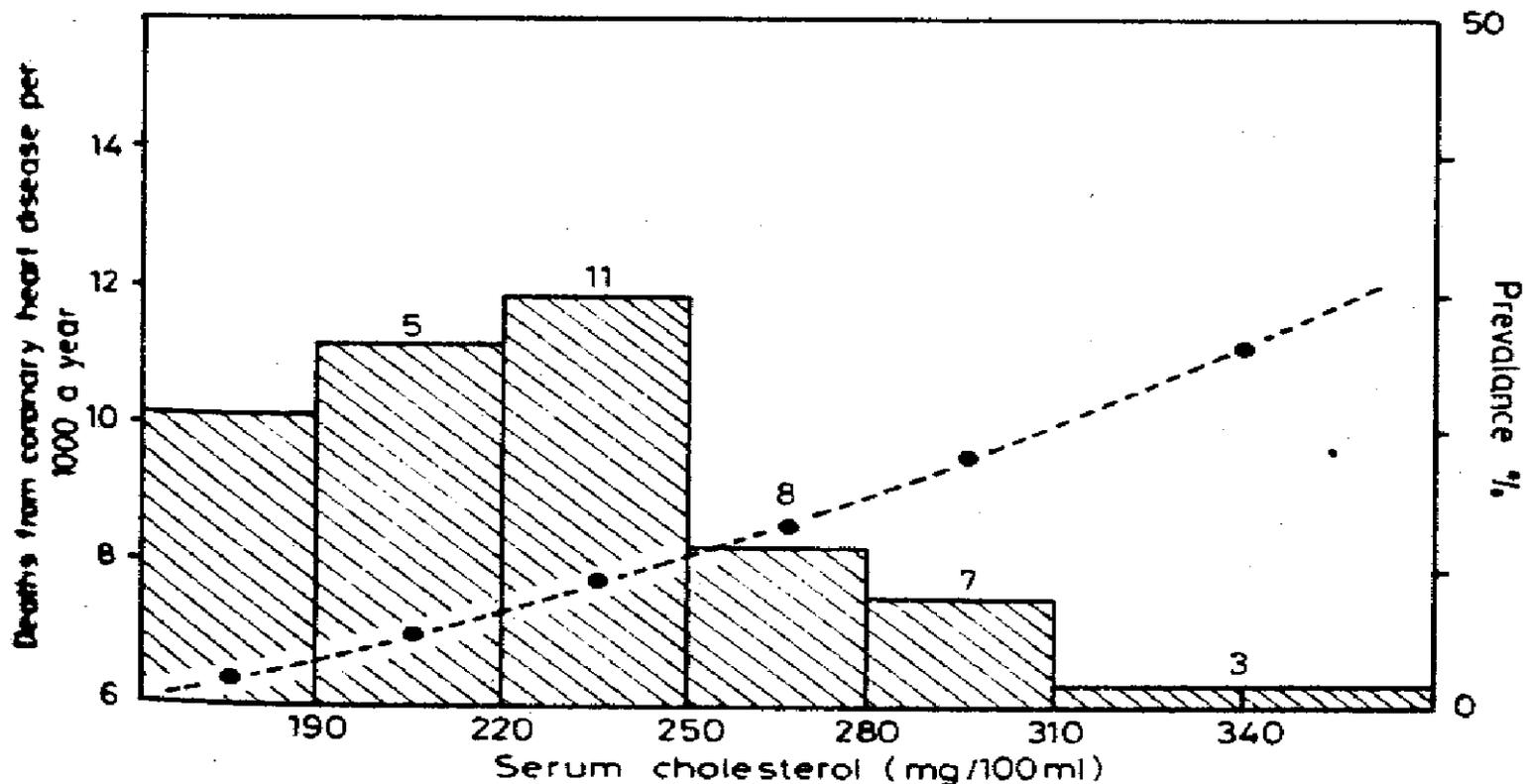


FIG 3—Prevalence distribution of serum cholesterol concentration related to coronary heart disease mortality (---) in men aged 55-64. Number above each bar represents estimate of attributable deaths per 1000 population per 10 years. (Based on Framingham Study.<sup>4</sup>)

Conversion: SI to traditional units—Cholesterol: 1 mmol/l  $\approx$  38.6 mg/100 ml.

# Definition of Screening

***'The systematic application of a test or inquiry, to identify individuals at sufficient risk of a specific disorder to warrant further investigation or direct preventive action, amongst persons who have not sought medical attention on account of symptoms of that disorder'***

National Screening Committee, Department of Health, 1998

# Ethical Difference Between Medical Practice and Screening



“If a patient asks a medical practitioner for help, the doctor does the best he can. He is not responsible for defects in medical knowledge.

If screening is initiated, he should have conclusive evidence that screening can alter the natural history of the disease in a significant proportion of those screened.”



The charity for  
people with diabetes

## If your waist is wider than this you could need a test for diabetes

1. Overweight?
  2. Over 40 years old?
  3. Diabetes in your family?
  4. Black or South Asian origin?
- Two or more of these risk factors  
could mean you have diabetes.  
Diabetes can lead to complications  
such as blindness if not diagnosed.**

**See your doctor now  
for a quick test.**

To find out more on the risk factors of diabetes visit  
[www.diabetes.org.uk/MeasureUp](http://www.diabetes.org.uk/MeasureUp)

Supported by an  
educational grant from



# Wilson and Jungner Criteria

- The condition
- The test
- The treatment
- The entire programme



# Undiagnosed Type 2 Diabetes Is Common

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- **4.5 % of 40-65 yr olds in Ely have previously undiagnosed diabetes**  
(Williams DRR et al. *Diabetic Med* 1995;12:30-5)

Diabetes UK

**2.4 million people in the UK have diabetes  
1 million don't know it yet**

You could be one of them. To find out more call 0800 996 1403

- **50% of people with Type 2 diabetes are undiagnosed**  
(Harris MI. *Diabetes Care* 1993;16:642-652)

# High Burden of Undiagnosed Disease



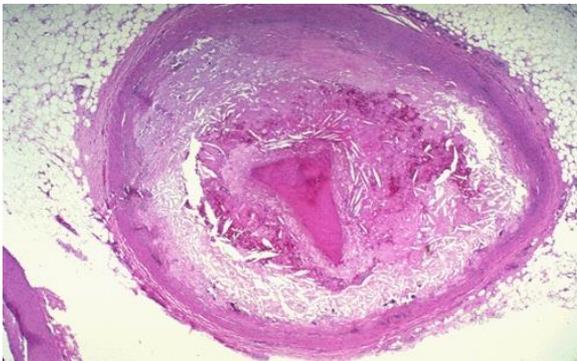
- **50% of newly diagnosed patients have evidence of diabetic tissue damage**

(UKPDS. *Diabetologia* 1991;34:877-90)



- **Increased cardiovascular risk predates the diagnosis of diabetes by many years**

(McPhillips JB. *Am J Epidemiol* 1990;131:443-53)



- **Undiagnosed and diagnosed have similar macrovascular risks**

(Jarrett RJ. *Diabetologia* 1988;31:737-40)

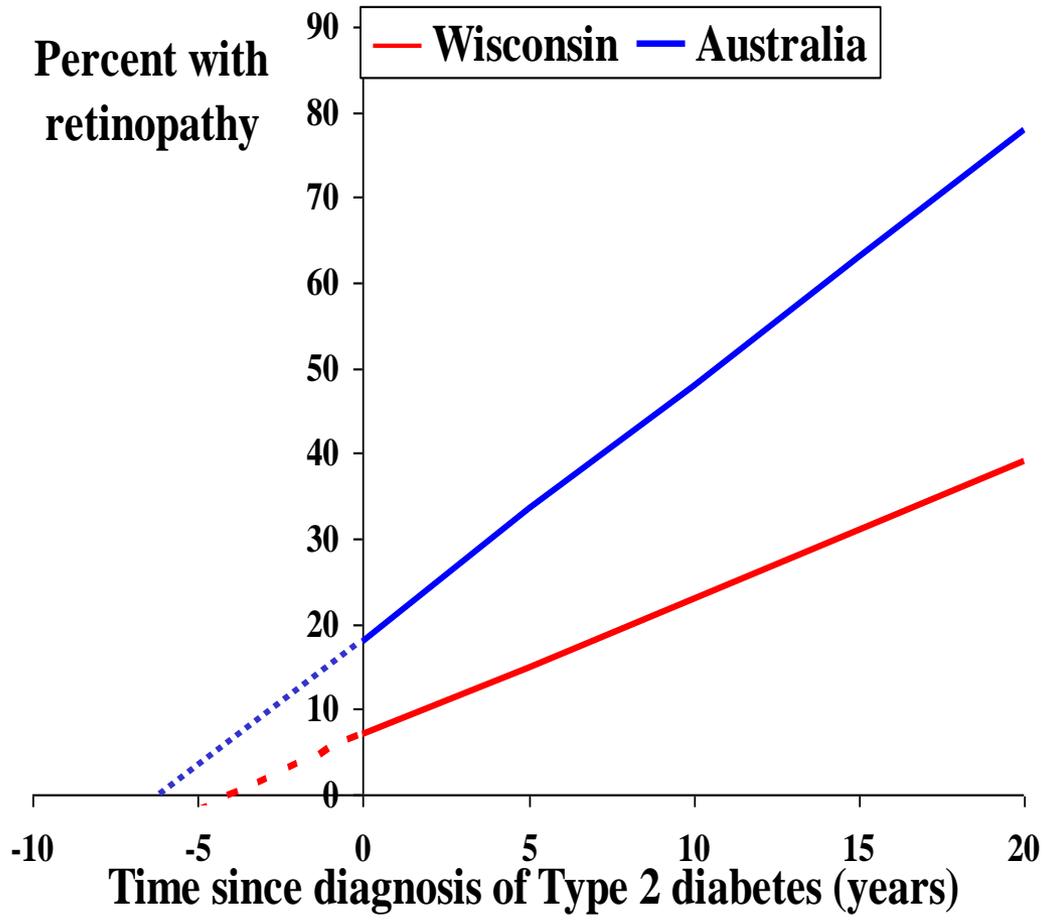
# Lower Fasting Plasma Glucose Levels at Diagnosis Are Associated With Improved Outcomes



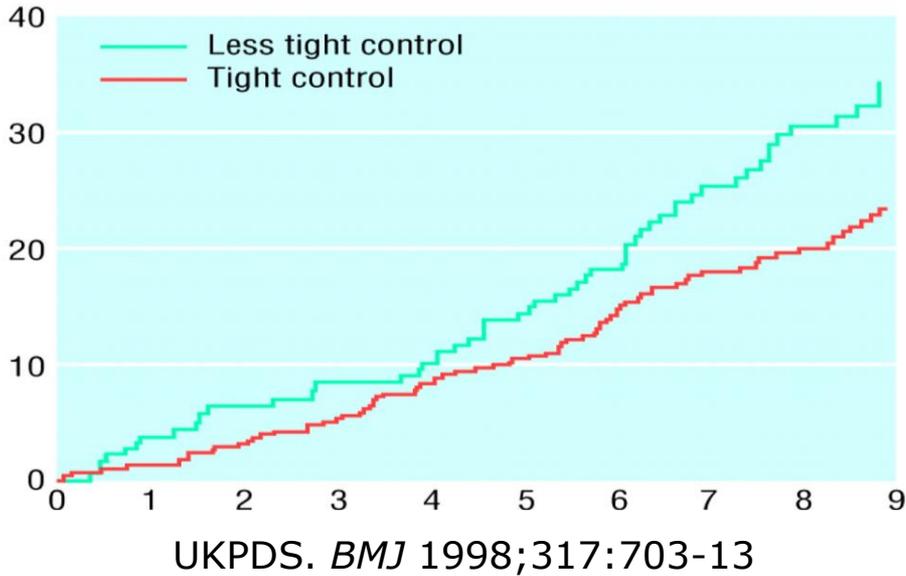
- **Relative risk of death in the UKPDS**

- **High FPG (>10mmol/l) 1.0**
- **Intermediate FPG (7.8-9.9mmol/l) 0.8  
(95% CI: 0.68 to 0.94)**
- **Low FPG (<7.8mmol/l) 0.68  
(95% CI: 0.55 to 0.84)**

# The Delay Between Disease Onset and Diagnosis May Be up to 10 Years



## Blood pressure treatment

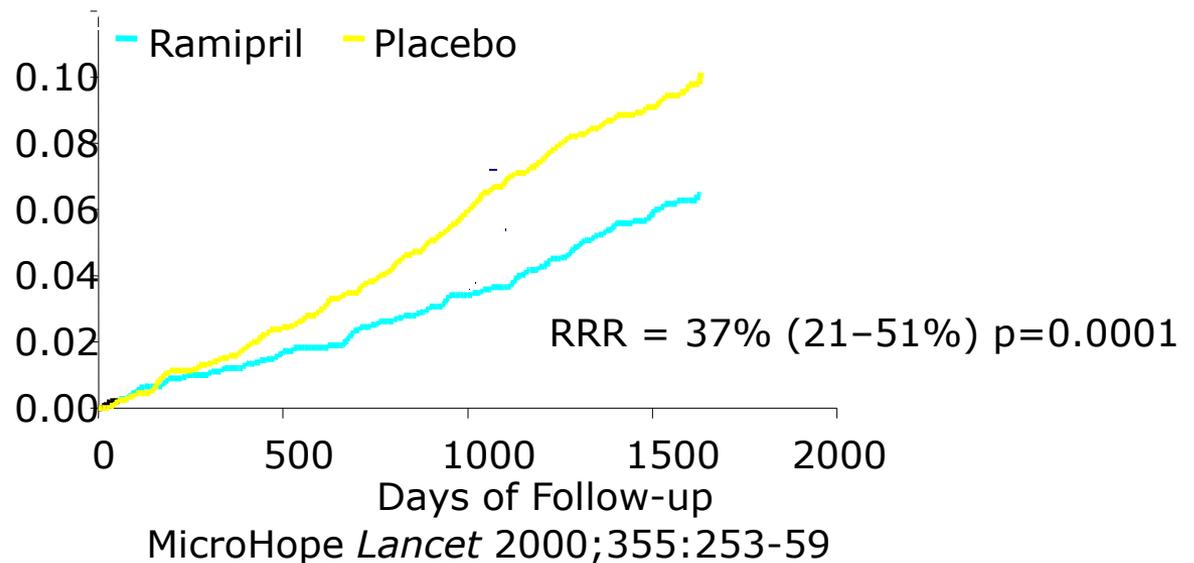


## Lipid lowering

In people with diabetes Simvastatin was associated with a 25% reduction in the rate of first major vascular event (20.2% vs 25.1%,  $p < 0.0001$ )

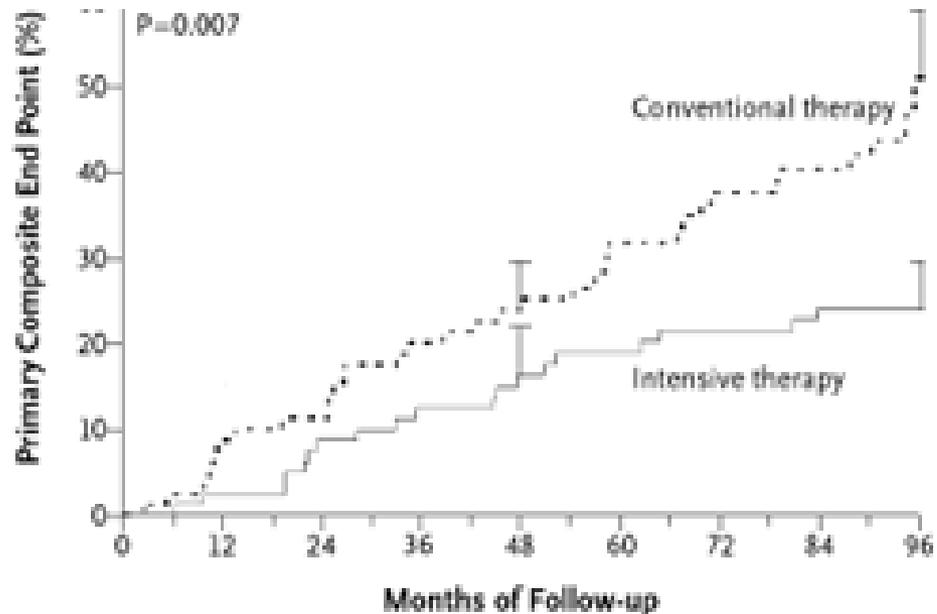
HPS *Lancet* 2002;360:7-22

## ACE inhibition



# The Effectiveness of Combined Therapy

Benefits of multifactorial therapy are known in patients with established diabetes and microalbuminuria

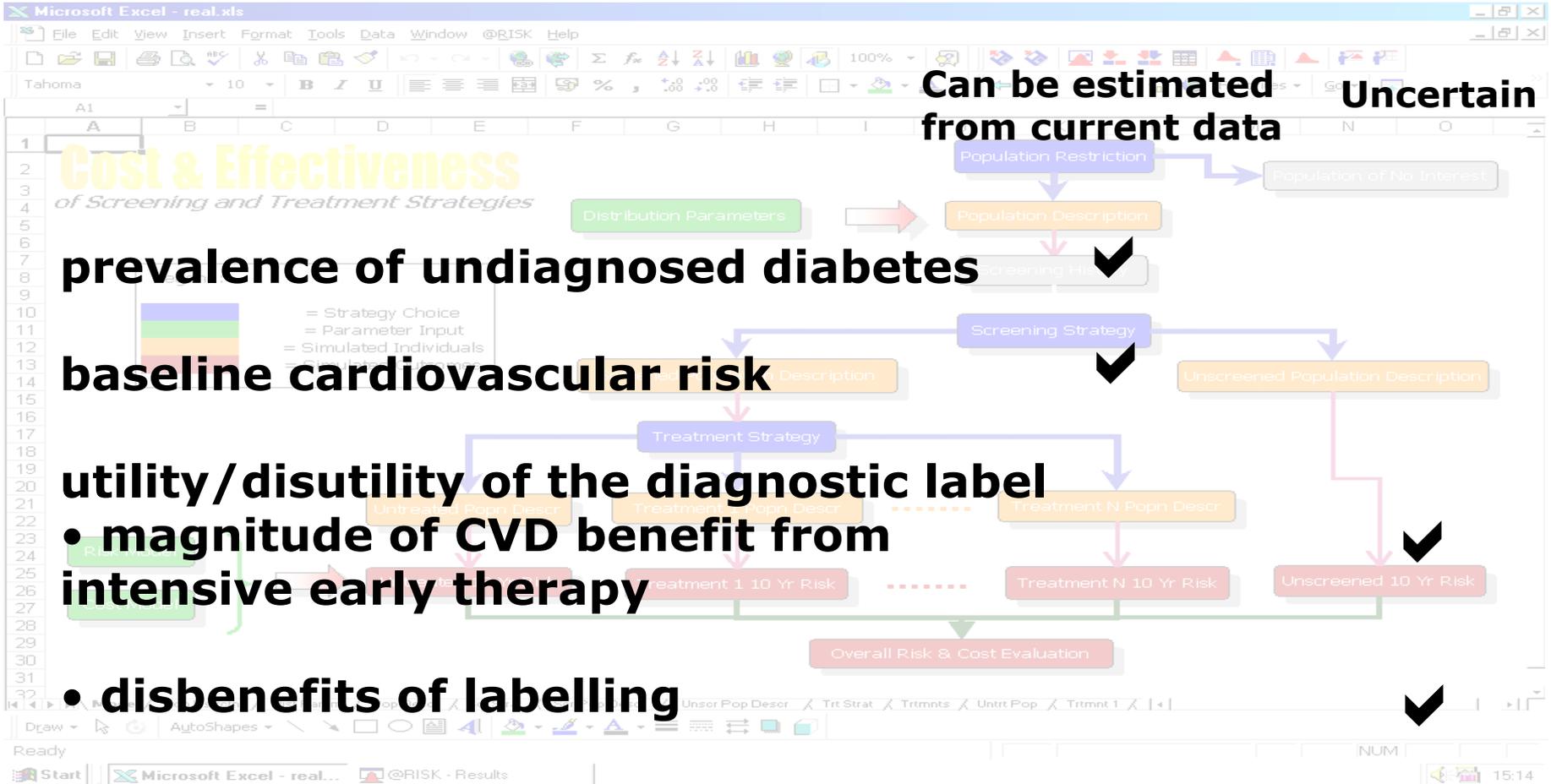


The Steno Study

Hazard Ratio for CVD in Intensively treated group: 0.47 (0.24 – 0.73)

No. at Risk	0	12	24	36	48	60	72	84	96
Conventional therapy	80	72	70	63	59	50	44	41	13
Intensive therapy	80	78	74	71	66	63	61	59	19

# What determines the cost-effectiveness of diabetes screening?



Glümer C et al. What determines the cost-effectiveness of diabetes screening? *Diabetologia* 2006;49:1536-1544.

Wareham NJ, Griffin SJ. Should we screen for type 2 diabetes? Evaluation against National Screening Committee criteria. *BMJ* 2001;322:986-988.

# Published Data on Harmful Effects of Screening for Diabetes

- **minimal anxiety among non-diabetic siblings offered screening by the Oxford group**  
Farmer AJ et al. *Diabetic Med* 2003;20:996-1004.
- **those who screened positive and those who screened negative had similar SF-36 scores at baseline and one year after screening**  
Edelman et al. *Diabetes Care* 2002;25:1022-1026
- **interviewed participants were positive about screening, the psychological impact of diagnosis through screening appeared limited**  
Adriaanse et al. *Diabetic Medicine* 2002;19:406-411

# Disadvantages of Diagnosis and Treatment

## Hypoglycaemia

**Among patients aged 40-65yrs on SU**

**20% experienced symptoms in the previous 6 months**

**6% experienced symptoms at least monthly**

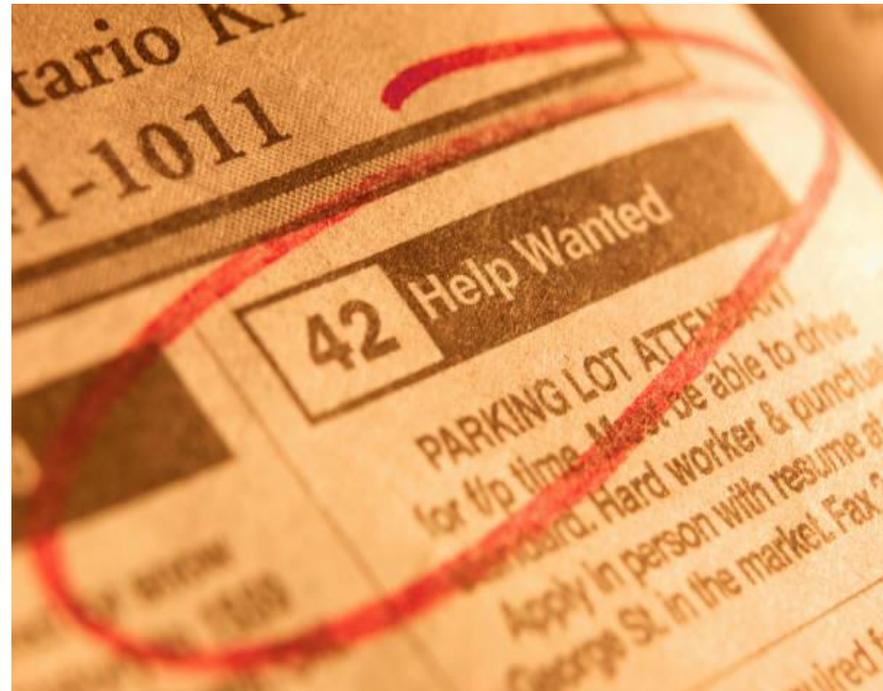
(Jennings et al. *Diabetes Care* 1989)

**Employment**

**Driving**

**Discrimination**

**Costs of care**



**Diagnosis of diabetes following screening does not appear to be associated with raised anxiety, distress or depression**



**Some evidence of adaptation, minimisation and misrepresentation of disease severity.**

# 'Giving the 'label' Diabetes Might Be a Good Thing

- **The beneficial effect of “knowing your number”, greater falls in cholesterol achieved by people who were informed of their cholesterol value**
  - **in factories**  
Elton PJ et al. *J Epidemiol Community Health* 1994;48:22-5
  - **in health promotion clinics in general practice**  
Robertson I et al. *Br J Gen Pract* 1992;42:469-72
- **Induces significant responses from the primary care team**
  - **improved recording of cardiovascular risk**  
Van Drenth BB et al. *Br J Gen Pract* 1998;48:1054-8
  - **more aggressive risk reduction**

# 'Certificate of Good Health Effect'



- **Individuals at high risk are less inclined to change lifestyles after normal cholesterol blood test results**

Kinlay S, Heller RF. Effectiveness and hazards of case finding for a high cholesterol concentration. *BMJ* 1990;300:1545-7

# A Randomised Trial of Screening for Diabetes: effects on Anxiety

1200 people aged 40-69 yrs without known diabetes

354 in the top 30 % of risk for having undiagnosed diabetes

116 Invited

238 Not Invited

After 6 weeks postal questionnaires:  
SF-Spielberger Anxiety, Self Perceived Health

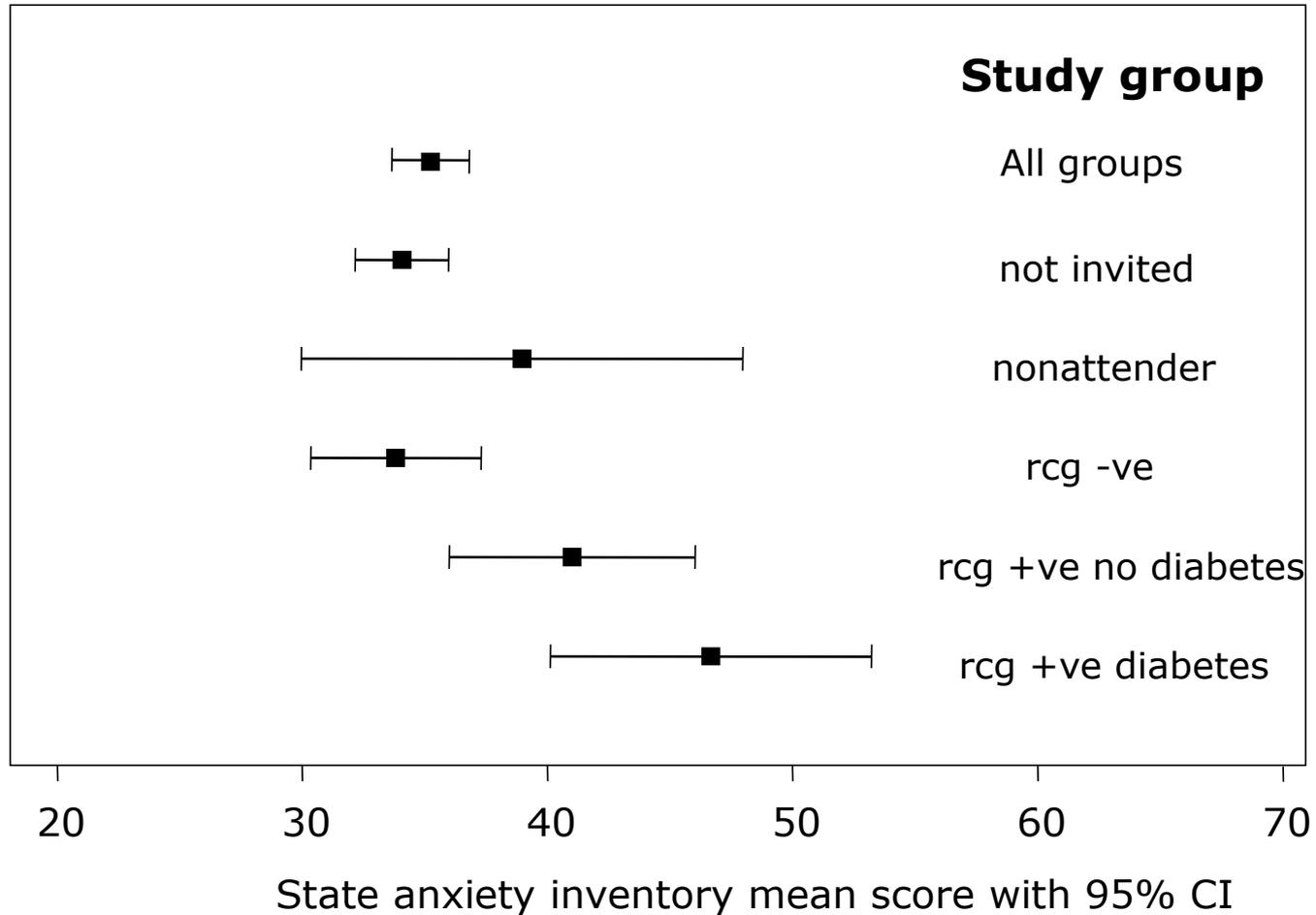
70% response rate

# Results

	<b>Invited</b> Mean (SD)	<b>Not Invited</b> Mean (SD)	<b>p-value</b> <b>(MWU test)</b>
<b>Anxiety</b>	37.6 (12.2)	34.1 (12.1)	0.015
<b>Self perceived health</b>	3.03 (0.86)	3.05 (0.87)	0.998

- **Mean anxiety score in the 6 new patients, 51 days after diagnosis was 46.7**
- **ICD-10 threshold for 'clinical anxiety' is 42**
- **Mean anxiety score in pregnant women who have just received an abnormal test result for Down's syndrome/Spina Bifida screening is 46.4**

# Mean State Anxiety Score by Study Group

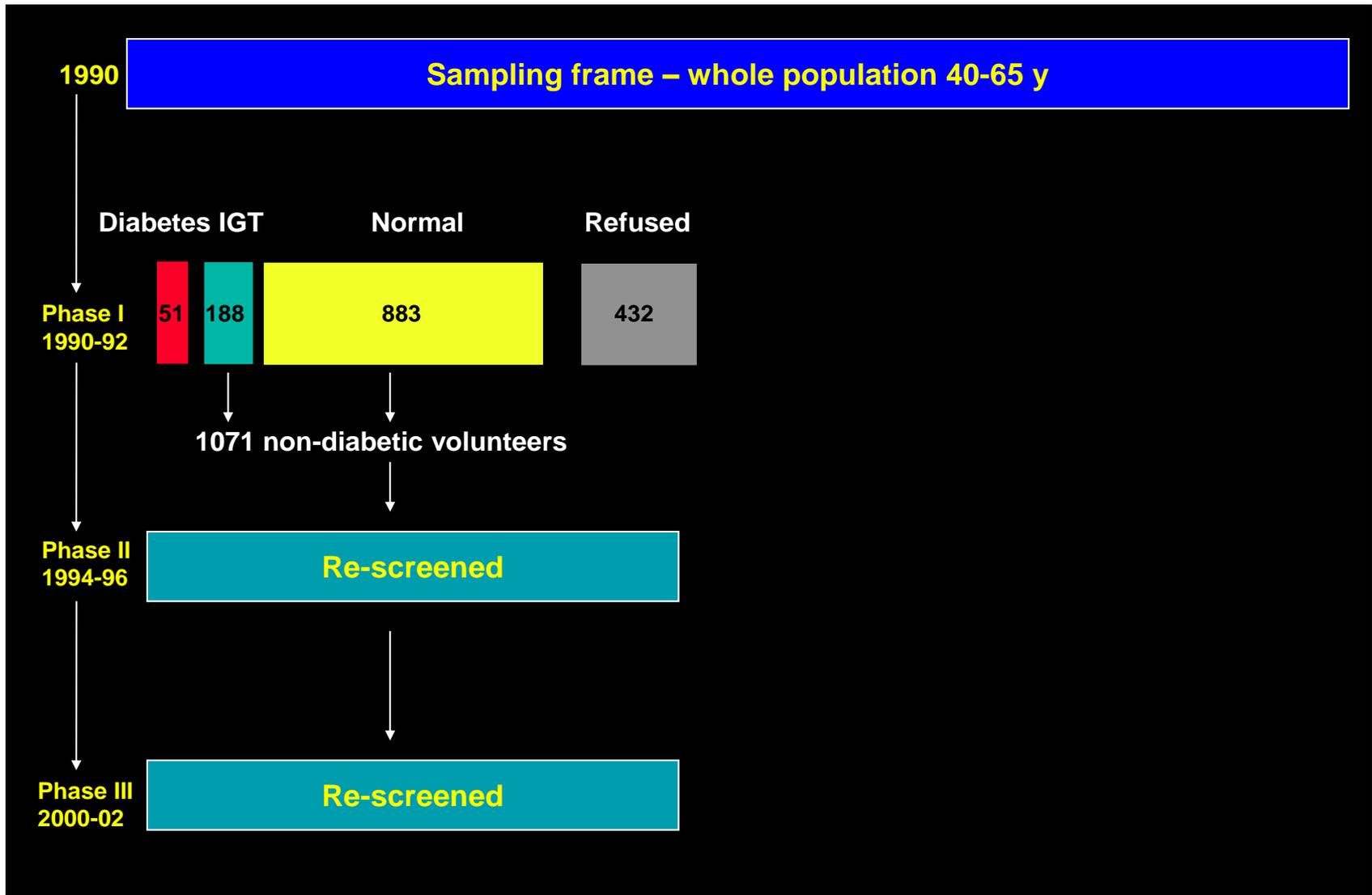


# Ely retrospective study

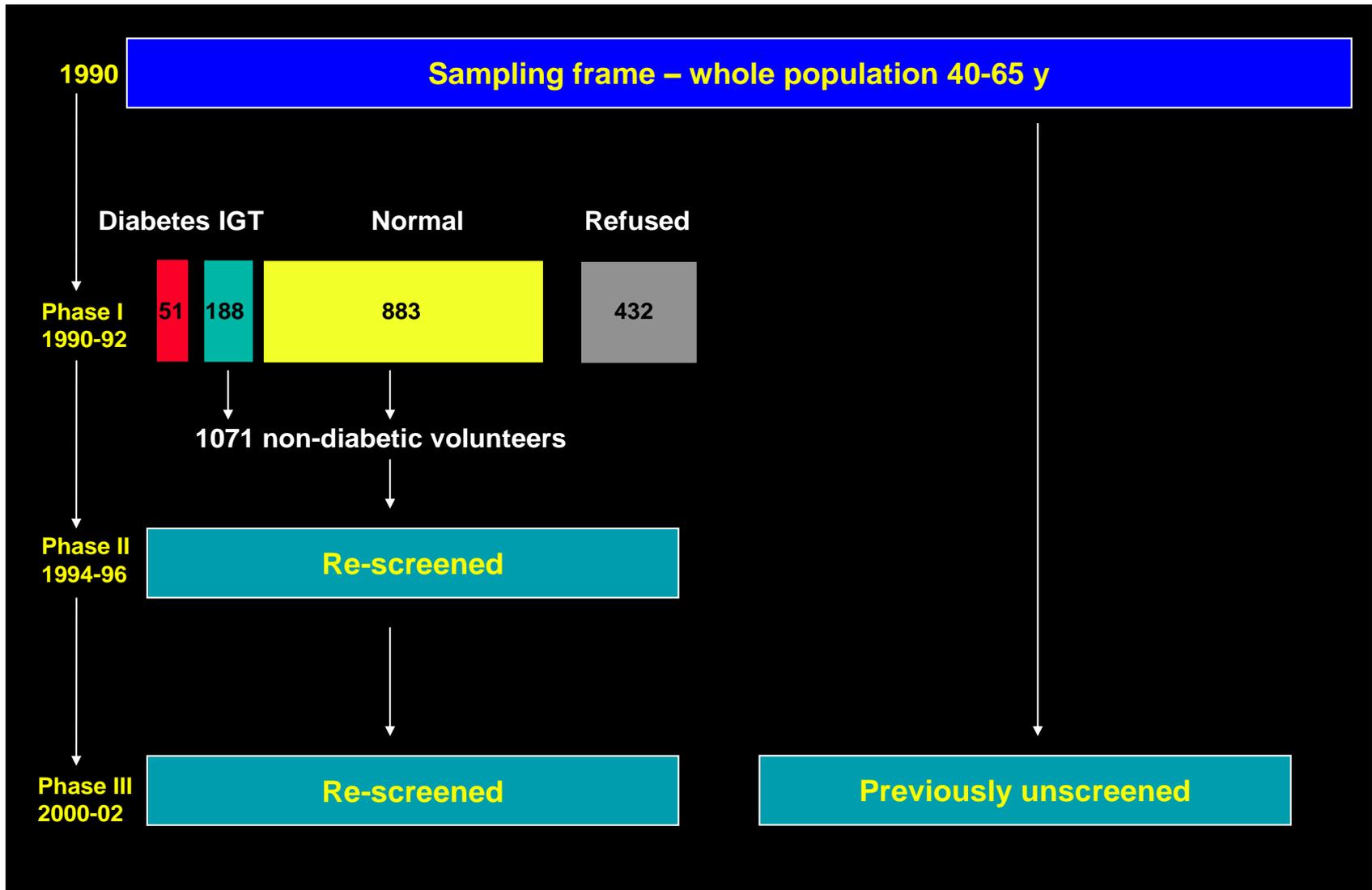
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# Study design



# Study design



# Results

- **68% initial attendance**
- **Non-attenders were more likely to be male ( $p=0.035$ ) and more deprived ( $p=0.005$ )**
- **581 deaths were notified over 14.3 years**
  - **245 cancer**
  - **197 cardiovascular**
  - **Diabetes recorded on 41 death certificates**

# Survival Curves by Attendance at Screening (adjusted for age, gender and social class)

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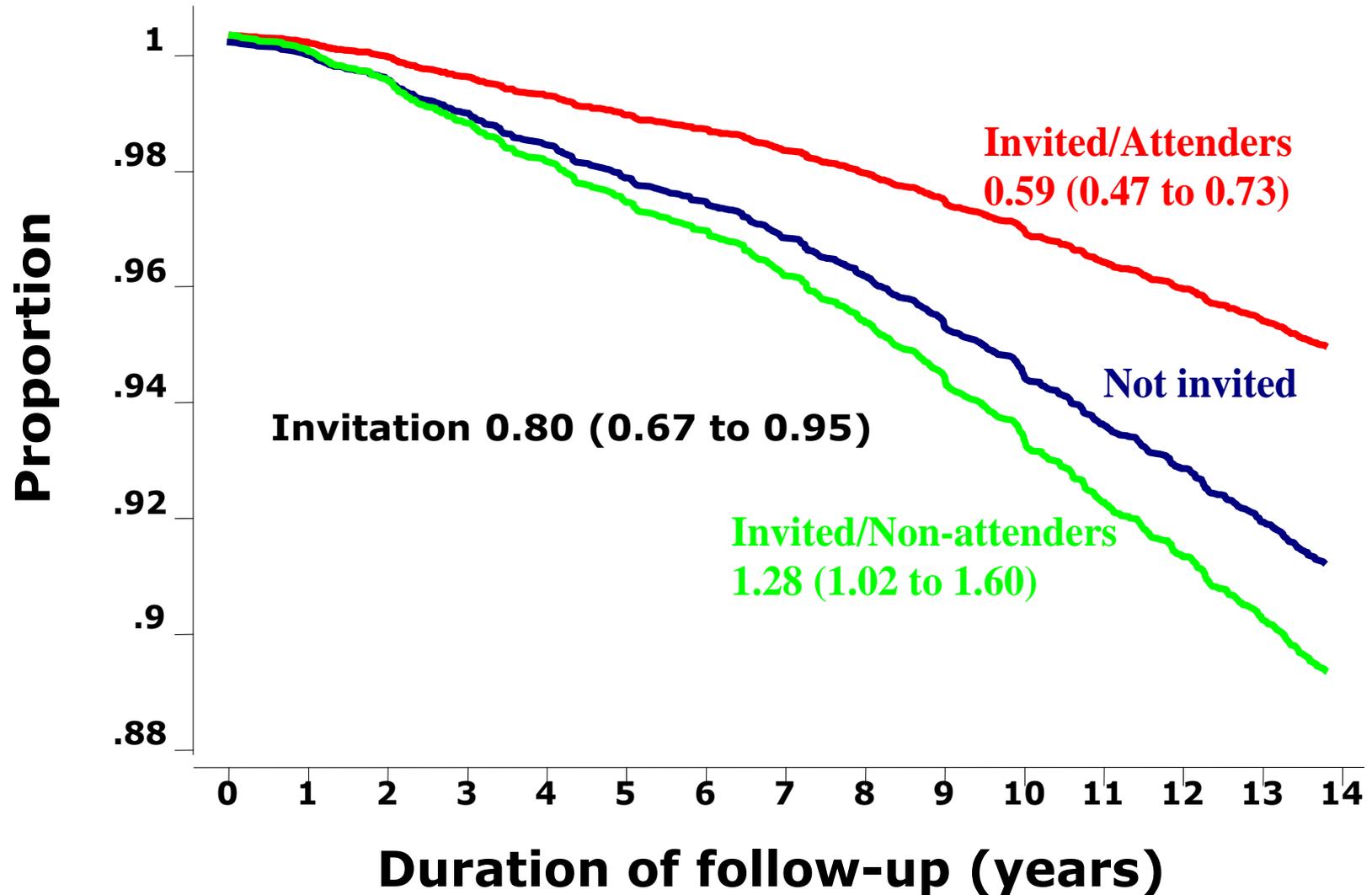
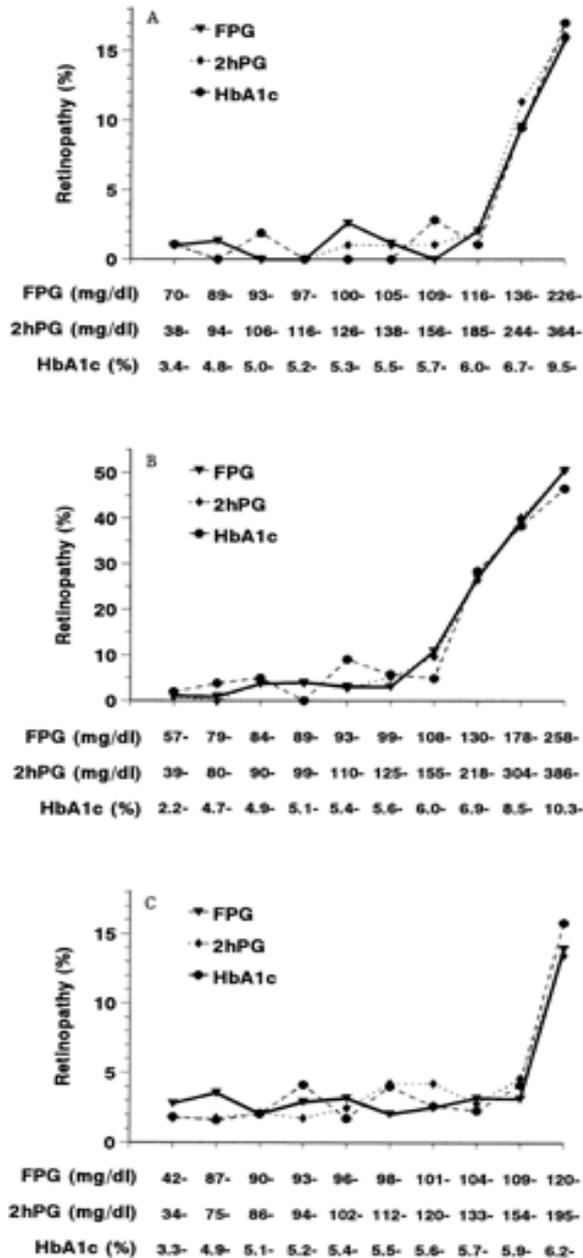


Figure 2.

# Diabetes Is Defined According to The Risk of The Microvascular Complication Retinopathy



*Prevalence of retinopathy by deciles of the distribution of FPG, 2-h PG, and HbA<sub>1c</sub> in Pima Indians (A) described in McCance et al. (BMJ 1994;308:1323–1328), Egyptians (B) described in Engलगau et al. (Diab Care 1997;20:785–791), and in 40- to 74-year-old participants in NHANES III (C) (K. Flegal, National Center for Health Statistics).*

# Screening questionnaires and scores

## Diabetes Risk Test

### TYYPIN 2 DIABE SAIRASTUMISRI

Rengasta oikea vaihtoehto

- Ikä**  
0 p. Alle 45 v.  
2 p. 45 – 54 v.  
3 p. 55 – 64 v.  
4 p. Yli 64 v.
- Painoindeksi**  
(katso taulukosta kääntöpöytä)  
0 p. Alle 25 kg/m<sup>2</sup>  
1 p. 25 – 30 kg/m<sup>2</sup>  
3 p. Yli 30 kg/m<sup>2</sup>

- Vyötärön ympärysmitta**  
alapuolelta (yleensä  
MIEHET)  
0 p. Alle 94 cm  
3 p. 94 – 102 cm  
4 p. Yli 102 cm



- Sisältyykö jokaiseen puoli tuntia liikuntaa ns. arkiliikunta mukana?**  
0 p. Kyllä  
2 p. Ei
- Kuinka usein syöt kasvatamarjoja?**  
0 p. Päivittäin  
1 p. Harvemmin kuin joskus

Testin suunnitteli: Professori Jaakko Tuomi

Complete the questionnaire below to find out if you are at risk of developing type 2 diabetes.

	Answer	Tick appropriate box	Score
1. How old are you?	44 & under	<input type="checkbox"/>	0
	45-49	<input type="checkbox"/>	7
	50-54	<input type="checkbox"/>	13
	55+	<input type="checkbox"/>	18
2. What sex are you?	Male	<input type="checkbox"/>	4
	Female	<input type="checkbox"/>	0
3. What is your Body Mass Index (BMI)?	24 & under	<input type="checkbox"/>	0
	25-29	<input type="checkbox"/>	7
	30+	<input type="checkbox"/>	15

Use your height and weight to work out your Body Mass Index (BMI) using the graph below: e.g. 4 ft10 ins 11 stone = obese class 1, i.e. BMI is over 30 therefore score 15.



	Answer	Tick appropriate box	Score
4. Have you been diagnosed with high blood pressure?	Yes	<input type="checkbox"/>	10
	No	<input type="checkbox"/>	0
5. Are you physically active in your leisure life? e.g. 30 minutes of moderate physical activity, such as brisk walking, at least 5 days a week	Yes	<input type="checkbox"/>	0
	No	<input type="checkbox"/>	6
6. Are either of your parents diabetic?	Yes	<input type="checkbox"/>	7
	No	<input type="checkbox"/>	0
<b>TOTAL (max 60)</b>			<input type="text"/>

### SCORE RANGES

If you have a total score of 31 or more you may be at increased risk of having undiagnosed diabetes. Please consider following the advice below and overleaf to arrange a simple blood sugar test at a local pharmacy, or discuss the result with your practice nurse.

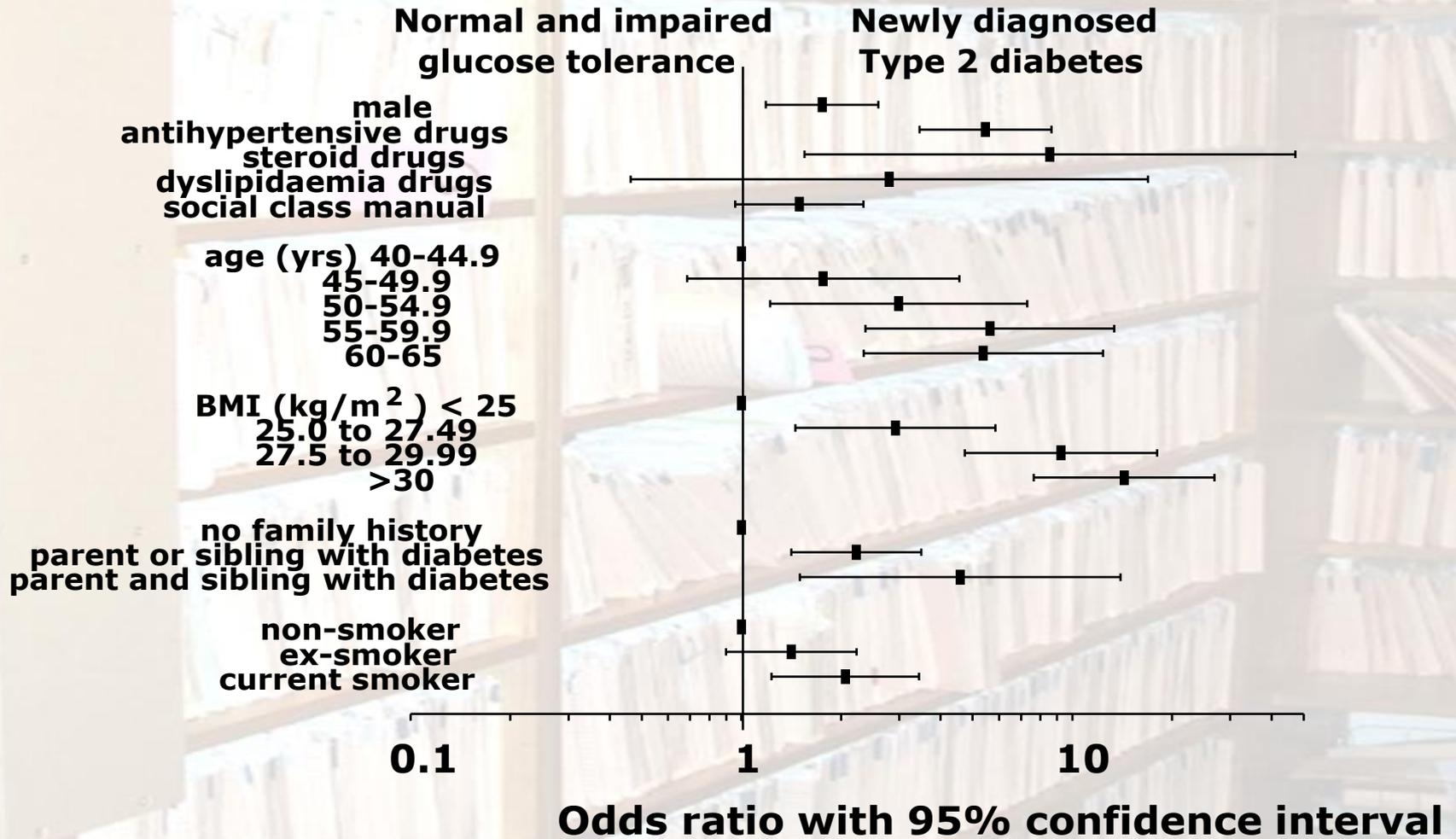
## Identify diabetes early

Diabetes causes elevated levels of sugar in the blood and may run in families. Untreated diabetes may cause damage to the heart, eyes, kidneys and feet. Early diagnosis and treatment can reduce the risk of complications.

Some of the signs of diabetes include always feeling tired, being irritable, being thirsty, passing urine excessively and getting infections and numbness in the feet.

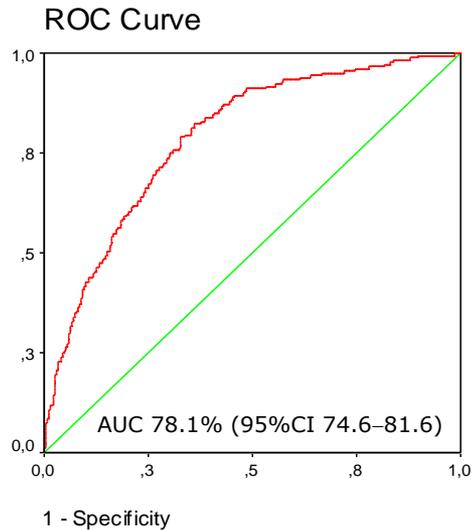
See overleaf

# Univariate Associations Between Patient Variables and Glucose Tolerance

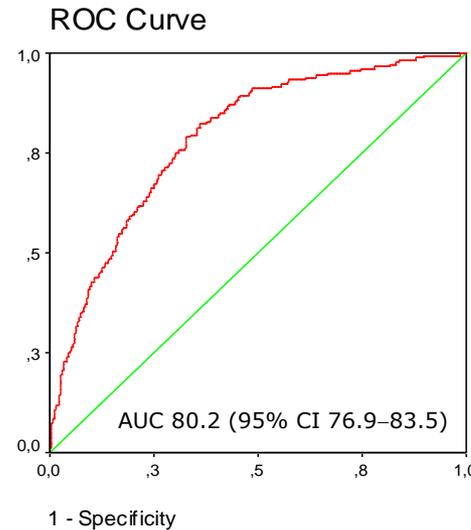


# Performance of the Risk Score in Identifying Metabolic Syndrome, Type 2 Diabetes and Impaired Glucose Regulation in a Danish Population

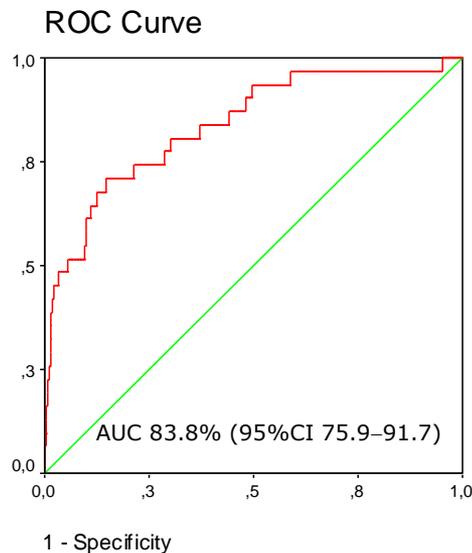
Metabolic Syndrome (EGIR)



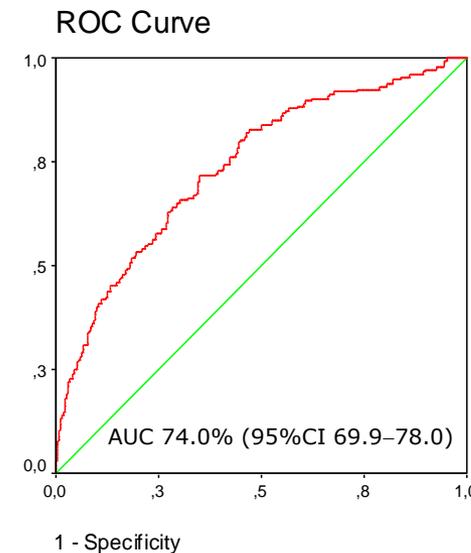
Metabolic Syndrome (NCEP)



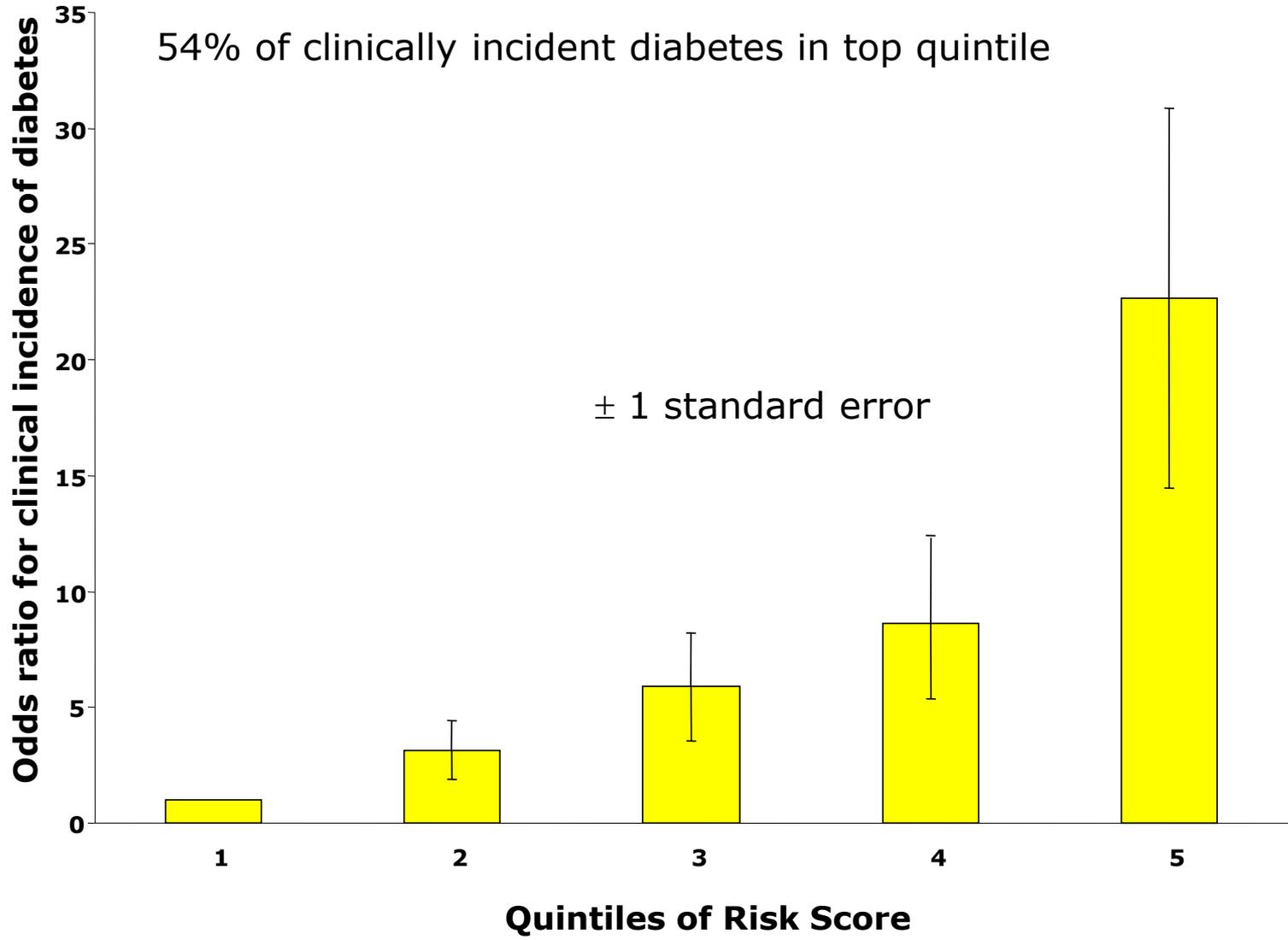
Type 2 diabetes



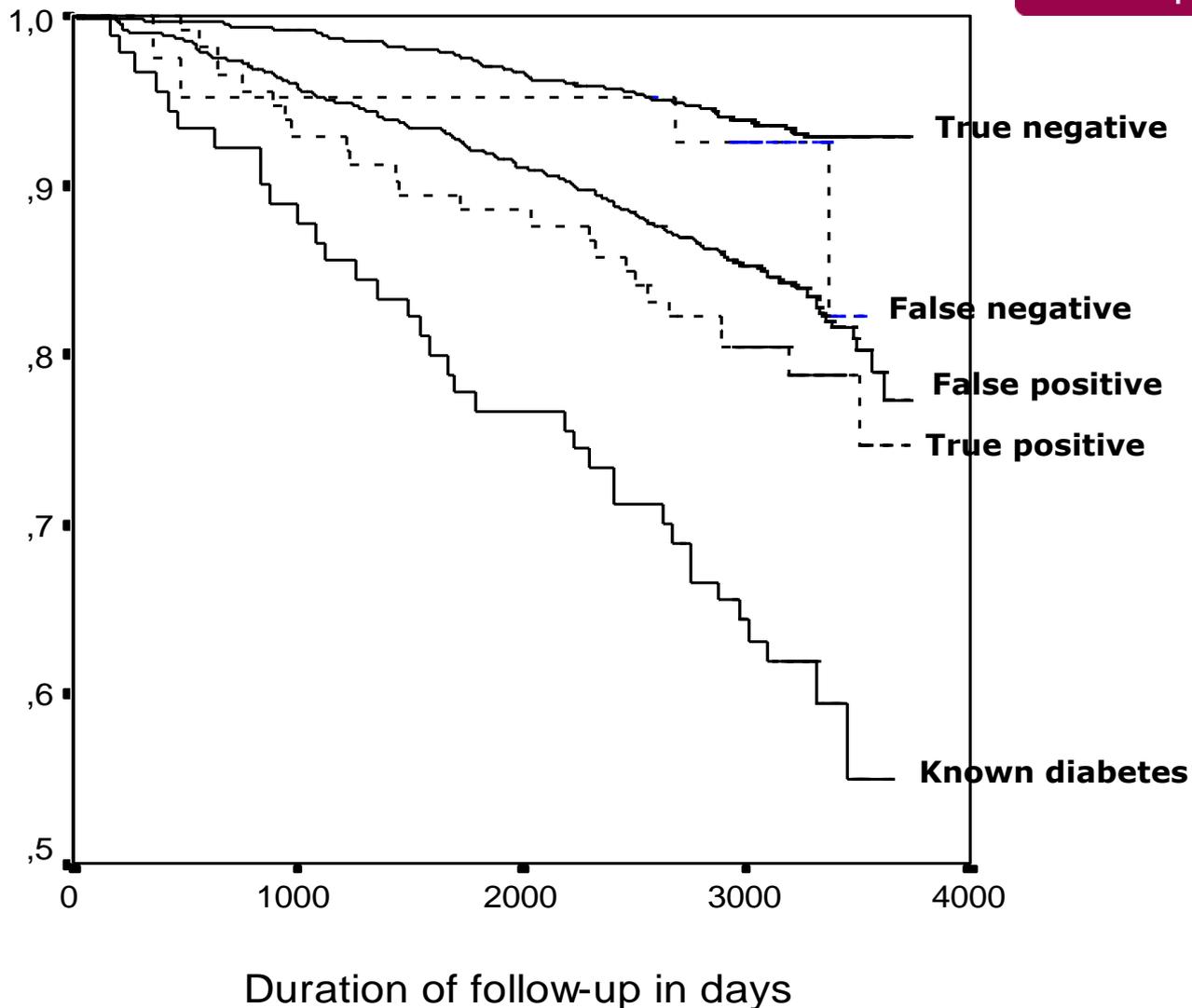
Impaired Glucose Regulation



# Association of Quintiles of Risk Score With Clinical Incidence of Diabetes



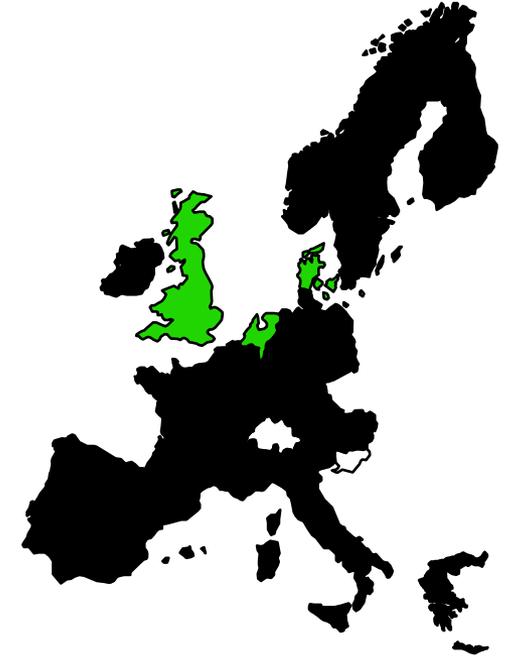
# Mortality According To Risk Score Screening Status



Kaplan-Meier curves according to screening status, with the survival curve of the known diabetic patients as a reference (Hoorn Study)

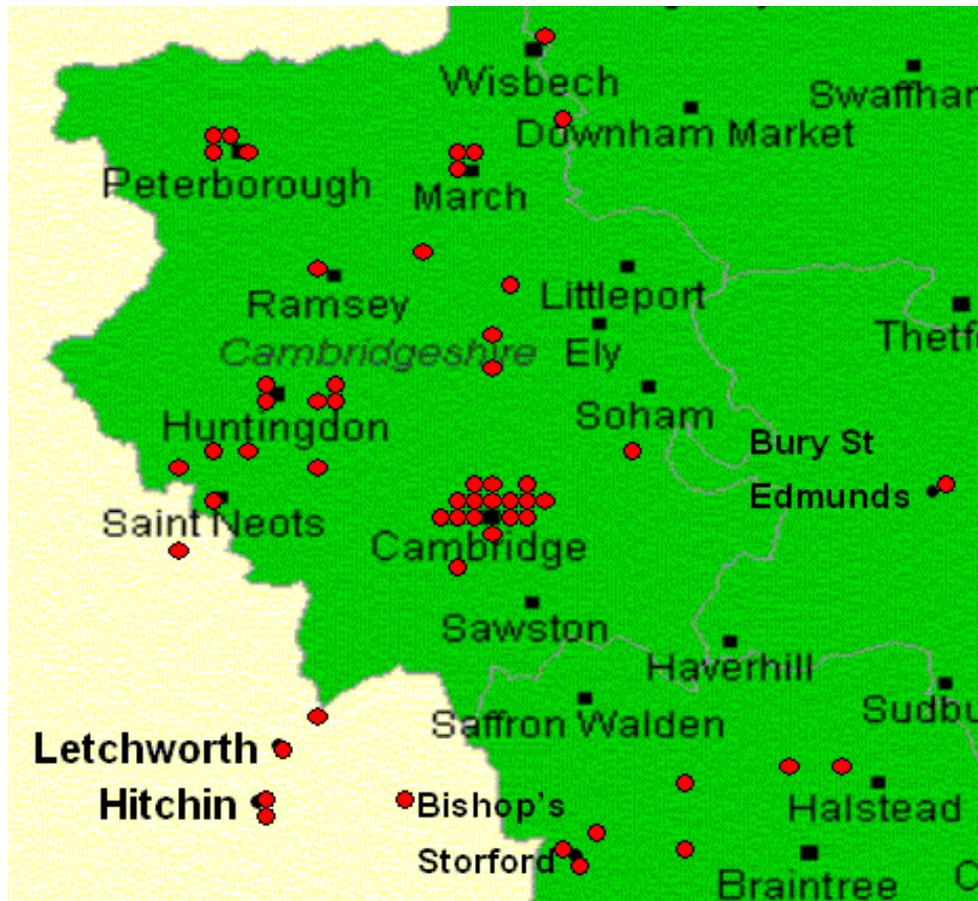
# The Addition Study

Anglo-Danish-Dutch Study of Intensive Treatment In People with Screen Detected Diabetes



- **Feasibility of screening**
- **Disbenefits of screening**
- **Cost-effectiveness of intensive CV risk reduction on 5 year cardiovascular outcomes**

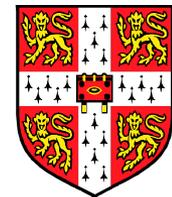
**55 practices in the Eastern Region**  
**~ 150,000 people aged 40-69 yrs without known diabetes**  
**top 25% of risk invited for random capillary screening**



wellcome trust

MRC | Medical Research Council

DH | Department of Health



RCGP

# Study design

**55 practices in the Eastern Region**

**26 practices  
screening and intensive  
target driven management  
of risk factors**

**24 practices  
screening and  
routine care**

**5 control practices**

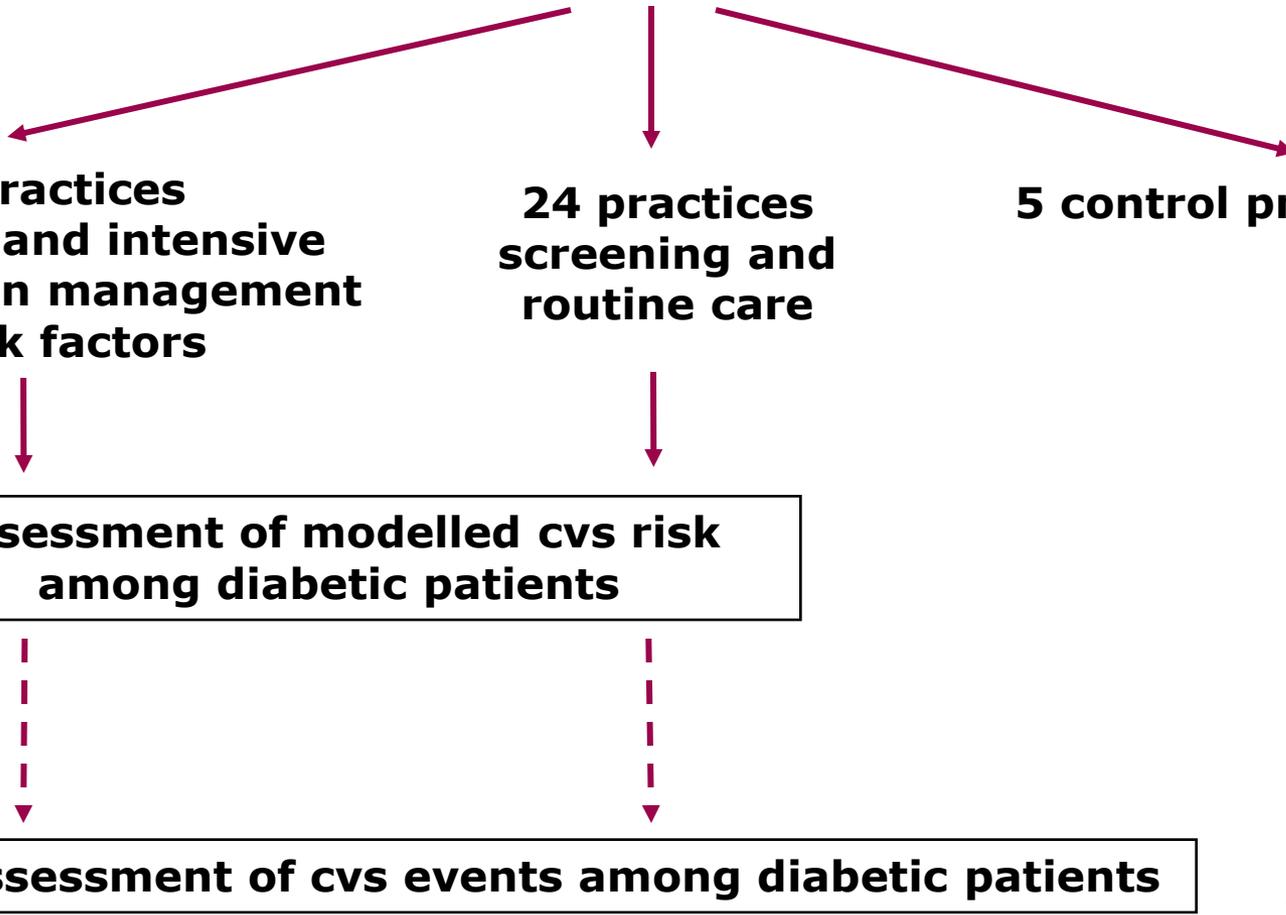
**1 year**

**Assessment of modelled cvs risk  
among diabetic patients**

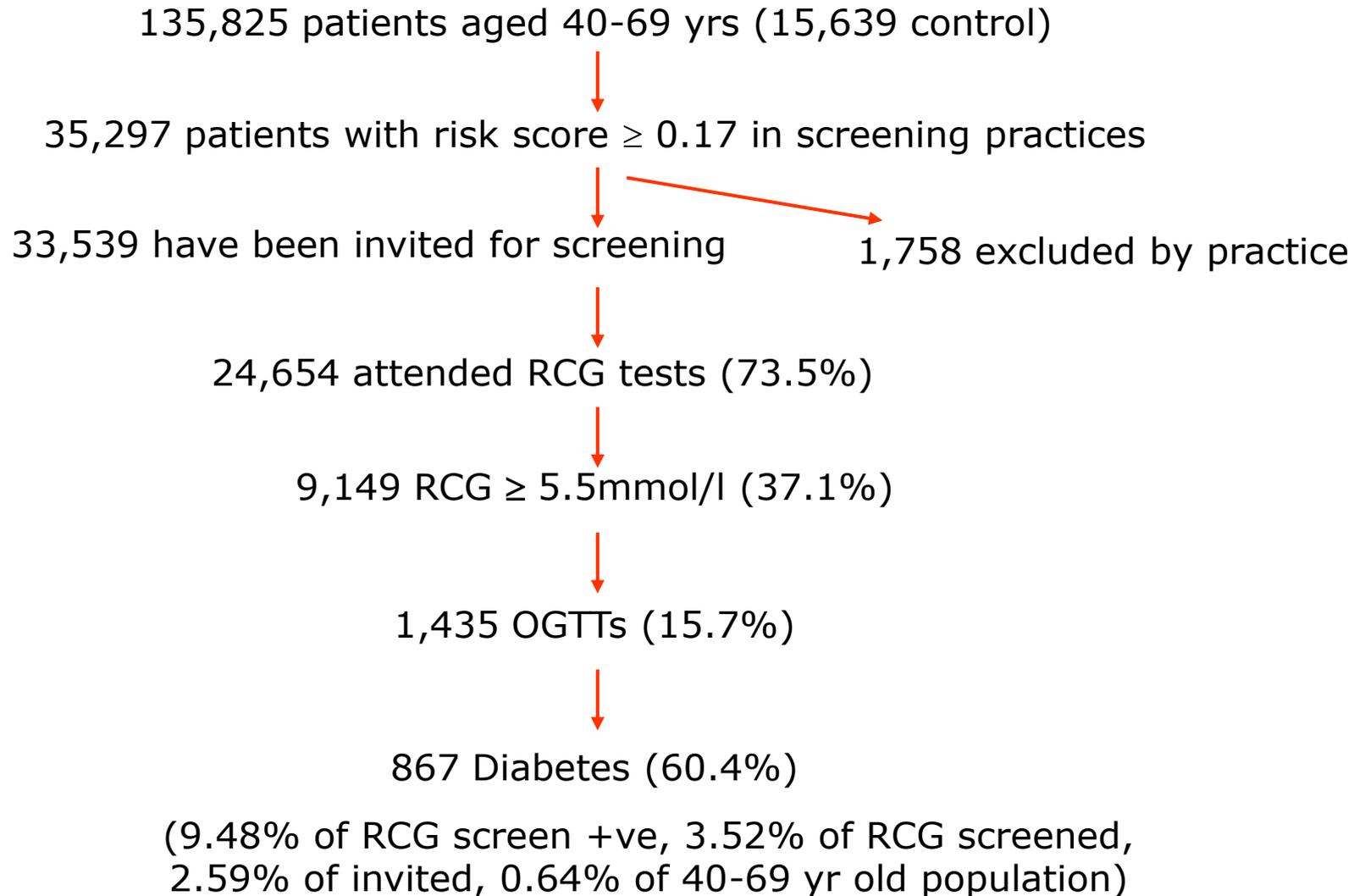
**5 years**

**Assessment of cvs events among diabetic patients**

**Assessment of mortality among total population**



# ADDITION Participant flow



## NSC Diabetes Screening Pilot Programme

- **24 practices in 8 urban, 'deprived', ethnically diverse PCTs.**
- **Original inclusion criteria  $\geq 40$  yrs,  $>25\text{kg}/\text{m}^2$ , no diabetes, no glucose test within 2 years.**

Total list size 165,828



After exclusions 41,418 invited for screening (25%)



25,356 reported to have been screened (61%)



8,367 positive screening test (33%)



358 Diabetes

(4.3% of screen +ve, 1.4% of screened, 0.86% of invited, 0.21% of population)

## NSC Diabetes Screening Pilot Programme

- **5.5% increase in practice diabetic population.**
- **811 hours/practice = 2hrs/invited patient (mainly HCA staff).**
- **RCG result available for only 50% of 'screened' patients.**
- **23% of those with an RCG result were  $<25\text{kg}/\text{m}^2$ .**
- **31% of screen +ve had no notes record of a diagnostic test result.**
  
- **Staff positive but concerned with equity.**
- **Opportunistic screening felt to be more efficient.**
- **Inverse care law applies.**
- **Consent assumed.....**



# NSC next steps?

- **Decision expected in December.**
- **Likely recommendations**
  - **Cardiovascular risk health check including blood glucose test**
  - **Population sub-groups (eg >40yrs, >25kg/m<sup>2</sup>)**
  - **Frequency?**
  - **Test?**



# Conclusions 1

- Type 2 diabetes meets many of the criteria for suitability for screening.
- It is a common serious condition, that remains undiagnosed for several years and when people are finally diagnosed many already have complications.
- It is easily screened for and diagnosed, and effective treatments are available.
- Screening is an intervention that can cause both benefit and harm.
- Even a modest harm to the large number of people tested might outweigh a large benefit to those found to have the disease and then treated.
- There is no published evidence of significant harms associated with screening but some observational evidence that screening for diabetes and related abnormalities is associated with reductions in population mortality.

# Conclusions 2

- No justification yet for universal screening in the UK and similar countries.
- Some support for screening in population sub-groups eg additional testing for hyperglycaemia in high-risk groups.
- Key uncertainties remain
  - The size of the benefit of earlier detection and treatment
  - The magnitude of the costs of earlier detection and treatment.
- The yield from screening will be lower than expected and the workload and cost higher than expected.
- There remains considerable potential to reduce the burden of diabetes through improved care and through individual and population-based preventive strategies.

**Thank you for your attention**

<http://bmj.com/cgi/reprint/322/7292/986.pdf>