



Definitions and approaches to prevention

Simon Griffin
Professor of General Practice

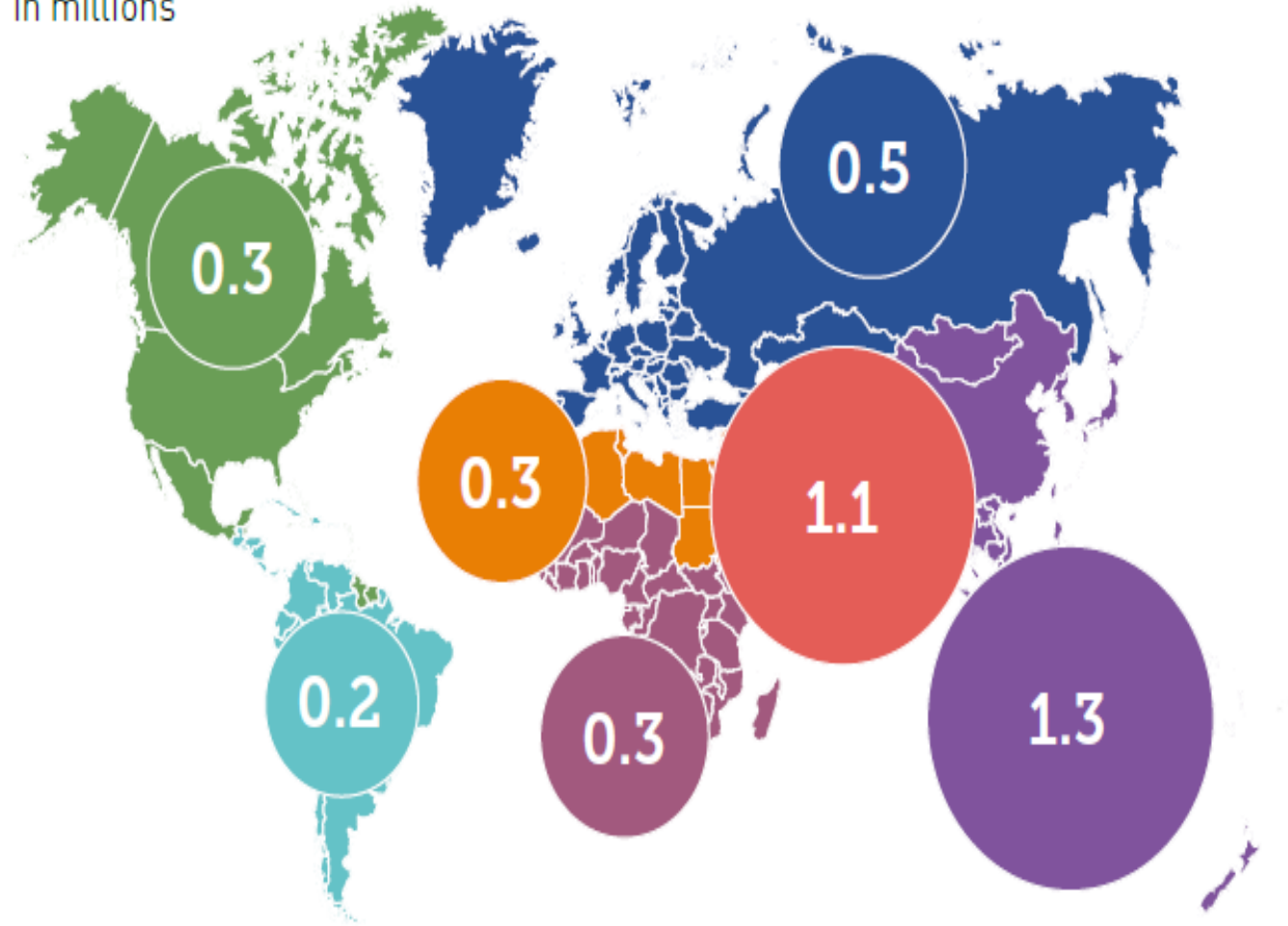
Cambridge Diabetes Seminar, Clare College, Wednesday 3 April 2019

Public health impact/ burden of diabetes

- **Premature mortality**
 - Globally, 5th leading cause of death (Roglic et al, 2005)
 - Life expectancy ↓ ~5-10 years

Mortality due to diabetes

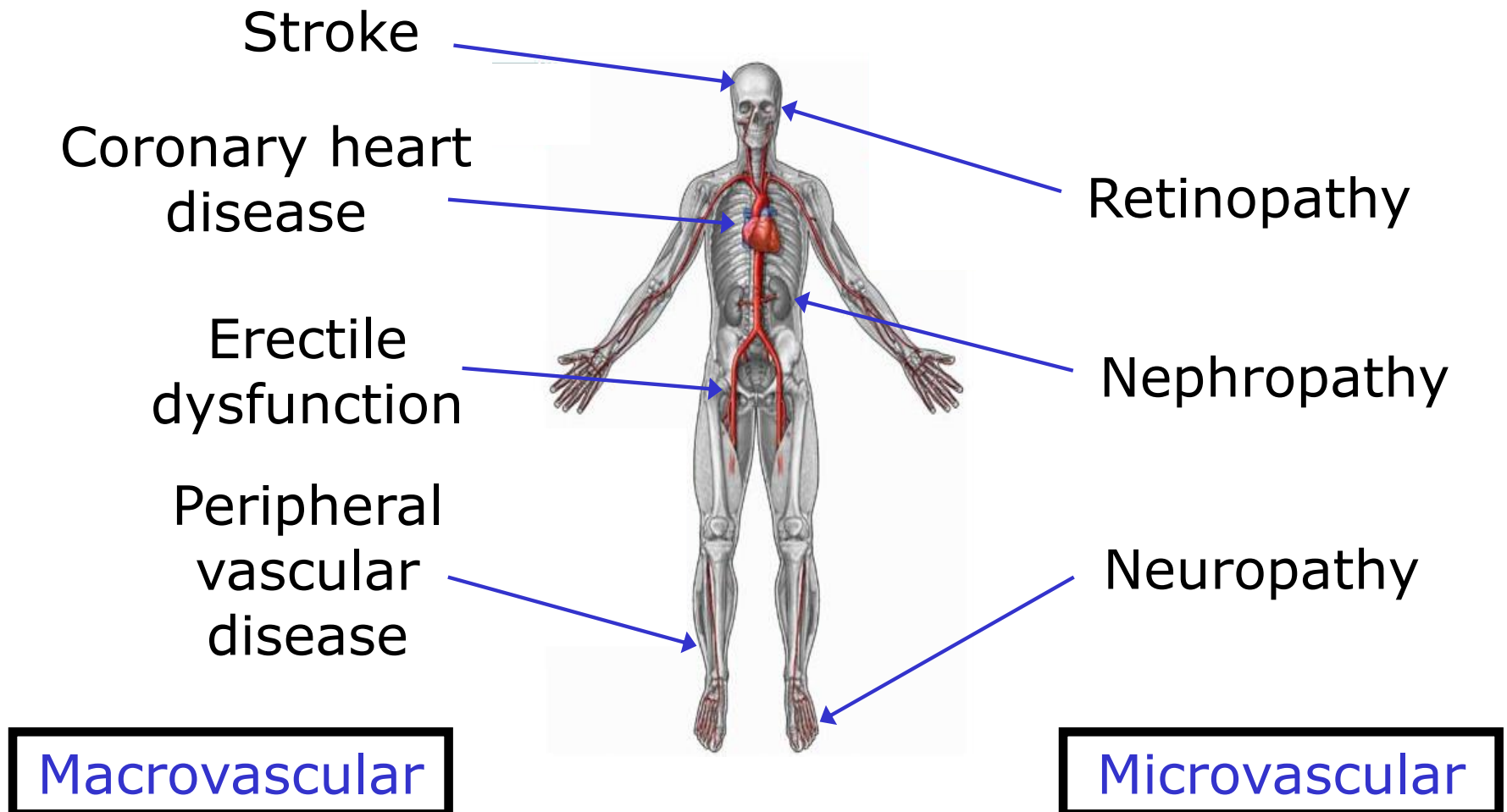
Number of deaths due to diabetes (20-79 years) in 2017
in millions



Public health impact/ burden of diabetes

- Premature mortality
 - Globally, 5th leading cause of death (Roglic et al, 2005)
 - Life expectancy ↓ ~5-10 years
- Premature **morbidity**

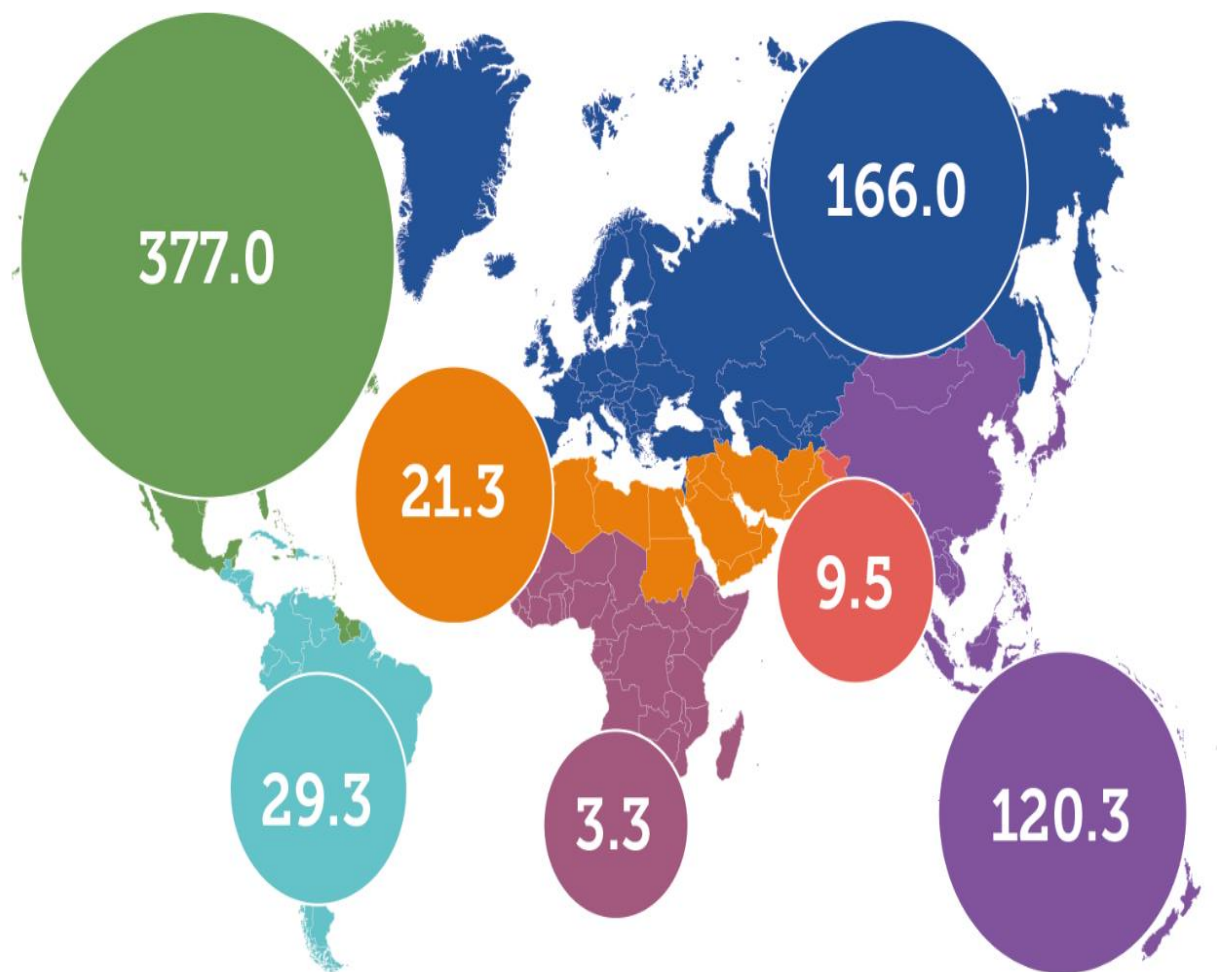
Complications of diabetes



Public health impact/ burden of diabetes

- Premature mortality
 - Globally, 5th leading cause of death (Roglic et al, 2005)
 - Life expectancy ↓ ~5-10 years
- Premature morbidity
- **Cost: financial**
 - **UK: in 2011, NHS spend on DM was ~£10 billion (~10% NHS costs) = £1m per hour**

Diabetes-related healthcare expenditure in adults (20-79 years) in 2017 by region



Public health impact/ burden of diabetes

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 - Life expectancy ↓ ~5-10 years
- Premature morbidity
- Cost: financial
 - UK: in 2011, NHS spend on DM was ~£10 billion (~10% NHS costs) = £1m per hour
- **Non-financial: Impacts individual, carer, health service, society**

Delivering good diabetes care



Julian Tudor Hart

Good management of chronic disease involves doing simple things well, for large numbers of people, few of whom feel ill



Glyncorrwg

Downstream and upstream prevention



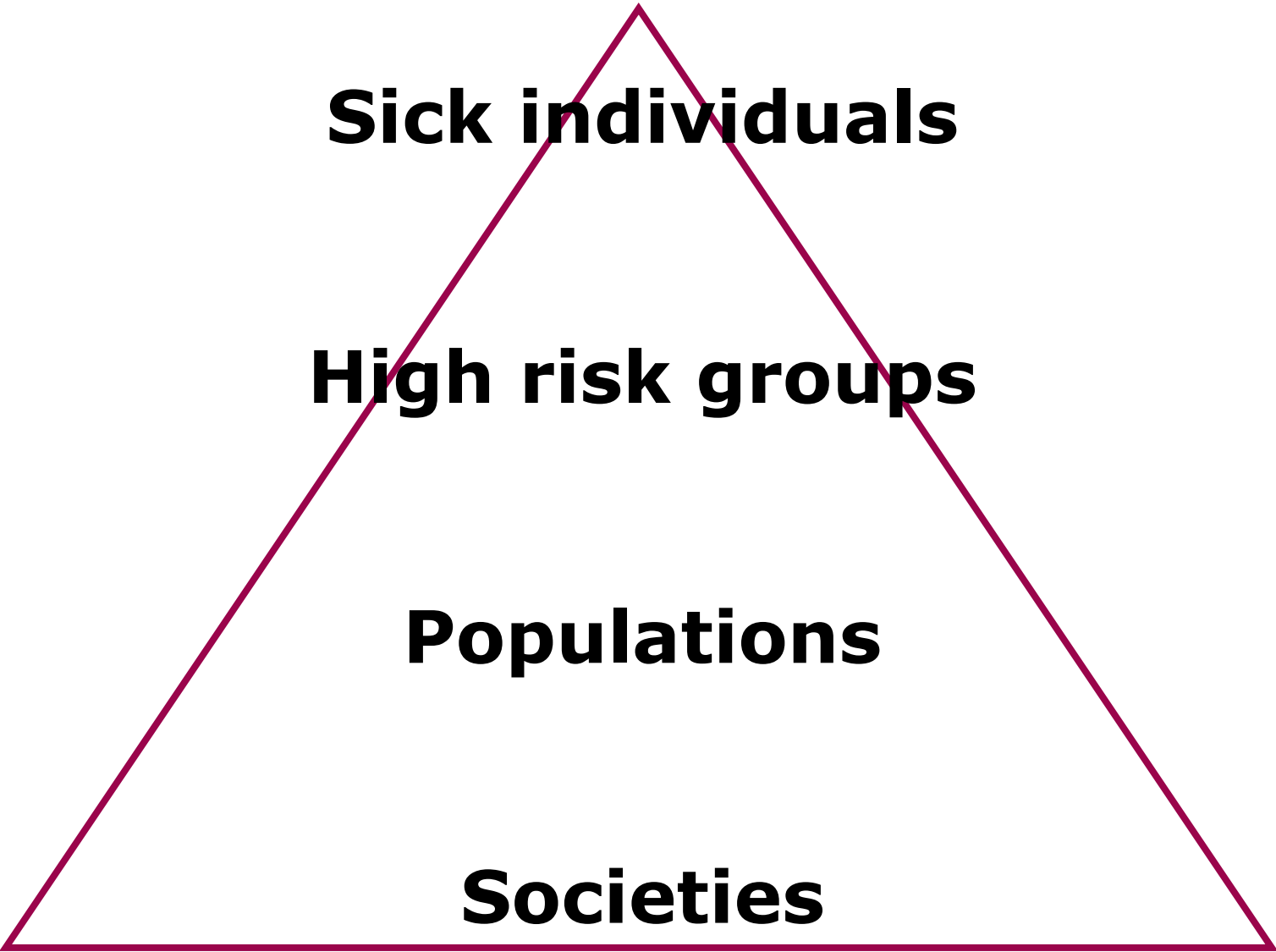
“There comes a point where we need to stop just pulling people out of the river. We need to go upstream and find out why they're falling in”



Desmond Tutu

Downstream

Upstream



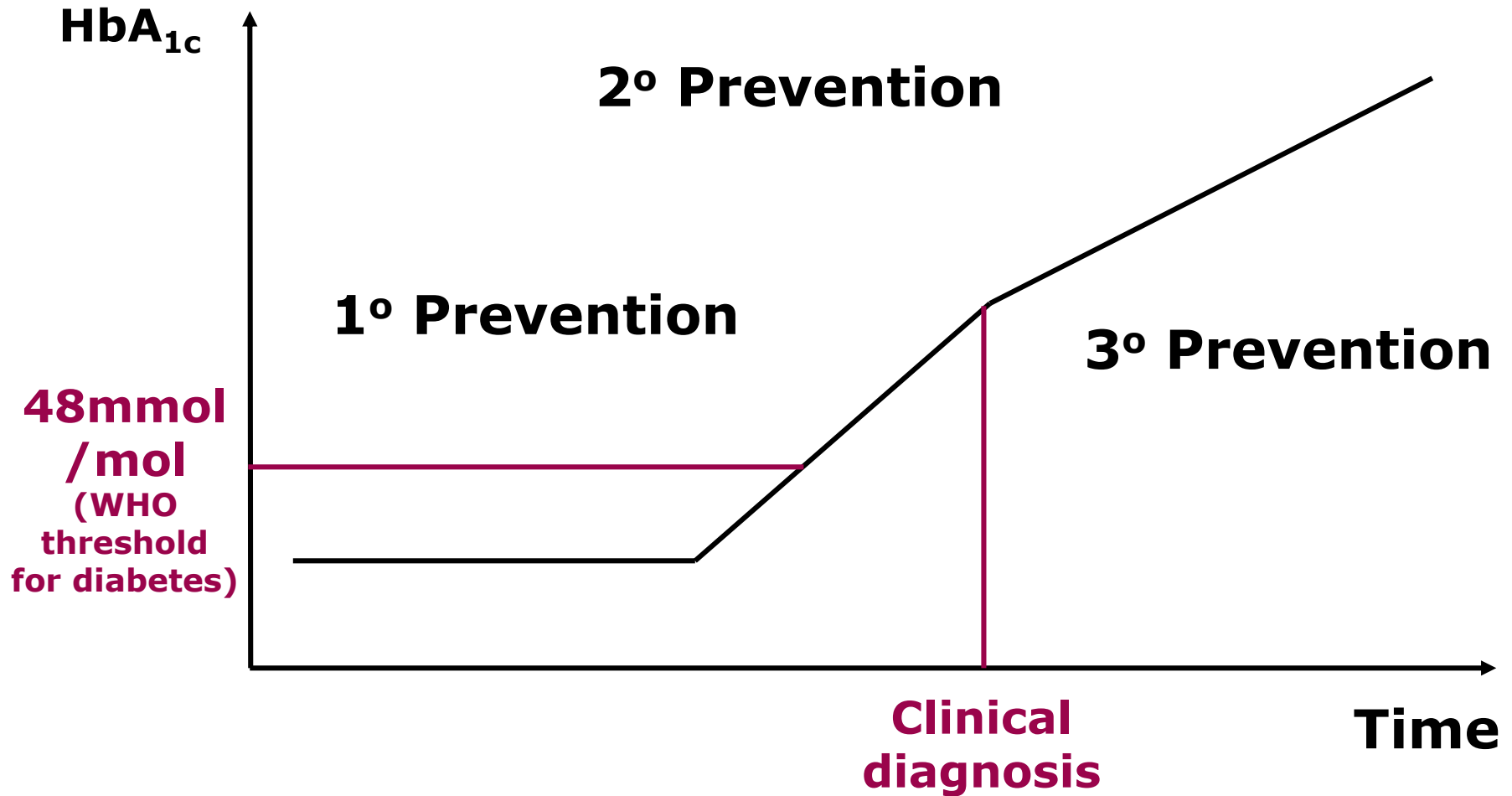
Sick individuals

High risk groups

Populations

Societies

Reducing the burden of type 2 diabetes



MRC | Epidemiology Unit

 UNIVERSITY OF CAMBRIDGE



The science base for prevention of diabetes related complications

Glycemic control
BP control
Lipid testing and management

Clinical Services

Promotion of Behaviors

Annual eye examinations
Foot care for high risk persons
Kidney disease testing
Flu immunization
Preconception care
Diabetes education
Case Management
Targeted Screening

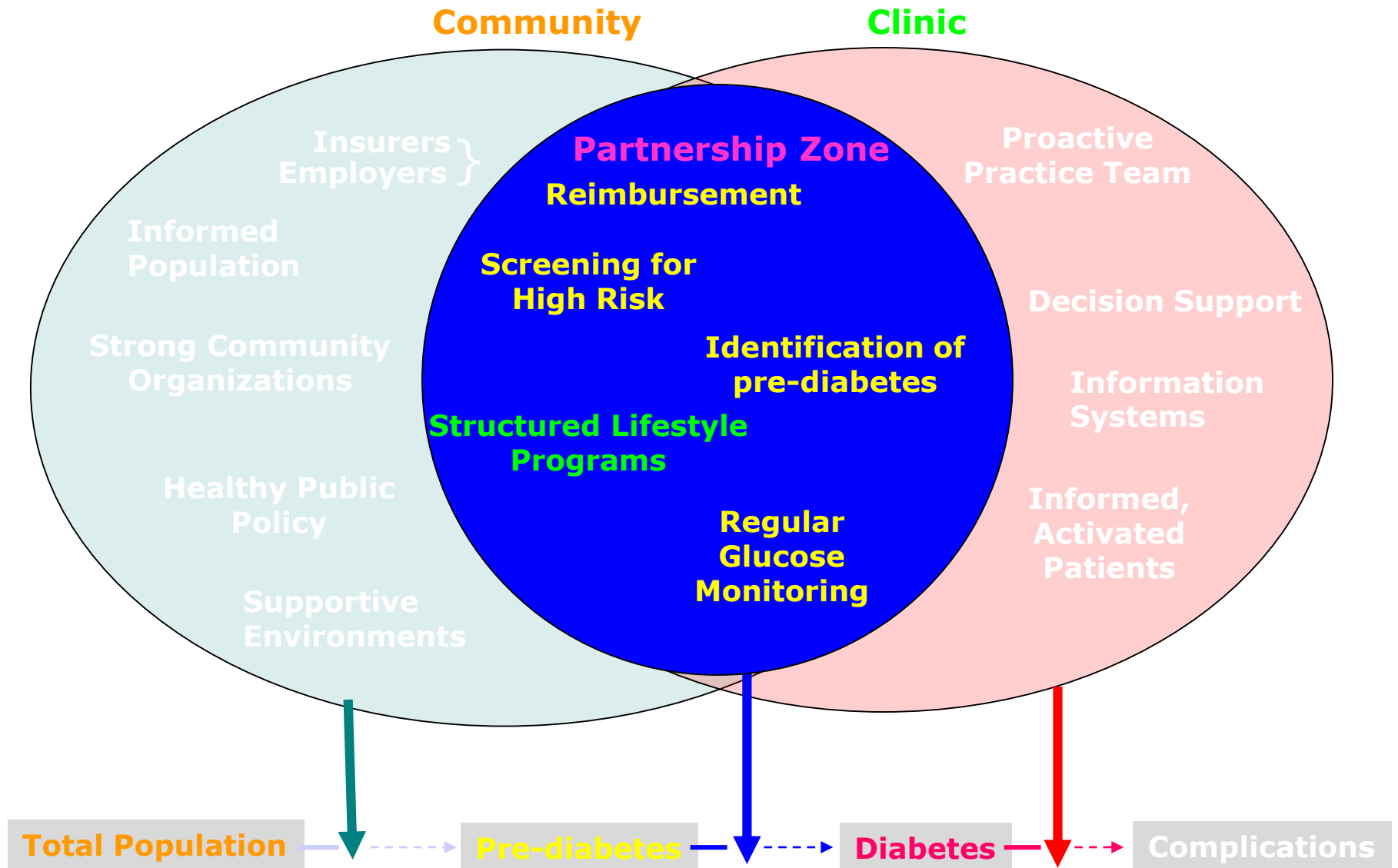
Physical activity
Reduced tobacco
Healthy diet
Regular doctor visits
Self monitoring
Self management education

Population-Targeted Policies

Health care access legislation
Drug and supply reimbursement policies
Population registry and feedback systems

Prevention of type 2 diabetes

The community – clinic partnership model



The strategy of prevention

The prevention paradox

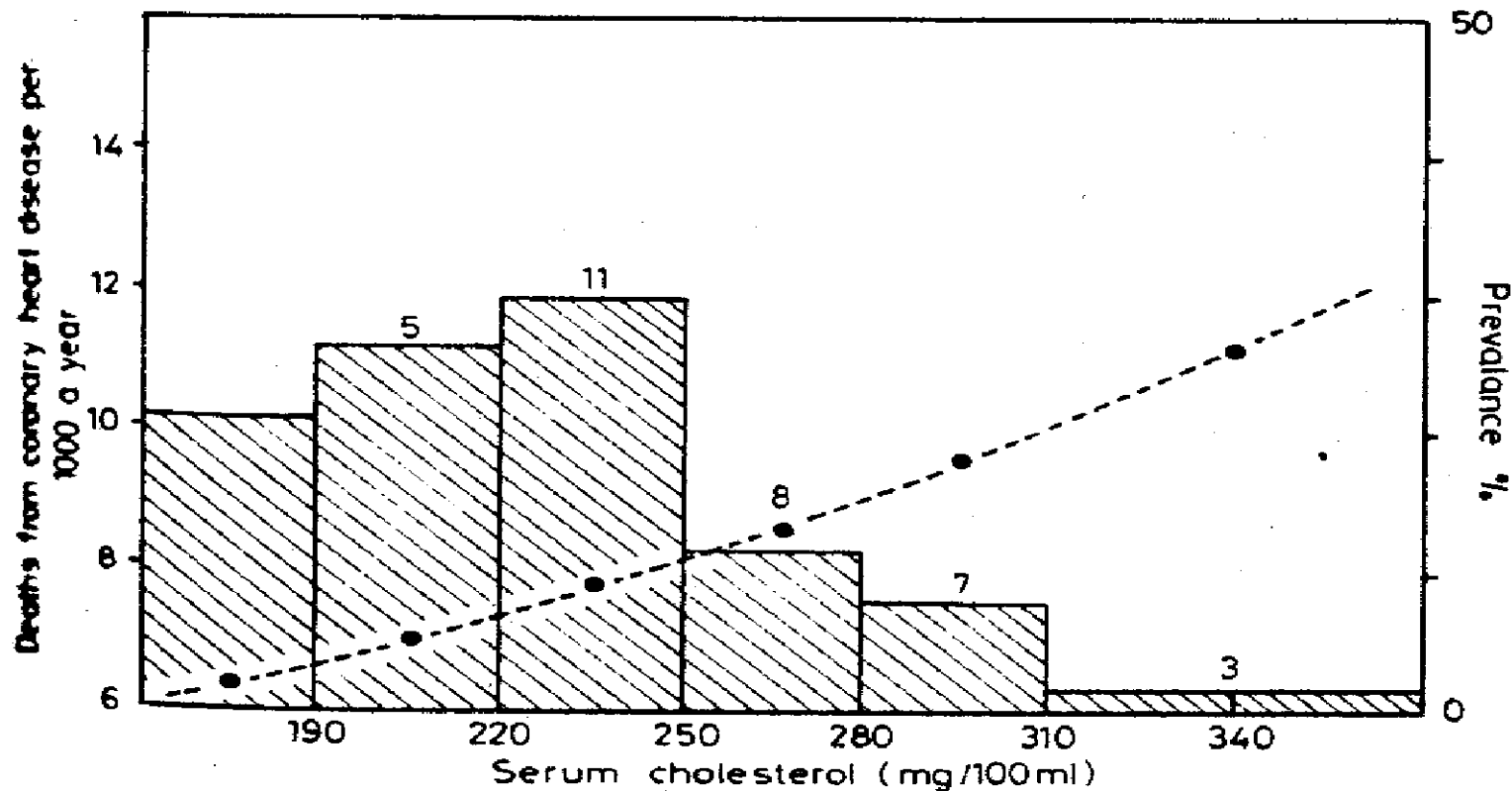


FIG 3—Prevalence distribution of serum cholesterol concentration related to coronary heart disease mortality (---) in men aged 55-64. Number above each bar represents estimate of attributable deaths per 1000 population per 10 years. (Based on Framingham Study.⁴)

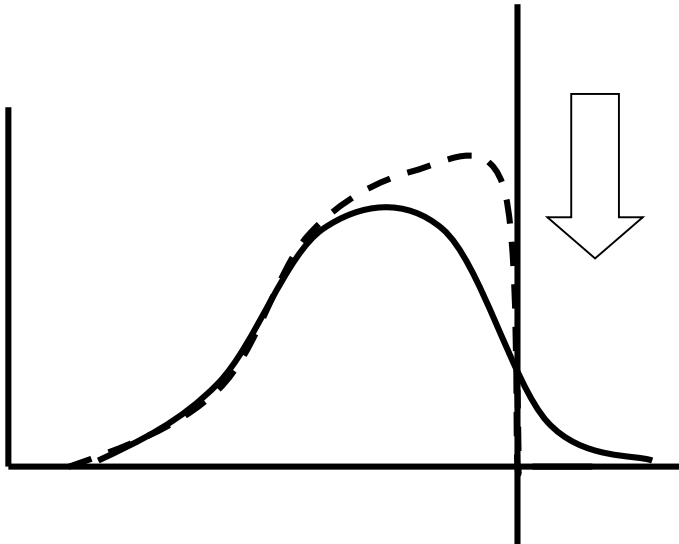
Conversion: SI to traditional units—Cholesterol: 1 mmol/l $\approx$ 38.6 mg/100 ml.

The strategy of prevention

The prevention paradox



High Risk Approach

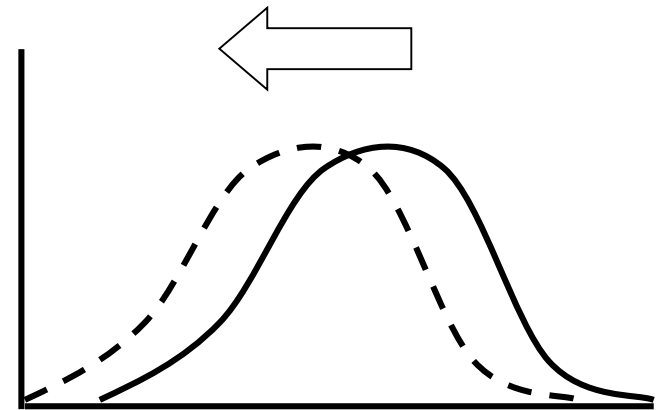


**Identify and treat those
beyond a threshold for risk
factor**

- Risk factor-outcome relationship is steep (risk factor increases risk a lot for minority).
- Interventions more effective at the high end of the distribution.
- Efficient means of risk stratifying the population exists.
- No practical, safe, policy lever exists.

Population Approach

- Risk factor increasing risk a modest amount for a large % of the population.
- Low-risk, low-cost interventions exist to alter the risk factor.
- Presence of a strong policy lever to implement the intervention efficiently.



Shift the whole population distribution of risk factor

Risk factors for type 2 diabetes

- Age
- Sex
- Family history
- Genetic factors
- Ethnicity/race

- Social factors
 - education
 - social class
 - income
 - ownership

- Lifestyle factors
 - diet
 - physical activity

- Perinatal factors

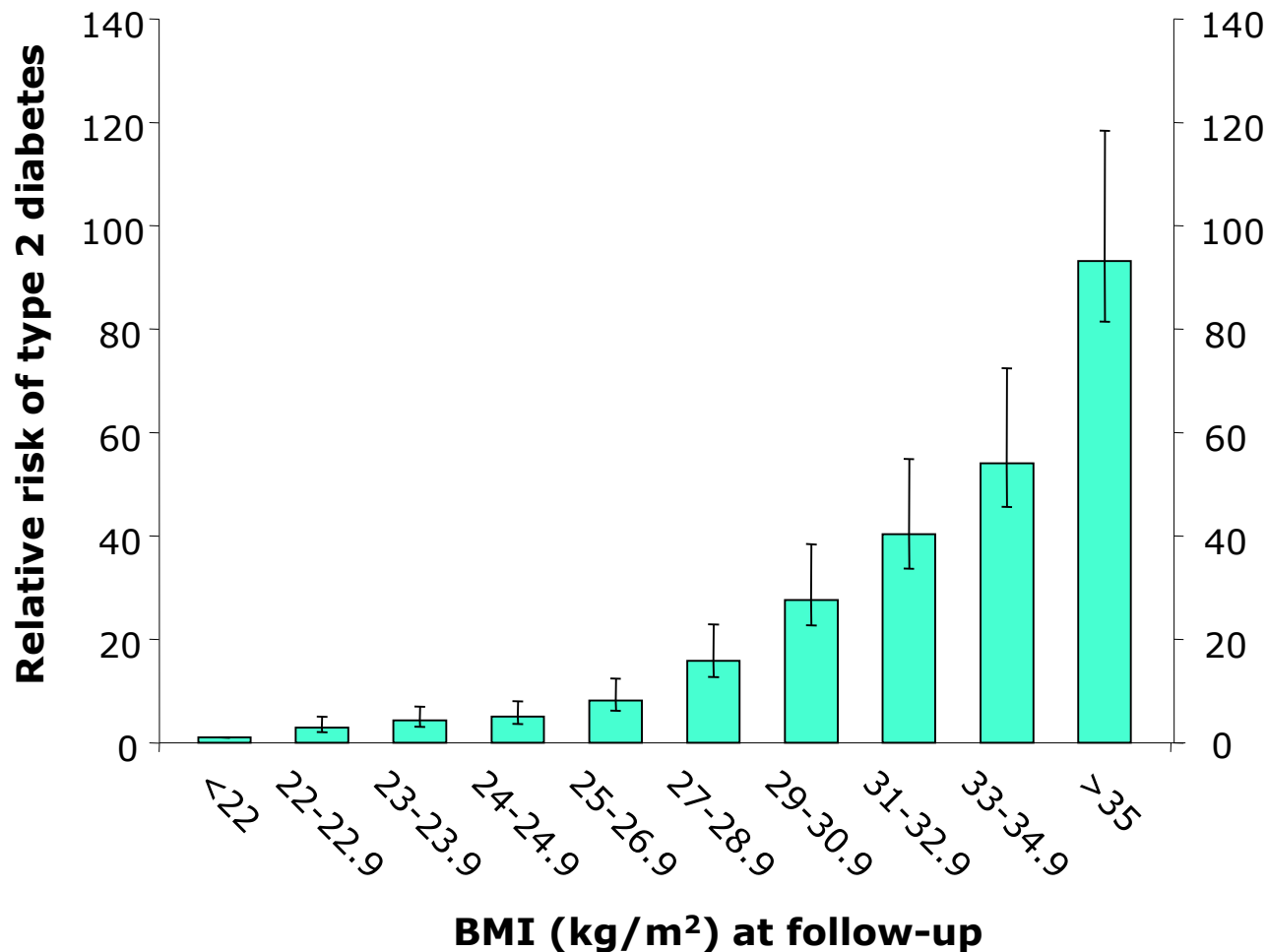
Modifiable & non-modifiable factors

- Complications of diabetes
 - coronary heart disease
 - stroke
 - kidney failure
 - eye fat distribution

- Environmental factors, pollutants

- New & emerging risk factors

BMI and diabetes risk: the Nurses' Health Study



Determinants of behaviour

Physical activity

Energy expenditure

Diet

Energy intake

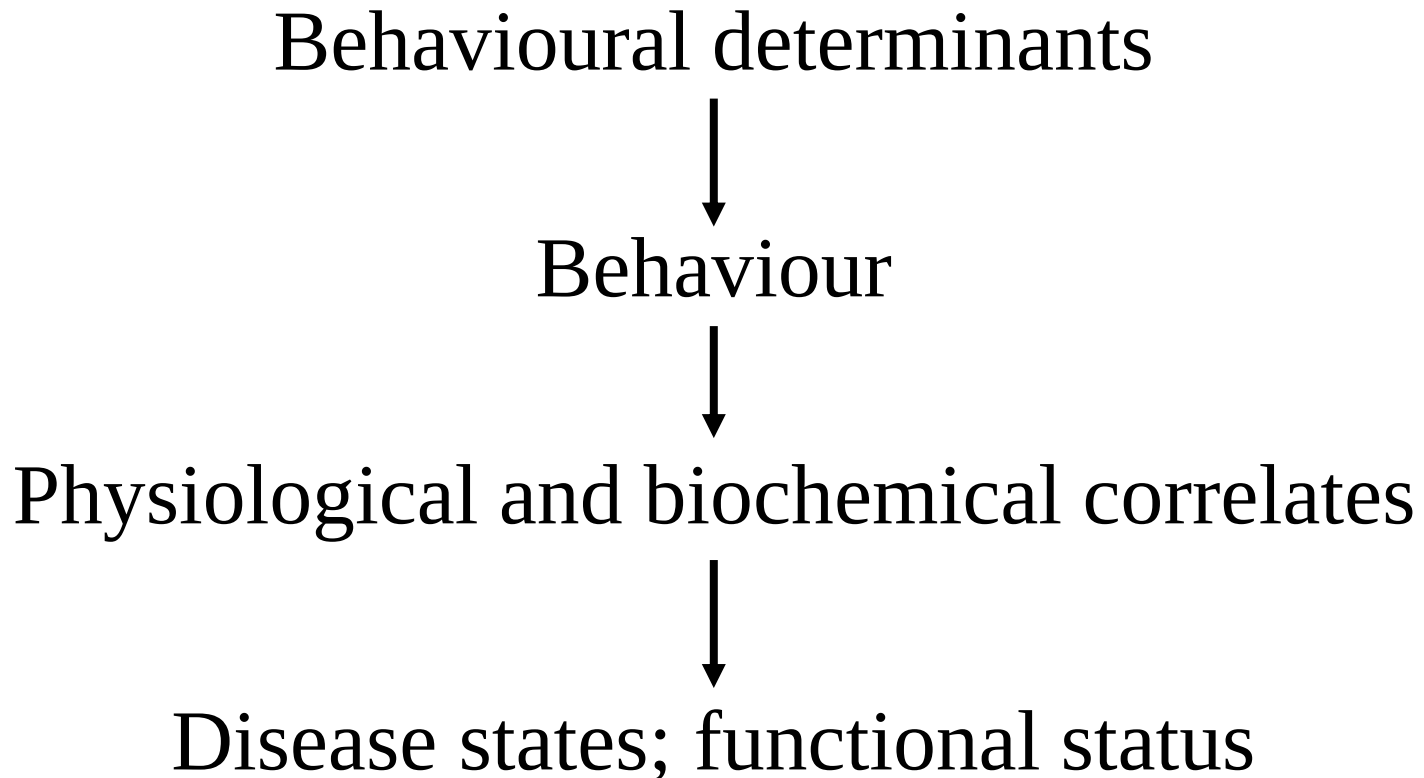
Type 2 diabetes

Mental health

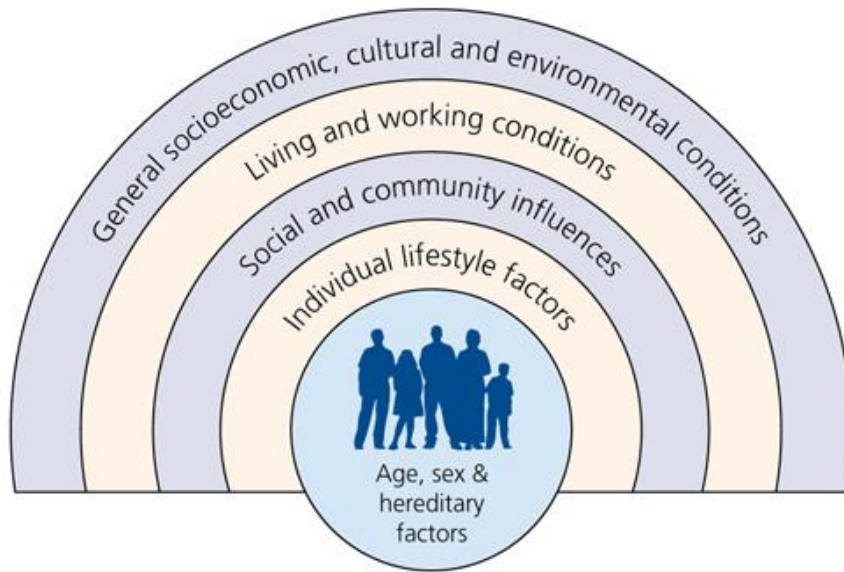
CVD risk factors



Causal Models



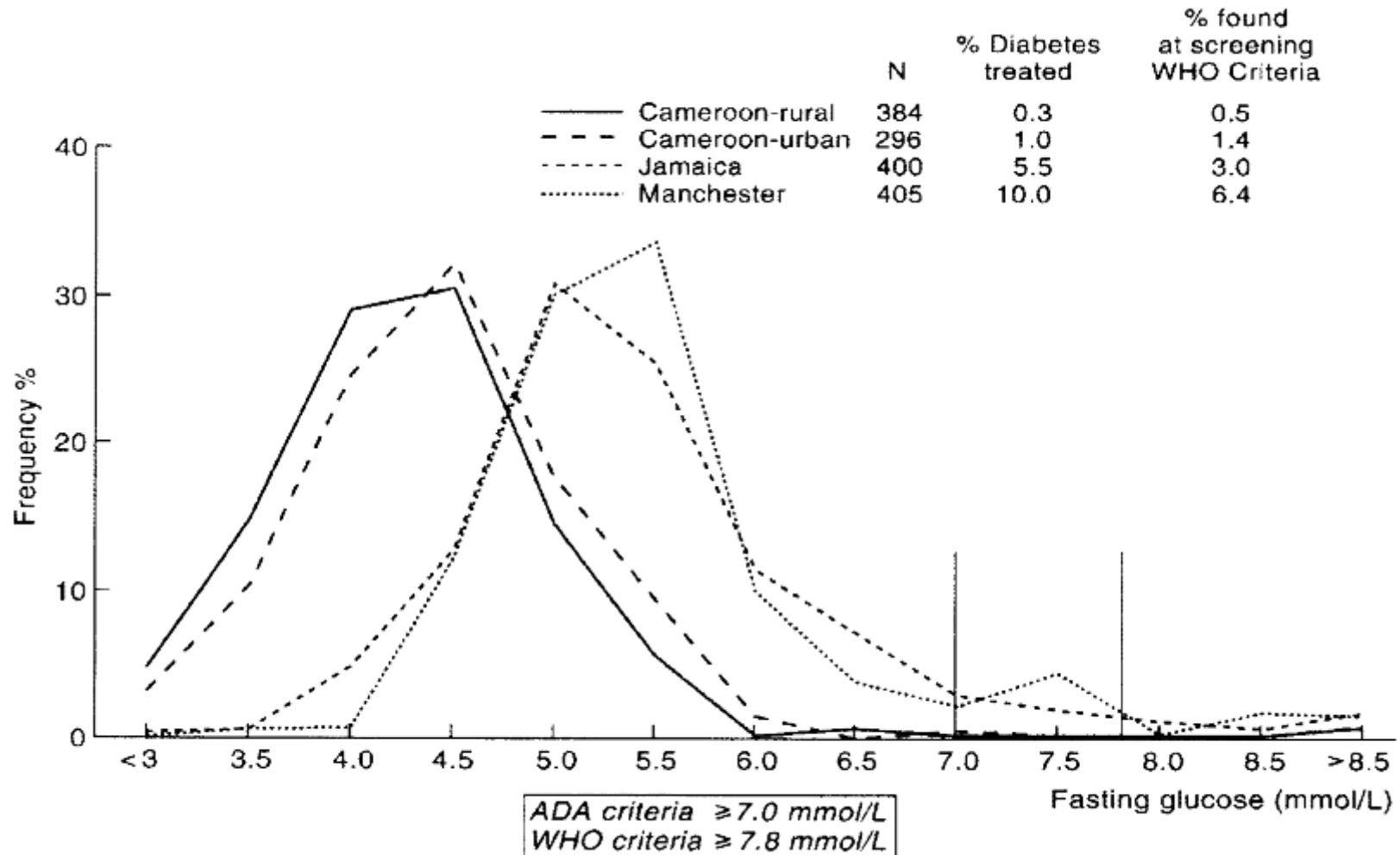
Individual and collective-level influences



Source: Dahlgren G and Whitehead M (1991) *Policies and strategies to promote social equity in health*. Stockholm, Institute for Futures Studies

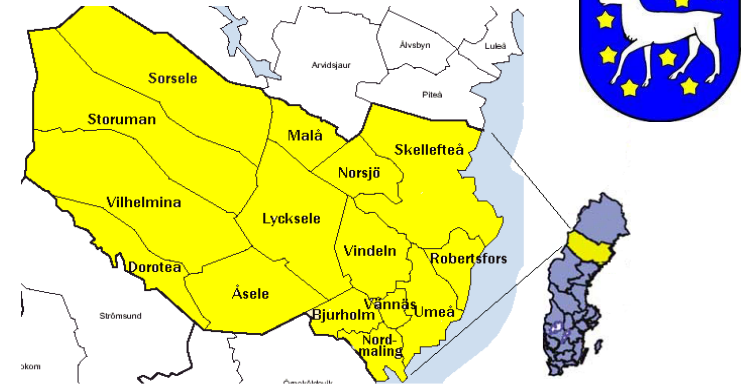


Population shifts



Vasterbotten Intervention Programme

Population-based prospective cohort study of 32120 participants including an OGTT, clinical measures and assessment of diet and activity on at least two occasions over 10 years



33142 Individuals aged 40 or 50 at baseline

999 Prevalent diabetes at baseline

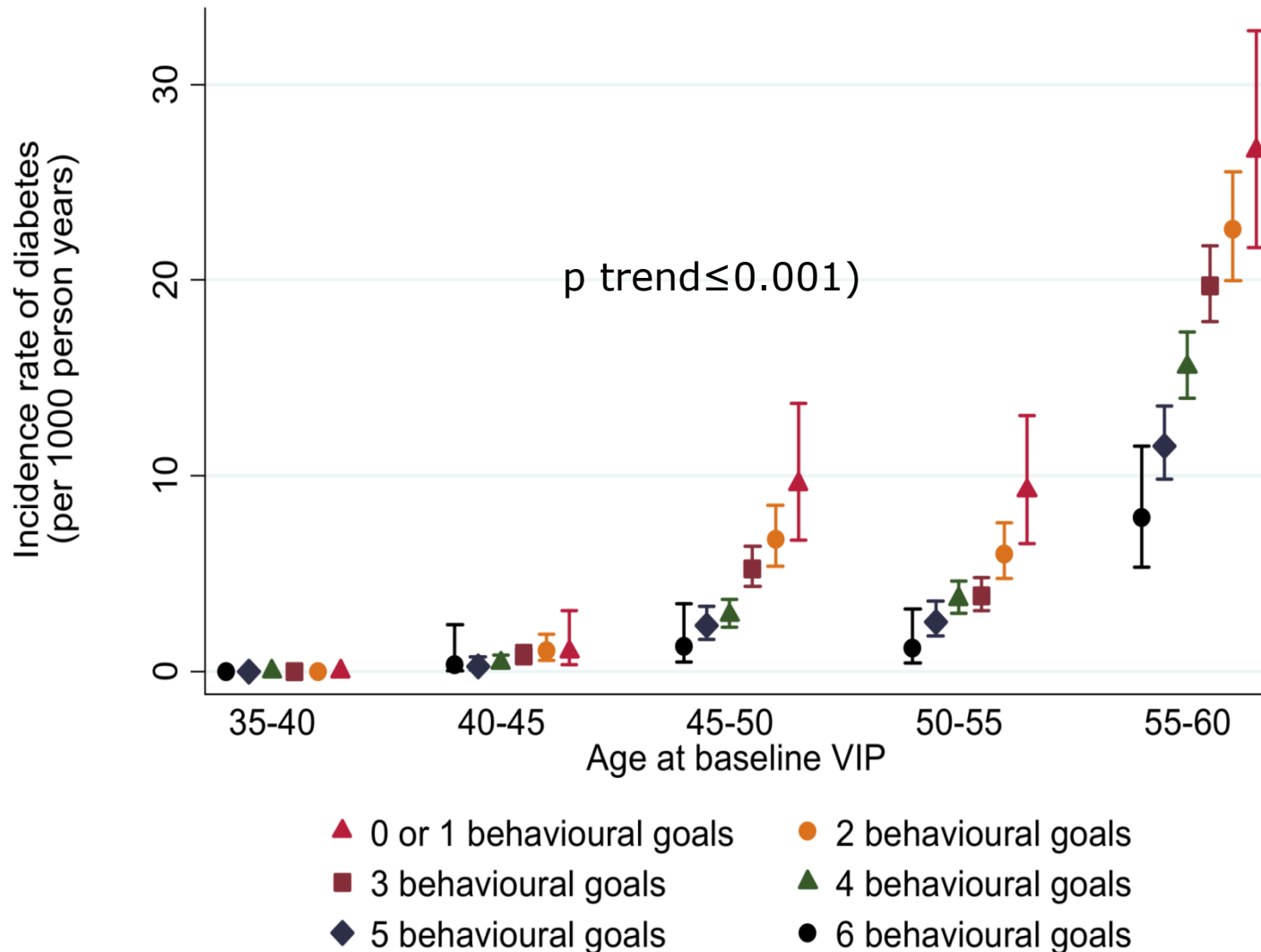
23 Diabetes diagnosed within 12 months

9.9 years
(IQR 0.3)

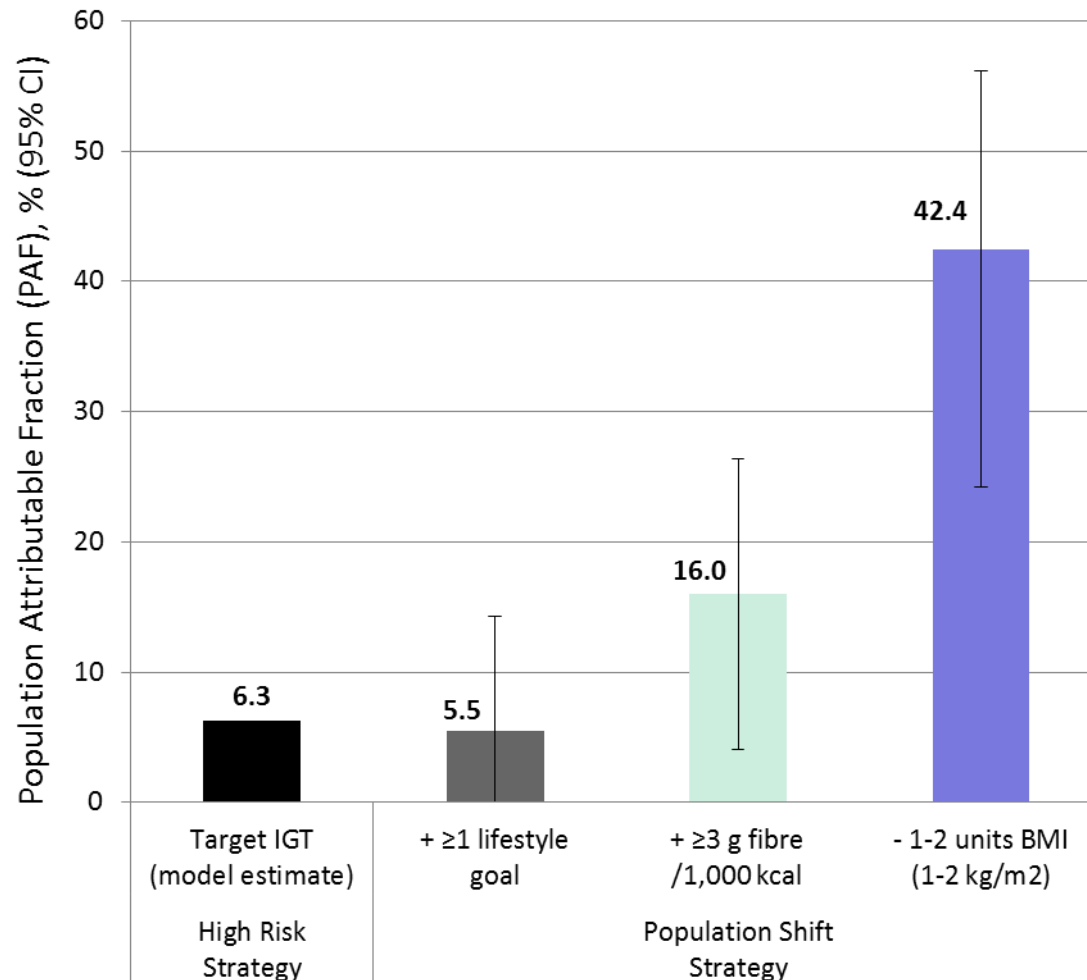
323324 pyrs

32120 Individuals included in analysis

Crude incidence of type 2 diabetes over 10 years by age and baseline health behaviour goals achieved



High Risk vs. Population Shift



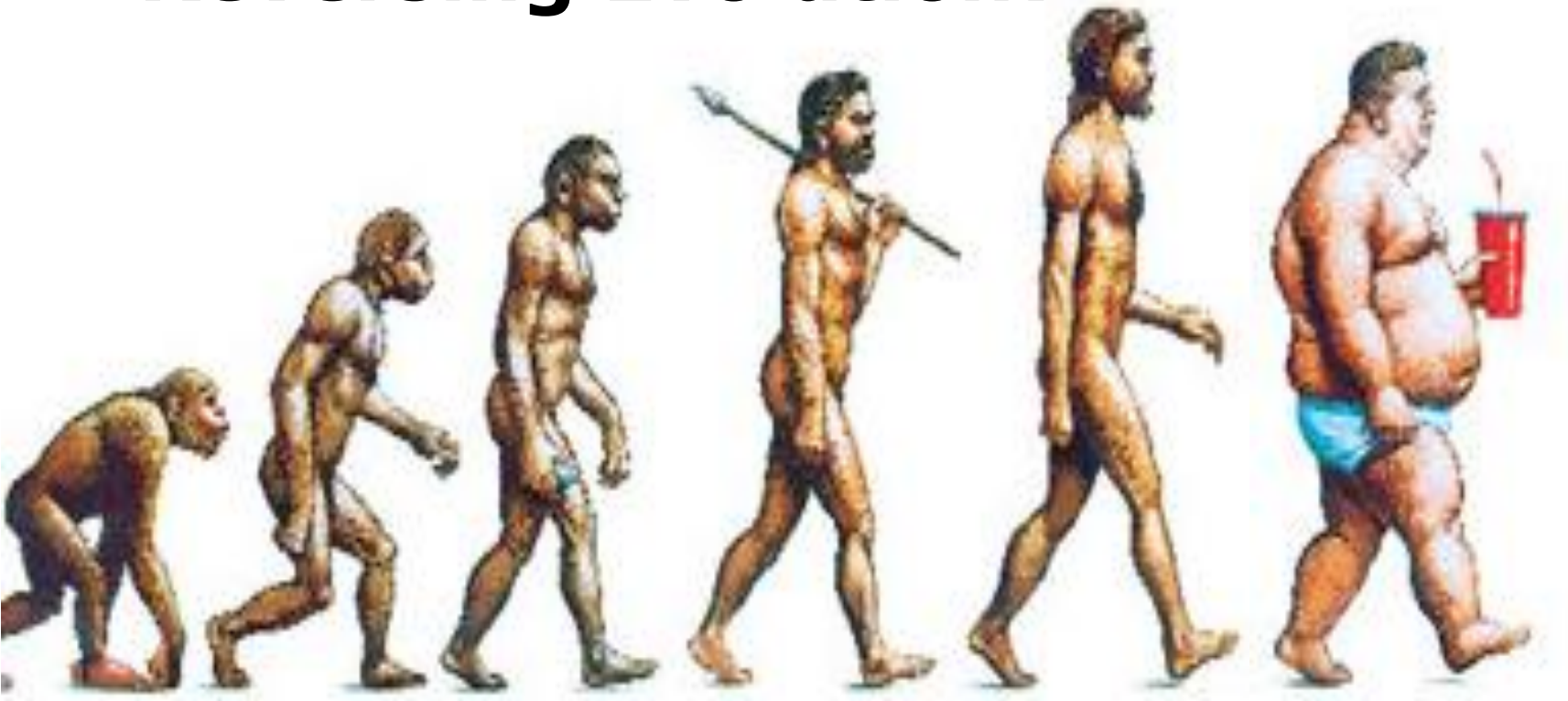
Change in 1-2 units BMI kg/m² $\approx$
 150 cm (4' 11") $\rightarrow$ 3.4 kg (7.5 lb)
 175 cm (5' 9") $\rightarrow$ 4.6 kg (10.1 lb)
 190 cm (6' 3") $\rightarrow$ 5.4 kg (11.9 lb)

Conclusion

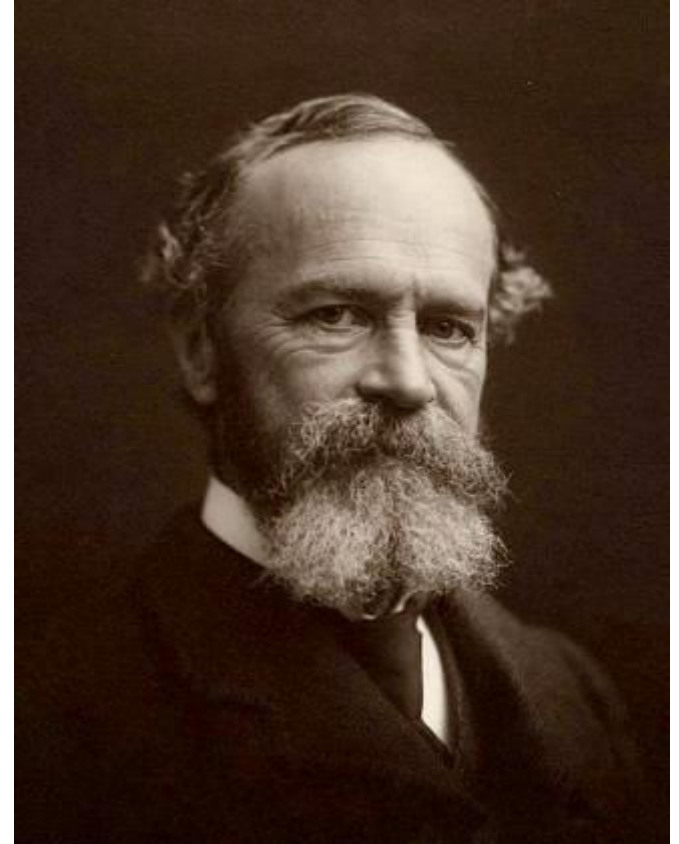
Shifting population distribution of risk could

- $\rightarrow$ Benefit more people
- $\rightarrow$ Reduce diabetes burden more effectively

Reversing Evolution?



Ninety-nine hundredths
or, possibly, nine
hundred and ninety-
nine thousandths of our
activity is purely
automatic and habitual,
from our rising in the
morning to our lying
down each night



William James
1842-1910





SOTORVET

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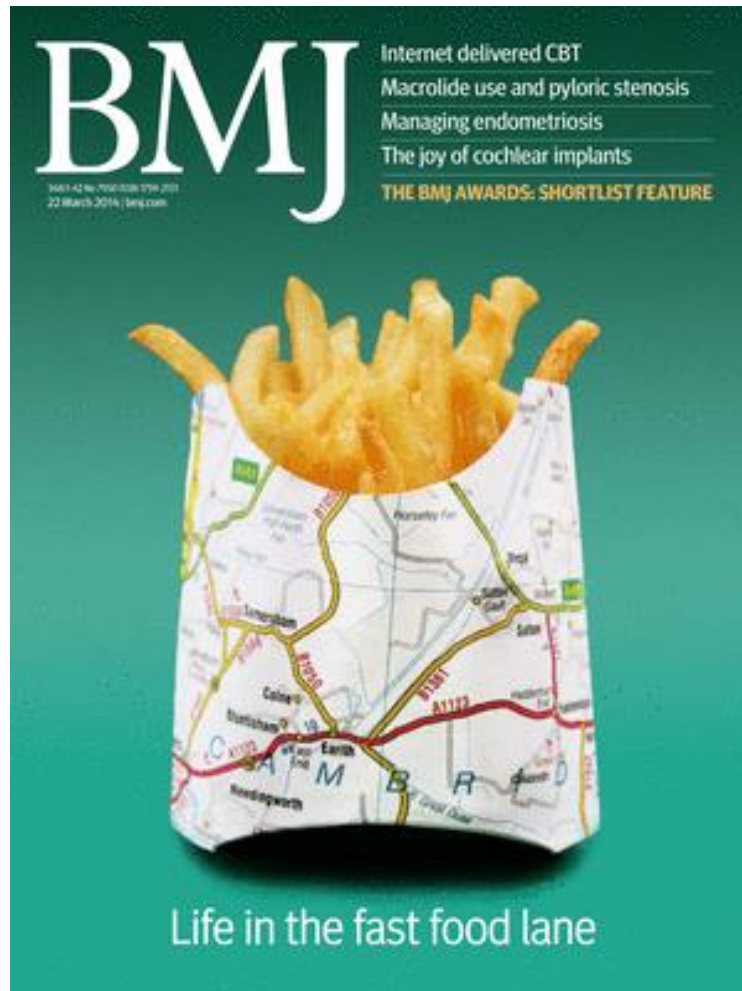
Low walkability



High walkability

'Land use mix, composite walkability indices and neighborhood type were [...] consistently associated with higher physical activity levels...

The influence of the Environment on our diet



Environmental exposure setting

Home

- Q1 (0)
- Q2 (1-2)
- Q3 (3-14)
- Q4 (15-47)

Work

- Q1 (0-2)
- Q2 (3-9)
- Q3 (10-23)
- Q4 (24-65)

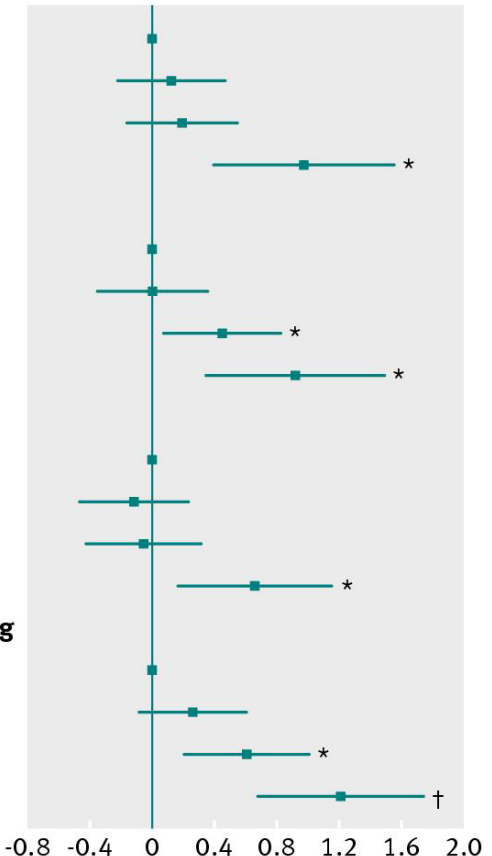
Commuting

- Q1 (0-1)
- Q2 (1-5)
- Q3 (5-14)
- Q4 (15-93)

Home + work + commuting

- Q1 (0-13)
- Q2 (14-30)
- Q3 (31-48)
- Q4 (49-165)

Difference in body mass index relative to Q1

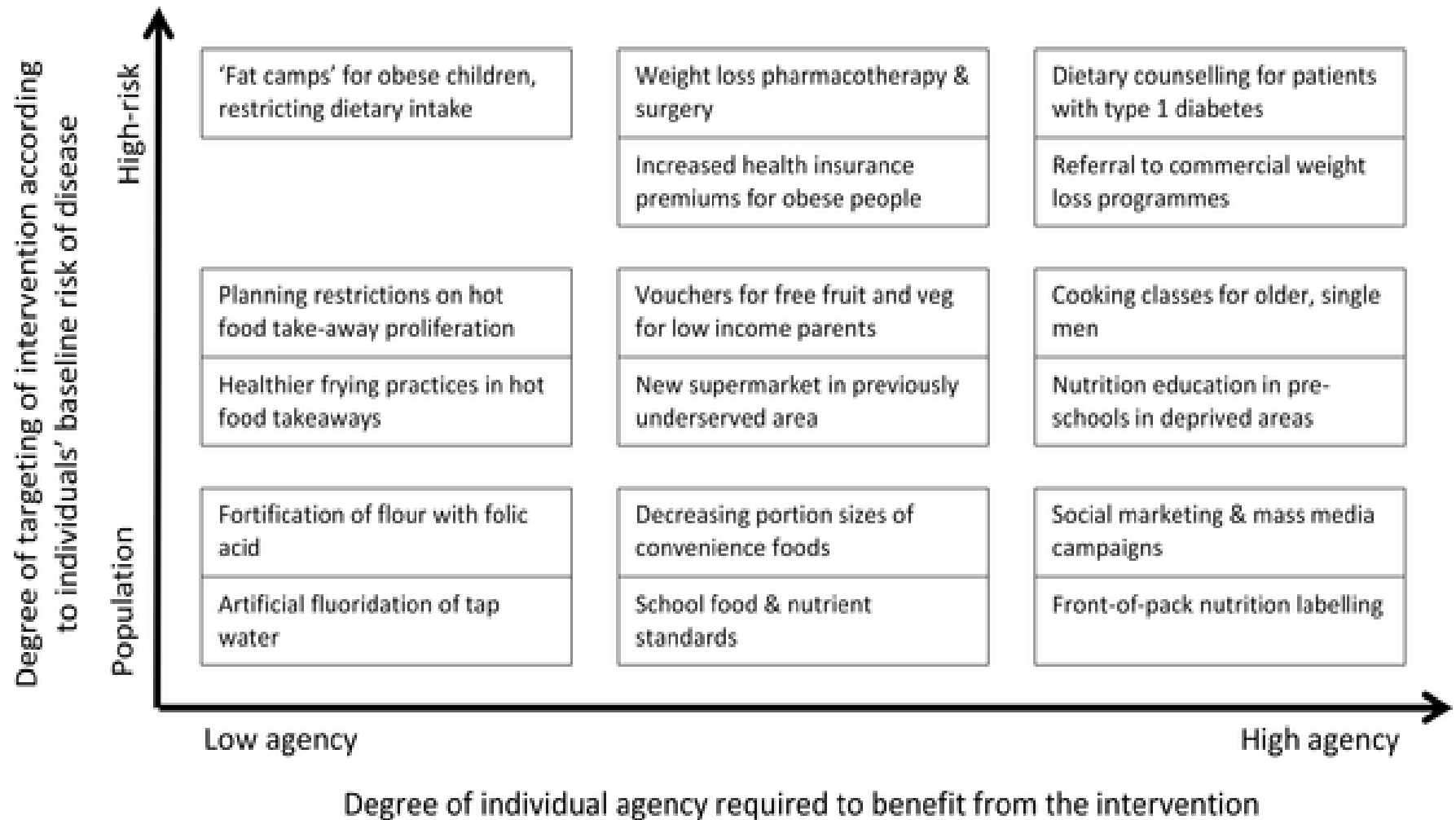


Difference in body mass index per quarter of exposure to takeaway food outlets, in the Fenland Study sample (n=5442)





Two continuums describe all public health interventions, with examples related to diet and obesity



Past examples of public health successes

- Safe drinking water
- Sanitation
- Slavery abolition
- Immunisation
- Road safety
- Seat belts
- Air pollution control
- Tobacco advertising bans
- Smokefree legislation

Graham MacKenzie *JAMA* 2011;**306**:38



1926-1993

“The primary determinants of disease are mainly economic and social, and therefore its remedies must also be economic and social. Medicine and politics cannot and should not be kept apart.”

Geoffrey Rose.
The strategy of preventive medicine.
Oxford (OUP) 1992:129

Nuffield ladder of state/public health interventions

- **Eliminate Choice**
 - isolate patient with infectious disease
- **Restrict Choice**
 - remove toxins from drinking water
- **Guide Choice**
 - through disincentives eg tobacco tax
 - through incentives, eg tax breaks for cycling
 - changing default, eg side dish routinely salad
- **Enable Choice**
 - provide free fruit at schools, free gyms etc
- **Provide information**
 - campaigns walking or eating fruit
- **Do nothing, or simply monitor situation**



Nuffield ladder of state/public health interventions

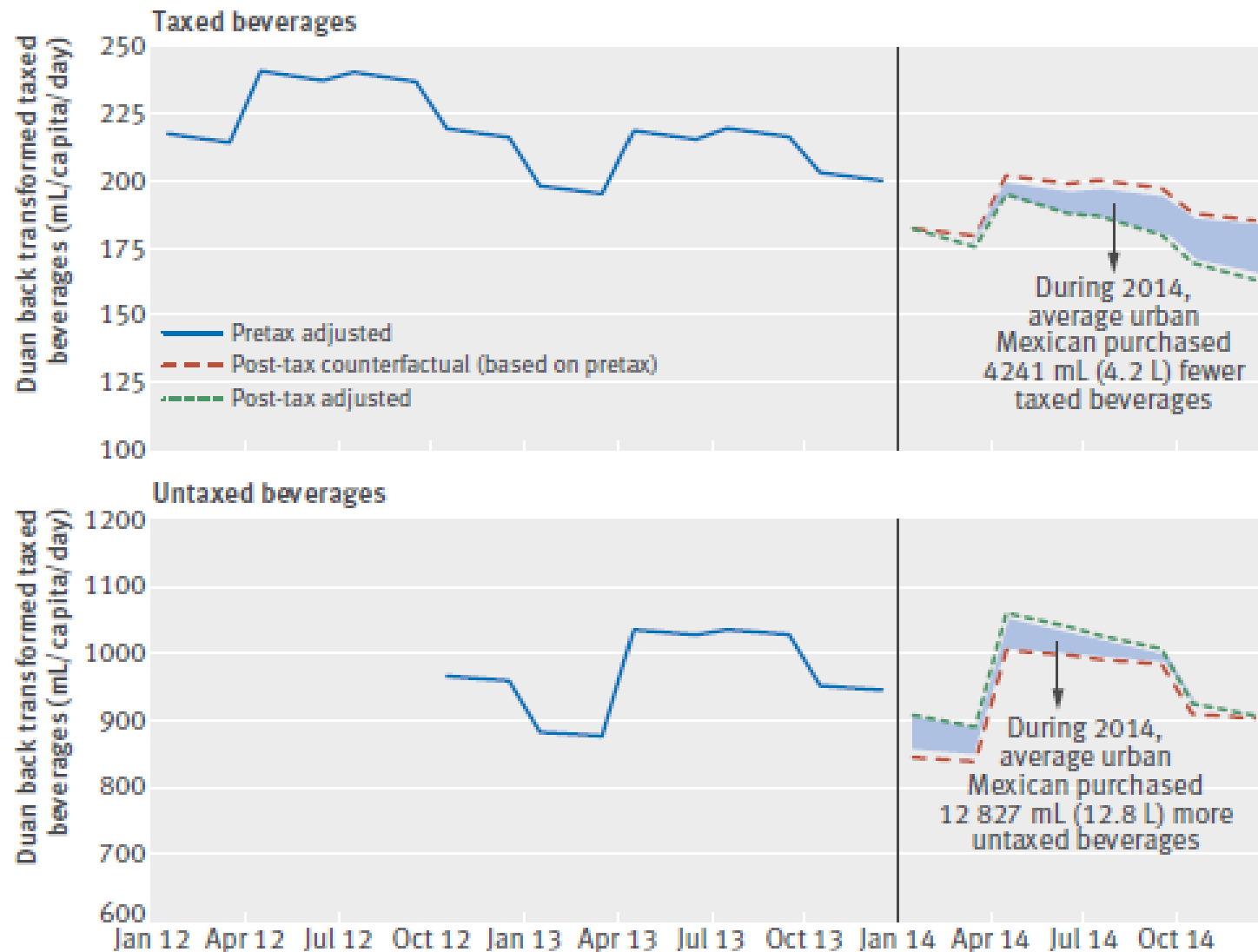
- Ban.
- Tax heavily.
- Regulate.
- 'Nudge' tax or intervention.
- Mass voluntary programme (eg vaccination, screening).
- Engage with industry.
- Inform.
- Leave up to individuals.



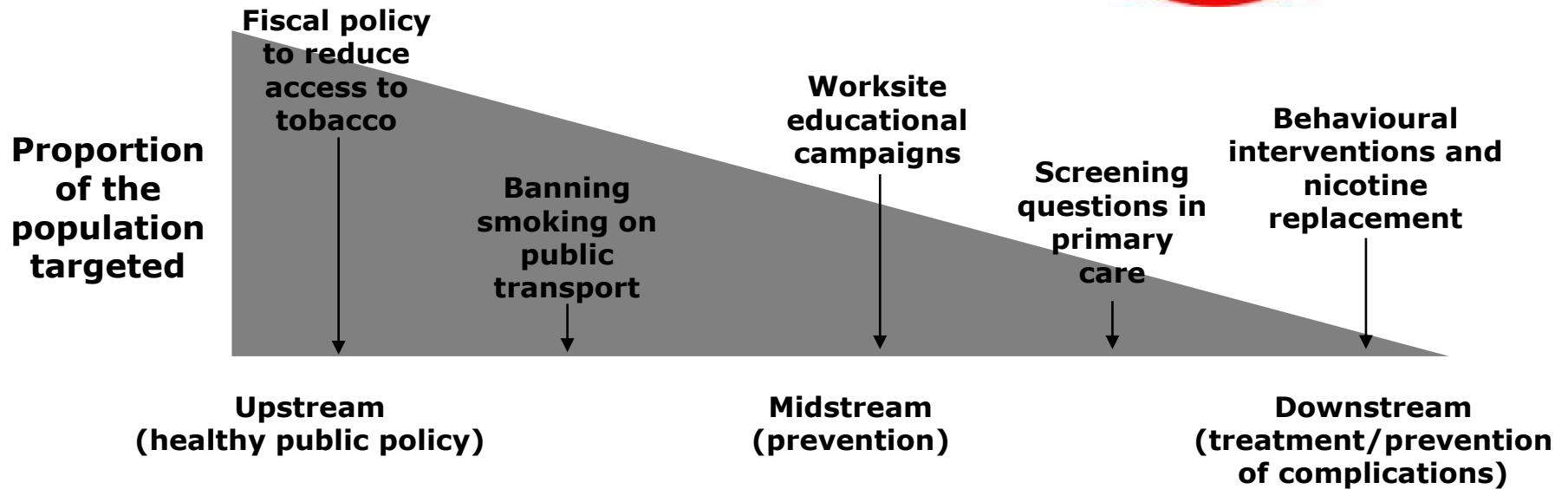
Policy options to influence diabetes risk

- **Taxation**
- **Food and Menu labeling**
- **Engage private industry**
- **Crop subsidy policies**
- **Incentives/promotion for community availability and affordability of foods**
- **Incentives/promotion for community support for physical activity**
- **Regulation of foods in public areas**
- **School food and physical education policies**

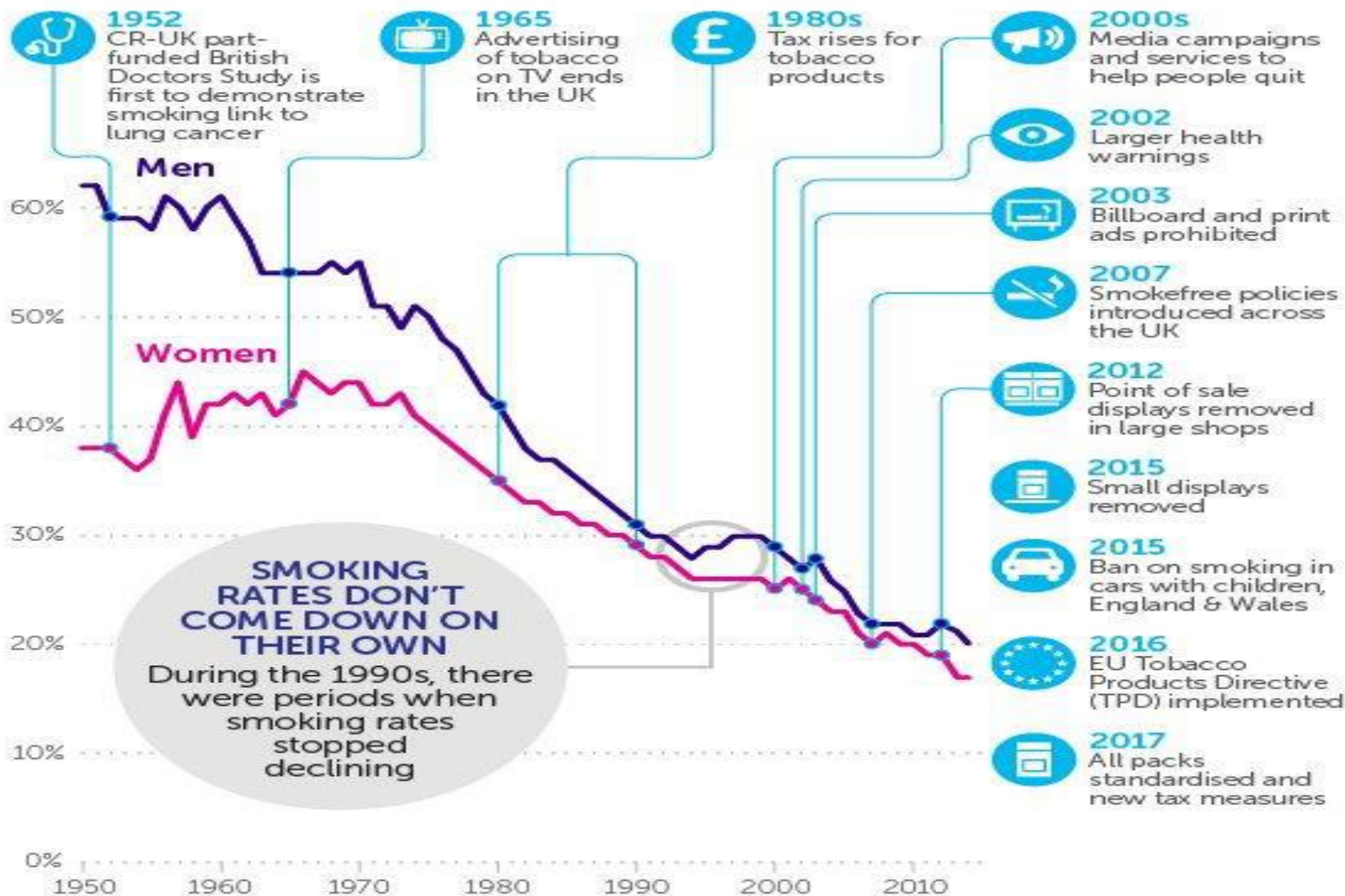
Taxing sugar-sweetened beverages?



Where can we look to see what works?



SMOKING RATES DECLINE WITH ACTION



Source: Adult Smoking Habits in Great Britain. Opinions and Lifestyle Survey, ONS

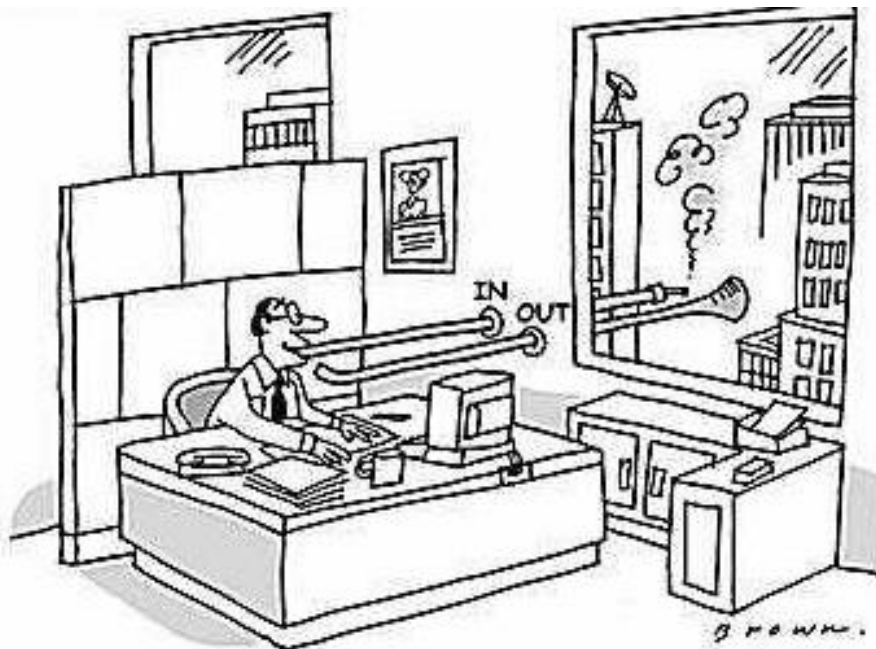
LET'S BEAT CANCER SOONER.
cruk.org



**CANCER
RESEARCH
UK**

Dramatic early effects of the Scottish ban on smoking in public places

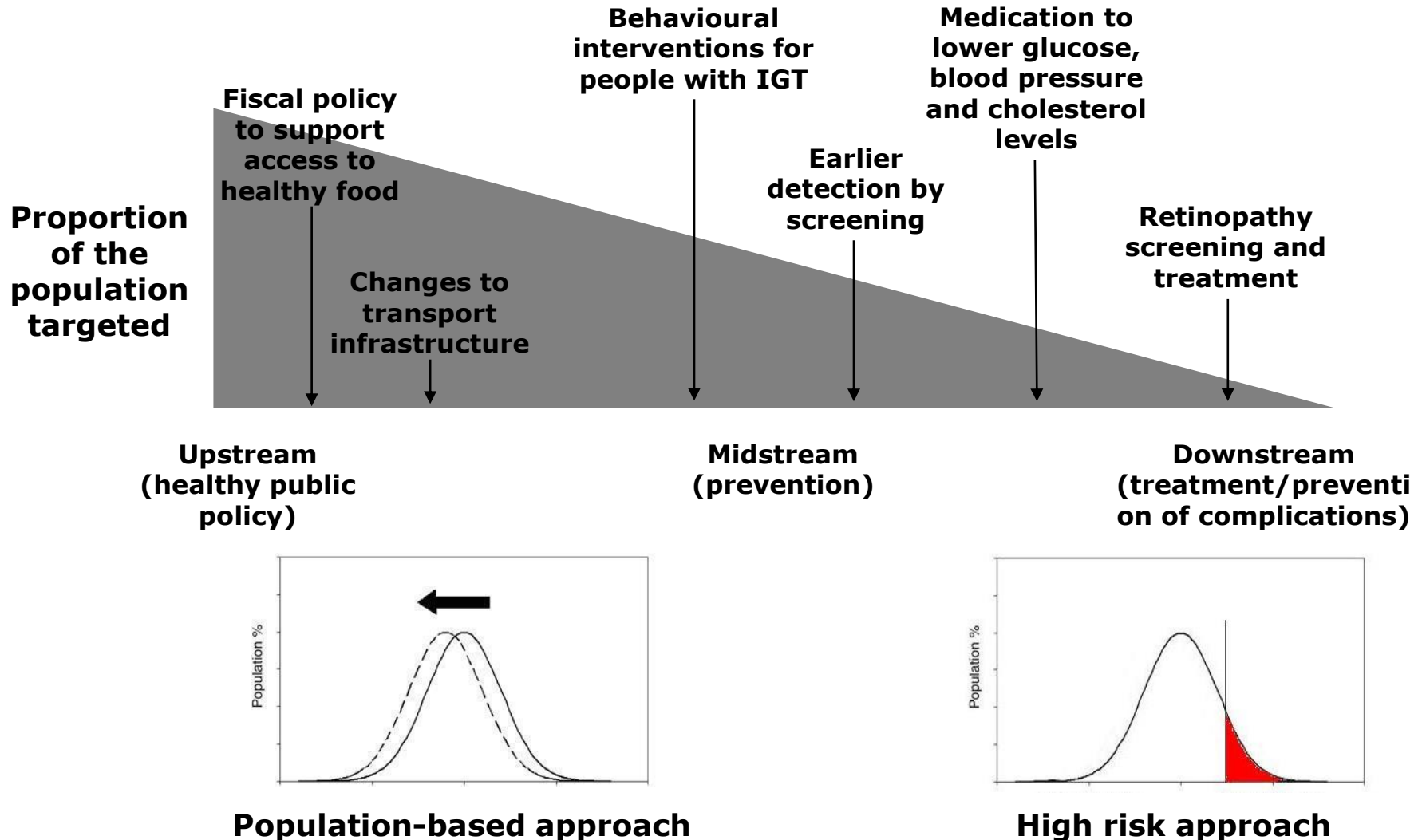
- **17% (95%CI: 16 to 18) reduction in hospital admissions for acute coronary syndrome (3235 to 2684) in the 10 months following the ban**

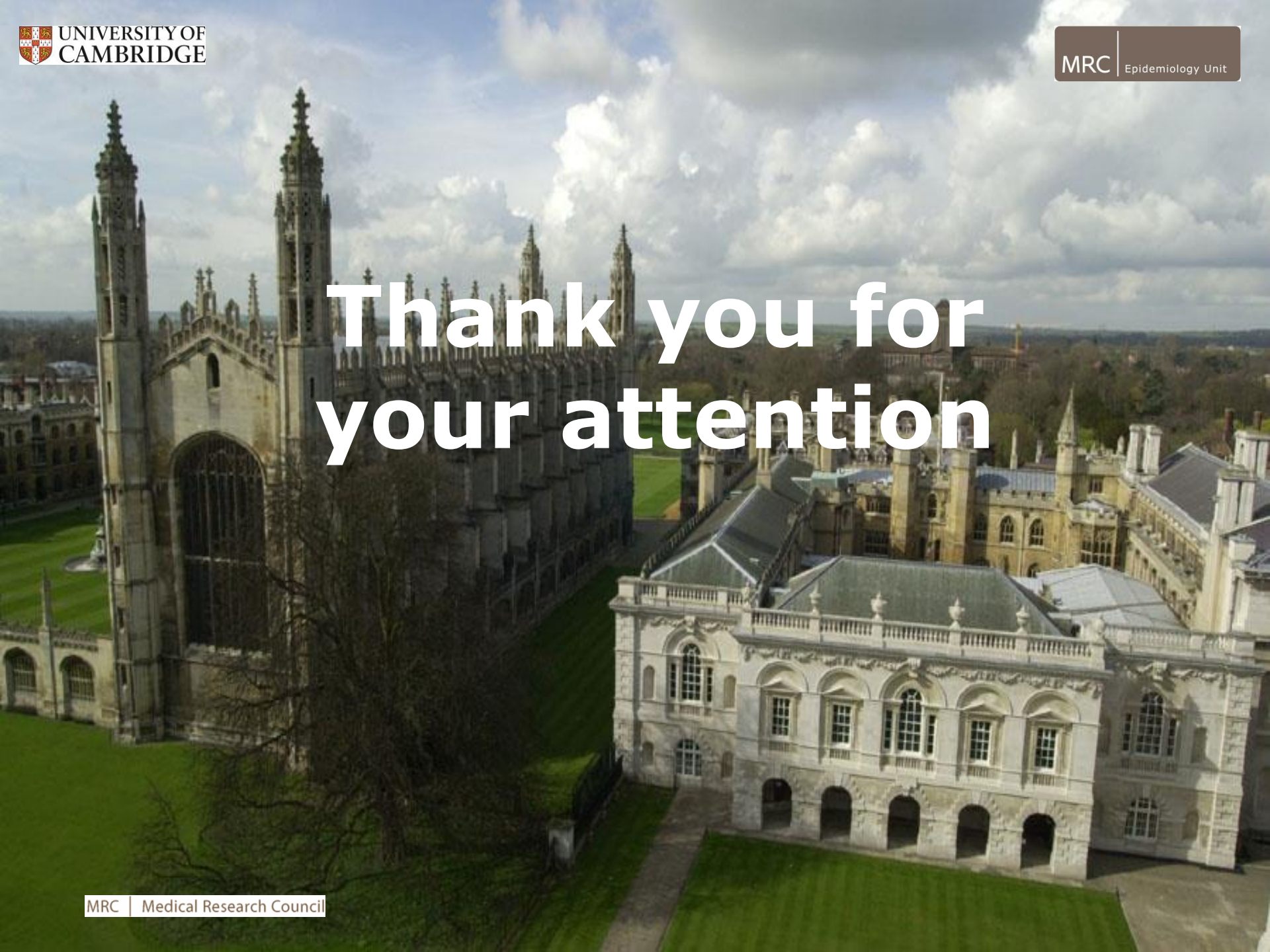


THE 'CLEAN OFFICE AIR' SMOKING DEVICE



How can we reduce the burden of type 2 diabetes?





Thank you for your attention