Inequalities in CVD risk factors
Causes, Consequences & Challenges

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Thanks: Julia Critchley, Martin O'Flaherty, Peter Phillimore, Susanne Logstrup, Sophie O'Kelly, Muriel Mioulet, Lars Ryden, Ilaria Leggeri, Robin Ireland, Philip James, Hilary Graham, Maddy Bajekal, Margaret Whitehead, Peter Whincup, Earl Ford, Pedro Marques-Vidal, Rosalind Raine, Sarah Wild, Ann Capewell

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European Society of Cardiology & European Heart Network

Inequalities in CVD risk factors
Causes, Consequences & Challenges

RESCAP-MED
Research Capacity for public health in the Mediterranean

THIS TALK

Big inequalities in CVD

Big inequalities in CVD risk factors

Choices for CVD prevention

Presentation Outline

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- **Coronary Heart Disease (CHD)**
  - Mortality trends
  - Risk factor trends
  - Socio-economic circumstance (SEC)
- **DISCUSSION 1**
- **IMPACTsec:** explaining recent mortality trends
- **CVD prevention & inequalities**
- **DISCUSSION 2**

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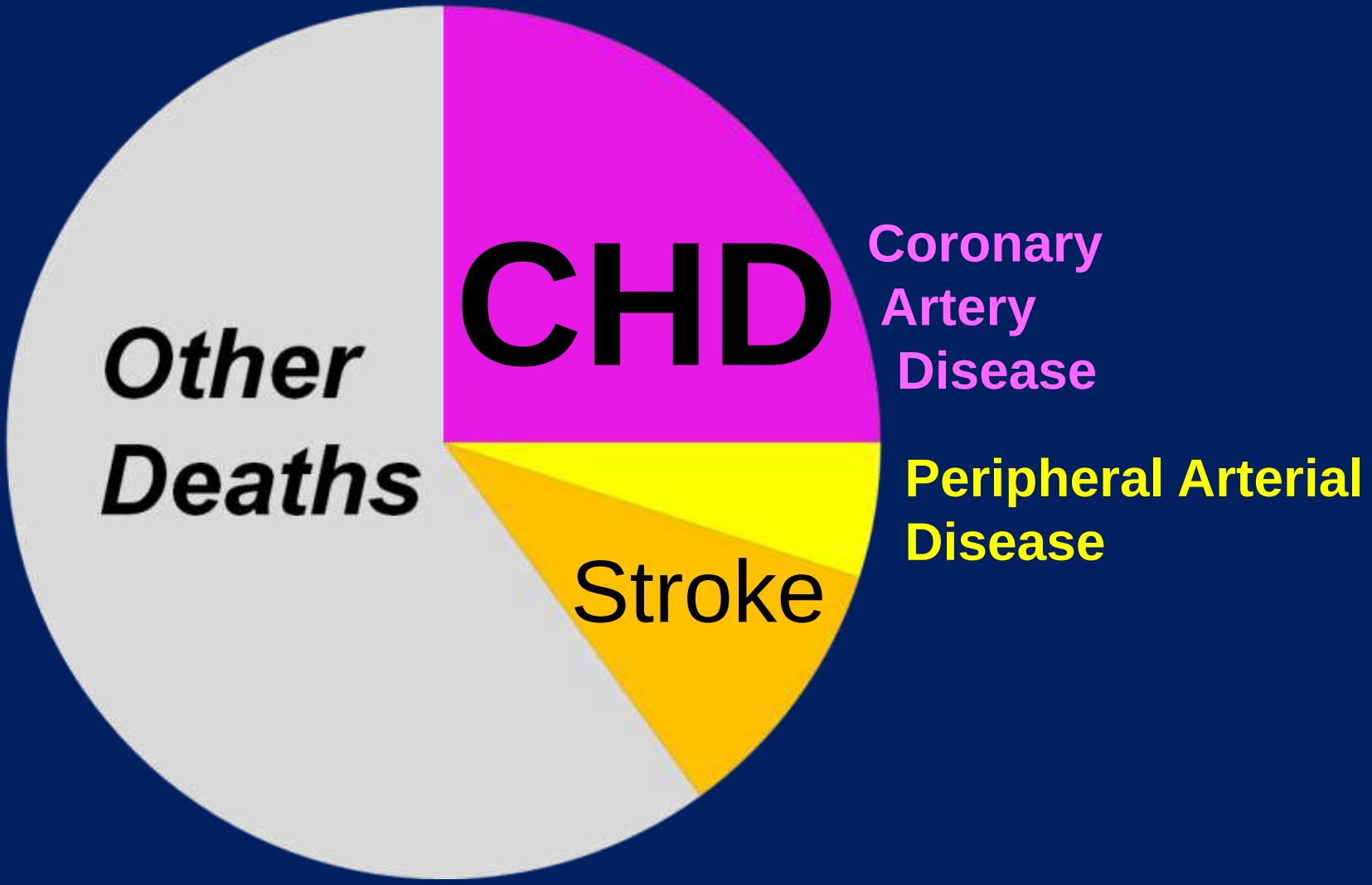
CHD Mortality trends

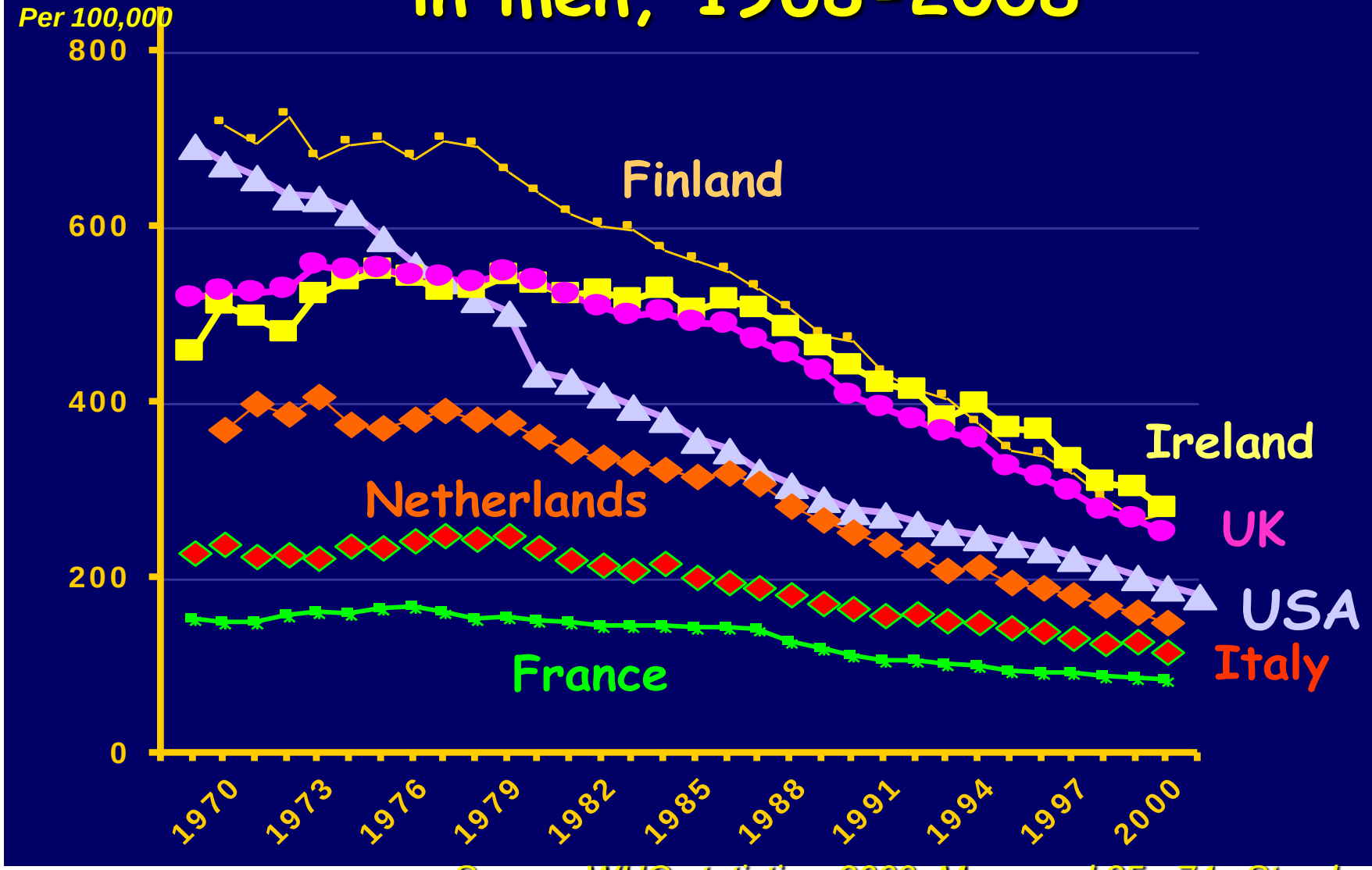
Global & UK

Cardiovascular Diseases(CVD)

account for **35%- 50%** of **all deaths** **USA, Europe & Australia**



CHD mortality trends in men, 1968-2008



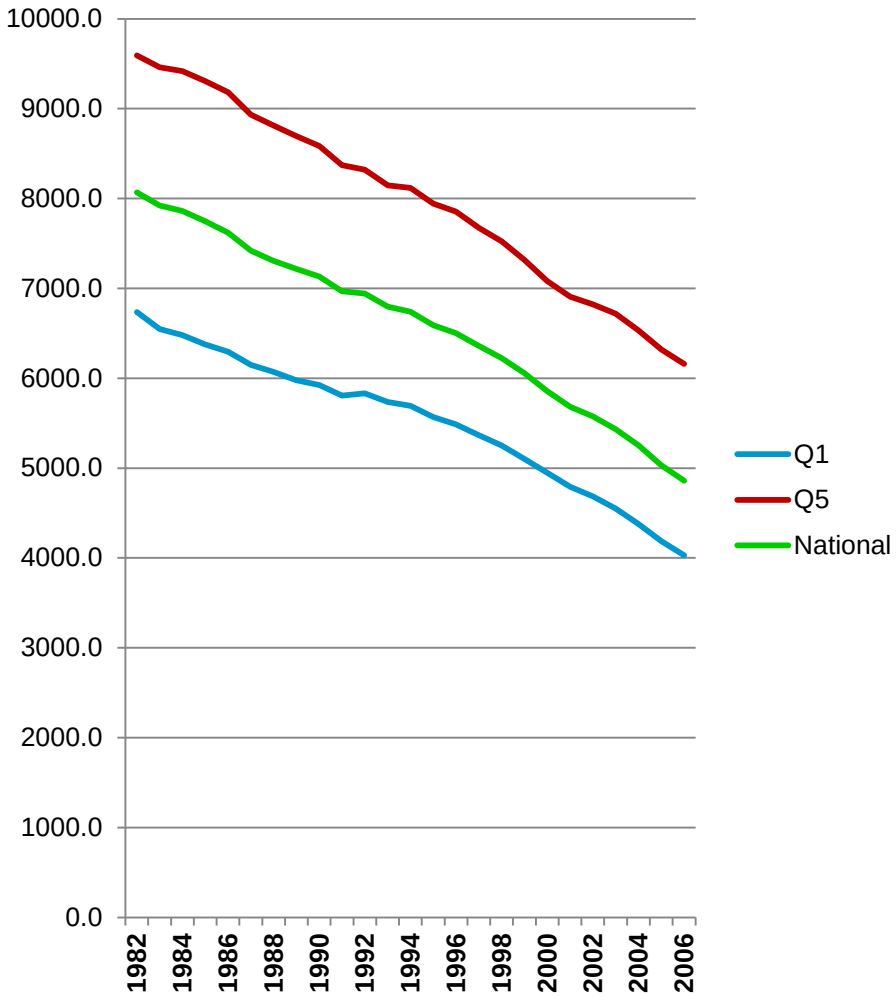
Source: WHO statistics 2009 Men aged 35 - 74, Standardised

UK trends by

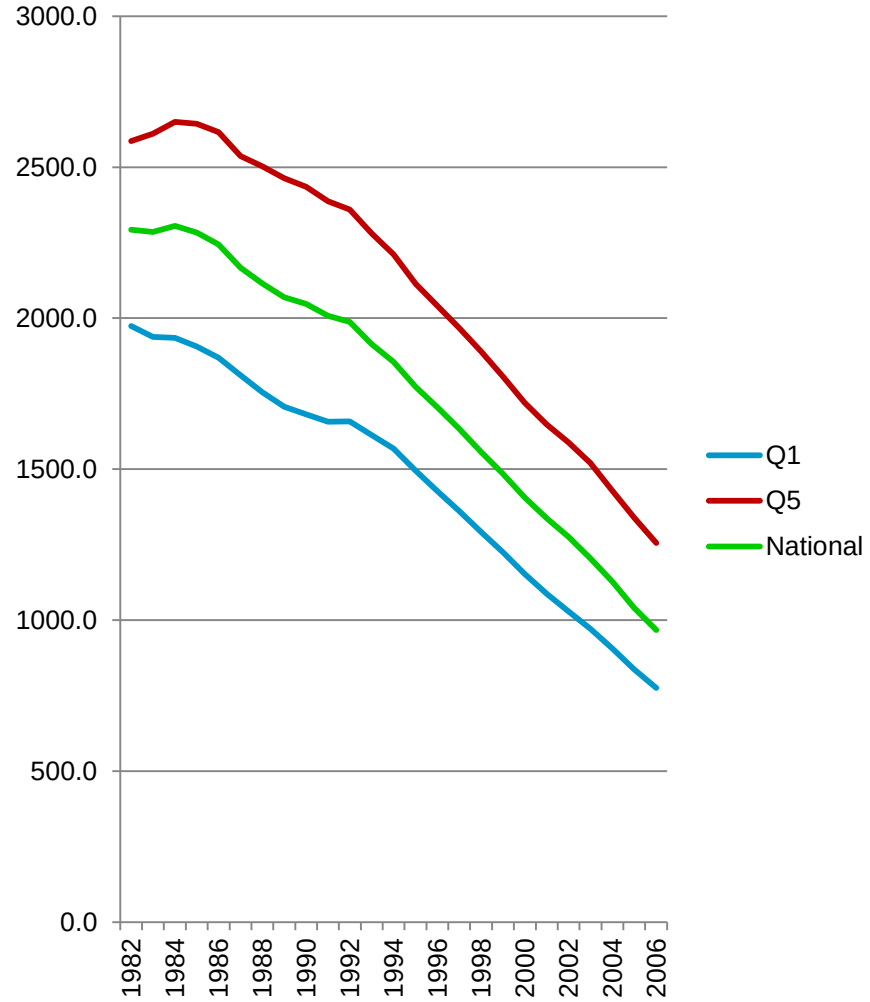
socio-economic circumstance (SEC)

Trends in age-standardised mortality rates, Men 65+: Q1(affluent) vs Q5(deprived) *1982-2006*

Total mortality, per 100,000



CHD mortality, per 100,000



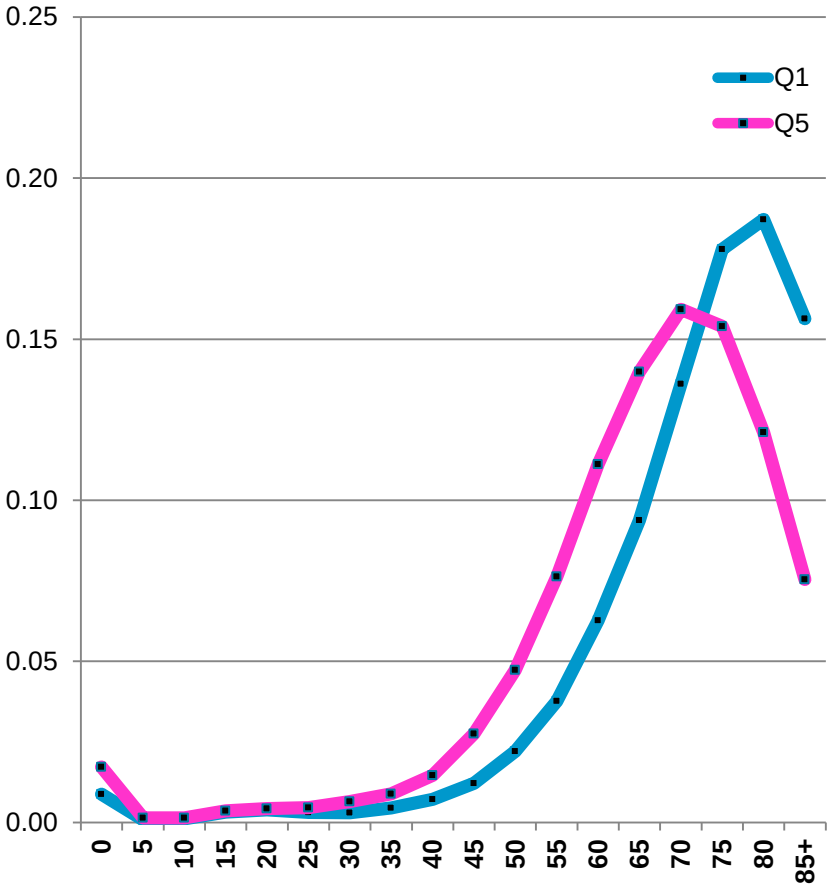
TOTAL MORTALITY TRENDS 1985-2005

Curves of death: Men Q1(affluent) v Q5(deprived)

Derived from life table qx & sx (survivor) values

Show differential pace of ageing of mortality improvement

1985



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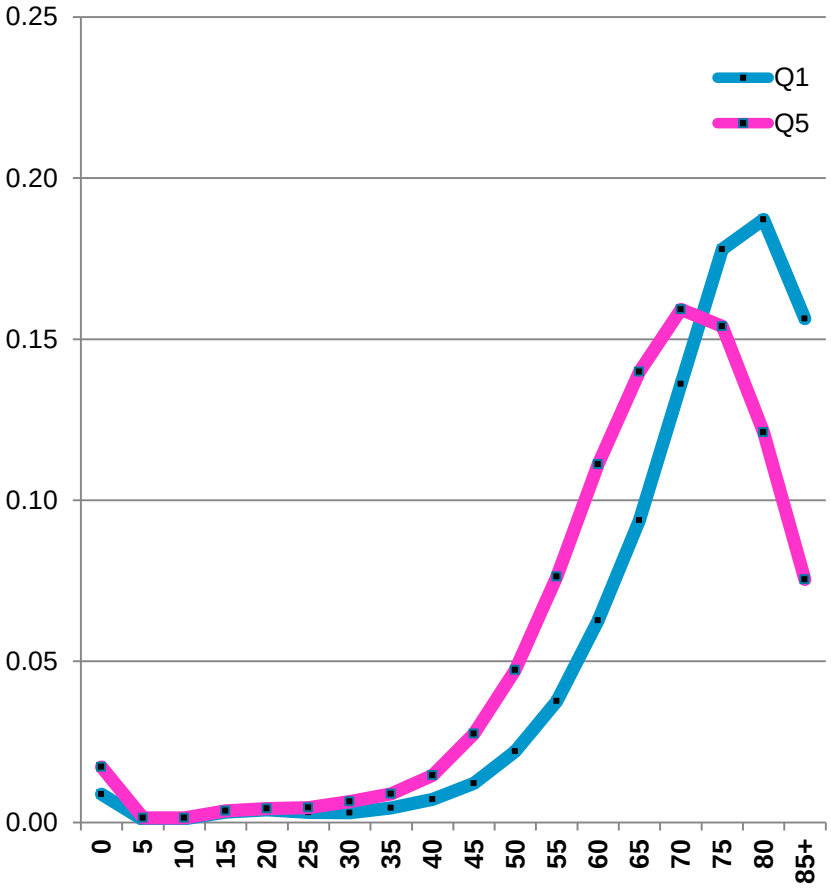
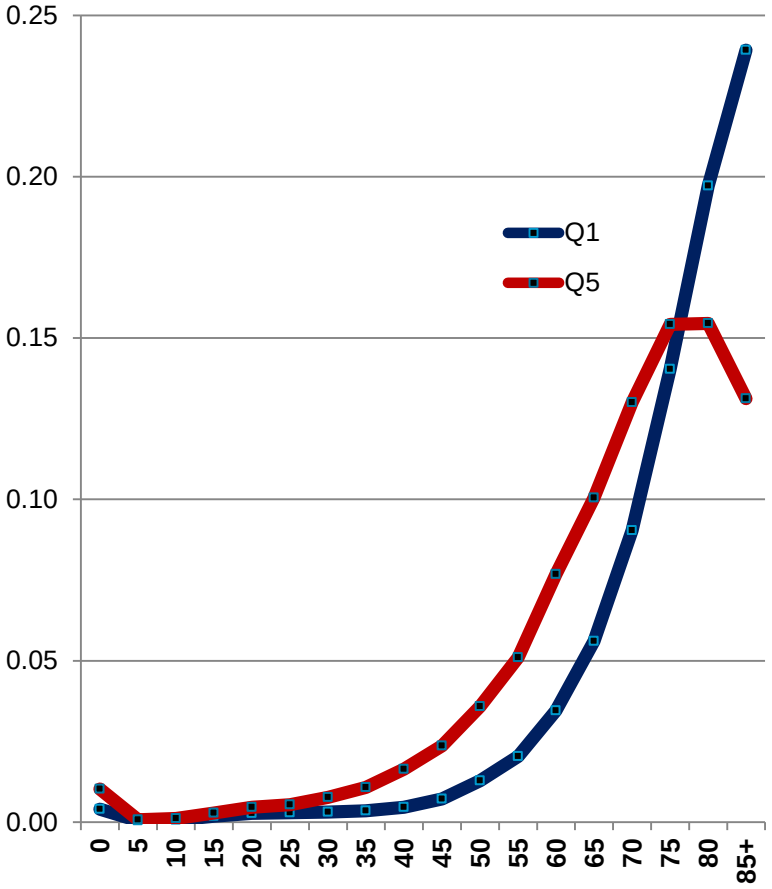


2005



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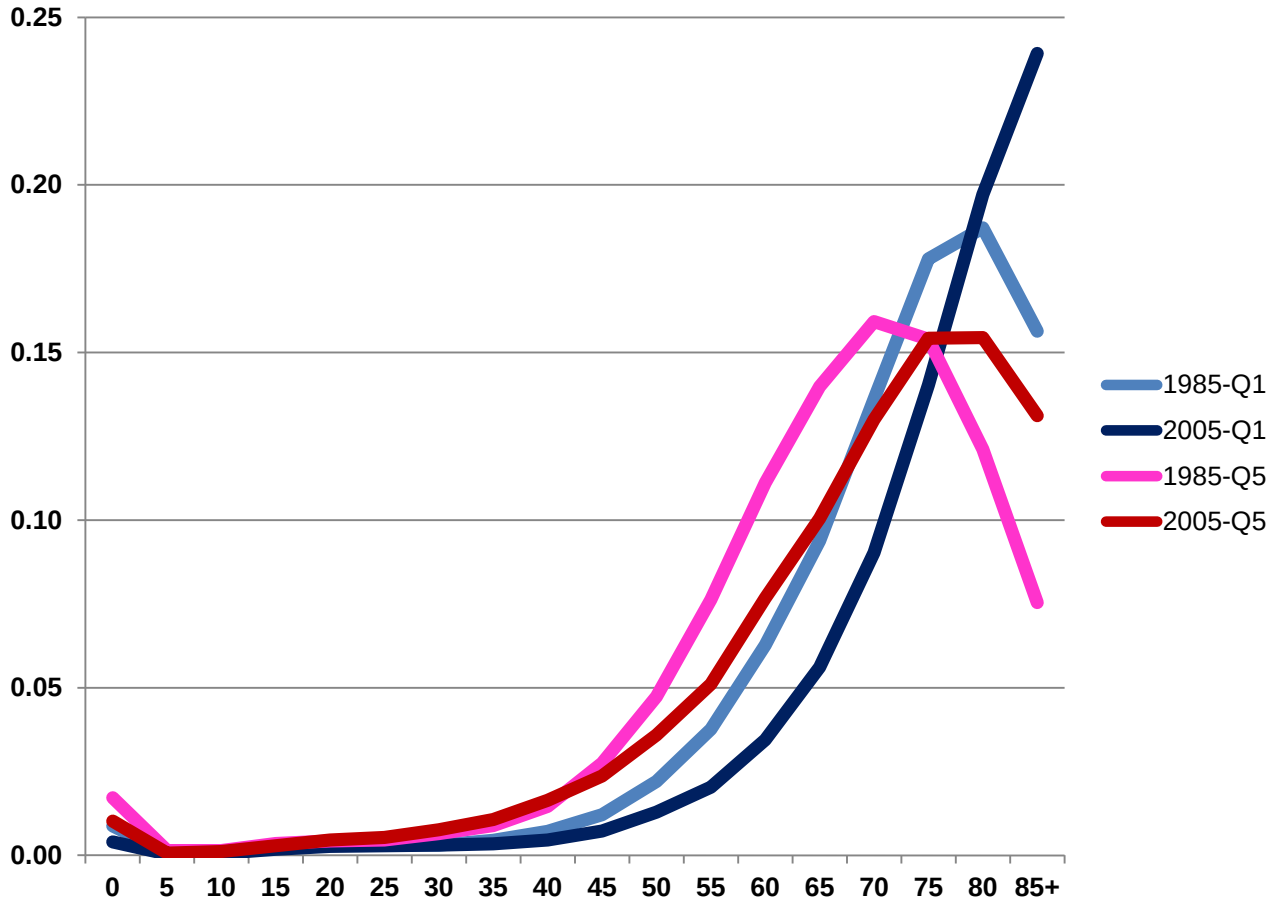
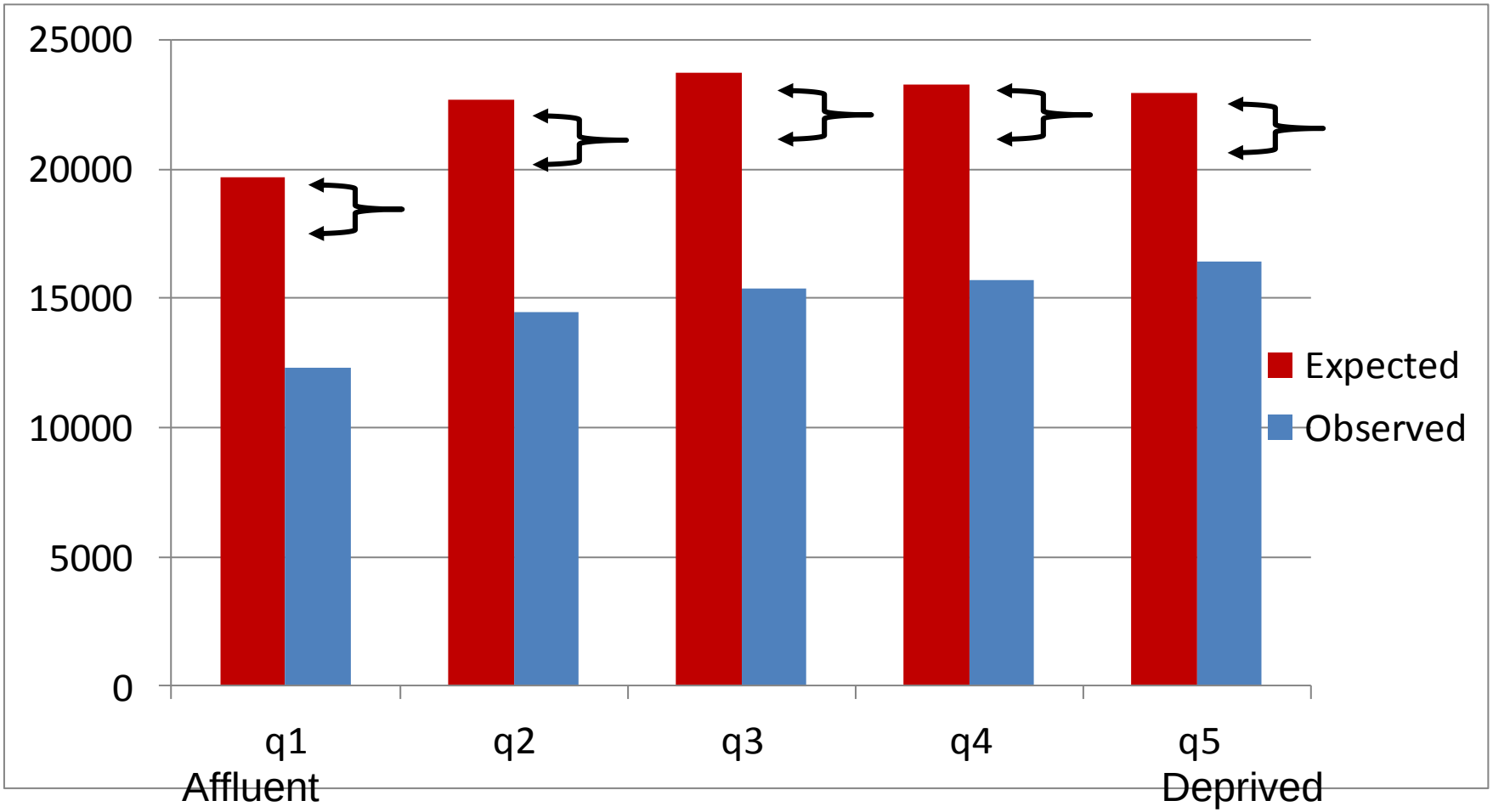


CHD Mortality fall 2007 vs 2000

by IMD quintiles



Target DPPs = 38, 068

CHD Mortality fall 2007 vs 2000

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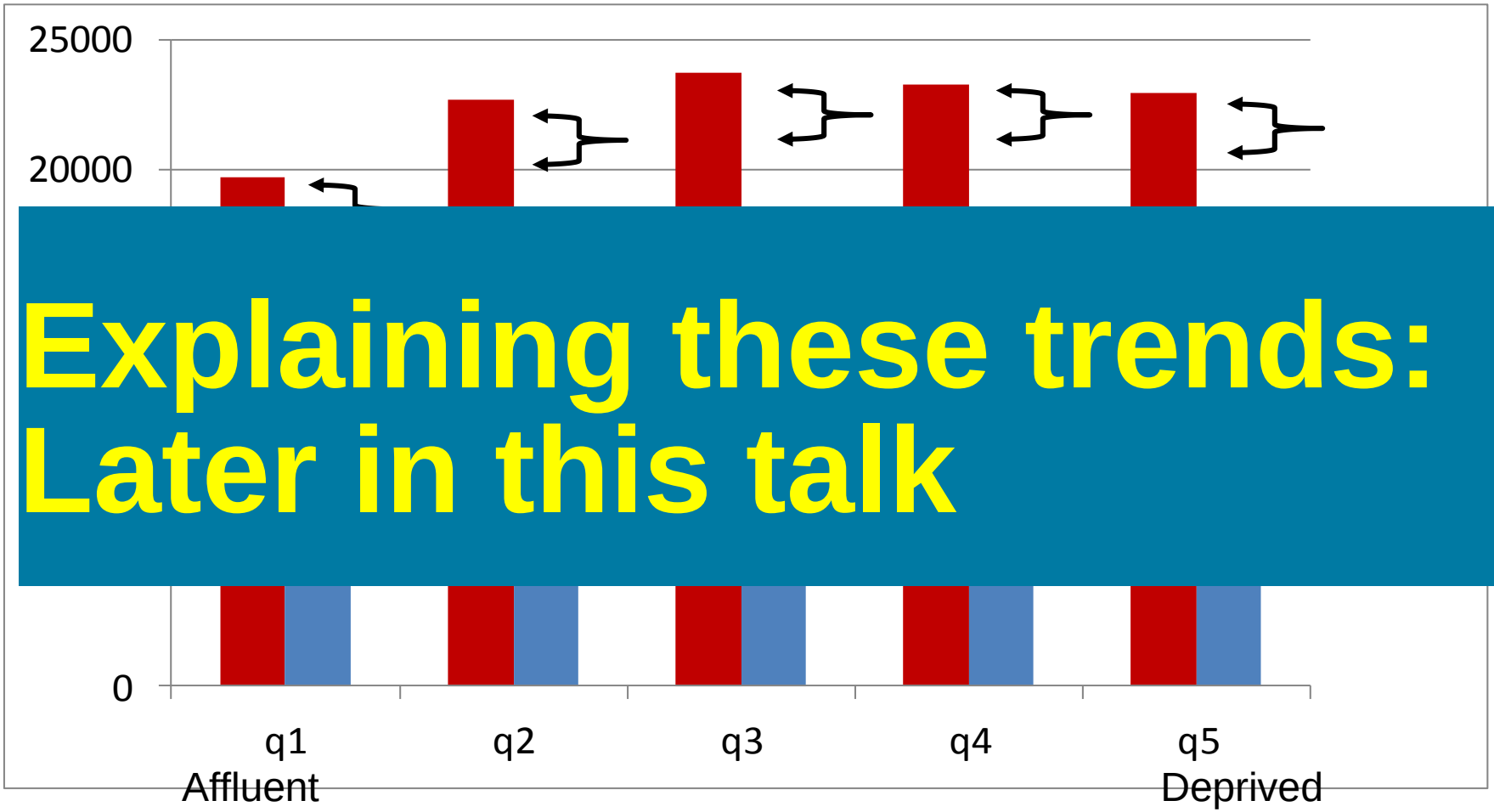
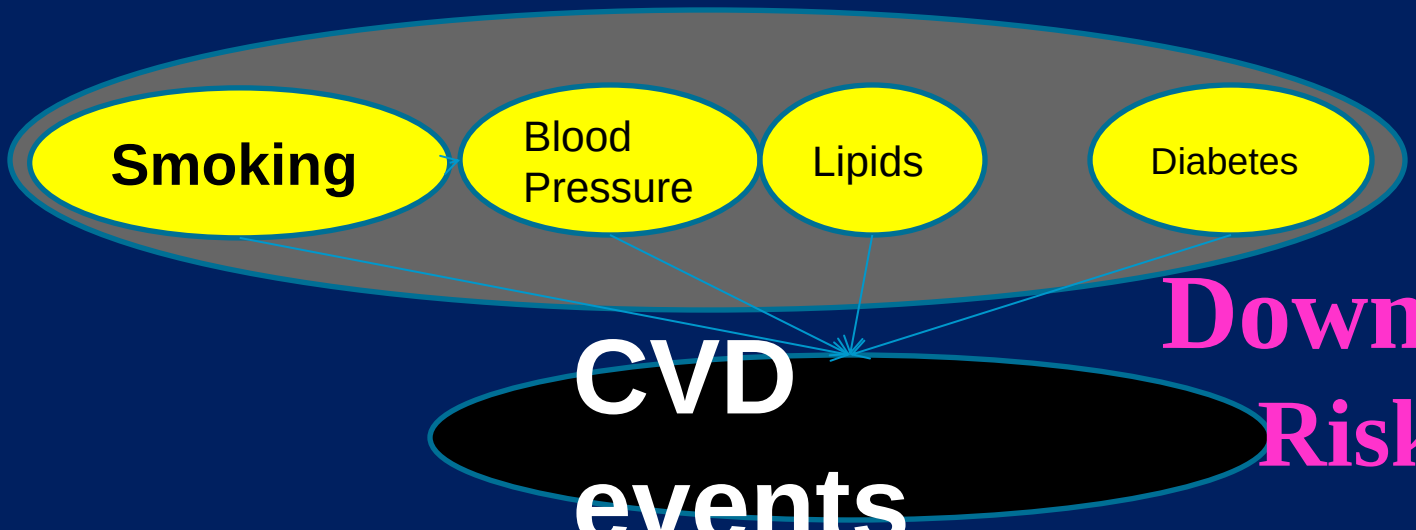


Explaining these trends: Later in this talk

Target DPPs = 38, 068

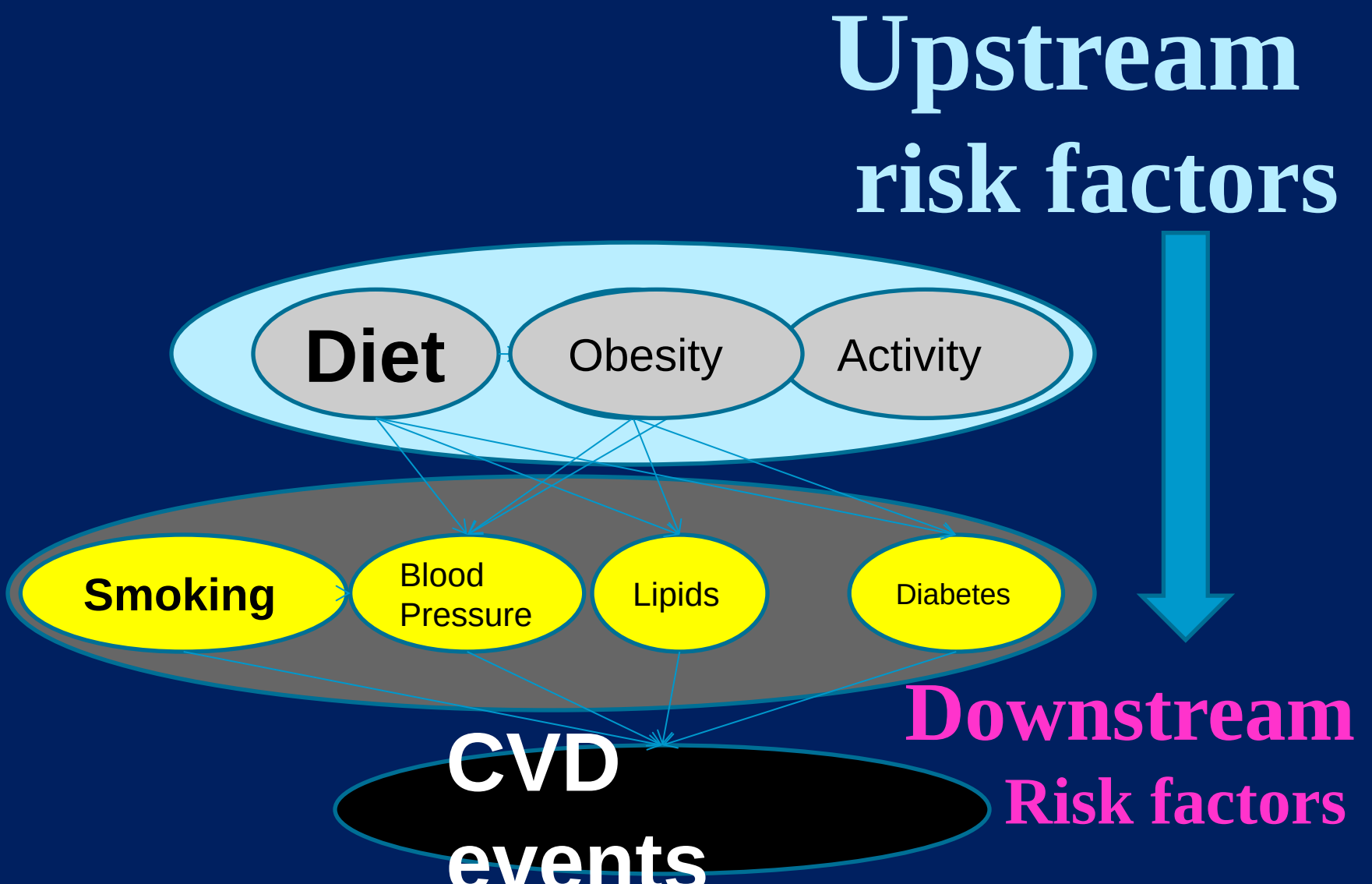
CVD causation pathways

Upstream risk factors

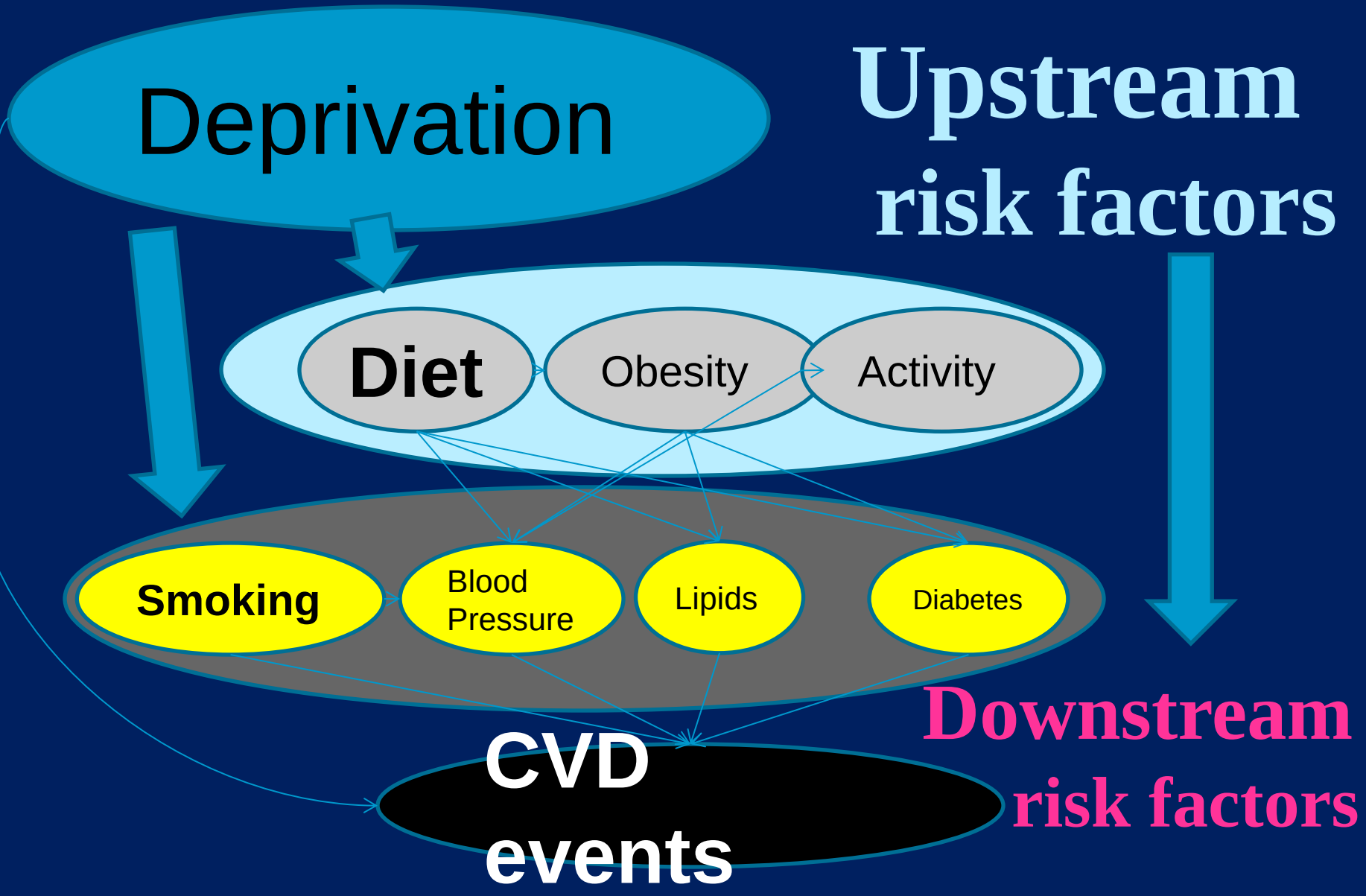


Downstream Risk factors

CVD causation pathways



CVD causation pathways



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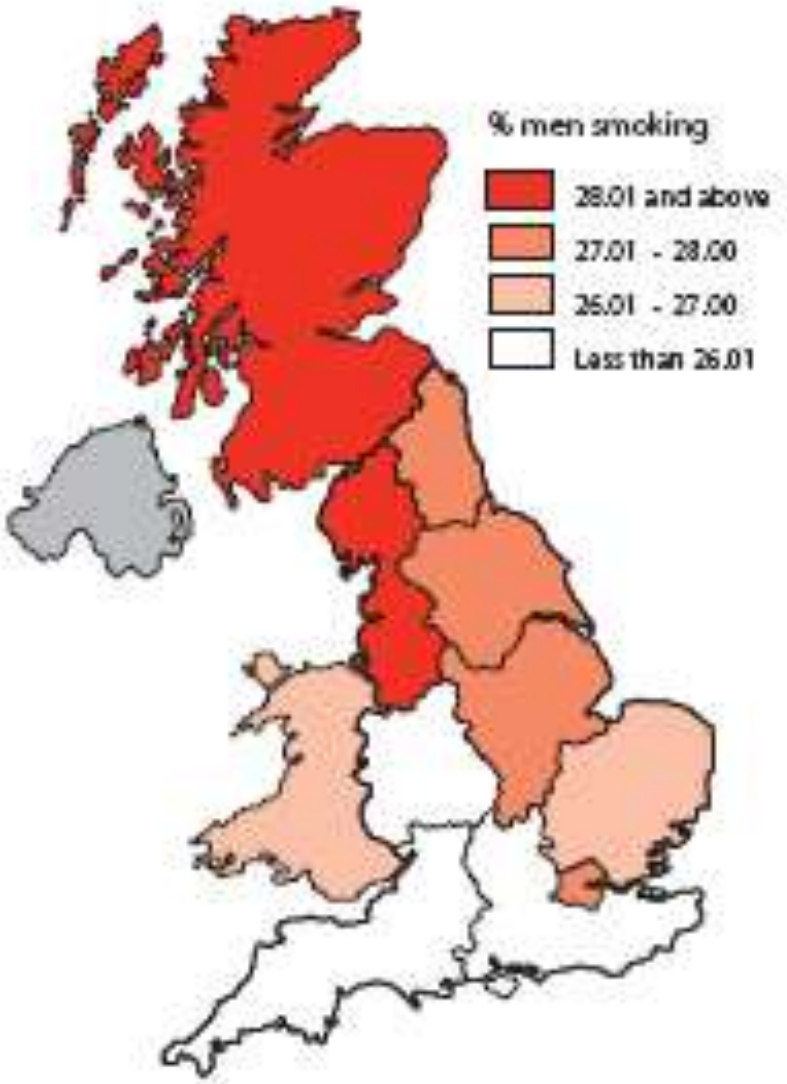
GRADIENTS IN CVD risk factors

SMOKING

Smoking

Place & Social Class

Percentage of men smoking by region, 2002/04 United Kingdom



Trends in Cigarette smoking among women

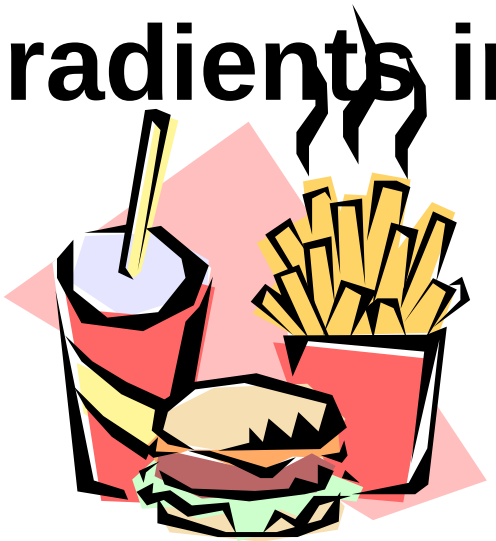
Affluent & Deprived groups Britain, 1958-2000

Goddard 2008

Graham 2009

Socio-economic inequalities

- Five fold social gradients in premature CVD mortality rates
- Mostly explained by gradients in <u>smoking</u> & <u>diet</u>



UK Risk Factor trends 2000-2007

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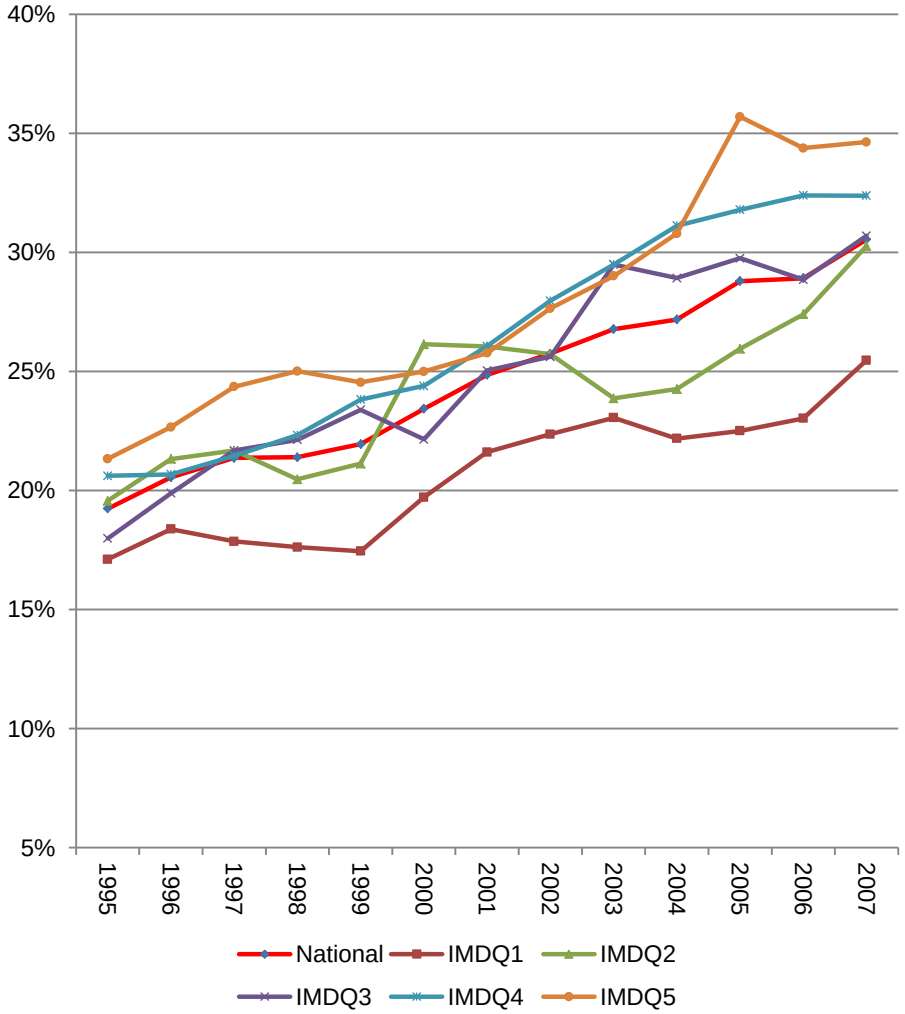
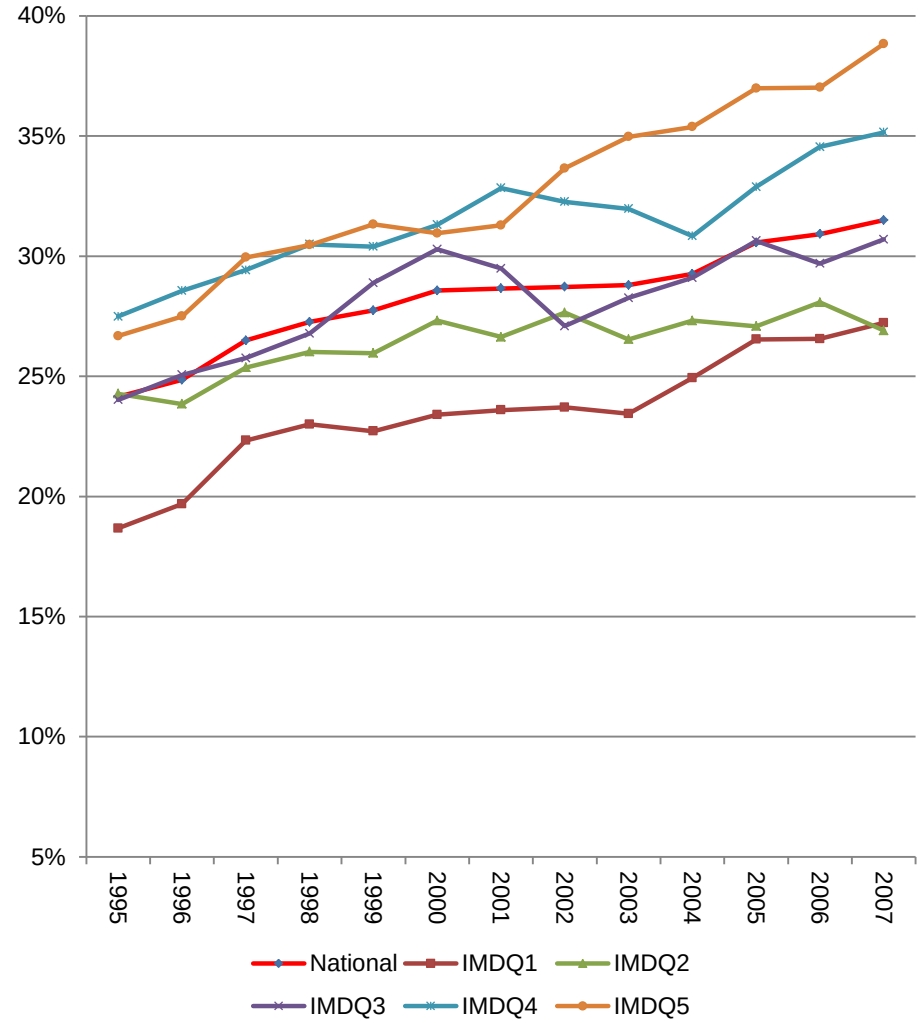
Obesity (%): trends by deprivation quintiles

Men 55+

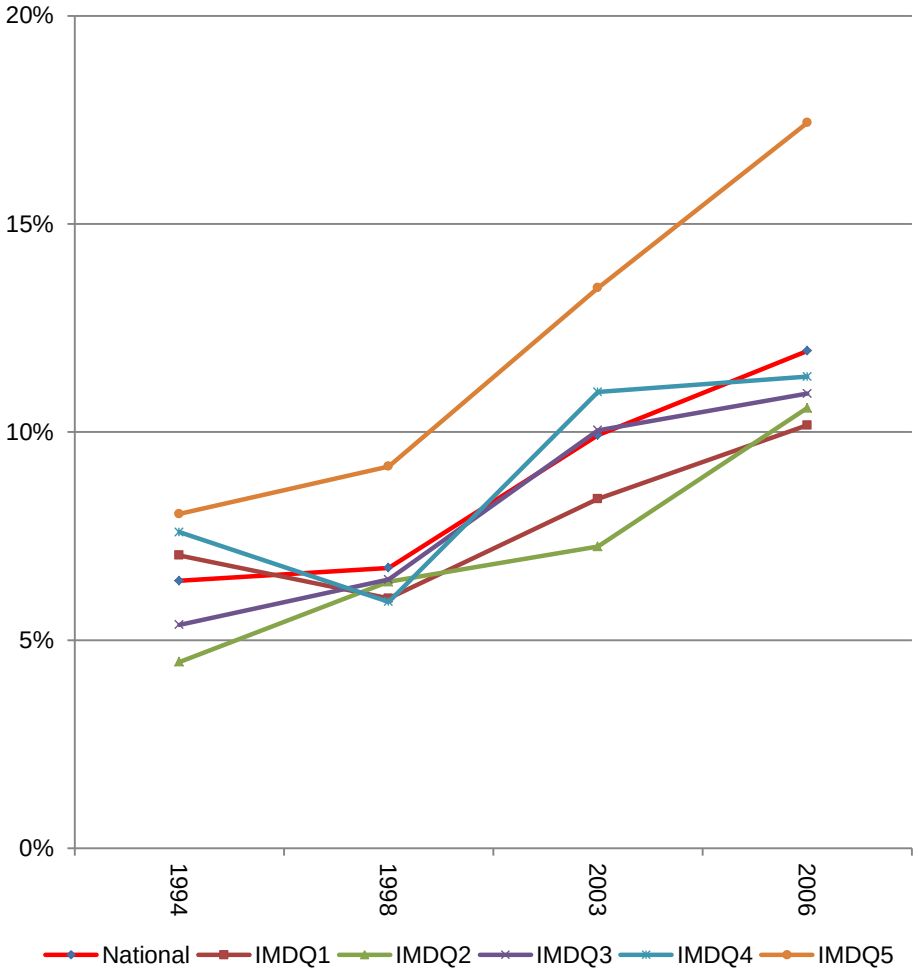


Women 55+



Diabetes (%): trends by deprivation quintiles

Men 55+



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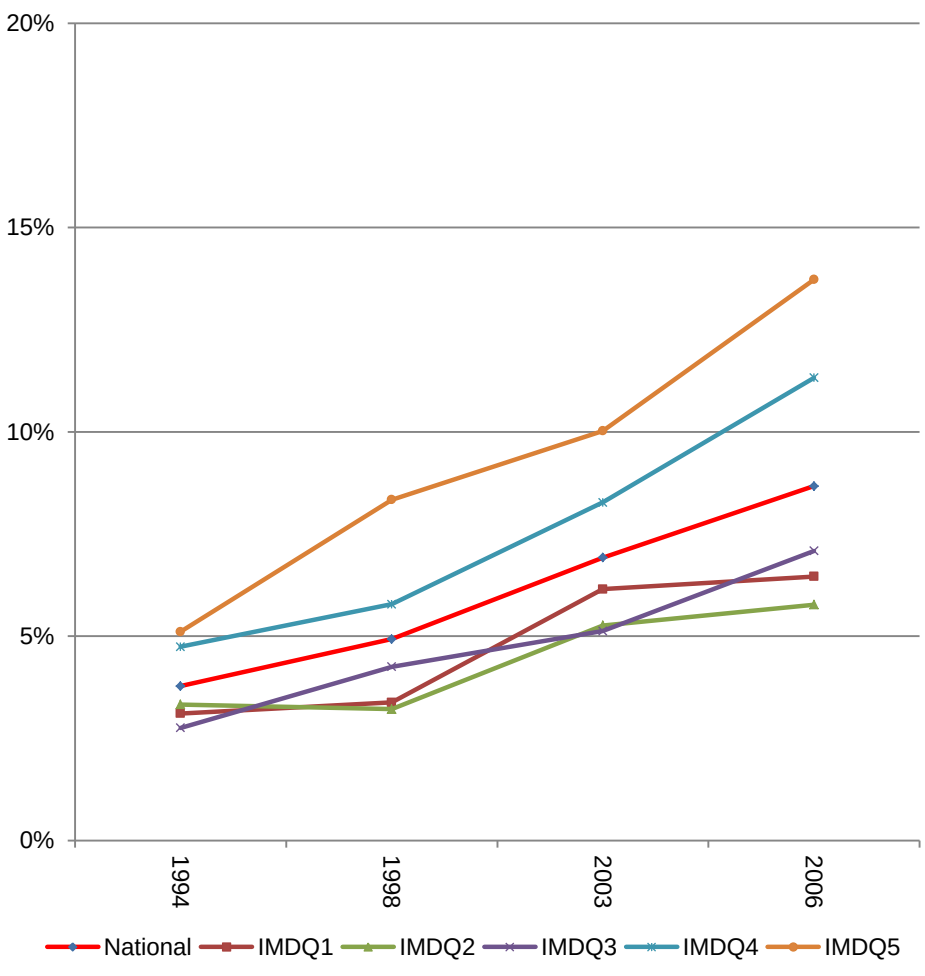
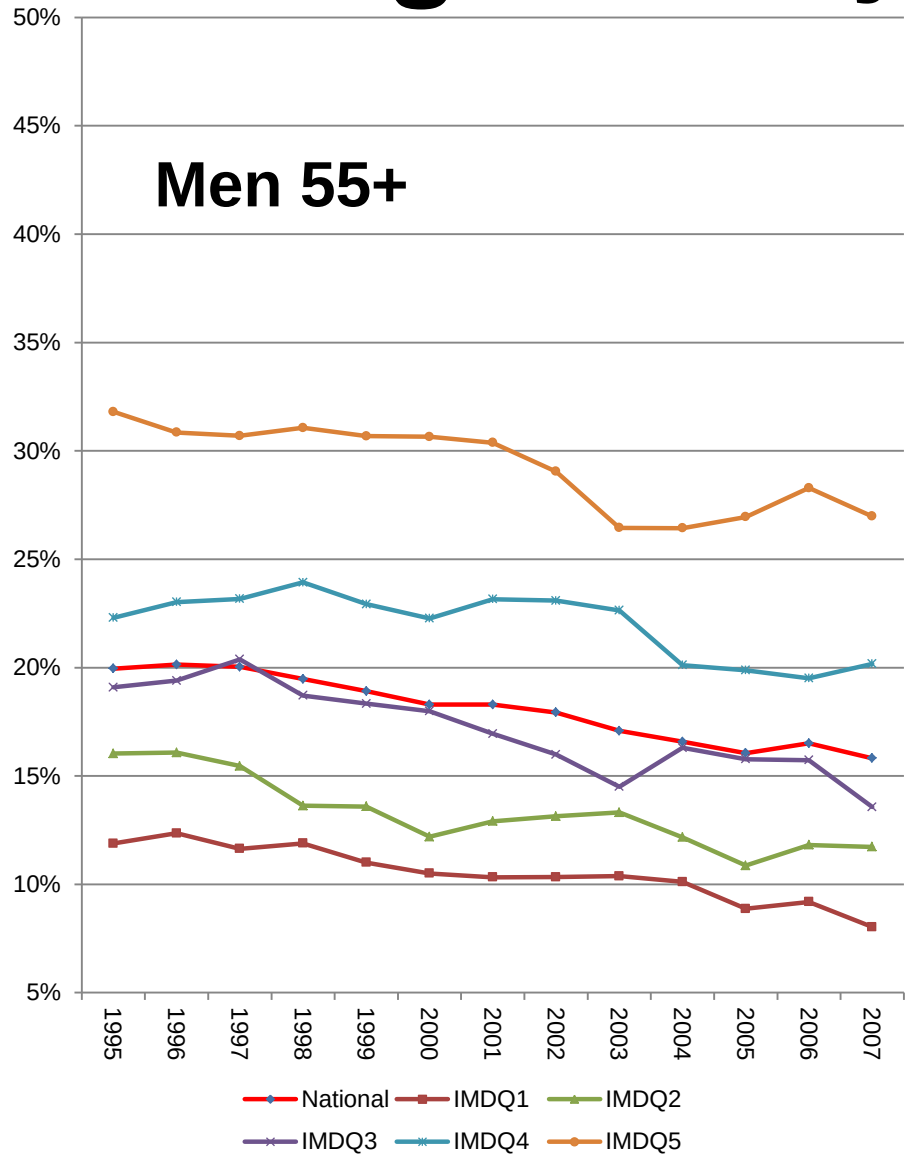
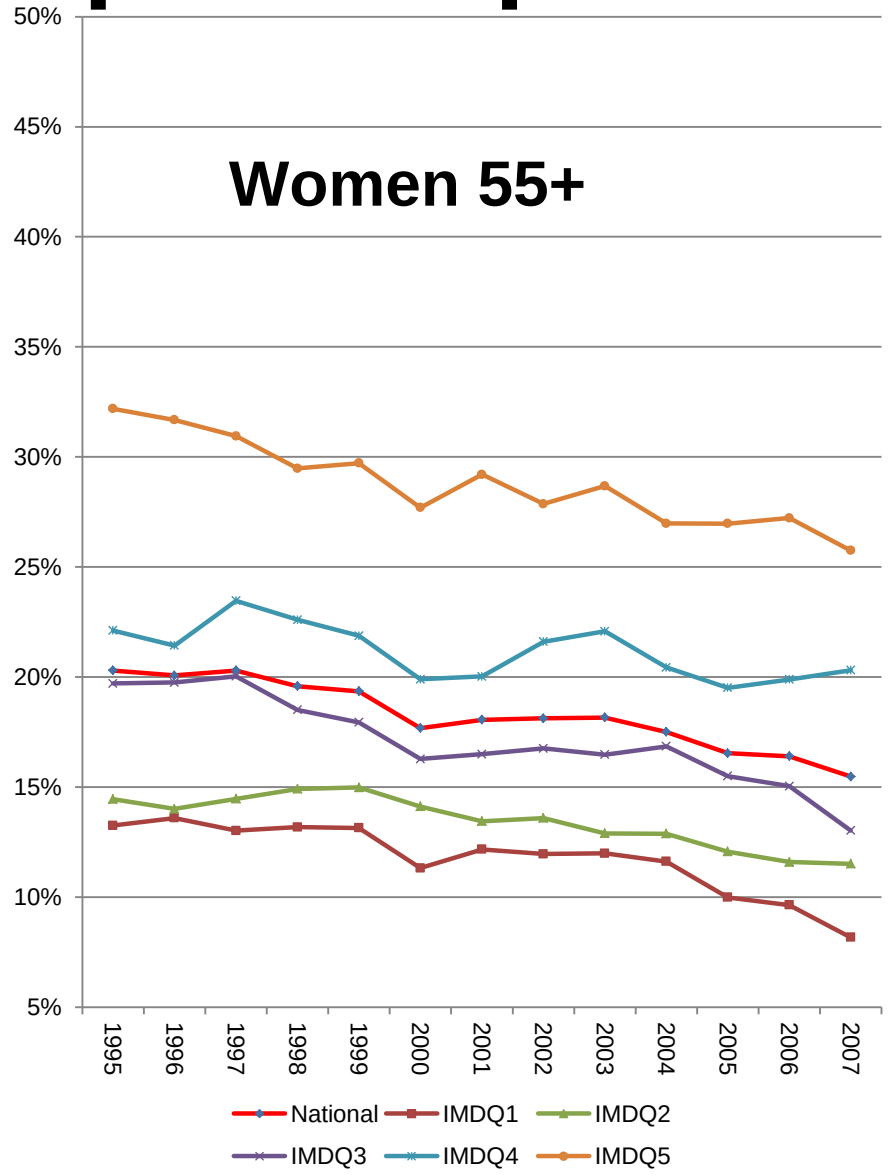


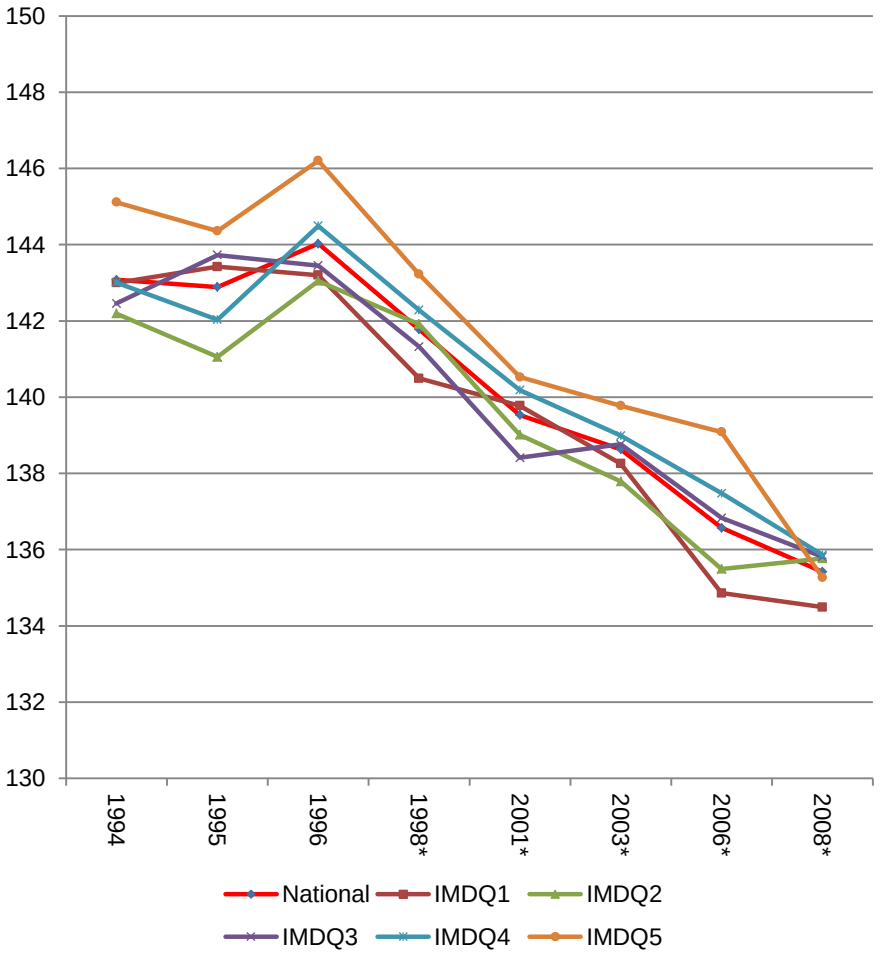
Smoking: trends by deprivation quintiles



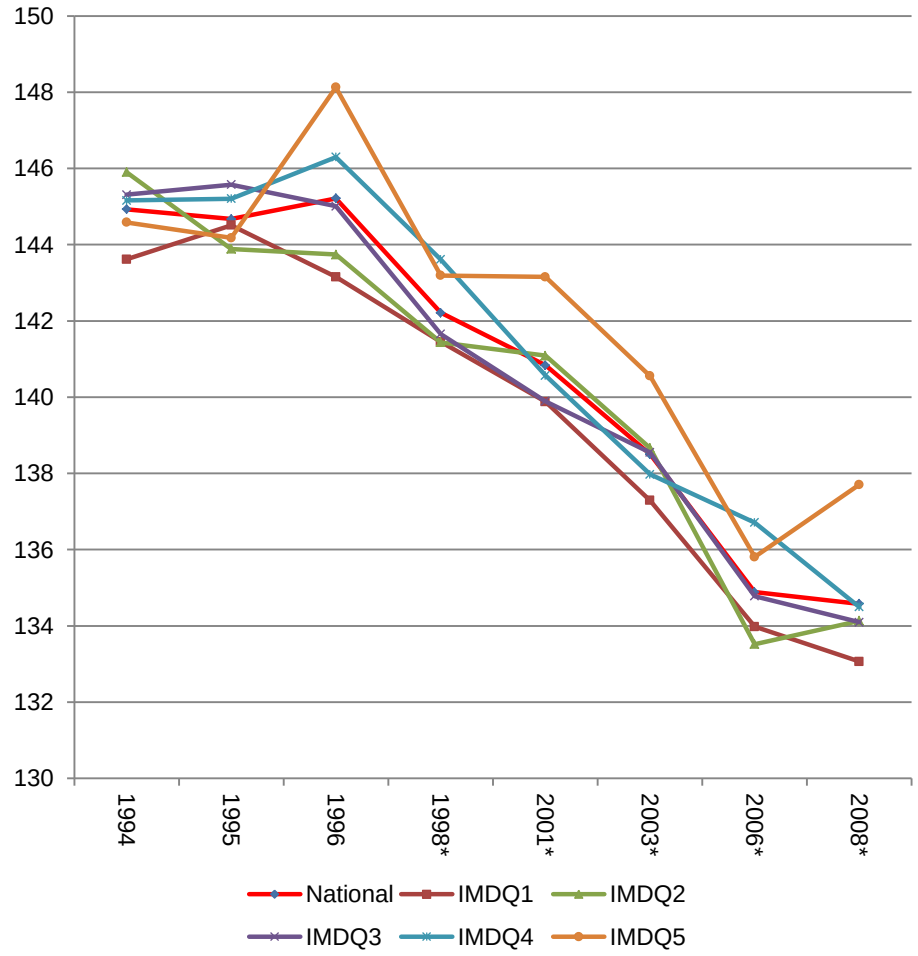


Systolic Blood Pressure (mm Hg): trends by deprivation quintiles

Men 55+

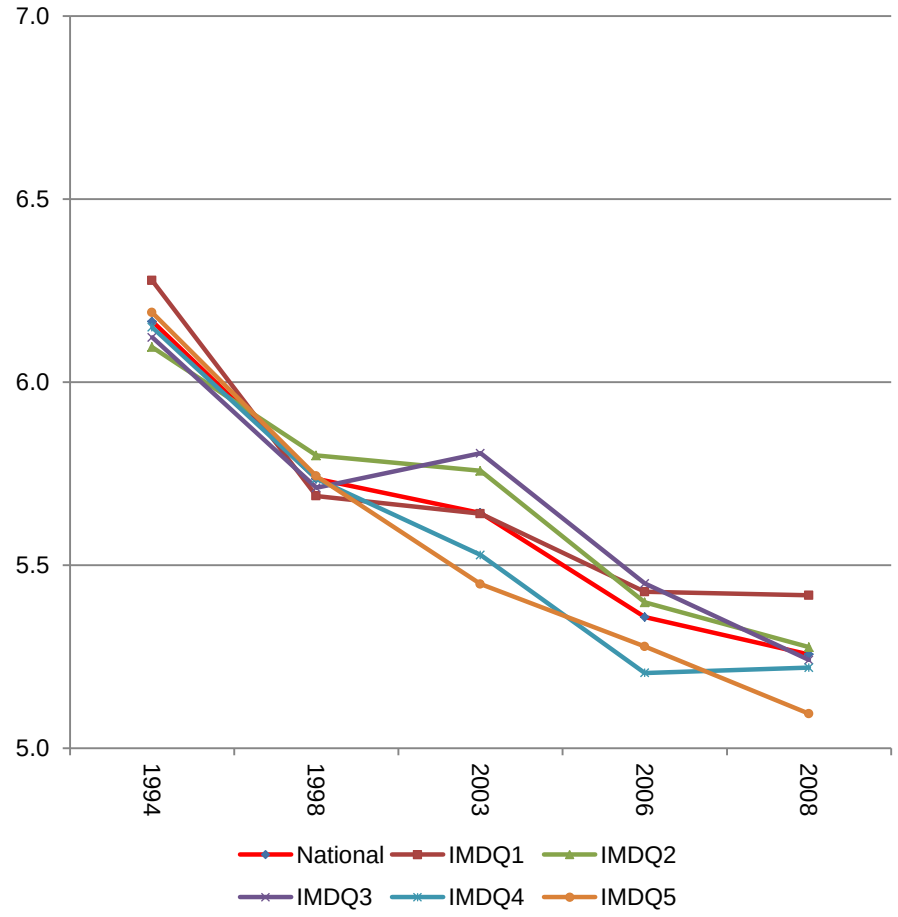


Women 55+

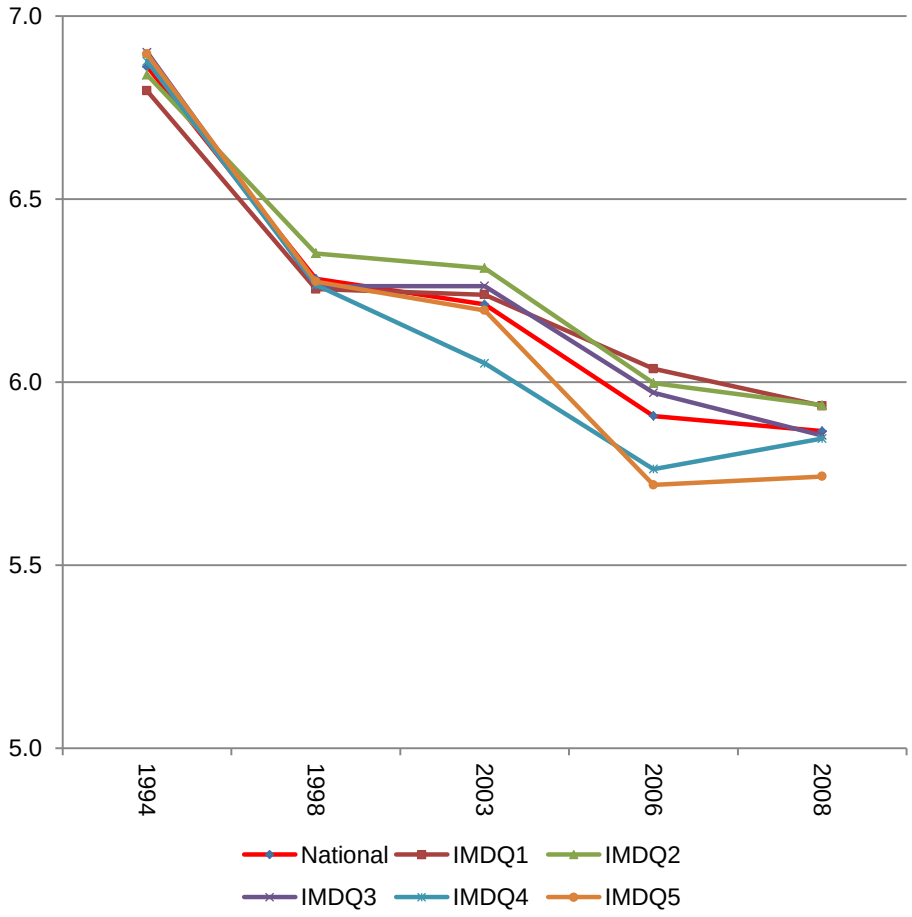


Total Cholesterol (mmol/l): trends by deprivation quintiles

Men 55+



Women 55+



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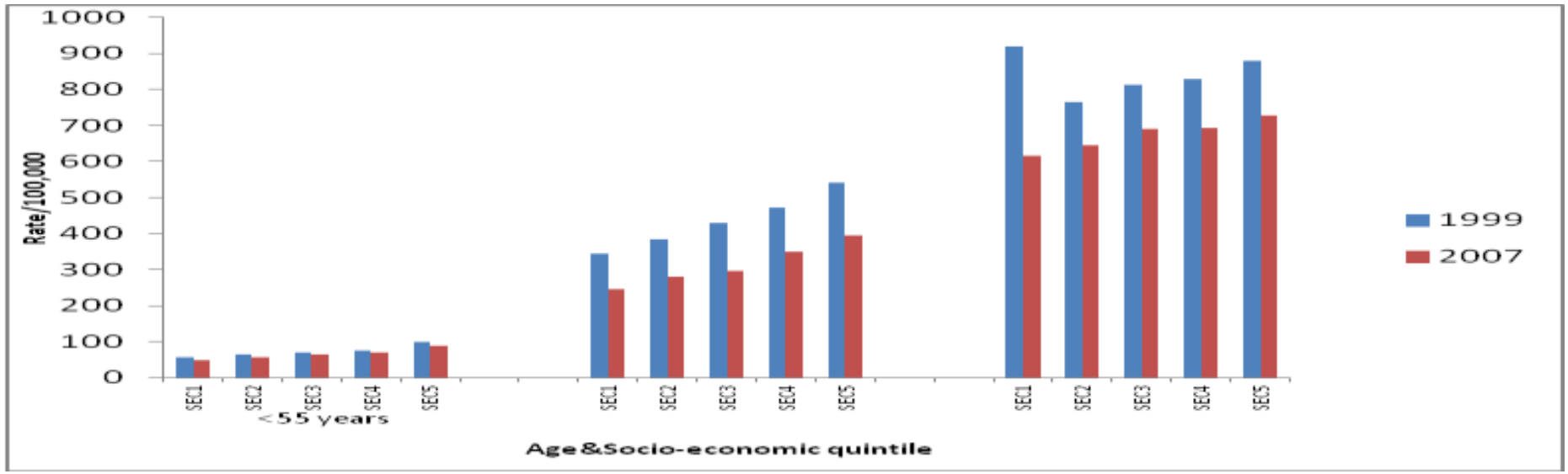
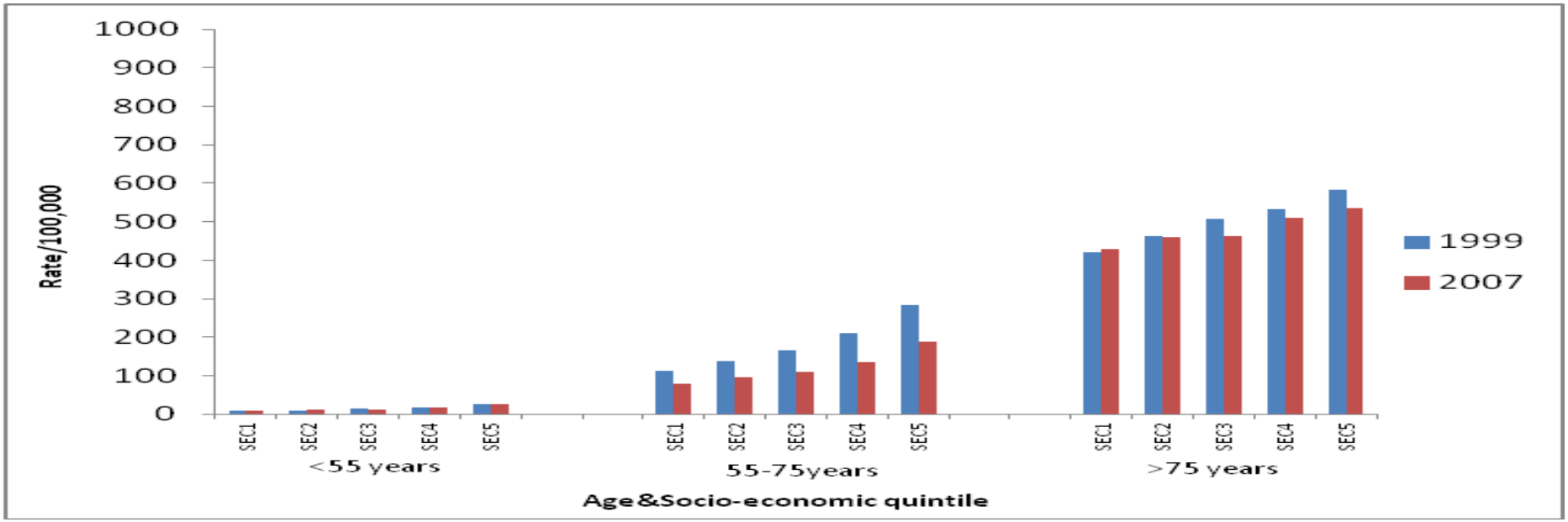
UK Trends in NHS burden 2000-2007

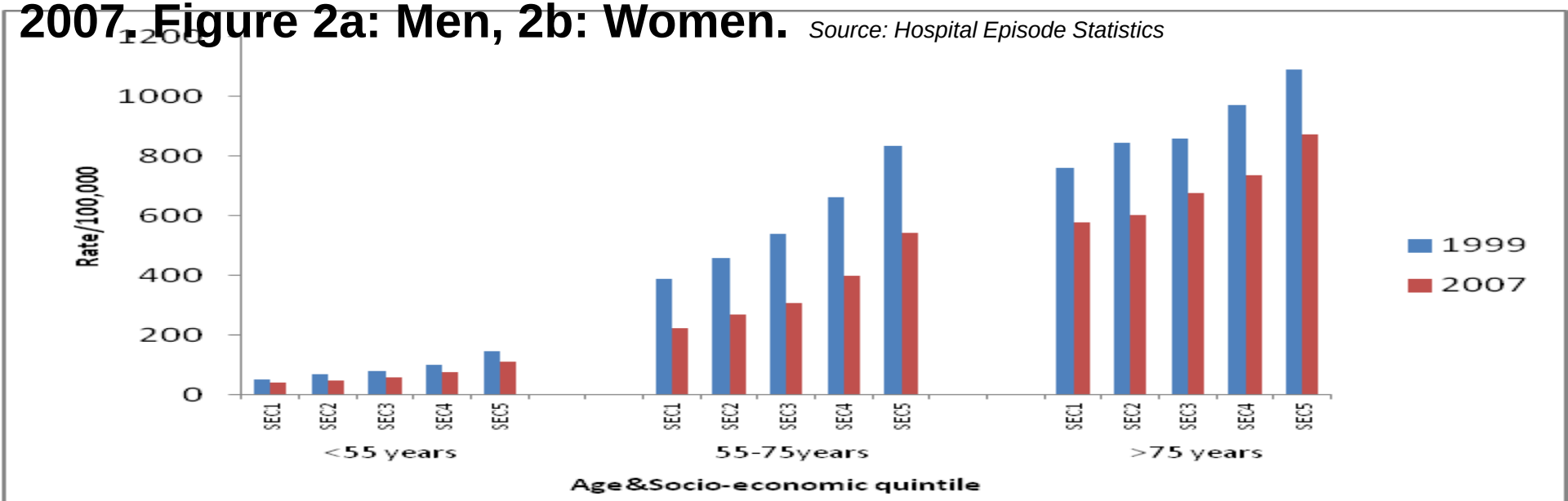
Trends in acute myocardial infarction admissions. Hospital admission rates by age, sex and socio-economic circumstance quintile (SEC) in 1999 and 2007. Figure 1a: Men, 1b: Women.

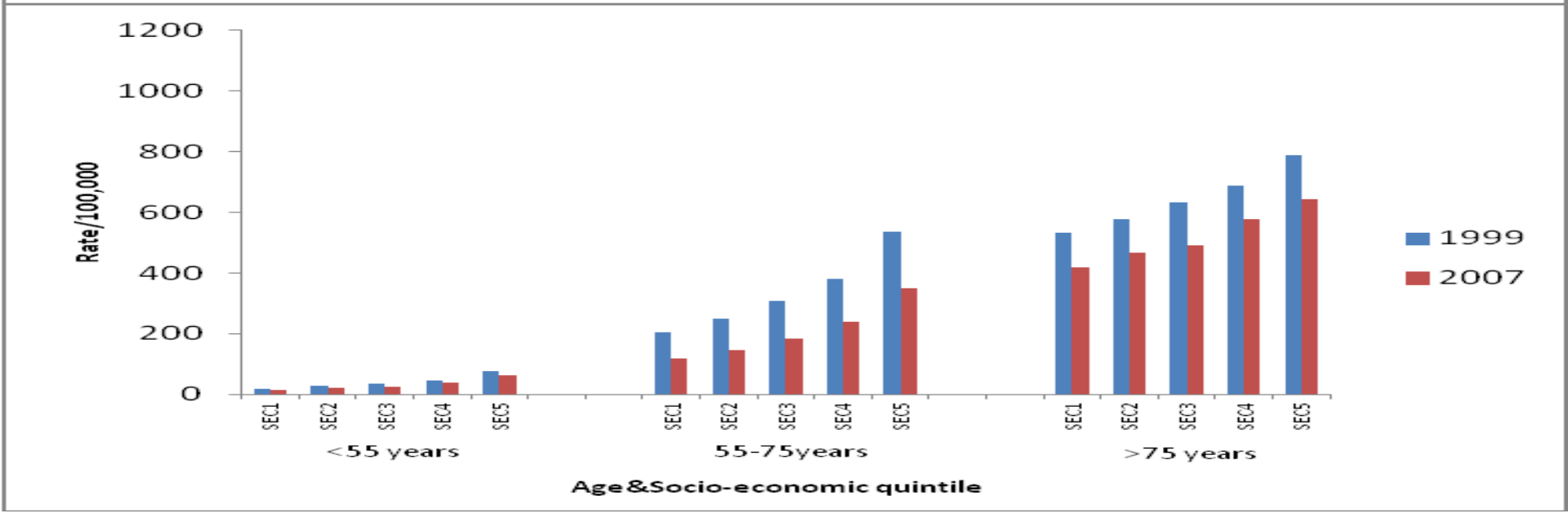




Trends in unstable angina admissions. Hospital admission rates by age, sex and socio-economic circumstance quintile (SEC) in 1999 and 2007. Figure 2a: Men, 2b: Women.

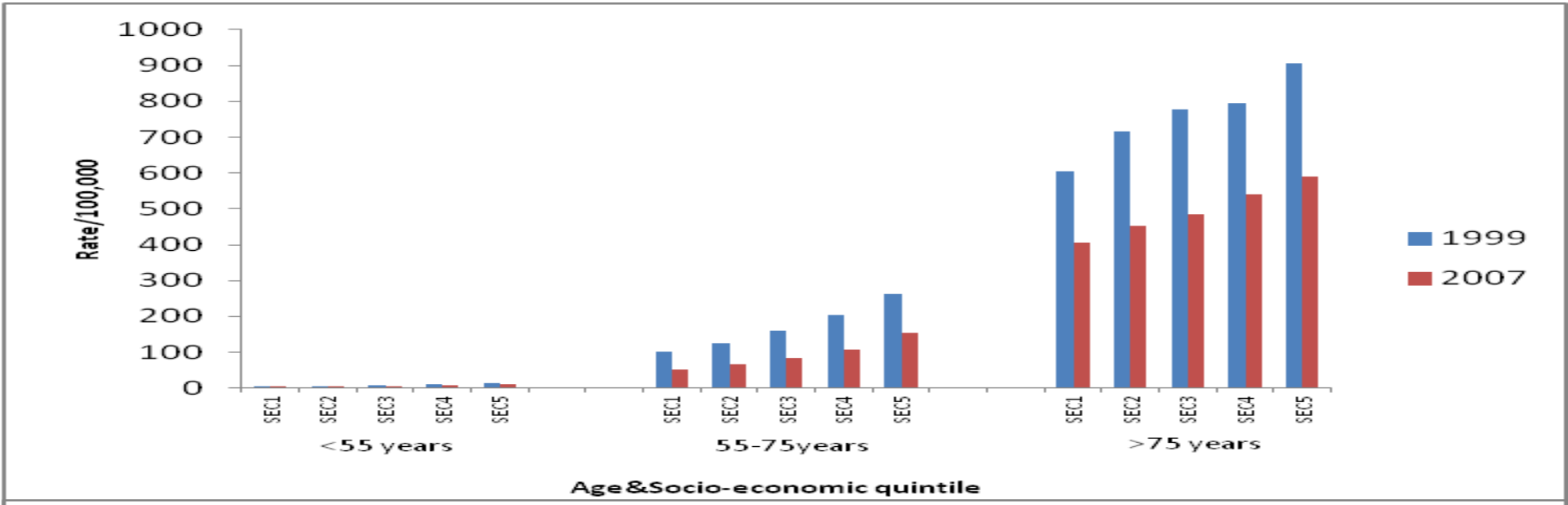
Source: Hospital Episode Statistics

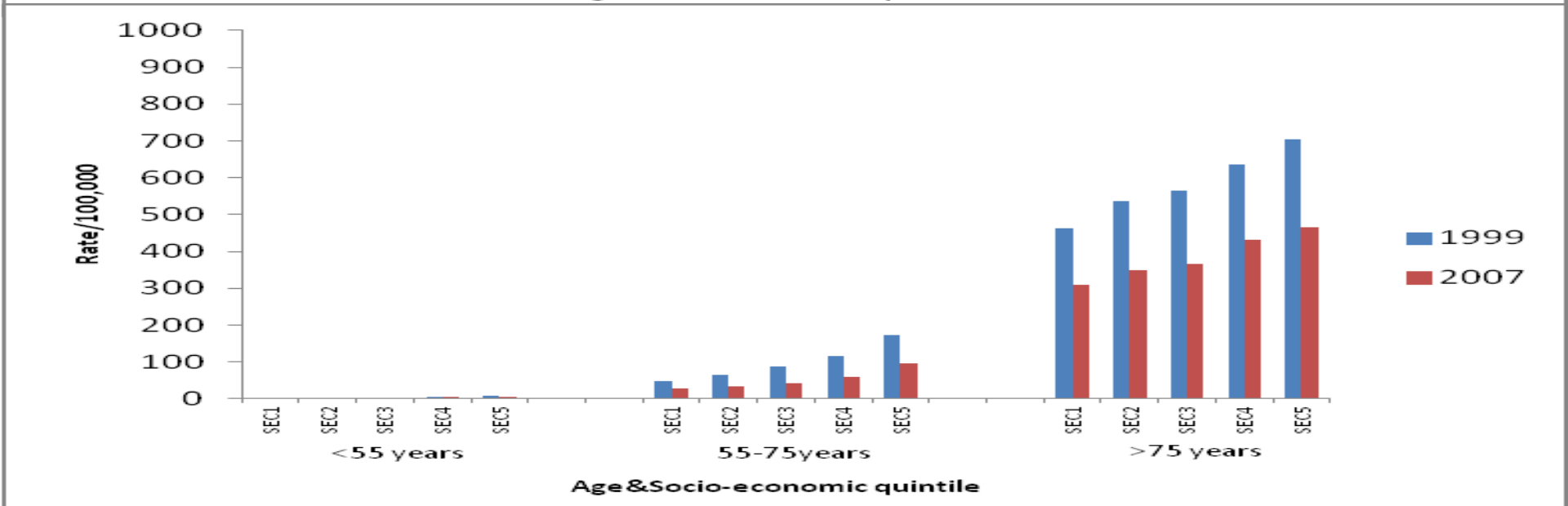




Trends in heart failure admissions. Hospital admission rates by age, sex and socio-economic circumstance quintile (SEC) in 1999 and 2007.

a: Men, b: Women. *Data source: Hospital Episode Statistics*





Treatment trends 2000-2007

generally equitable (comprehensive national health service)

CHAPTER 1 SUMMARY

Unequal UK Trends in

- Mortality
- Admissions & events
- Risk factors

IMPACT CHD model

explaining recent UK mortality trends

IMPACT model

Explaining the CHD mortality fall 1981-2000

↓**CHD Incidence** : improved population risk factors,
& detection/treatment of high risk individuals

↓**Case-fatality** : better treatments in acute phase,
plus improved secondary prevention

Unal, Critchley & Capewell Circulation 2004 109(9) 1101

IMPACT model
Explaining the CHD mortality fall 1981-2000

- 70% mortality fall due to **risk factor reductions**
- 40%: due to evidence-based **therapies**

Unal, Critchley & Capewell Circulation 2004 109(9) 1101

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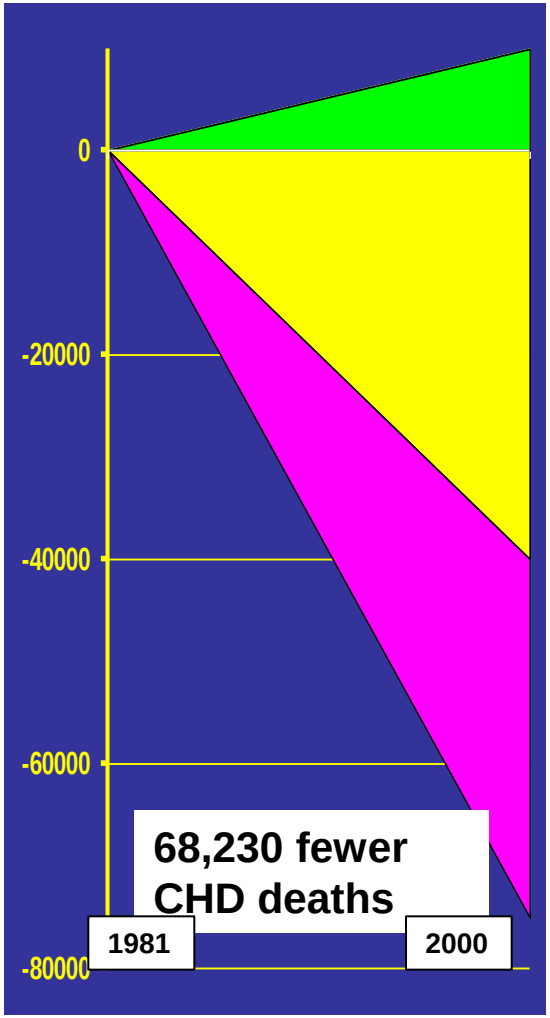

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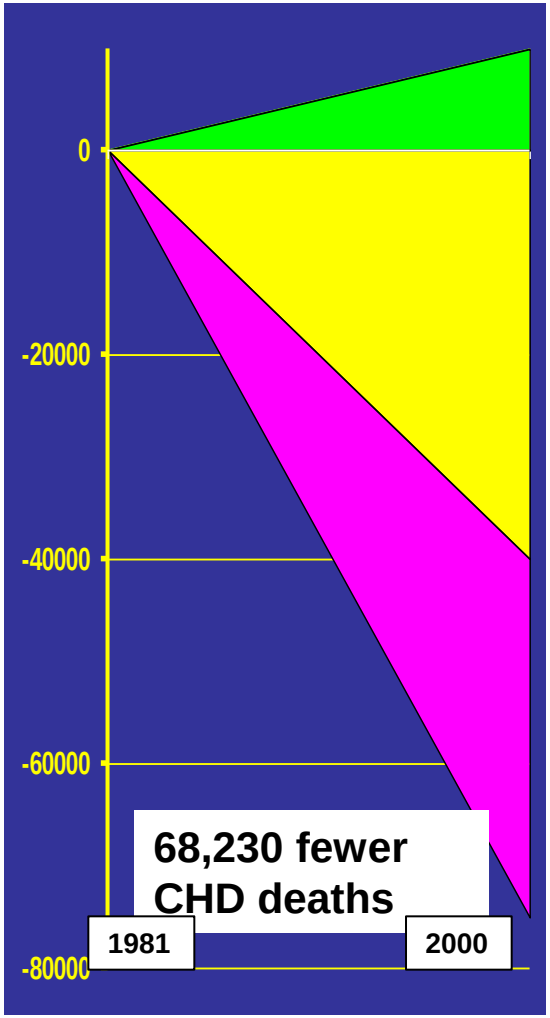

Risk Factors worse +13%

Risk Factors better -70%

Treatments -40%

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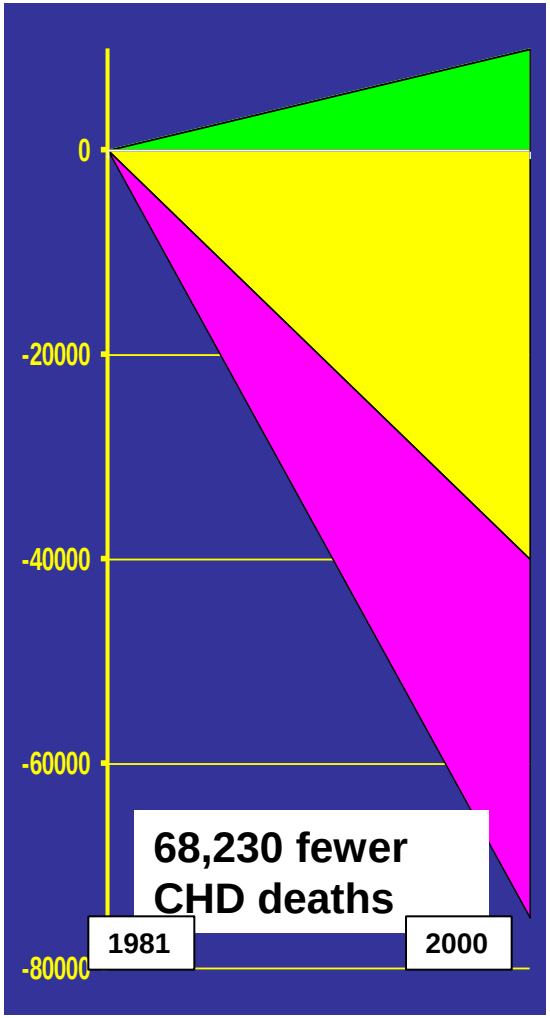


Risk Factors worse +13%

Obesity (increase)	+3.5%
Diabetes (increase)	+4.8%
Physical activity (less)	+4.4%

Risk Factors better -70%

Smoking	-41%
Cholesterol	-9%
Population BP fall	-9%
Deprivation	-3%
Other factors	-8%

Treatments -40%

AMI treatments	-8%
Secondary prevention	-11%
Heart failure	-12%
Angina: CABG & PTCA	-4%
Angina: Aspirin etc	-5%
Hypertension therapies	-3%

Unal, Critchley & Capewell Circulation 2004 109(9) 1101

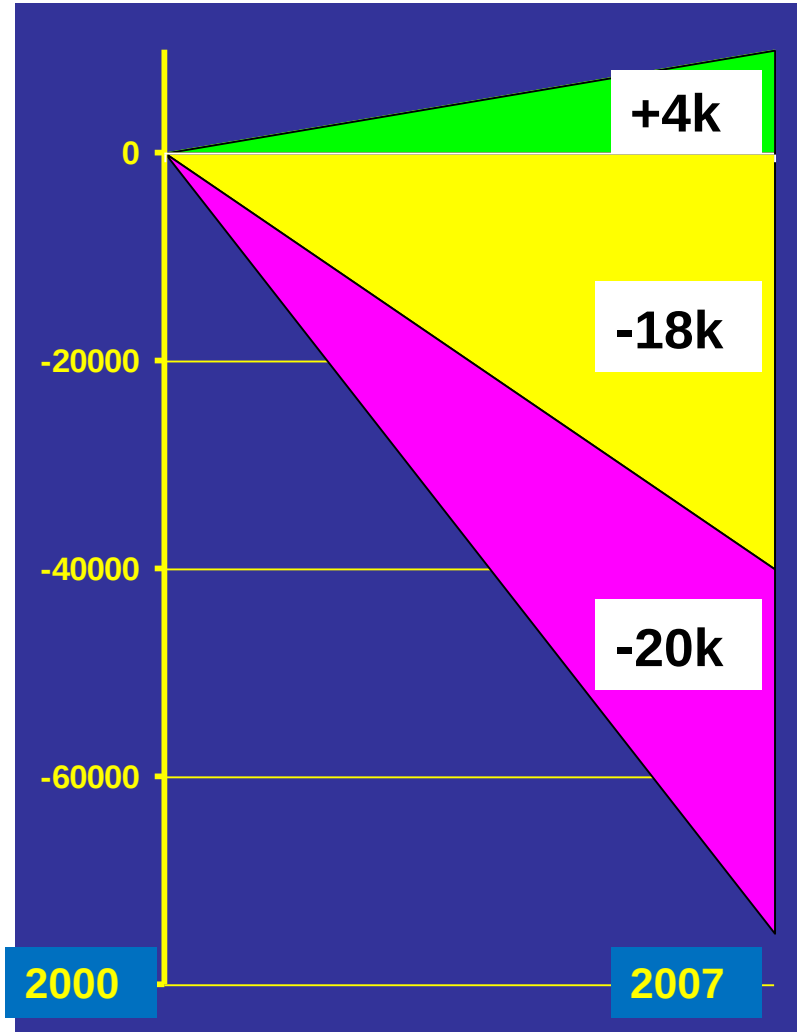
IMPACTsec

explaining recent UK mortality trends

+ stratification by Socio-economic Circumstances

(sec)

IMPACTsec: CHD Deaths prevented *England* *2000-2007*



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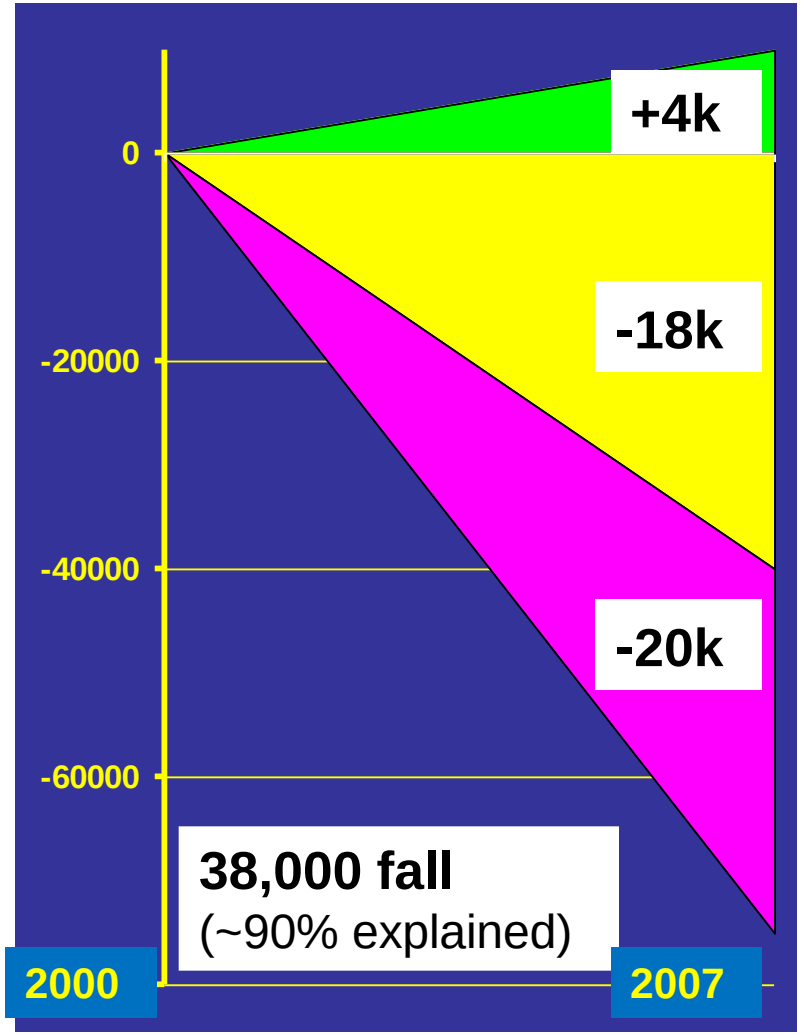

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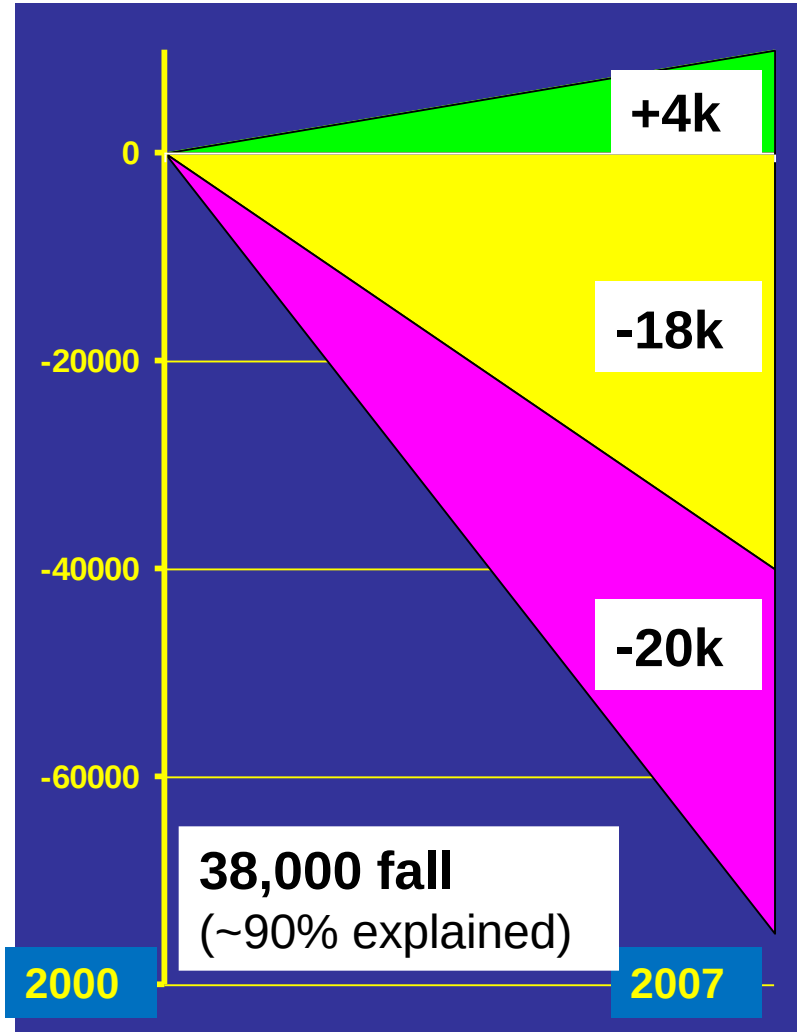
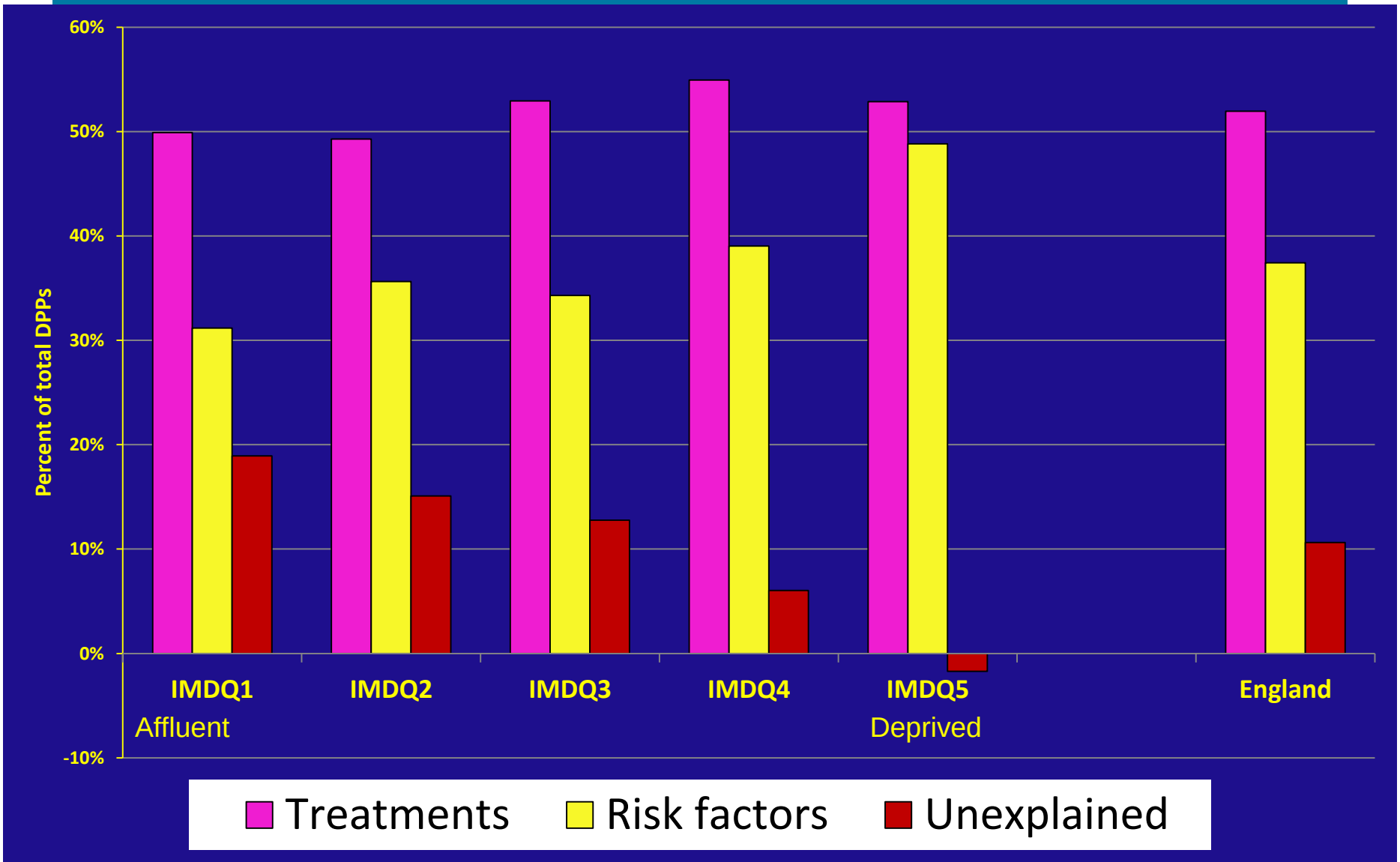


Risk Factors worse	*+ 11%*
BMI (increase)	+ 2%
Diabetes (increase)	+ 9%
Risk Factors better	*-49%*
Smoking	- 4%
Cholesterol	- 6%
SBP fall	- 33%
Physical inactivity	- 1%
Fruit & Veg	- 5%
Treatments uptake change	*-52%*
AMI/NSTEACS	- 1%
2' post MI	- 9%
2' post-revasc	- 2%
Stable Angina	- 13%
Heart failure	- 10%
Hypertension therapies	- 4%
Hyperlipidemia Rx	- 12%
Unexplained	11%

Distribution of deaths prevented by socio-economic group *(IMD quintiles)*



Main overall messages

- **35% CHD mortality decline accelerated after 2000**
- **Nationally, the proportion of mortality decline explained by Treatments and Risk Factors**

  changed from 40%:60% *(in 1980-2000 period)*

  to treatments 55%: 45% risk factors *(since 2000)*

Main overall messages

- CHD mortality decline accelerated post-2000 (35% fall)
- Nationally, the **proportion** of mortality decline explained by Treatments and Risk Factors

changed from **40%:60%** *(in 1980-2000 period)*

to **55%:45%** *(since 2000)*

- **No SEC gradients in most treatment uptakes**
- **Bigger than expected falls in population Blood Pressure**
- **% unexplained by model:**

small in deprived, larger in affluent

(range 2% Q5 to 20% Q1). **Why?**

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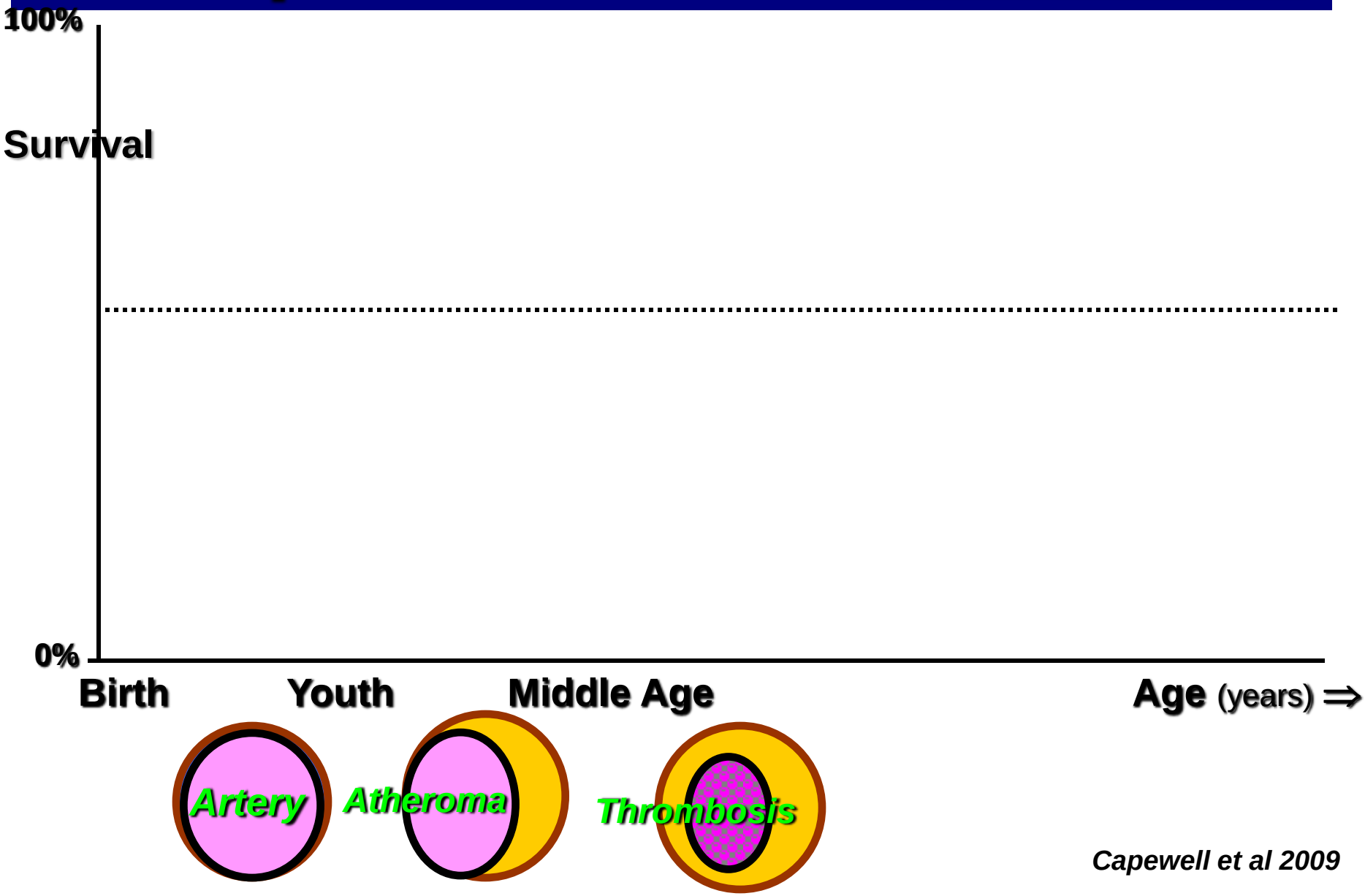
CVD PREVENTION

CVD process: in an individual



Capewell et al 2009

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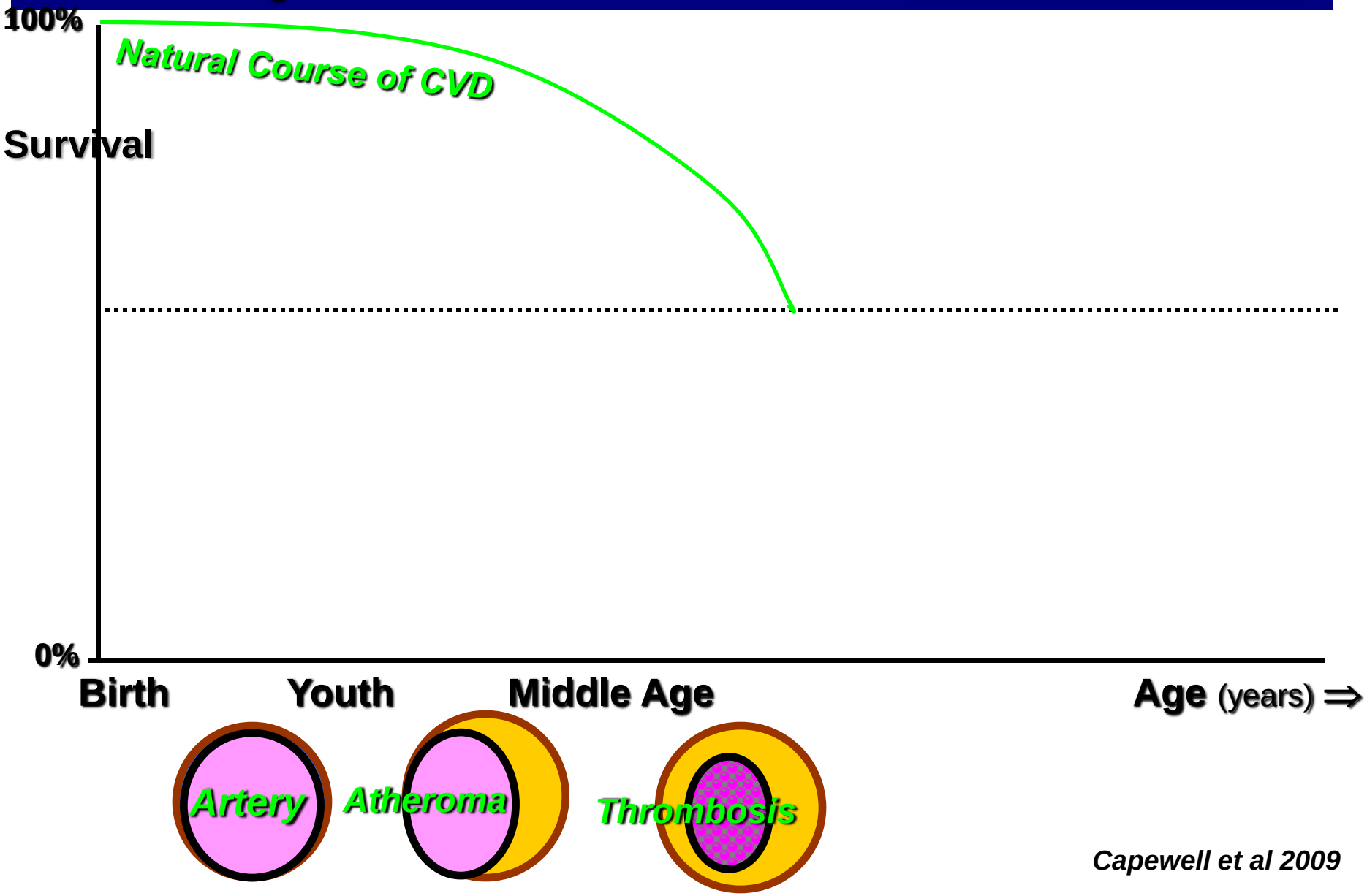

Capewell et al 2009

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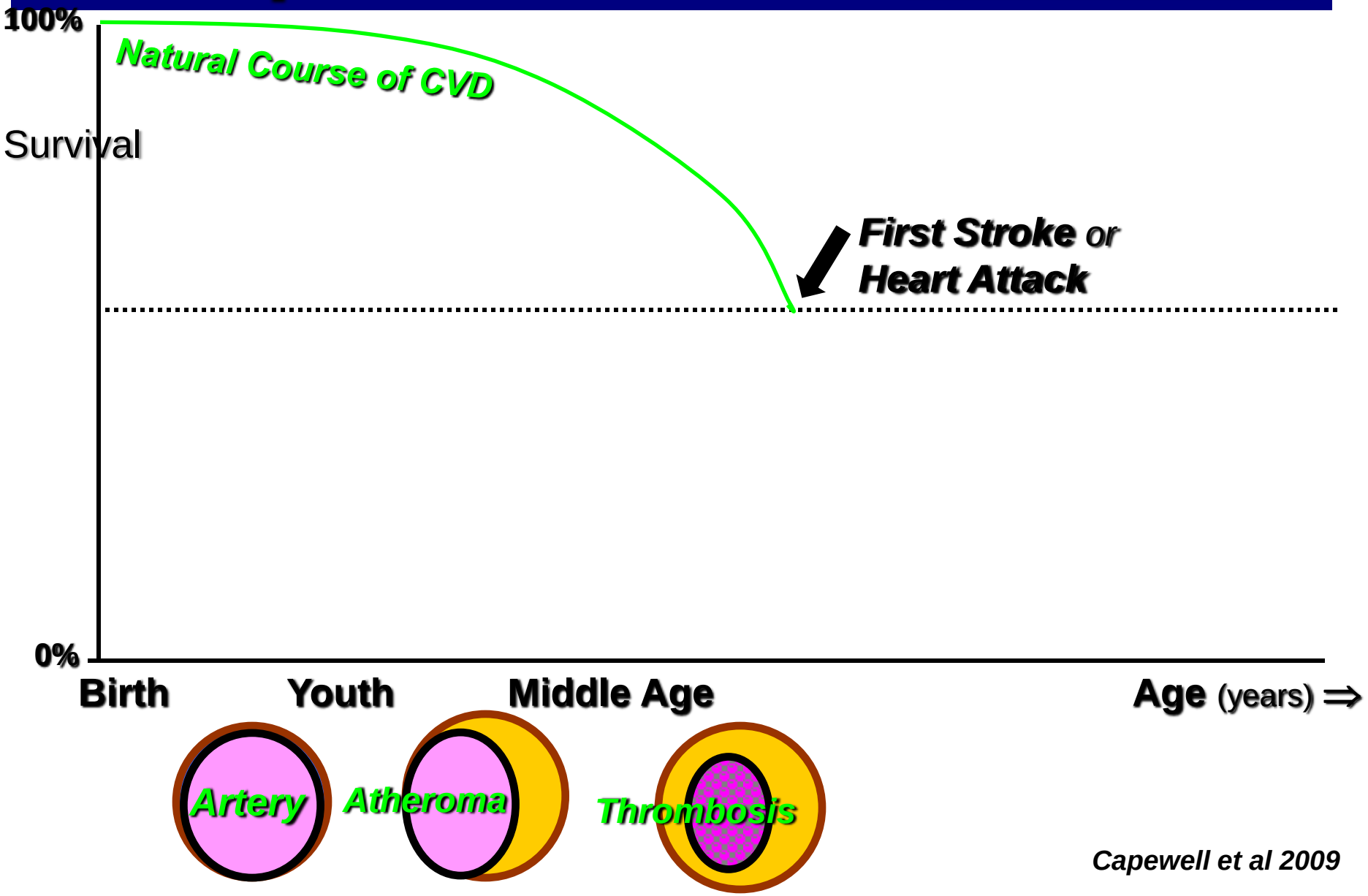

Capewell et al 2009

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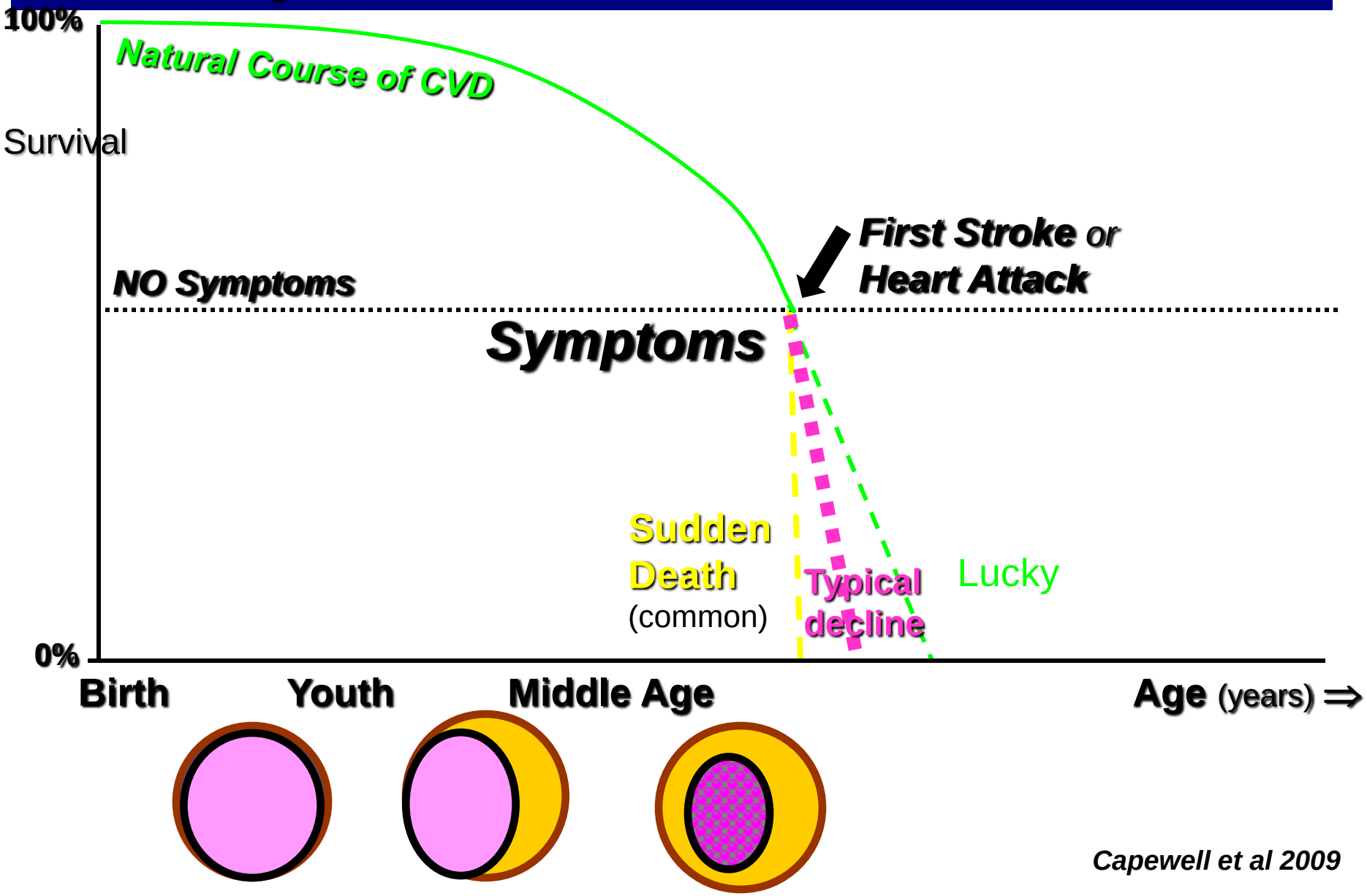

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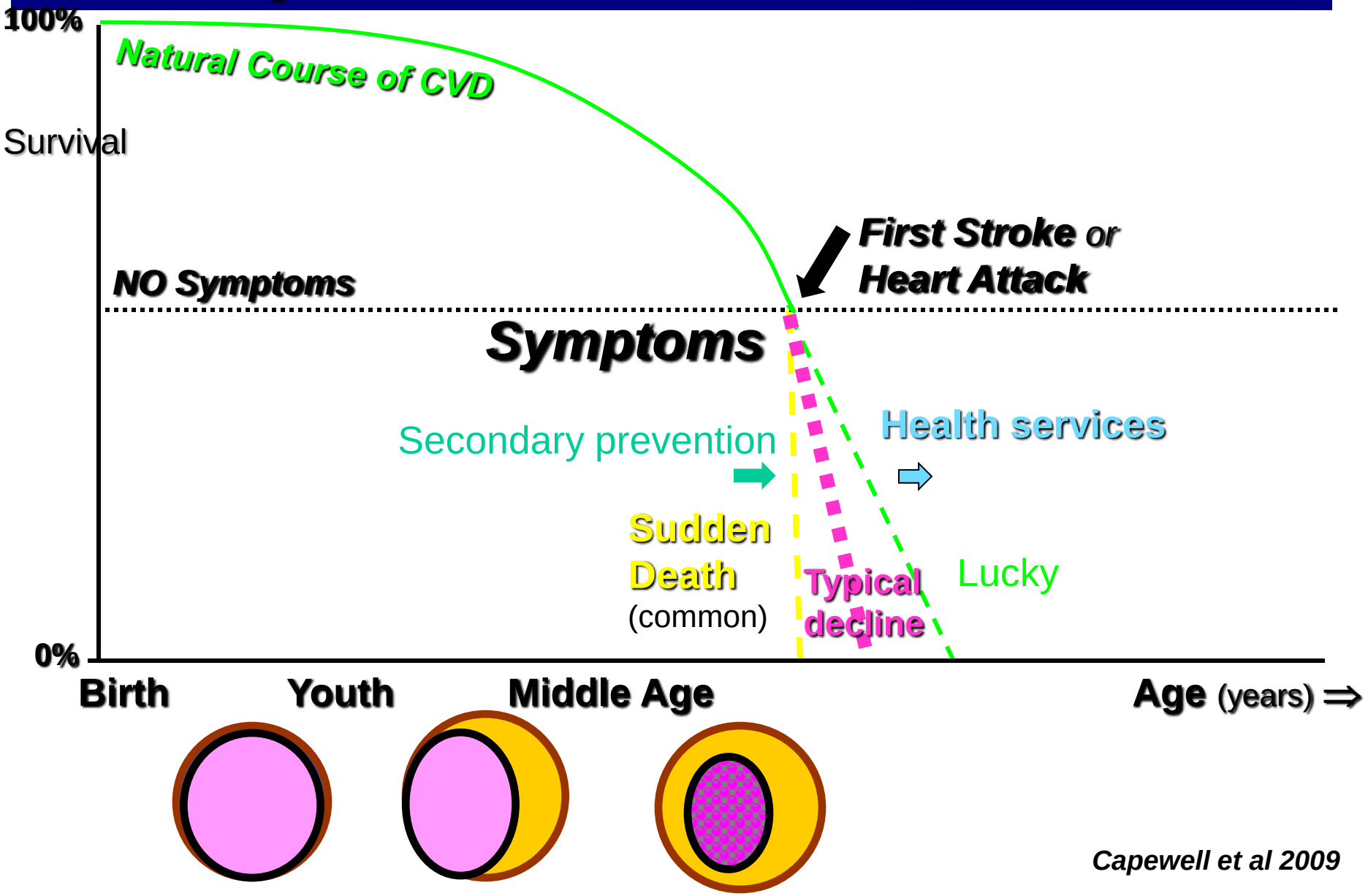

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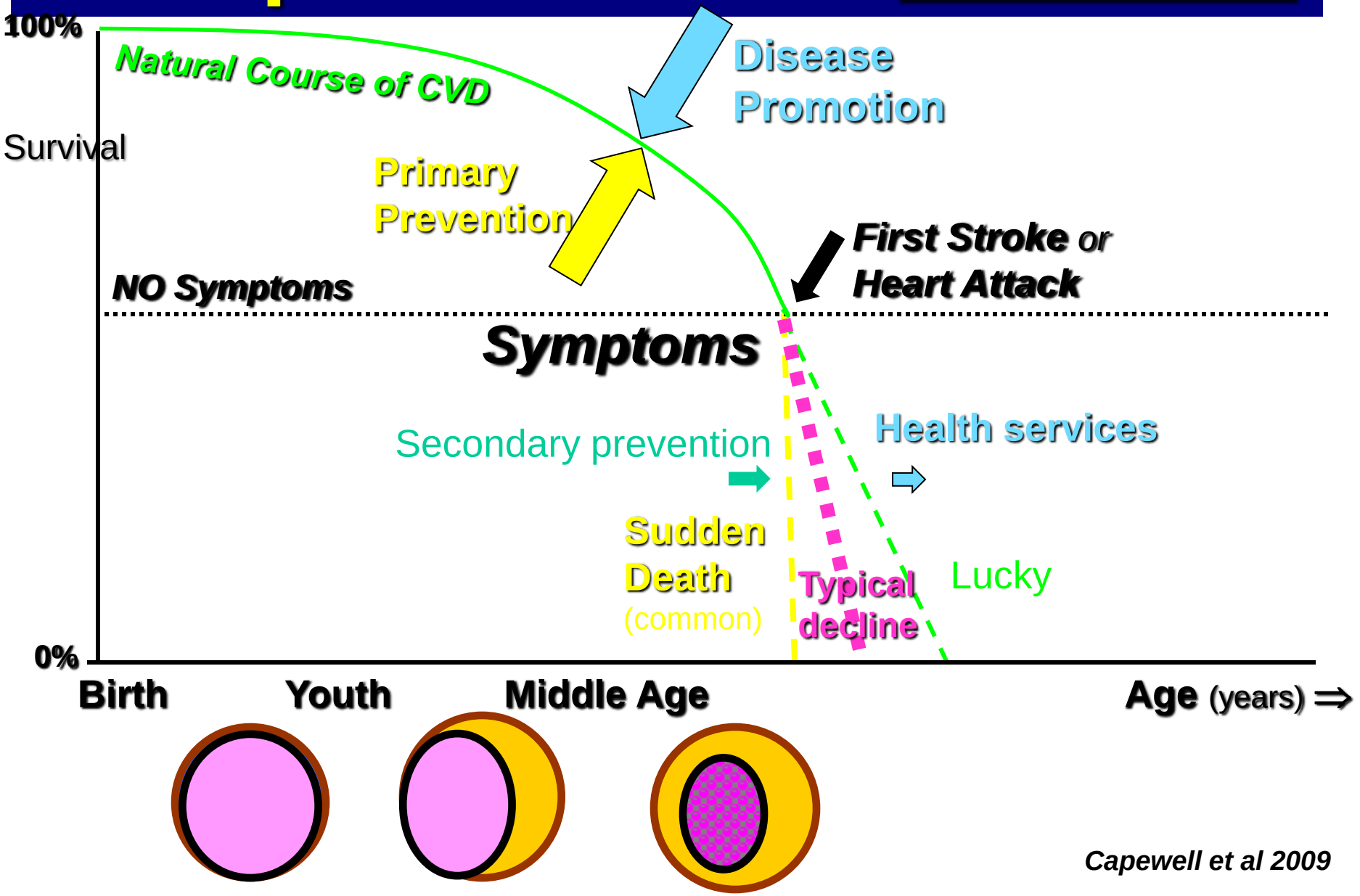
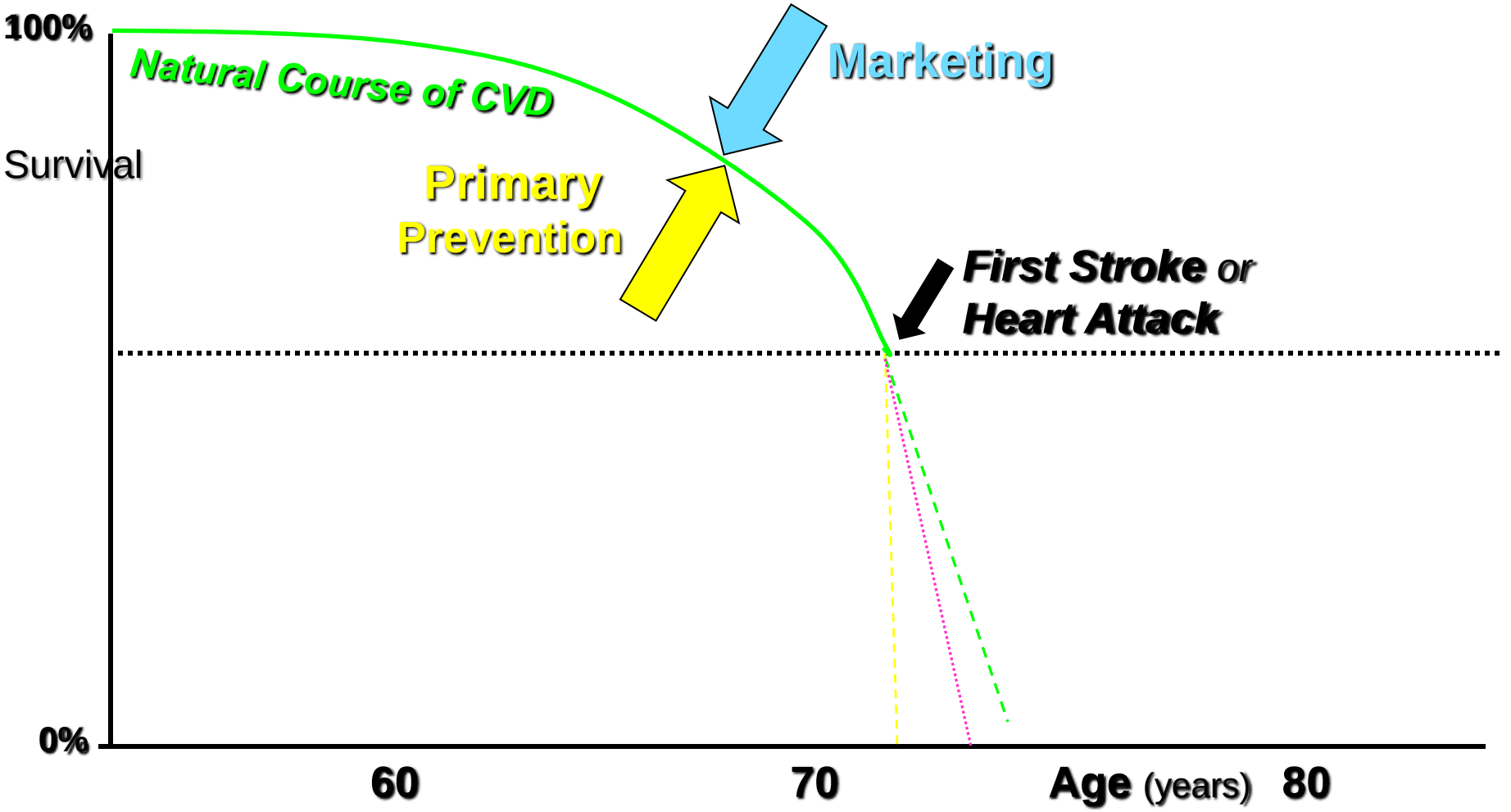


Capewell et al 2009

CVD Prevention in a POPULATION



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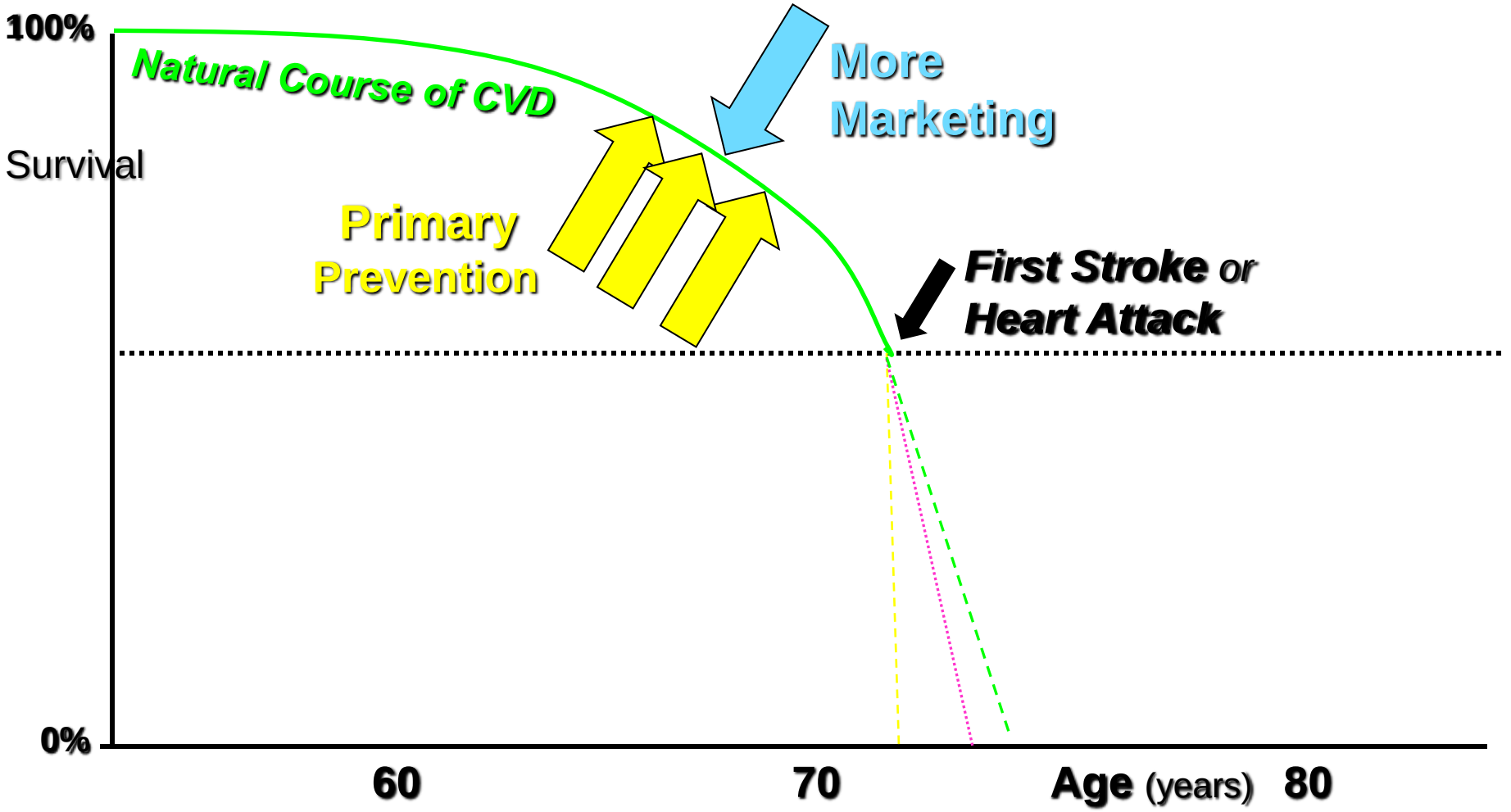

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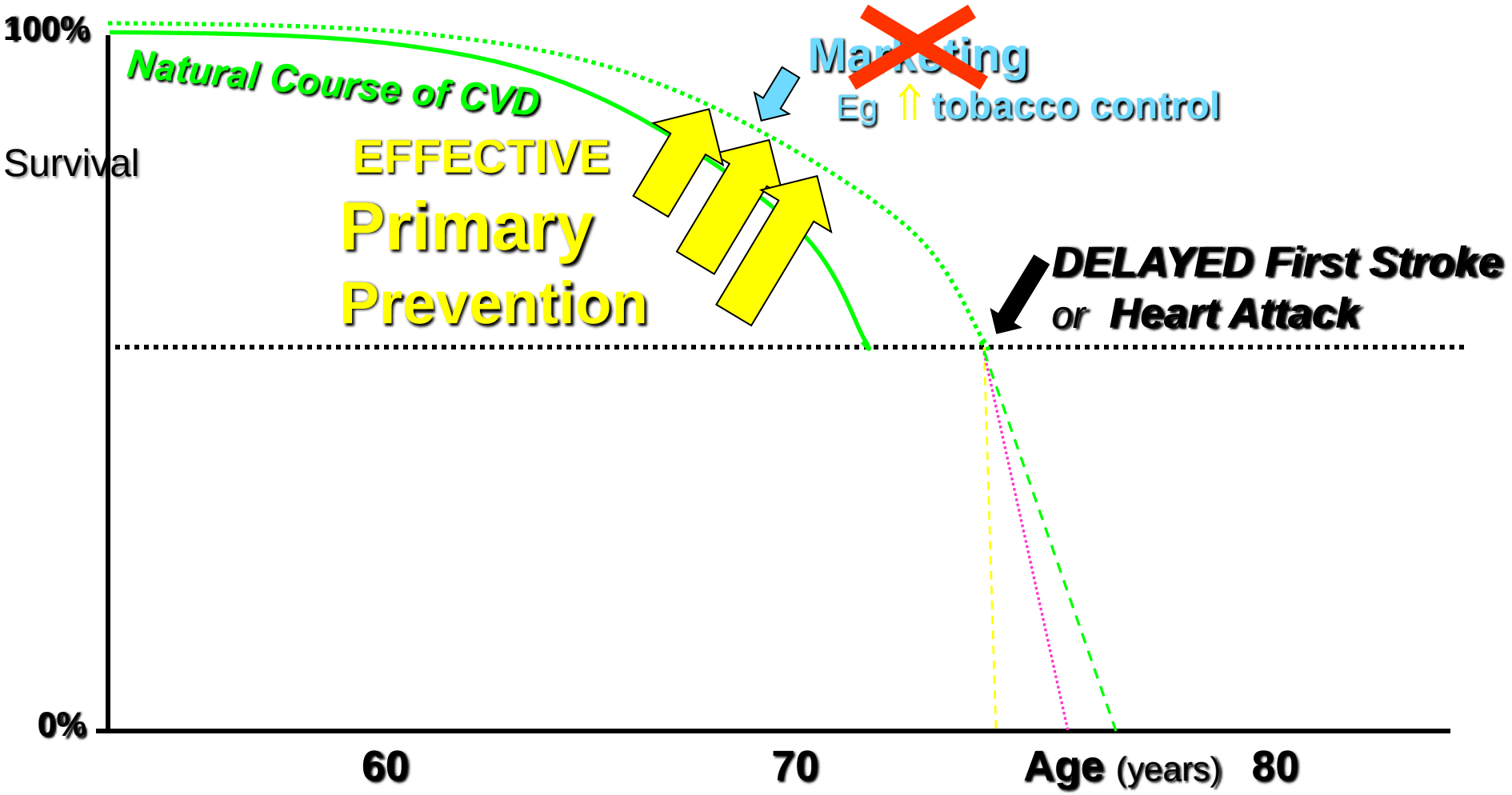
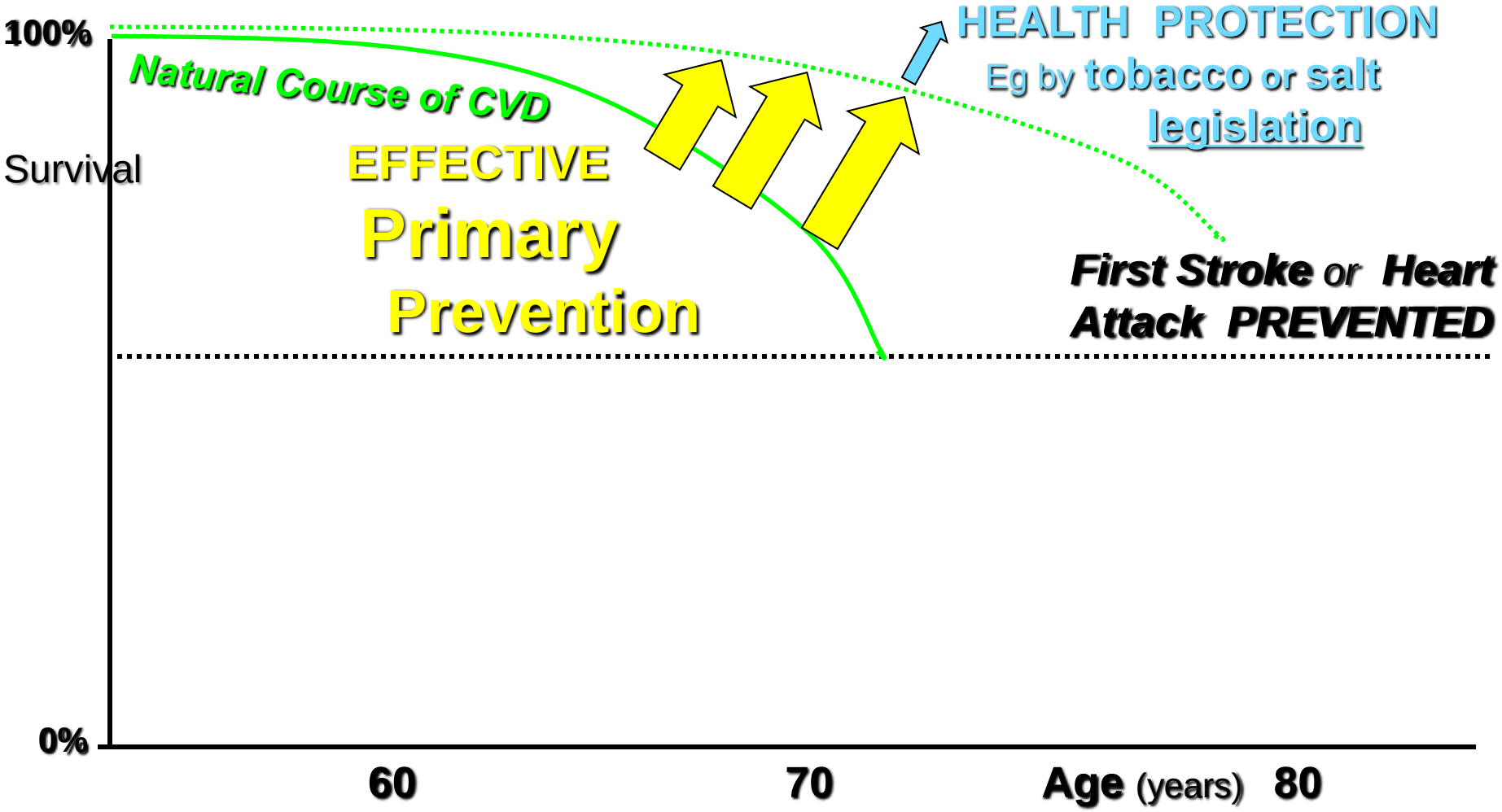


Capewell et al 2009

CVD Prevention in a POPULATION

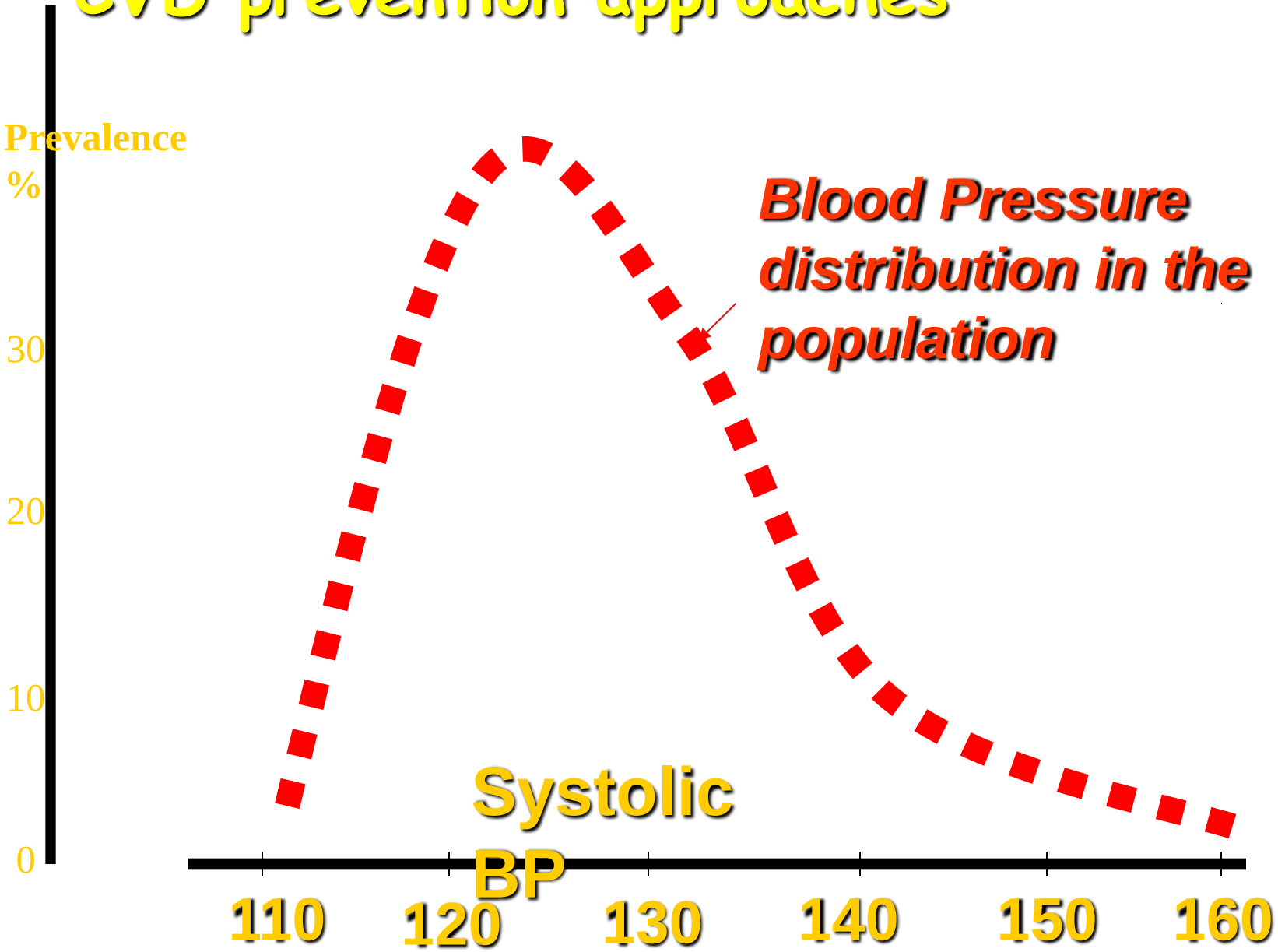


Capewell et al 2009

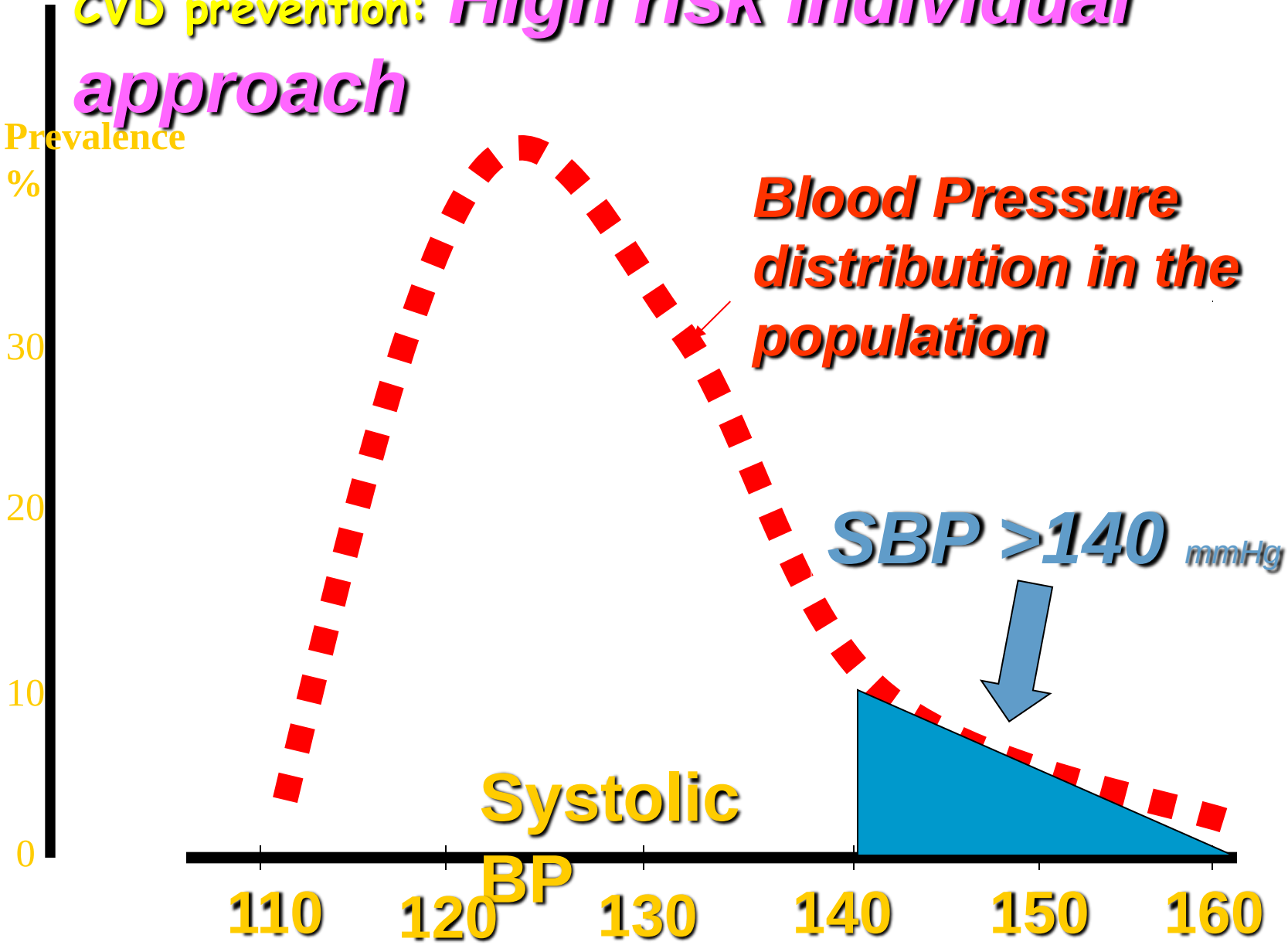
CVD prevention strategies

- *High Risk Individual approach*
- Population-based approach

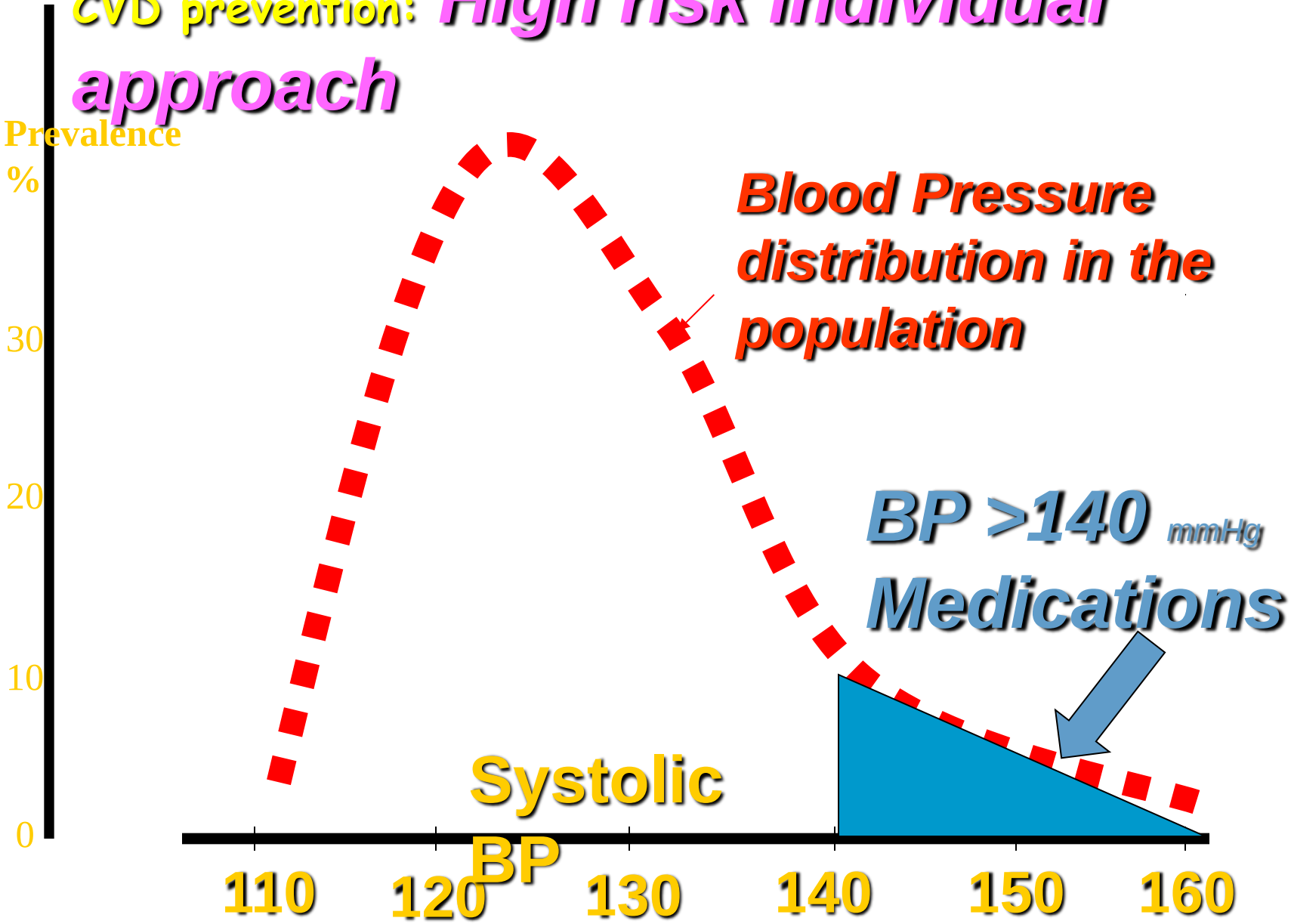
CVD prevention approaches



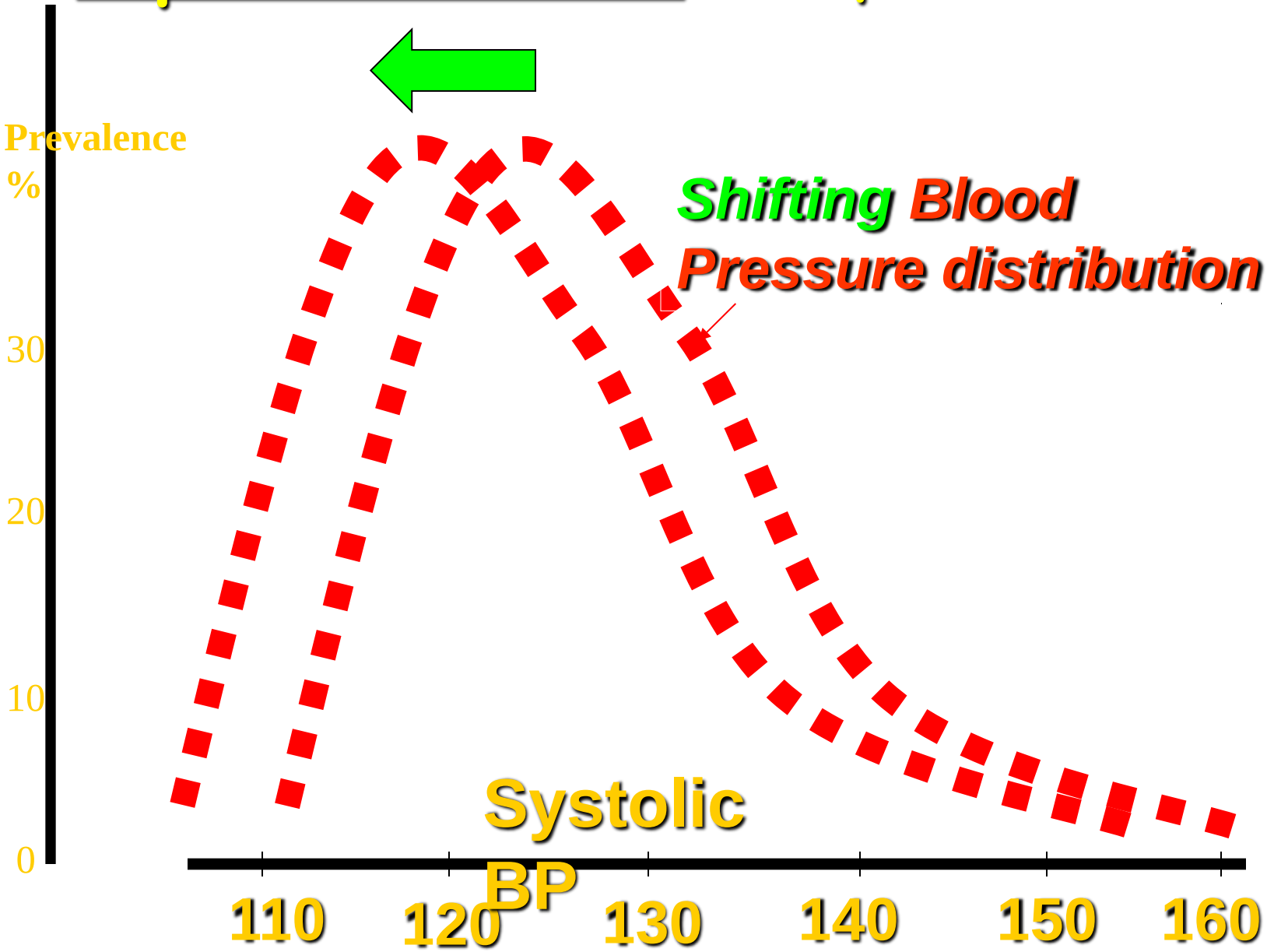
CVD prevention: *High risk individual approach*



CVD prevention: High risk individual approach



Population-based CVD prevention strategy



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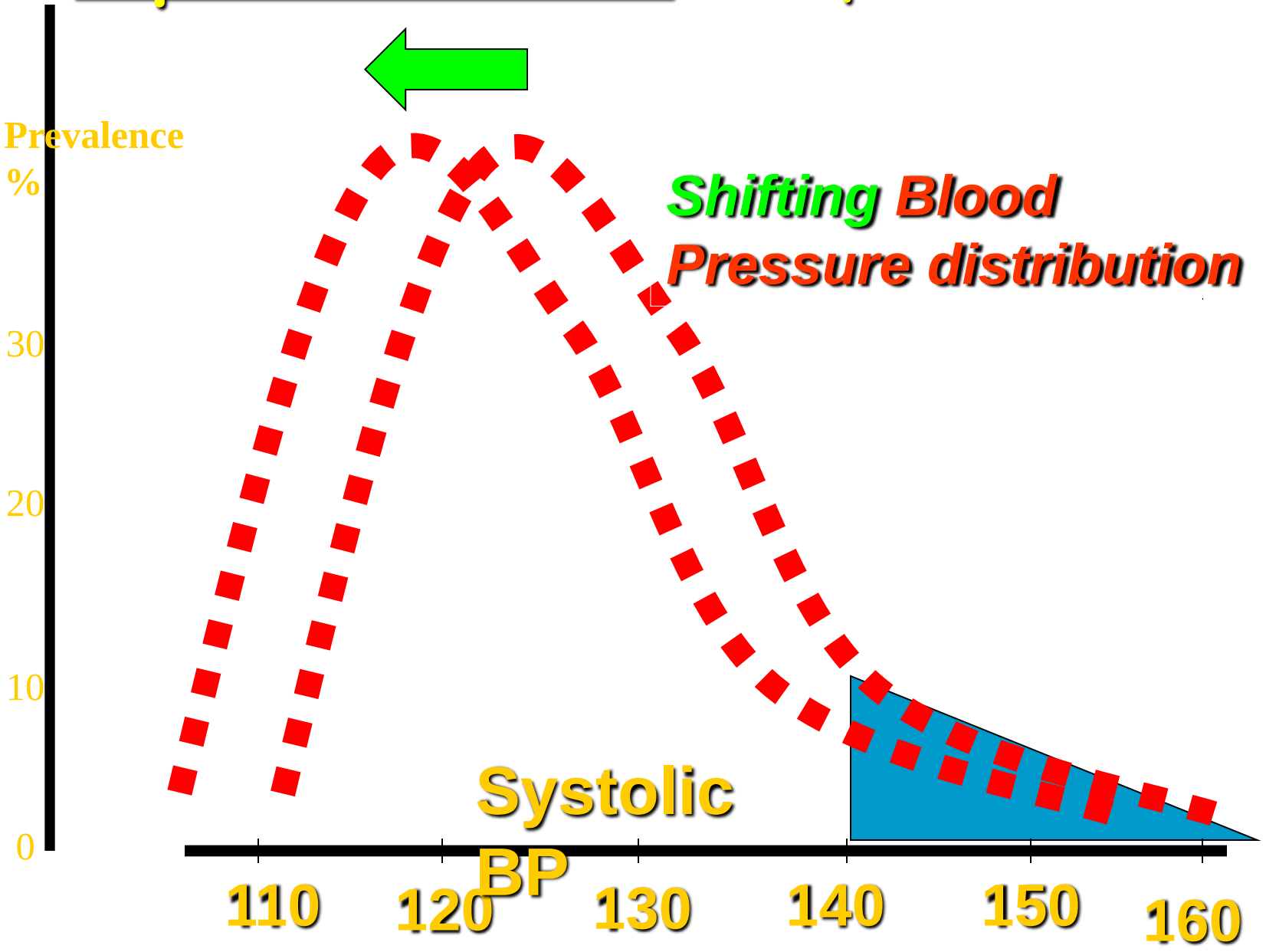

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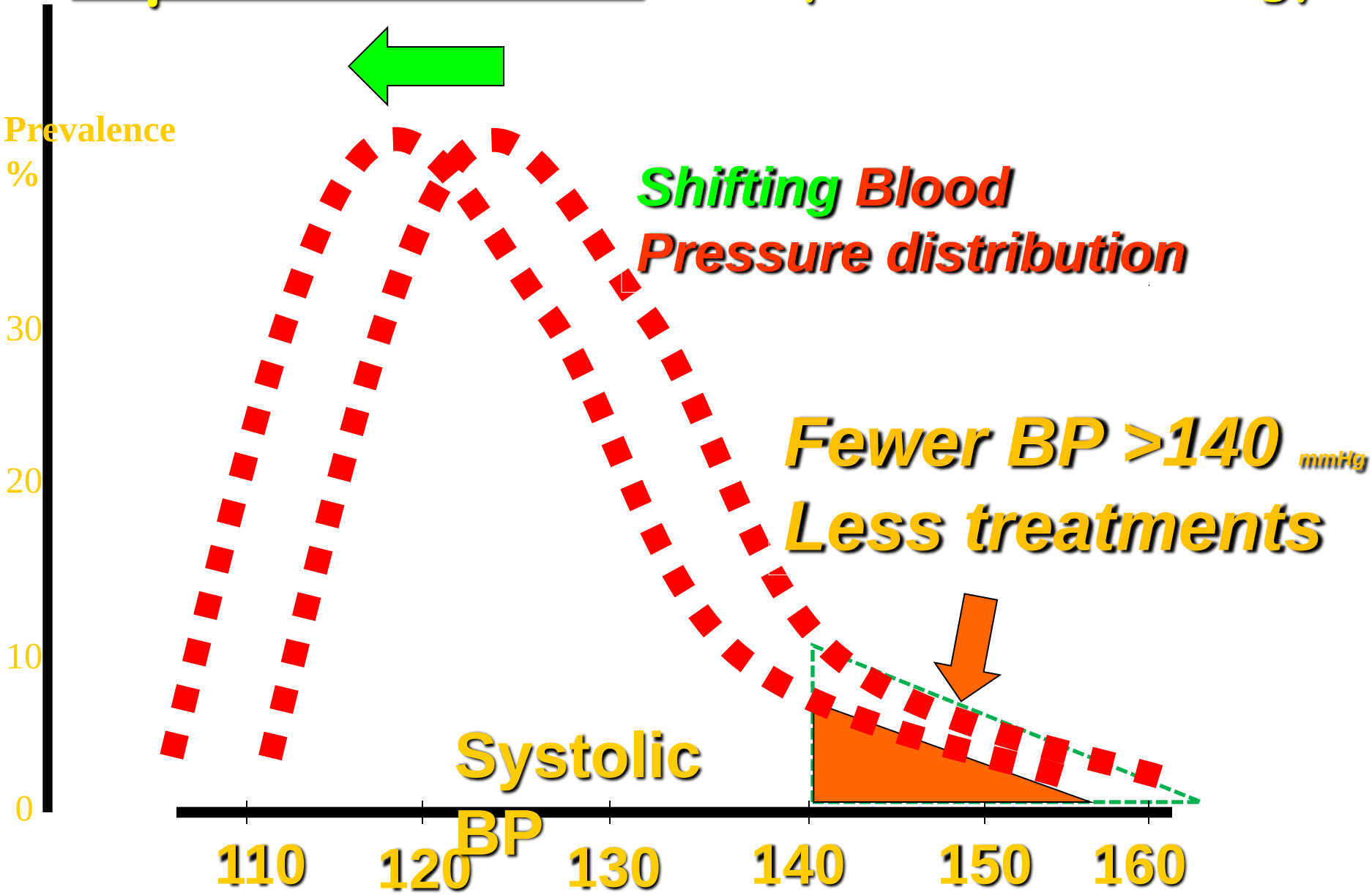

Whole-population approach for preventing CVD: successful policies

- ***Farmers' subsidies to stop dairy & beef ,***

& increase fruit & berry production *(Finland)*

- ***Support food reformulation*** *(All)*

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Whole-population approach for preventing CVD: successful policies

- ***Farmers' subsidies to stop dairy & beef , start fruit & berry production*** *(Finland)*
- ***Support food reformulation*** *(All)*
- ***Banning transfats*** *(Denmark, Switzerland, Austria)*
- ***Slashing dietary salt*** *(Finland)*
- ***Promoting smoke-free public spaces***

(Ireland, UK ,Italy etc)

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Ireland: modelling reductions in cardiovascular risk factors

Primary Prevention

Population Approach

⇓ Risk Factors in everyone

Versus

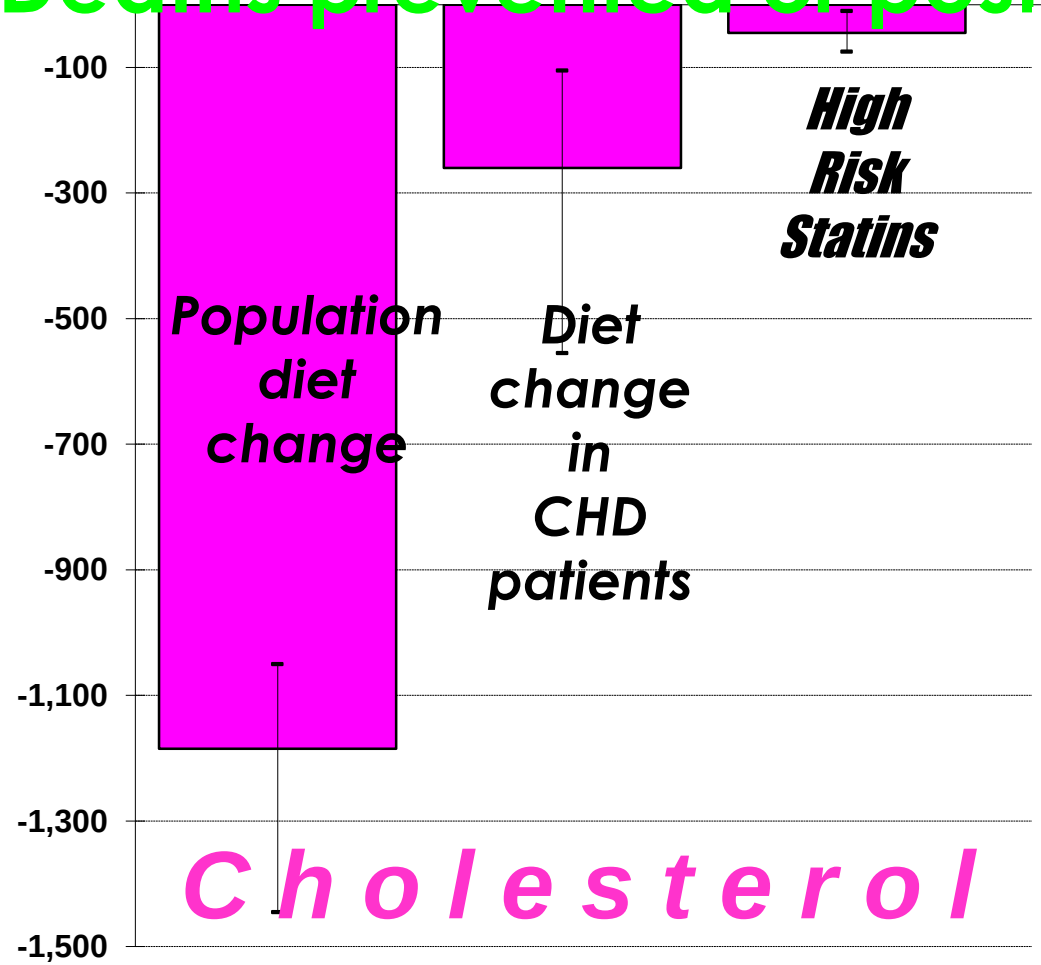
High Risk strategy

using statin & blood pressure medications

BMC Public Health 2007 7 117

CHD prevention in Ireland 1985-2000: Population v. *High Risk Strategies*

Deaths prevented or postponed (Sensitivity analysis)



BMC Public Health. 2007; 7:117.

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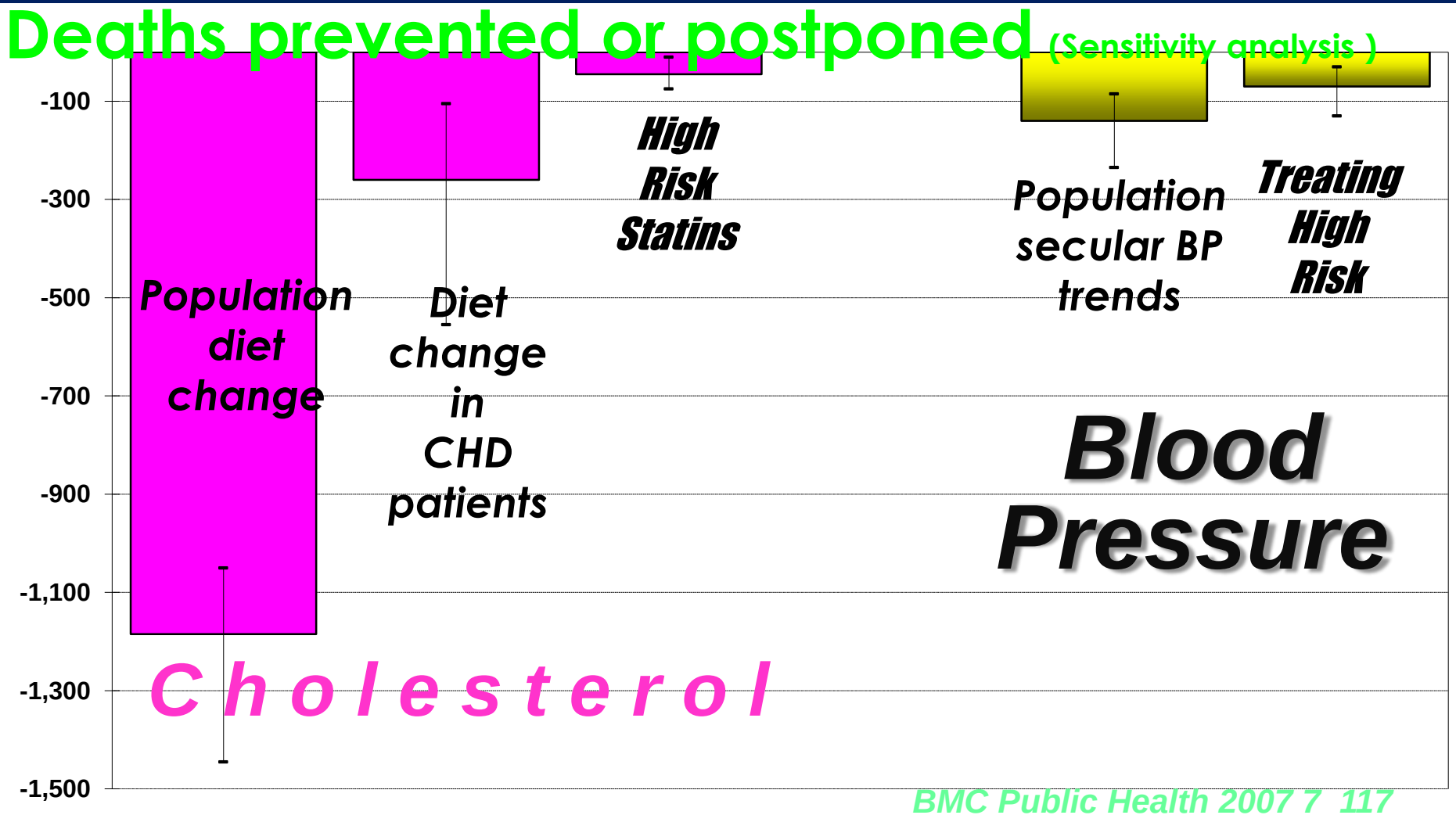

BMC Public Health 2007 7 117

RESCAP-MED
Research Capacity for public health in the Mediterranean

CVD PREVENTION & INEQUALITIES

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Will CVD prevention widen health inequalities?

Capewell & Graham PLoS Medicine 2010

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The *UK high risk approach* for preventing CVD

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UK Department of Health programme:

NHS Health Checks

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The *UK high risk approach* for preventing CVD

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UK Department of Health programme:

NHS Health Checks

- All adults aged 40+ screened for CVD risk
- If 20%+ risk CVD event in the next ten years, treat with:
  - lifestyle advice plus
  - tablets to reduce cholesterol & blood pressure

Capewell & Graham PLoS Medicine 2010

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Evidence that high risk approach may increase social inequalities

Tudor Hart's "Inverse Care Law"

Tugwell's "staircase effect"

J Tudor Hart . The inverse care law. Lancet 1971; 1; 405. P Tugwell; BMJ 2006; 332; 358

Capewell & Graham PLoS Medicine 2010

Evidence that high risk approach may increase social inequalities

Tudor Hart's "Inverse Care Law"

- The availability of good medical care tends to vary inversely with actual need

Tugwell's "staircase effect"

Disadvantage can occur at every stage:

- Health beliefs, health behaviour, presentation participation, persistence or adherence

J Tudor Hart . The inverse care law. Lancet 1971; 1; 405. P Tugwell; BMJ 2006; 332; 358

Evidence that high risk approach may increase social inequalities

Prescribing gradients

Long term adherence

Smoking cessation

Nutrition interventions in individuals

Oldroyd J. JECH 2008; 62:573. Thomsen R W, Br J Clin Pharm. 2005; 60;534; Ashworth, M, QJof Amb Care Management: 2008; 31; 220; Vrijens B, BMJ 2008;336:1114; Morisky D. Clin Hypertension 2008; 10; 348 Johnell K BMC Public Health 2005, 5:17 Chaudhry HJ. Current Ather. Rep 2008; 10; 19; Bouchard MH, Br J Clin Pharmacol. 2007 63(6): 698

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Evidence that whole POPULATION CVD prevention reduces social inequalities

Kivimaki, Marmot et al ***Lancet 2008***

15 year risk of CHD death

- **calculated in British men aged 55**
- **quantified the benefits of decreasing risk factors uniformly across population**

[systolic blood pressure ⇓10mmHg

total cholesterol⇓ 2mmol/l & glucose ⇓ 1 mmol/l]

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- **calculated in British men aged 55**
- **quantified the benefits of decreasing risk factors uniformly across population**

  [systolic blood pressure ⇓10mmHg

  total cholesterol⇓ 2mmol/l & glucose ⇓ 1 mmol/l]
- **Would reduce the *absolute* mortality gap between affluent & deprived by ≈70%**

Evidence that whole POPULATION CVD prevention reduces social inequalities

Diet interventions

Folic acid fortification of cereals (USA population1996)

Dowd IJE 2008; 37(5):1059

Evidence that whole POPULATION CVD prevention reduces social inequalities

Diet interventions

Folic acid fortification of cereals (USA population1996)

Blood folate levels: Social gradients ⇓⇓ ≈ 70%

Dowd IJE 2008; 37(5):1059

Evidence that whole POPULATION CVD prevention reduces social inequalities

Smoking

- **cigarette price increases more effective in deprived groups** Townsend BMJ 1994; 309; 923

"increase in tobacco price may have the potential to reduce smoking related health inequalities"

Main Meta-analysis. BMC Public Health 2008; 8; 178

CVD prevention & health inequalities

VERDICT

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♥ High Risk Strategies

to screen & treat individuals

typically widen social inequalities

Capewell & Graham PLoS Medicine 2010

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CVD prevention & health inequalities

RESCAP-MED
Research Capacity for public health in the Mediterranean

VERDICT

- High Risk Strategies to screen & treat individuals typically widen social inequalities
- Population wide policy interventions usually narrow the inequalities gap

SEVENTH FRAMEWORK PROGRAMME

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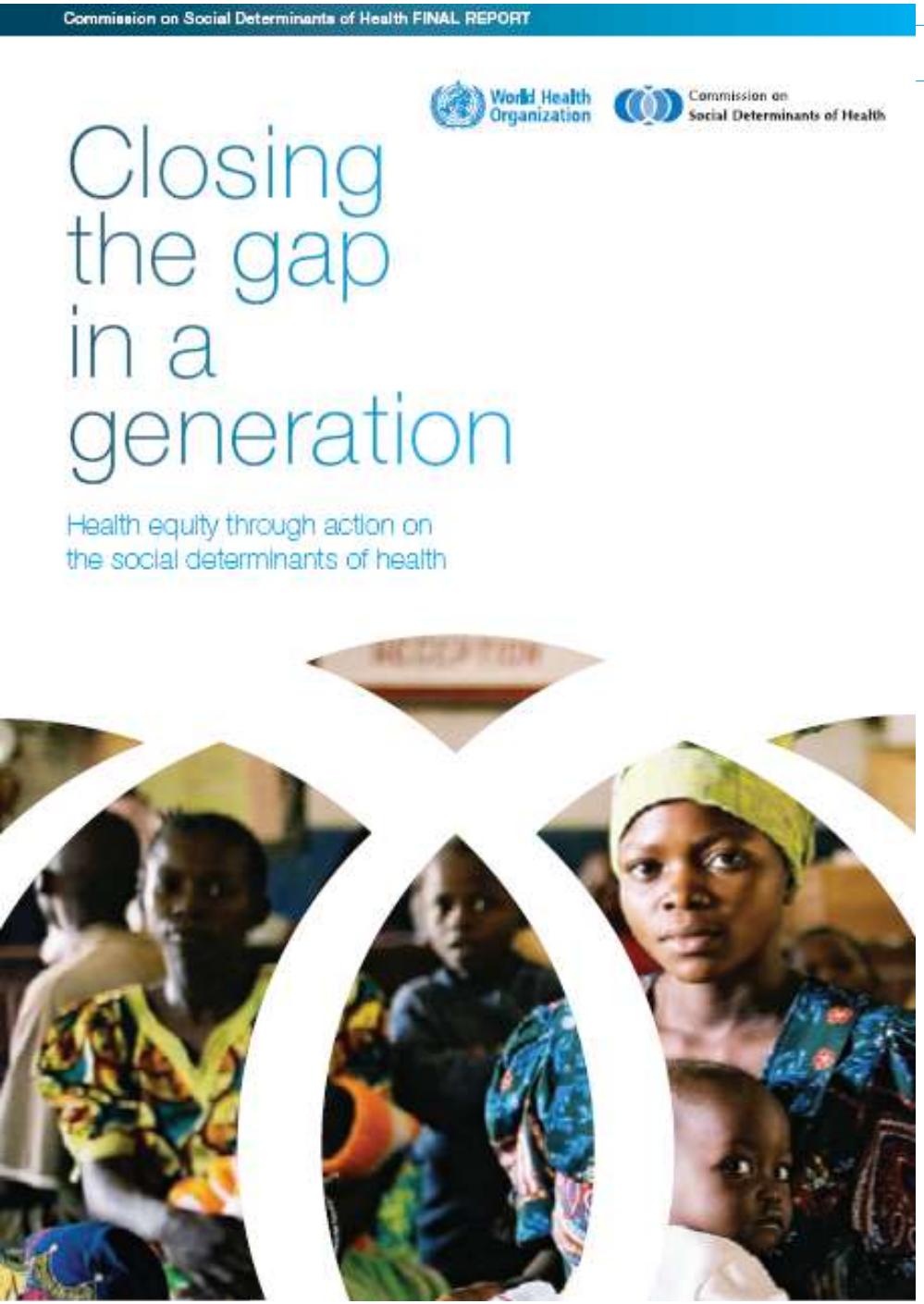
RESERVE SLIDES



WHO Commission on Social Determinants of Health

2008

Life expectancy at birth (men)

Glasgow, Scotland (deprived suburb)	54
India	61
Philippines	65
Lithuania	66
Poland	71
Mexico	72
Cuba	75
US	75
UK	76

WHO Commission on Social Determinants of Health 2008

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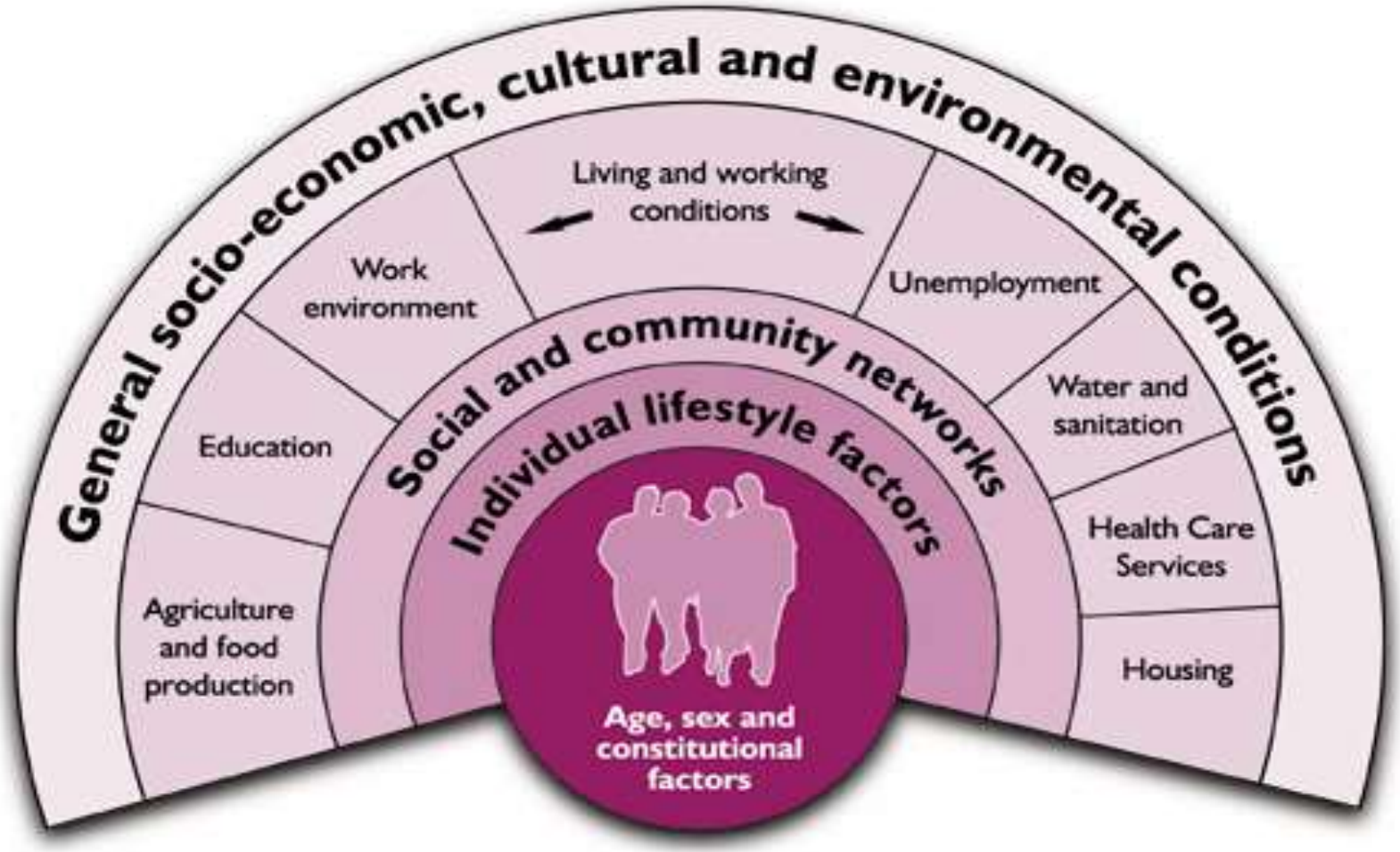
Cuba	**75**
US	**75**
UK	**76**
Glasgow, Scotland (affluent suburb)	**82**

WHO Commission on Social Determinants of Health 2008

Determinants of Health - Broadening Involvement



Whitehead and Dahlgren (1996) Tackling Inequalities in Health

Key determinants of health call for an 'open' health sector

Environment, water and sanitation, education, employment, trade, tourism, agriculture, fisheries and food, transport and infrastructure, social policy and welfare, energy, accommodation and housing

WHO Commission on Social Determinants of Health

Three overarching recommendations:

- **Improve** conditions of daily life
- **Tackle** the inequitable distribution of power, money & resources
- **Measure** & understand the problem and assess the impact of action

http://www.euro.who.int/socialdeterminants/publications/publications

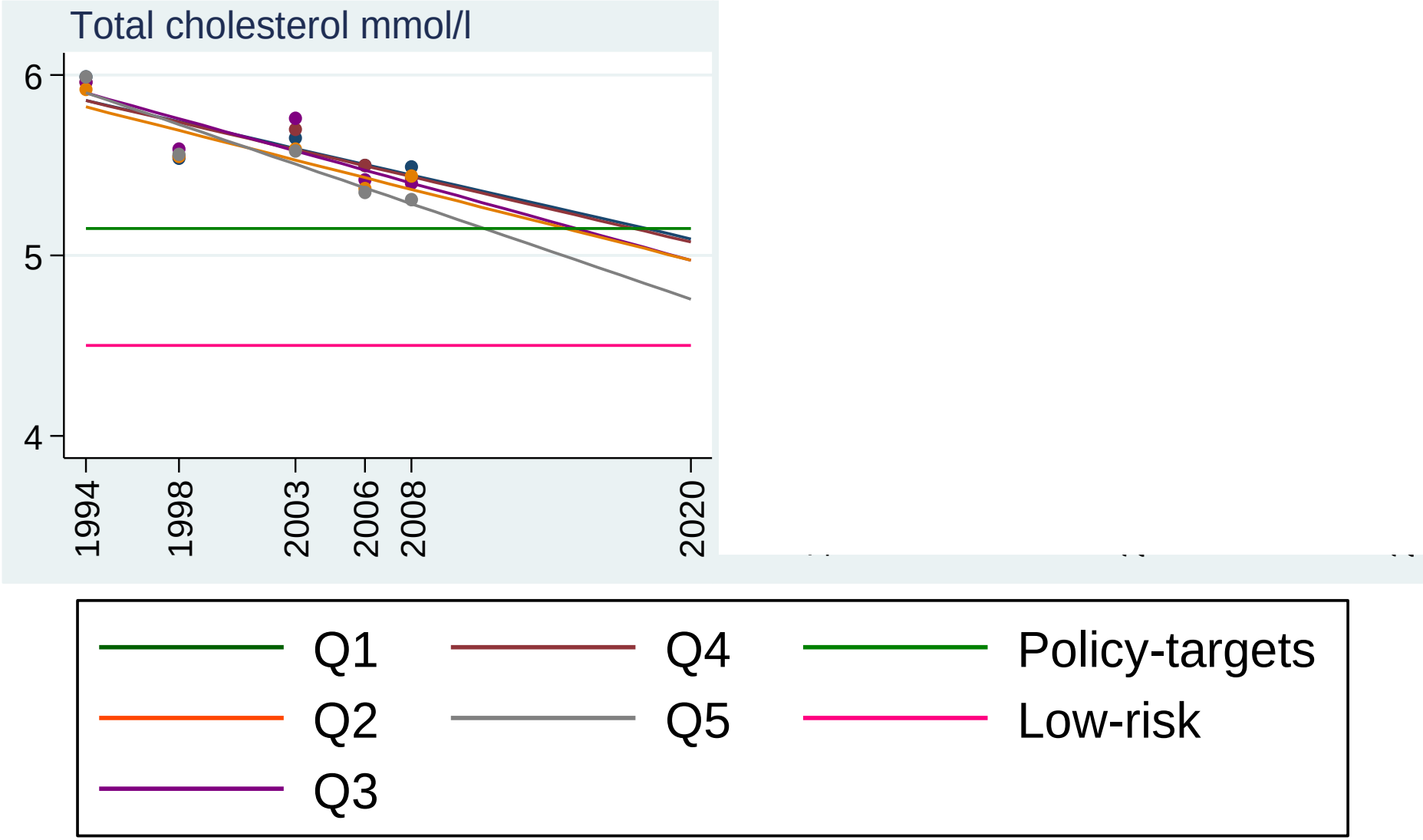
- CHD Mortality trends Global & UK
- UK trends by socio-economic circumstance (SEC):
  - CHD Mortality trends; risk factor trends
- IMPACTsec: explaining recent UK mortality trends
- DISCUSSION 1: Main research messages for L&G

UK trends to 2020

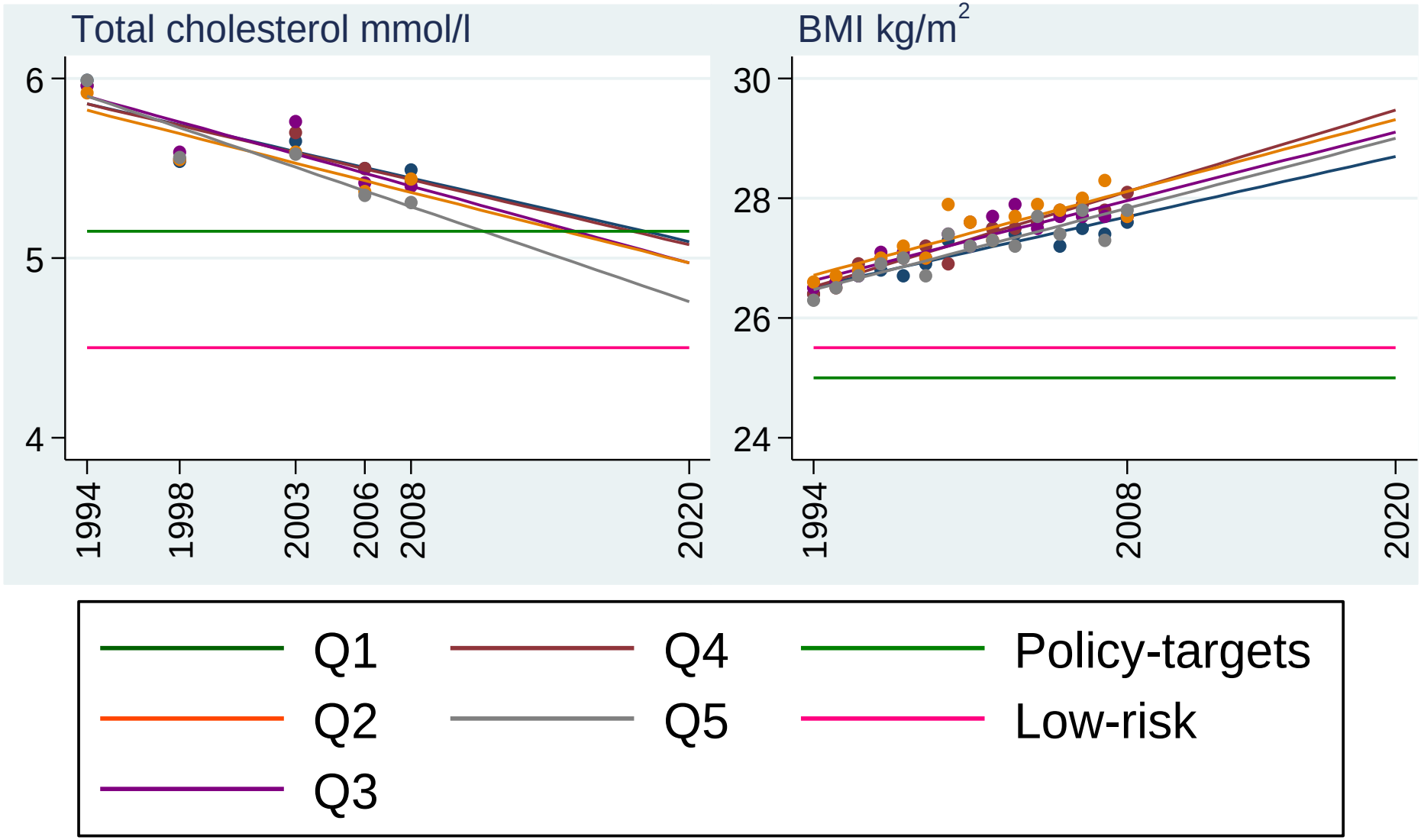
- **Risk factors; Treatments; CHD mortality**

Major risk factors: projecting trends to 2020

Major risk factors: projecting trends to 2020

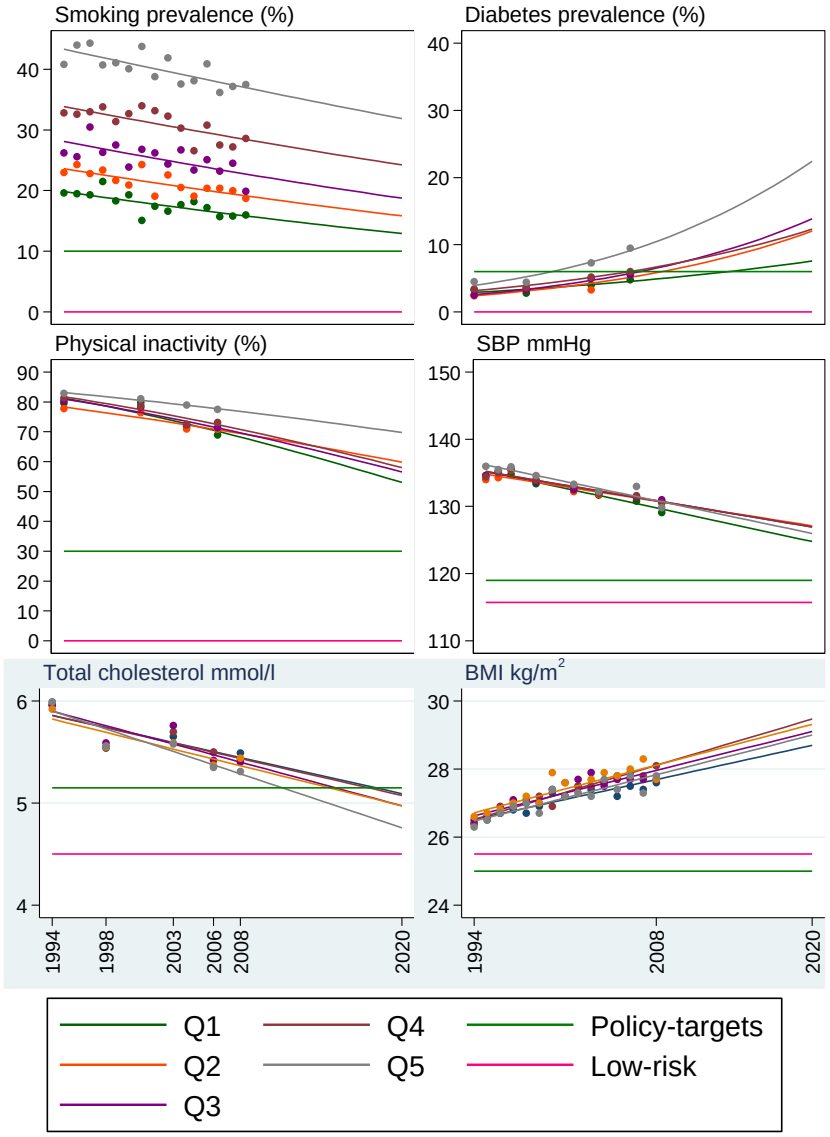


Major risk factors: projecting trends to 2020



Major risk factors: projecting trends to 2020

Men



Major risk factors: projecting trends to 2020

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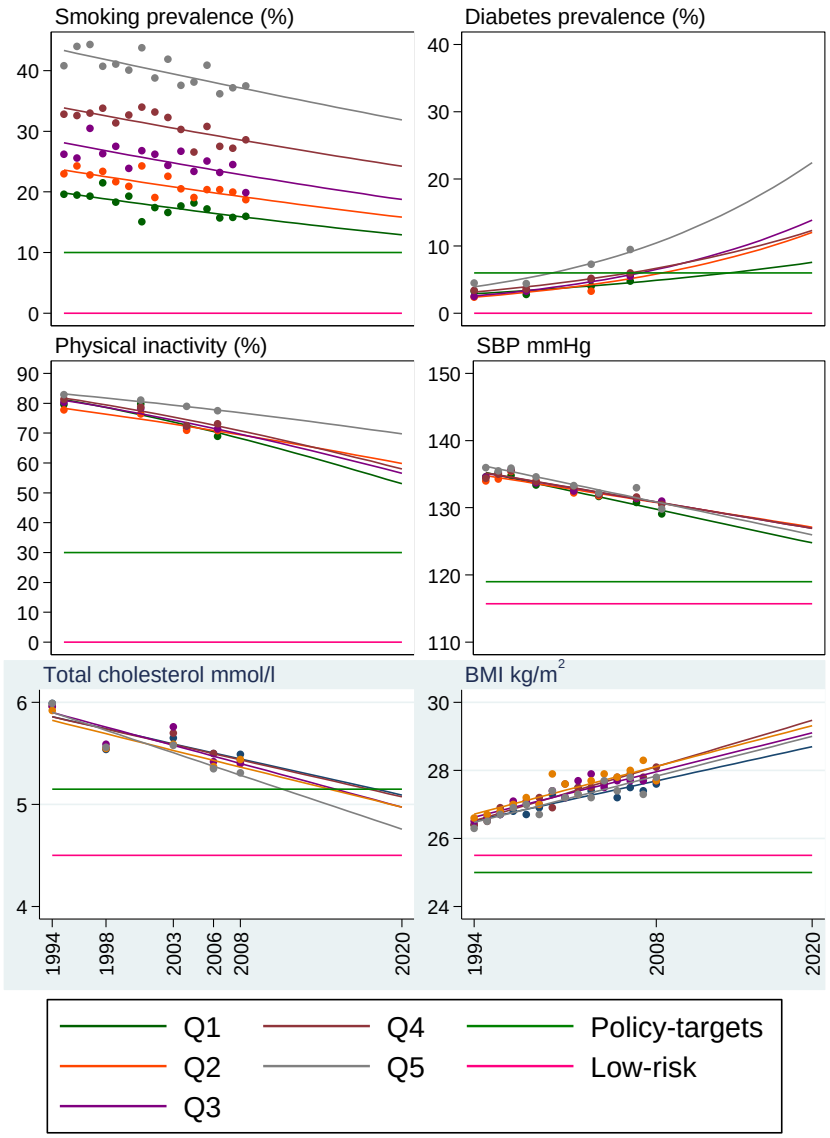
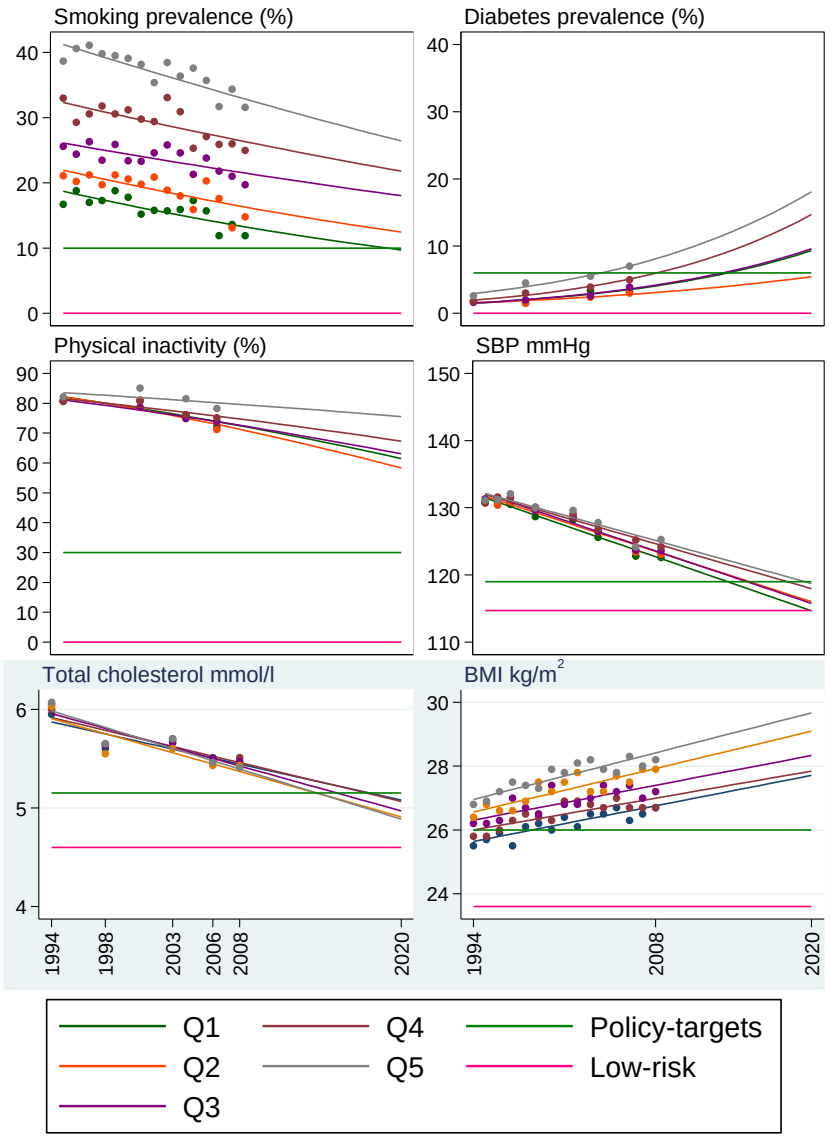


Women



IMPACTsec 2020

Future scenarios to 2020

IMPACTsec 2020

Future scenarios to 2020: What will happen to CHD inequalities if recent trends continue, or targets met, or low-risk levels achieved?

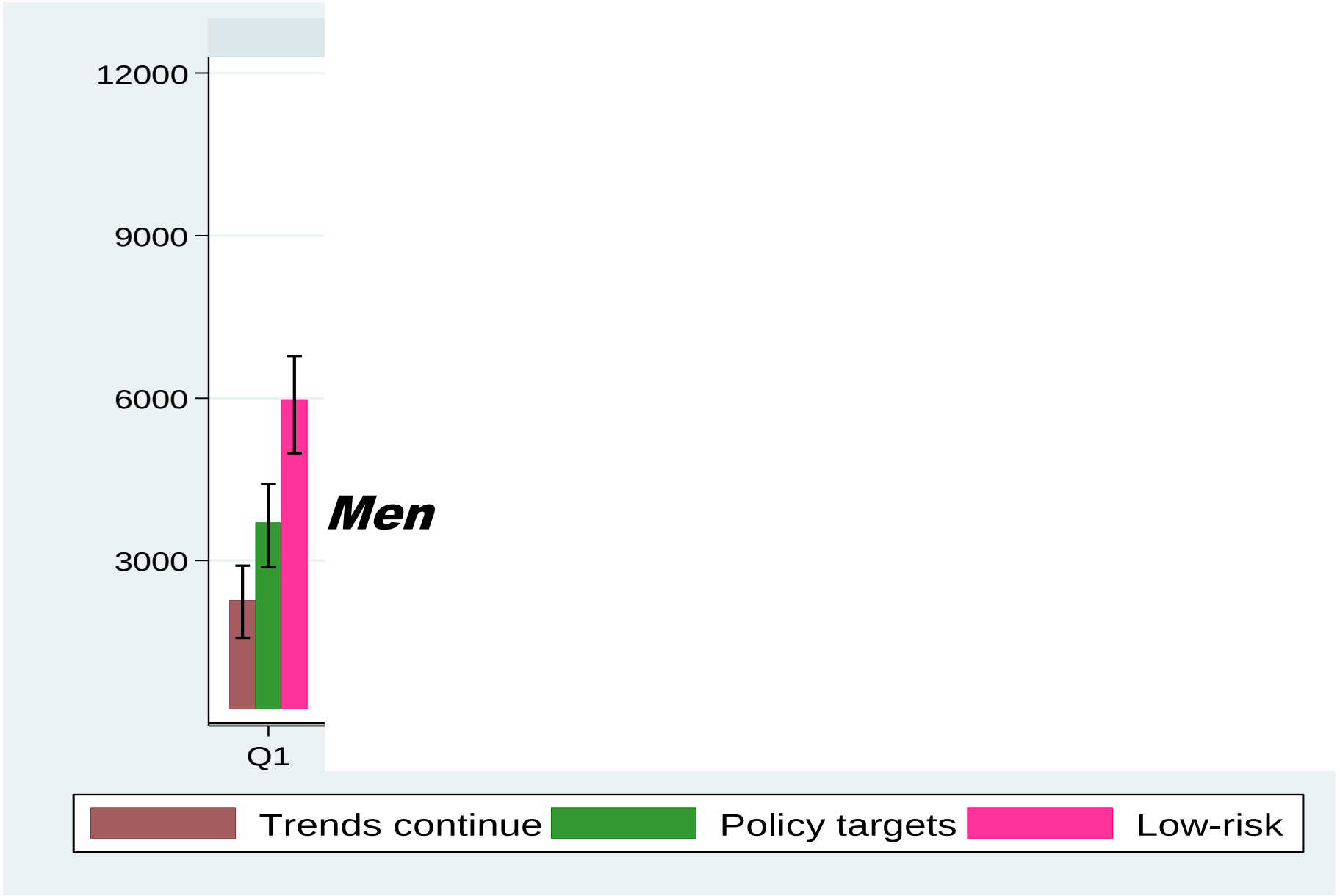
- 3 scenarios
  - Project past trajectories forwards (from mid-1990s)
  - Health targets met for ALL social groups
  - ALL social groups reach the healthy low-risk profile

IMPACTsec 2020

Future scenarios to 2020: What will happen to CHD inequalities if recent trends continue, or targets met, or low-risk levels achieved?

- 3 scenarios
  - Project past trajectories forwards (from mid-1990s)
  - Health targets met for ALL social groups
  - ALL social groups reach the healthy low-risk profile
- Only Risk Factor trends considered
  (assumed treatment uptakes remain equitable)

IMPACTsec Deaths potentially prevented in 2020



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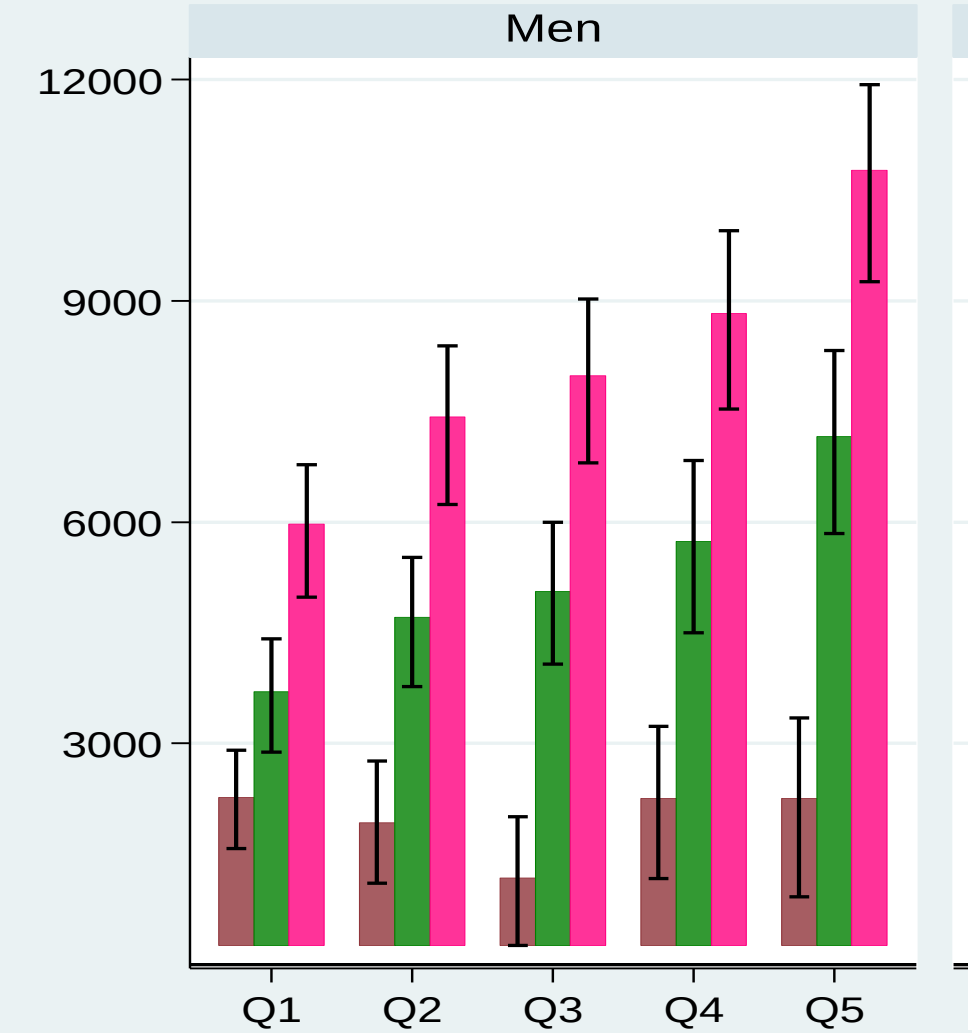

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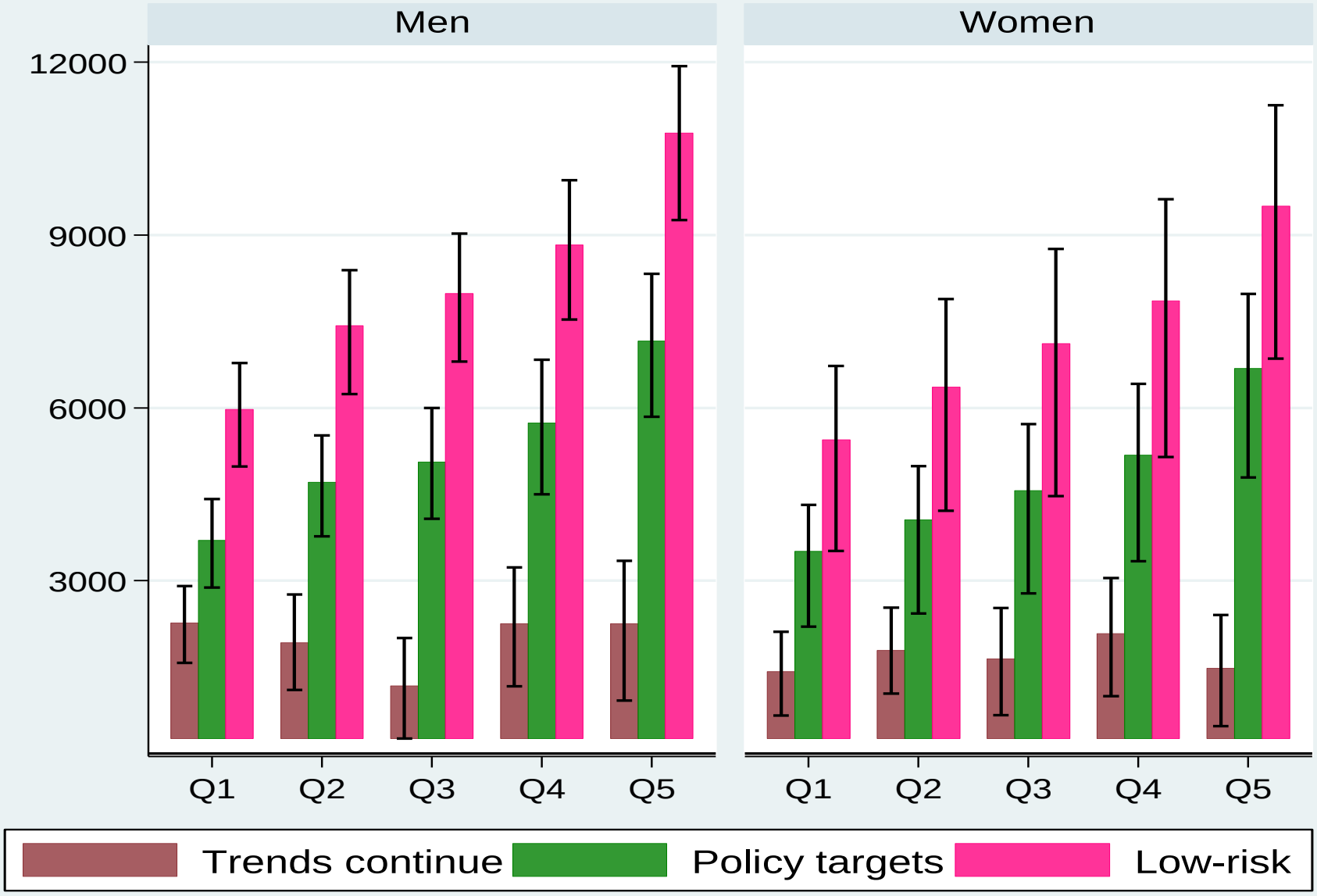

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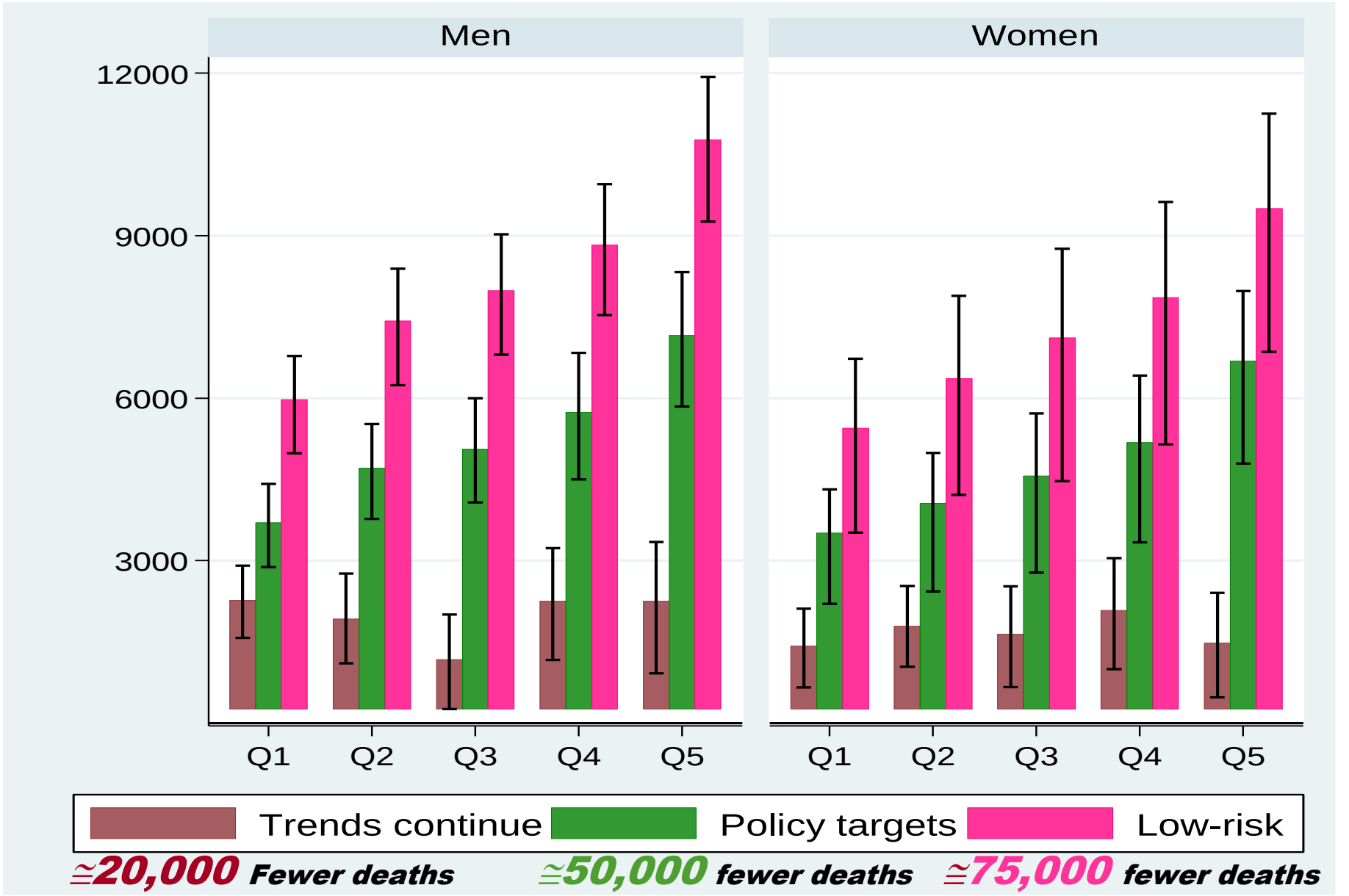


Policy implications of 2020 'scenarios'

- **Actuaries**
  - **Falls in overall mortality rates anticipated**
  - **Relative inequalities in CHD mortality likely to persist**
  - **Risk factor trajectories suggest that SEC differentials will continue to widen *(unless stronger policy actions)***

Policy implications of 2020 'scenarios'

- Actuaries
  - Falls in overall mortality rates anticipated
  - Relative inequalities in CHD mortality likely to persist
  - Risk factor trajectories suggest that SEC differentials will continue to widen *(unless stronger policy actions)*

- **Health Policy Interventions**
  - **Regulation & Legislation would have biggest impact on reducing risk factor levels, especially in disadvantaged**

    (Capewell, NICE)
  - **?Target disadvantaged groups, aim to level-up to 'best', 'proportionate universalism'?**

DISCUSSION 2

Burning questions for Istanbul?

DISCUSSION 2

Burning questions for Istanbul?

Increasing gap between **rich** & **poor**: effects on CHD?

Trends in **CHD, Cardiovascular disease** & **common cancers (NCDs)** ?

Future effects of **tobacco legislation**?

Transfat bans?

Why recent **population falls** in **cholesterol** or in **blood pressure**?

Key questions *(Istanbul)*

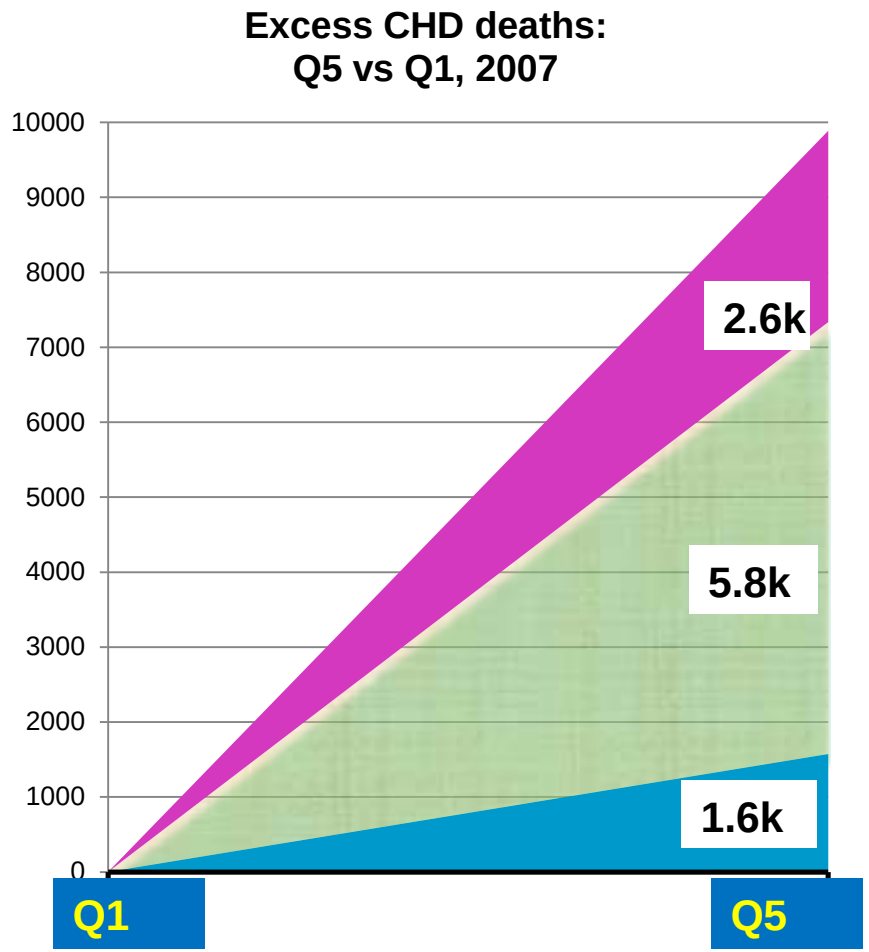
1. What are the key policy changes or new drug developments that would affect mortality trends in the near future?
2. How will the gap in life expectancy between SEC change over, *say next 30 years?*
3. How will the gap in life expectancy between genders change over, say next 30 years?
4. What are the key drivers for the future fall in mortality for different SEC?
5. How would these mortality drivers affect different SEC?

IMPACTsec team

- **Legal & General – Dr Madhavi Bajekal, Dr Shaun Scholes, Hande Love**
- **UCL – Prof Rosalind Raine,**
- **Liverpool University – Prof Simon Capewell, Dr Martin O'Flaherty, Dr Nat Hawkins**

- **Advisory Group**

Which factors explained 'excess' CHD mortality in Q5 compared to Q1?
(PROVISIONAL ANALYSIS)

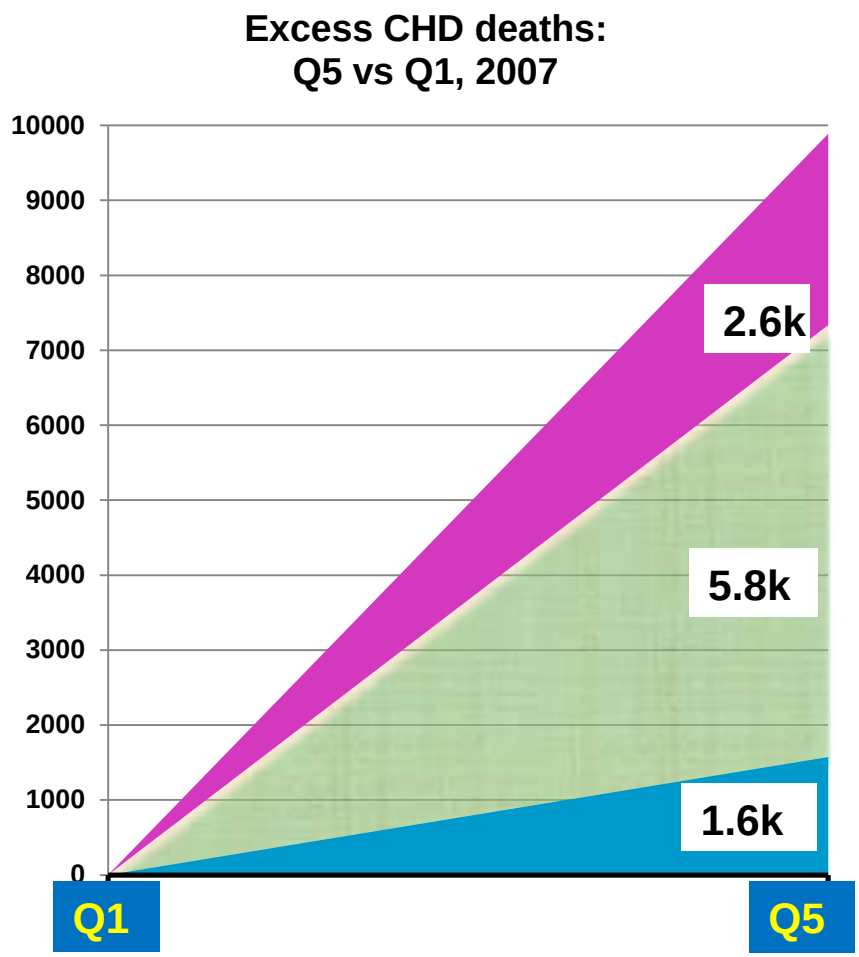


Higher treatments uptake in Q1 + 26%

Lower risk factor levels in Q1 + 58%

% Unexplained by model + 16%

Which factors explained 'excess' CHD mortality in Q5 compared to Q1?
(PROVISIONAL ANALYSIS)



Treatments uptake	*+ 26%*
AMI/NSTEACS	+ 4%
2' post MI	+ 5%
2' post-revasc	+ 1%
Stable Angina	+ 7%
Heart failure	+ 9%
1' statin/hypertension	+ 0%
Risk Factors	*+ 58%*
BMI	+ 2%
Diabetes	+ 11%
Smoking	+ 26%
Cholesterol (better Q5)	- 3%
SBP fall	+ 12%
Physical inactivity	+ 1%
Fruit & Veg	+ 10%
Unexplained	16%

Parameters and calculation

- **Treatments (numbers)**

  a) Eligible patients – Acute MI, Angina, Heart Failure

  b) Treatment uptake: 1^0 (eg statins, BP) + 2^0 prevention medication+ surgical interventions (CABG, PTCA)

  c) Case fatality rate by diagnosis (one year)

  d) Estimated mortality red'n due to treatment (one year)

Calculation

- ***DPP for one year = a*b*c*d***
- ***Change DPP= DPP final – DPP base***

Treatments 1- eligible patient counts

Condition	Hospital	Community
STEMI	60% AMI admissions (HES)	
NSTEMI + Unstable Angina (or NSTEACS)	40% AMI admissions + 100% UA admissions (HES)	
2' post-revascularisation (CABG/PTCA/PCI)	2000-2007 counts from HES, adjusted for survival	
2' post-MI		GPRD
Chronic angina (no MI)		GPRD
Heart Failure	50% admissions (HES)	50% prevalence (GPRD)
1' lipid lowering drugs		HSfE
1' hypertensive treatment		HSfE

Treatments 2 – medical therapies

Condition	Drugs	Interventions	Other
STEMI	MINAP	PPCI & thrombolysis (MINAP)	CPR – H (MINAP) CPR – cmty (no change)
NSTEMI + Unstable Angina	MINAP	CABG/PCI (HES)	CPR – H (MINAP)
2' post-revascularisation (CABG/PTCA)	GPRD		Rehabilitation (Bethell + National Audit)
2' post-MI	GPRD		Rehabilitation (Bethell + National Audit)
Chronic angina (no MI)	GPRD		
Heart Failure - H	NHS Heart Failure Survey, 2005		
Heart Failure - Cmty	GPRD		
1' lipid lowering drugs	HSfE (no CHD)		
1' hypertensive treatment	HSfE (no CHD)		

Treatments 3 - challenges

- **Low or *Negative* Tx DPPs – because numbers admitted *higher* in 2000 than 2007 eg for HF**

– Applied treatment uptake rates in 2000 to patient counts in 2007. Difference gives net DPPs

- **Patient overlaps**
- **Mants & Hicks adjustment to calc benefits from drug combinations**

Risk Factor methods

Legal & General

Parameters and calculation

Continuous measures

– Systolic BP, BMI, total cholesterol, fruit and vegetable consumption

- **Regression approach:**

(deaths base year)* (1-e $^{(\Delta \text{ in RF*beta coeff})}$)

Binary measures

– Smoking, diabetes, physical activity

- **PARF (population attributable risk factor) approach:**

(deaths base year)* (PARF final – PARF base)

Risk Factors 1 - description

Risk factor	HSfE survey years	Description
Current cigarette smoking	**2000-7**	Self-reported status
SBP (mmHg)	**2000-7, except 2004**	Mean of the 2nd and 3rd readings
Fruit and vegetable consumption	**2001-7**	Measured in portions per day
Body Mass Index	**2000-7**	Weight (kg)/ height squared (m^2)
Total cholesterol (mmol/l)	**1998, 2003, 2006**	Subdivisible into those on lipid-lowering drugs and those not on drugs
Physical (in) activity	**1998, 2003, 2006**	% not doing 30+ minutes of moderate or vigorous leisure –time activity at least 5 days/ per week.
Diabetes	**1998, 2003, 2006**	Doctor diagnosed diabetes, excl pregnancy

Risk factors 2 - challenges

- **Sample sizes per year too small for precise estimates by age (7), sex (2) and SEC (5)**
- **Fixed gradient approach used for SEC estimates**

– Pooled survey data (2000-07) by SEC and calc scaling factor for each SEC relative to the national level for each age/sex groups

– Applied SEC scaling factors to England values in 2000 & 2007 (or nearest available year)

– Where end-points 7+ years, adjusted down change estimates (eg *7/8 for 1998, 2006 est)

Other model parameters

Treatments

- **Case fatality rates: Canadian IMPACT**
- **RRR due to Tx: Canadian IMPACT + updated to most recent published (Nat Hawkins)**

Risk Factors

- **Beta coeffs: US IMPACT + Cholesterol (ICELAND) + new Fruit and Veg (Duchet)**
- **Relative risk – US IMPACT**

Treatment uptake - *summary*

- Uptake of all drugs increased in all SEC groups between 2000 and 2007.
- No socioeconomic gradients in the uptake of treatment - NHS delivering equitable service.
- Treatments in the community increased most: eg drug treatment for angina + 2' prevention doubled, from around 30% to over 60%.
- However, uptake levels were still below optimal and need to increase further.

Main overall messages

- **CHD mortality decline accelerated post-2000 (35% fall)**
- **Nationally, the proportion mortality decline explained by Treatments and Risk Factors**

  changed from 40:60 *(in 1980-2000 period)*

  to 55:45 *(in post-2000 period)*
- **No SEC gradient in Treatment uptake**
- **Bigger than expected falls in population Blood Pressure**
- **% unexplained by model small in deprived, larger in affluent** *(range 2% Q5 to 20% Q1).* **Why?**

LIMITATIONS: With hindsight..

- **Extend time period – minimum 10 years (1997-2007)**
- **Micro-level GPRD data:**

– for accurate drug combination uptake; compliance over year;

– Eligible patients tightly defined, eg excluding MIs recorded 10+ years ago, unconfirmed diagnosis?

- **Include upstream risk factors – eg psychosocial status – to explain the 'unexplained' part of the model?**
- **Refine sensitivity analysis method: Credible limits for risk factor DPPs narrower than Tx – counter-intuitive!**

β Coefficients = % fall in CHD mortality per unit decrease in risk factors

(from meta-analyses & cohorts , Ford et al, NEJM 2007 356 : 2388

	Reduction in CHD deaths
Cholesterol lowering *PSC 2007*	
⇓ 0.1mmol/l mean pop cholesterol	≅ ⇓ 5%
Fruit & Veg *Duchet J Nutrition 2006*	
⇑ 1 portion/day	≅ ⇓ 4%
Blood pressure *PSC Lancet 2003*	
⇓ 1 mm Hg Systolic BP	≅ ⇓ 3.5% (log -0.035)
Obesity *Bogers, 2008*	
1 Kg/M² ⇓ BMI	≅ ⇓ 2.5%
Diabetes *InterHEART, 2004*	
1% ⇓ diabetic population	≅ ⇓ 2%
Smoking *InterHEART, 2004*	
1% ⇓ Smoking prevalence	≅ ⇓ 1%
Physical Activity *InterHEART, 2004*	
1% ⇓ inactive population	≅ ⇓ 0.3%

Ford et al NEJM 2007

Population risk factor change 1980/2000: Impact on CHD Mortality US example

3mmHg fall in systolic BP in women aged 55-64

CHD deaths in 1980		Beta coefficient		Risk Factor reduction 1980-2000		Deaths prevented or postponed (DPP)
a	x	β	x	c	=	a*(1-(EXPβ x c))
26,350	x	-0.035	x	3	=	2700 DPP

SOURCES

Mortality statistics	Oxford PSC meta-analyses	NHANES surveys

Ford et al NEJM 2007

Treating individual CHD patients - impact on population CHD mortality: US example

AMI: Thrombolysis & Aspirin, Men 55-64 years

Patients eligible	Treatment uptake	Relative risk reduction	Case Fatality	Deaths prevented or postponed (DPP)
a	x b	x c	x d	= a x b x c x d
102,280	X 21%	x 0.26	x 0.054	= 303

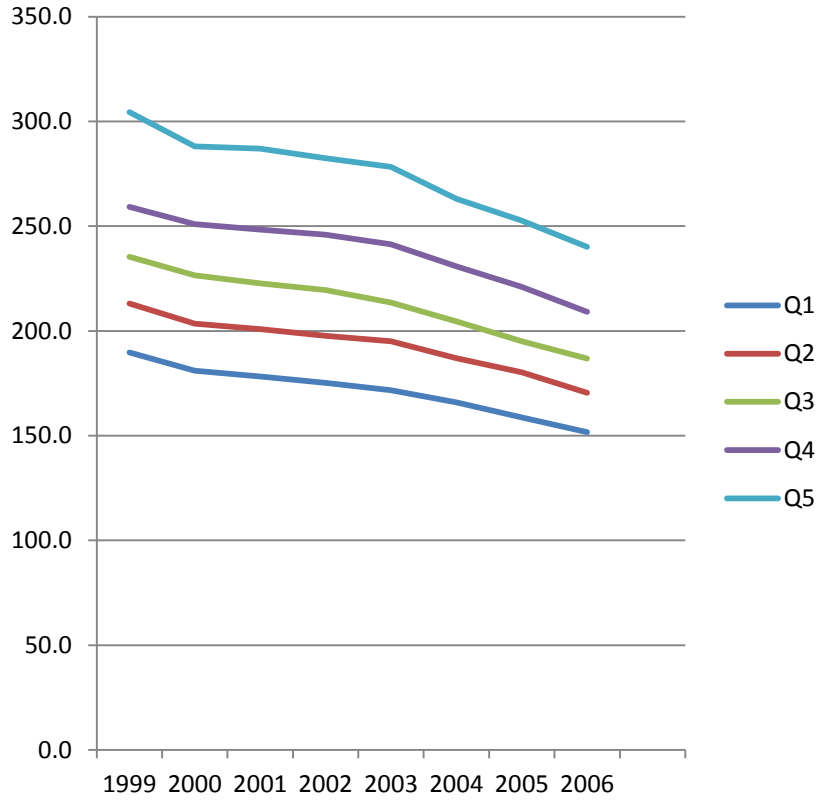
SOURCES

HES statistics	MINAP audits	Estess & FTT Meta-analyses	US/??

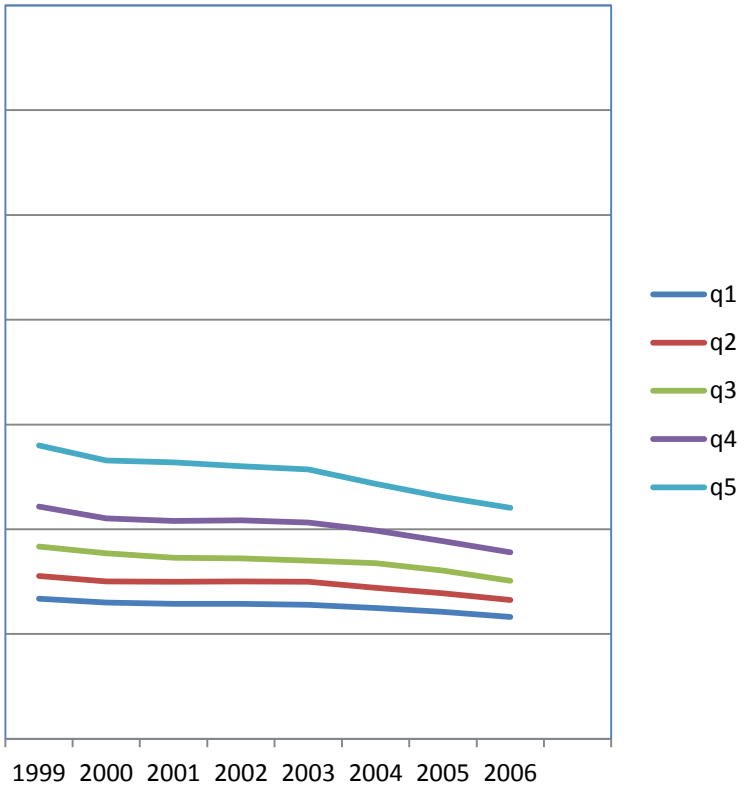
Ford et al NEJM 2007

Trends in AMI admissions 1999-2006 per 100,000 by deprivation quintiles

Males (3 year average)

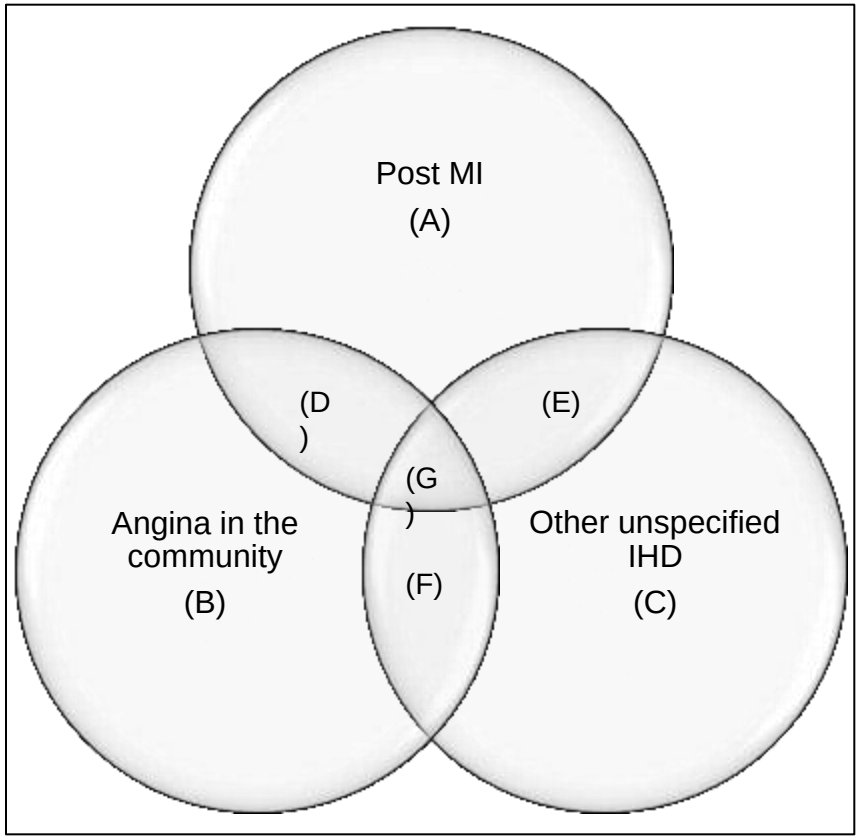


Females (3 year average)

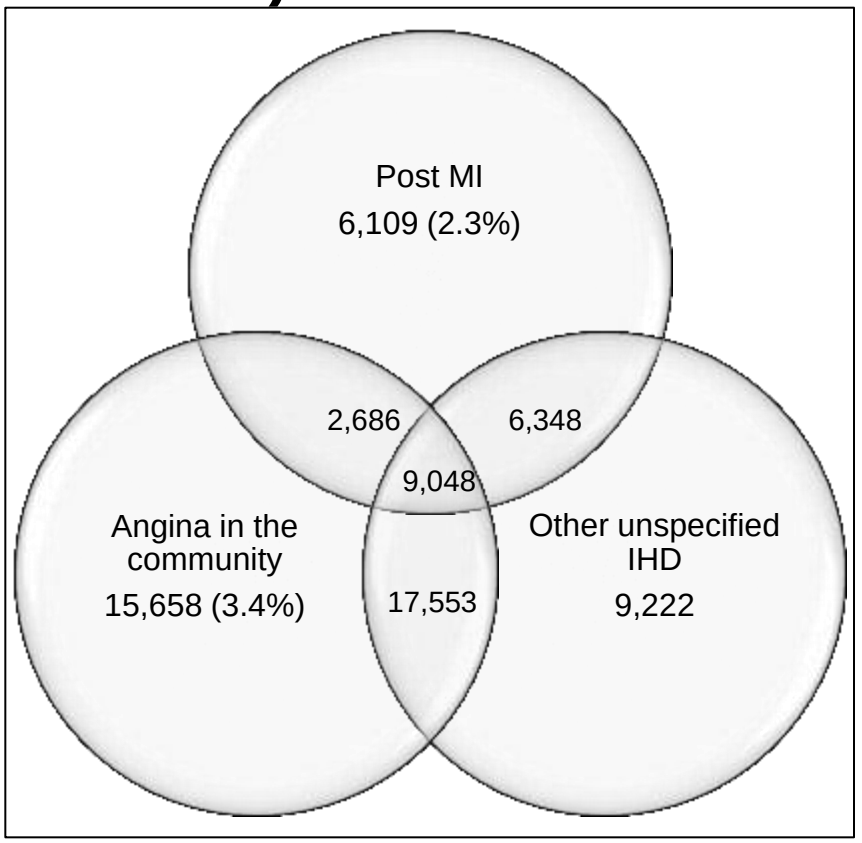


GPRD Data fuzziness: MI & Angina (not to scale)

Schematic diagram

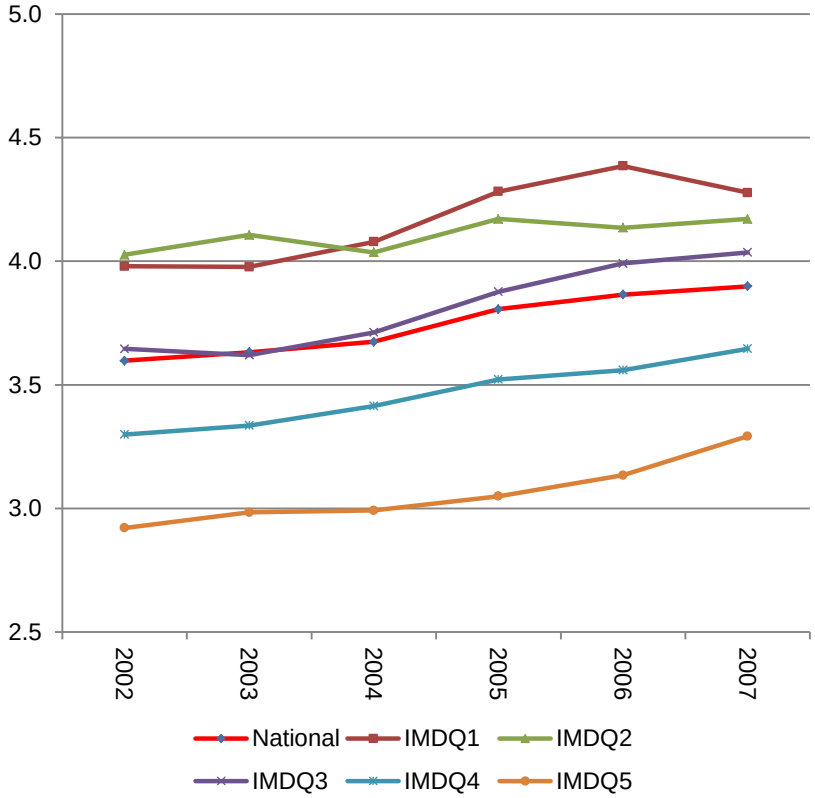


2006 – counts (pop prev in brackets)

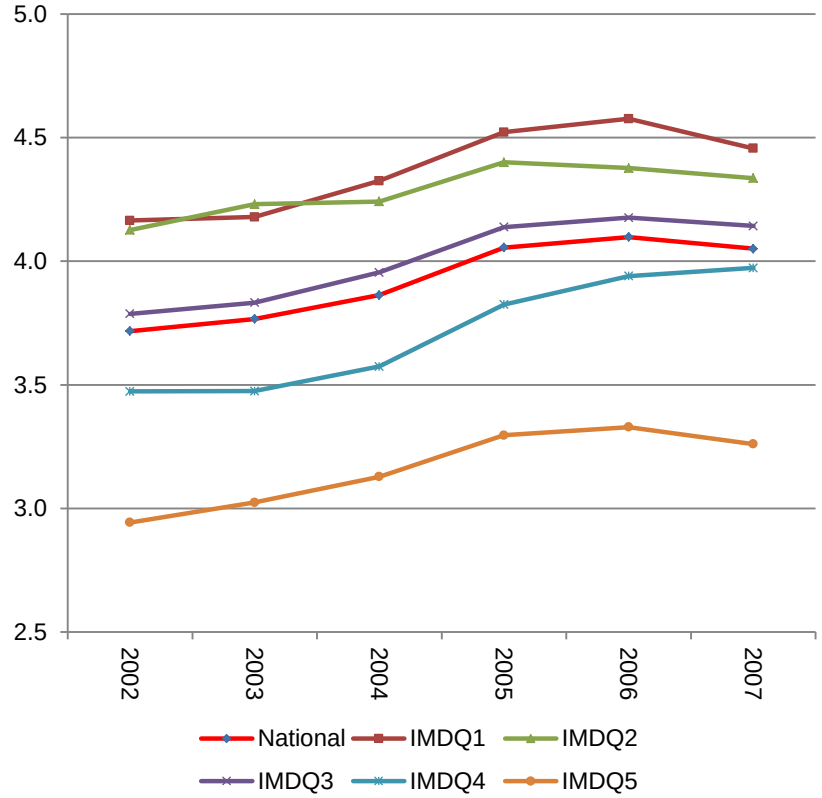


Fruit & veg (portions per day): trends by deprivation quintiles

Men 55+

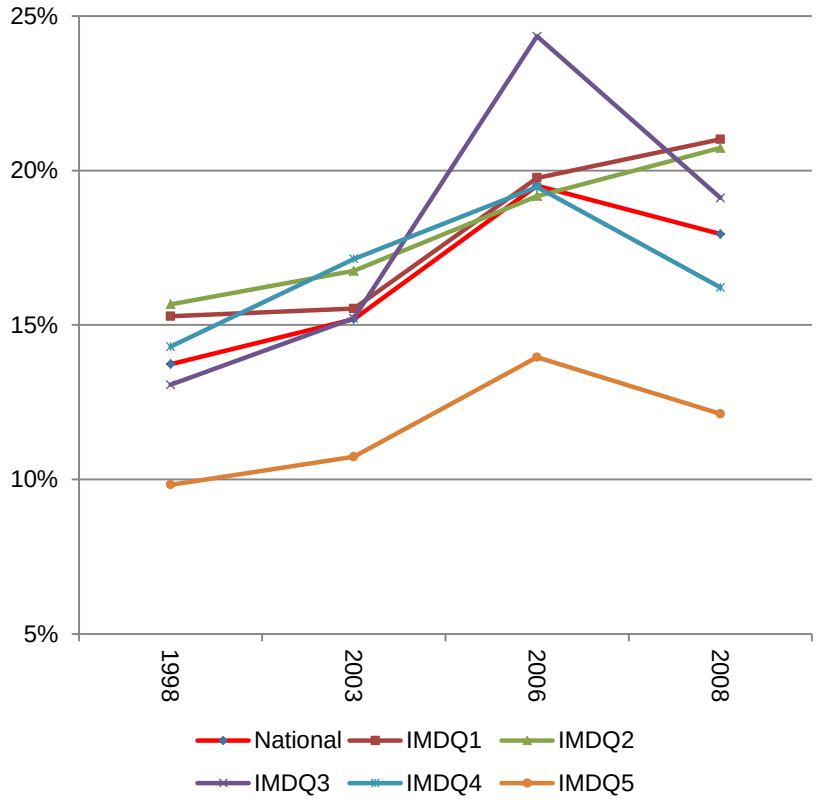


Women 55+

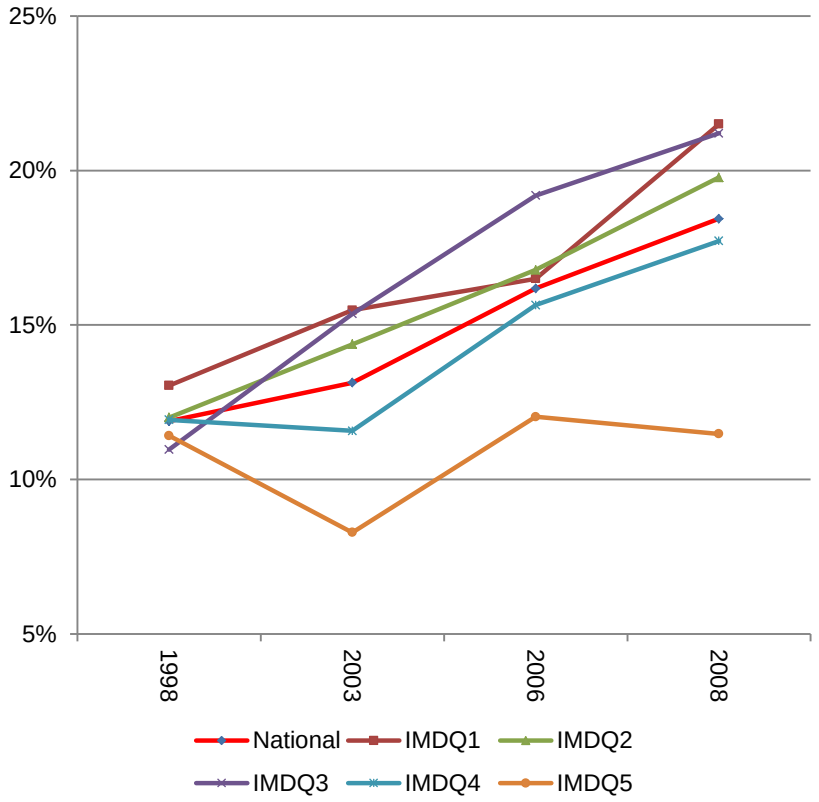


Meeting physical activity recommendations (%): trends by deprivation quintiles

Men 55+

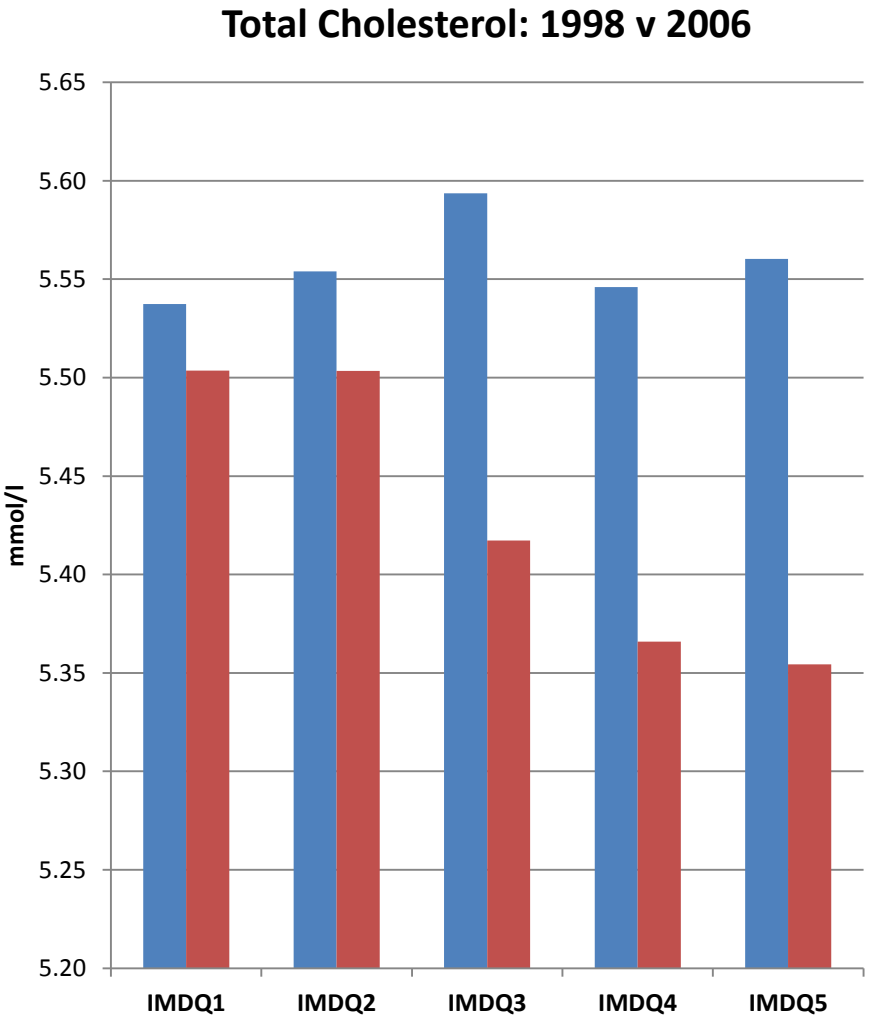


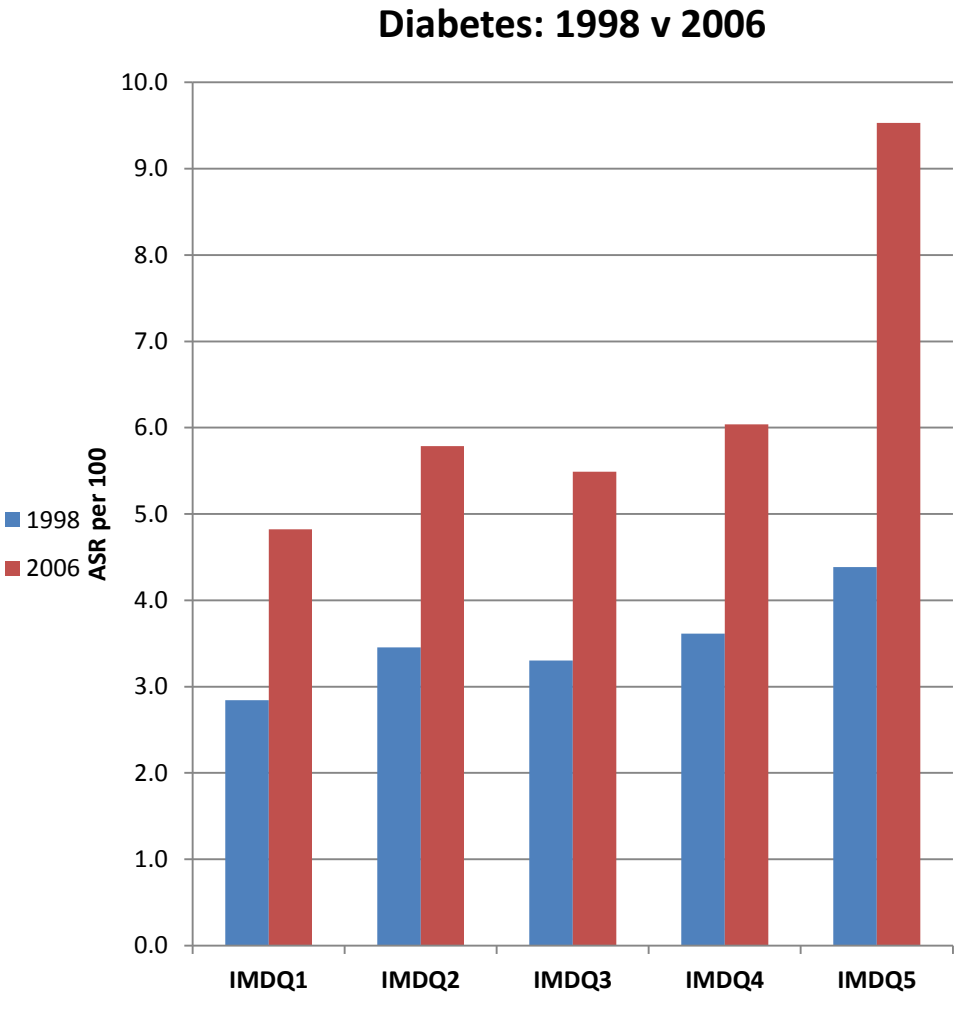
Women 55+



Change in key risk factor levels

Men 25+ Age-standardised rates, by IMD quintiles





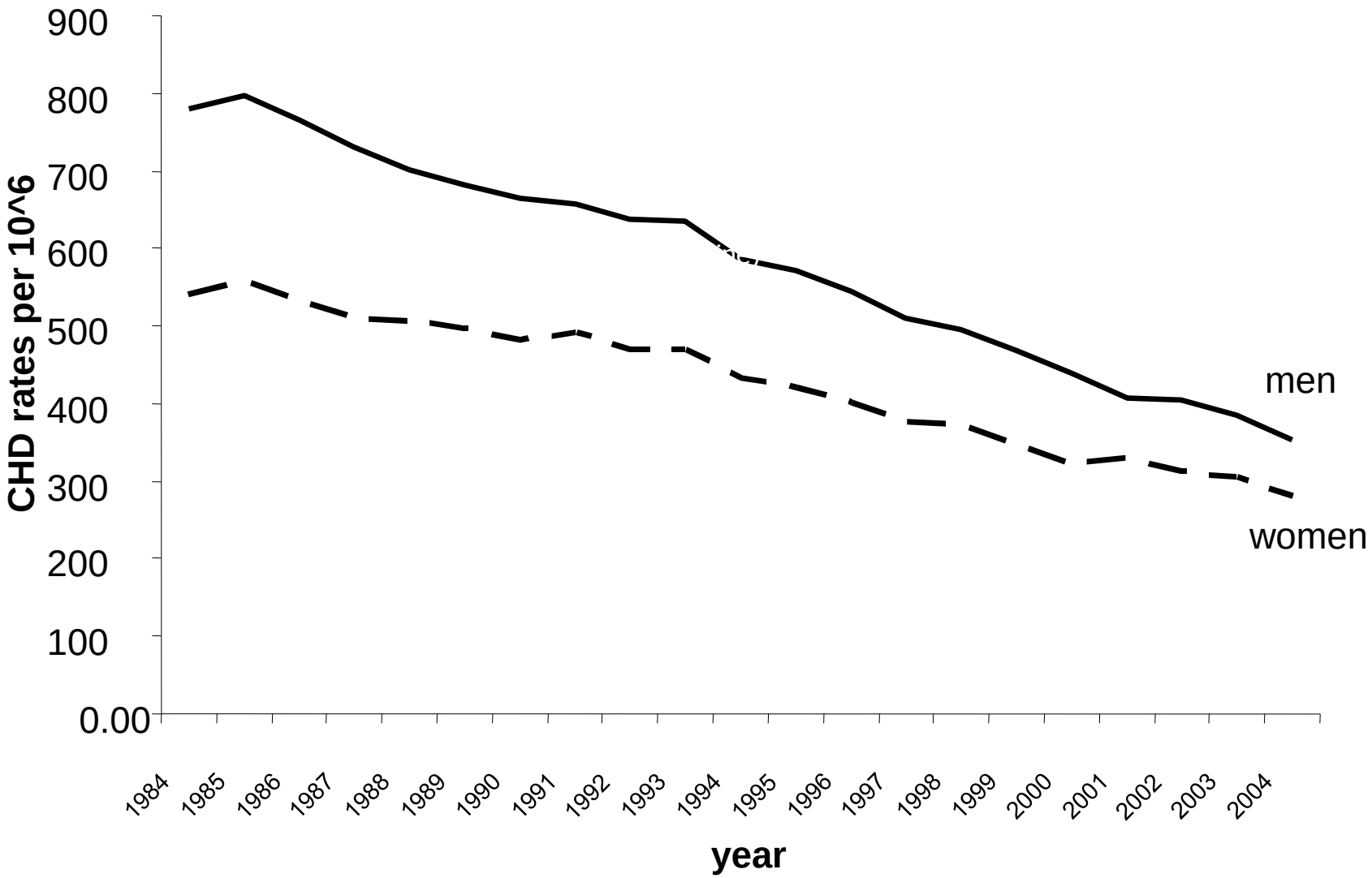
Risk factor trends by SEC: adults aged 55+

Annual % Δ	Men	Women
Significant <u>decrease</u> across all SEC groups	Smoking ⇓ SBP ⇓ Total cholesterol ⇓	Smoking ⇓ (x Q4) SBP ⇓ Total cholesterol ⇓
Significant <u>increase</u> across all SEC groups	Obesity⇑ Diabetes⇑	Obesity⇑ (x Q2) Diabetes⇑
Mixed picture by SEC	Phys activity increase: Q1-Q3 Fruit & veg increase: Q3	Phys activity increase: Q1-Q4 Fruit & veg increase: Q3-Q4

Q1 = least deprived; Q5 = most deprived

Scholes, SSM 2010

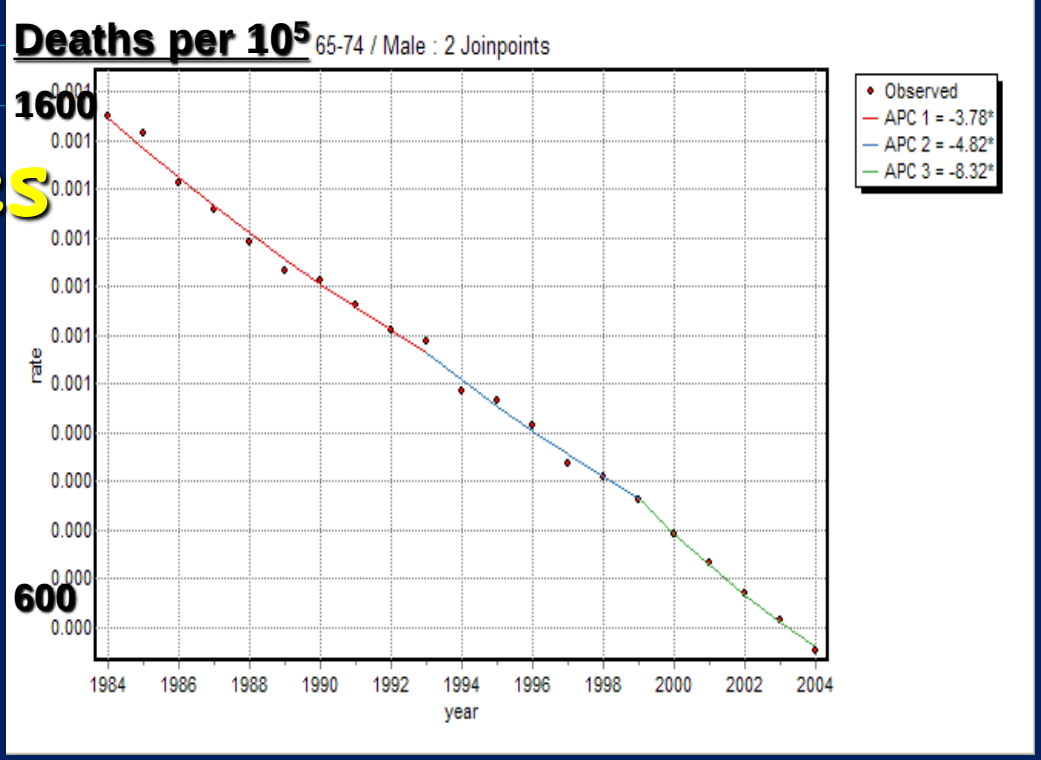
UK 1984-2004
Overall age-adjusted CHD mortality rates



UK Age-specific CHD mortality rates 1984-2004

Men 65 – 74 years

- JoinPoint Analysis
- 3 periods identified
- annual percent change increased



UK Age-specific CHD mortality rates 1984-2004

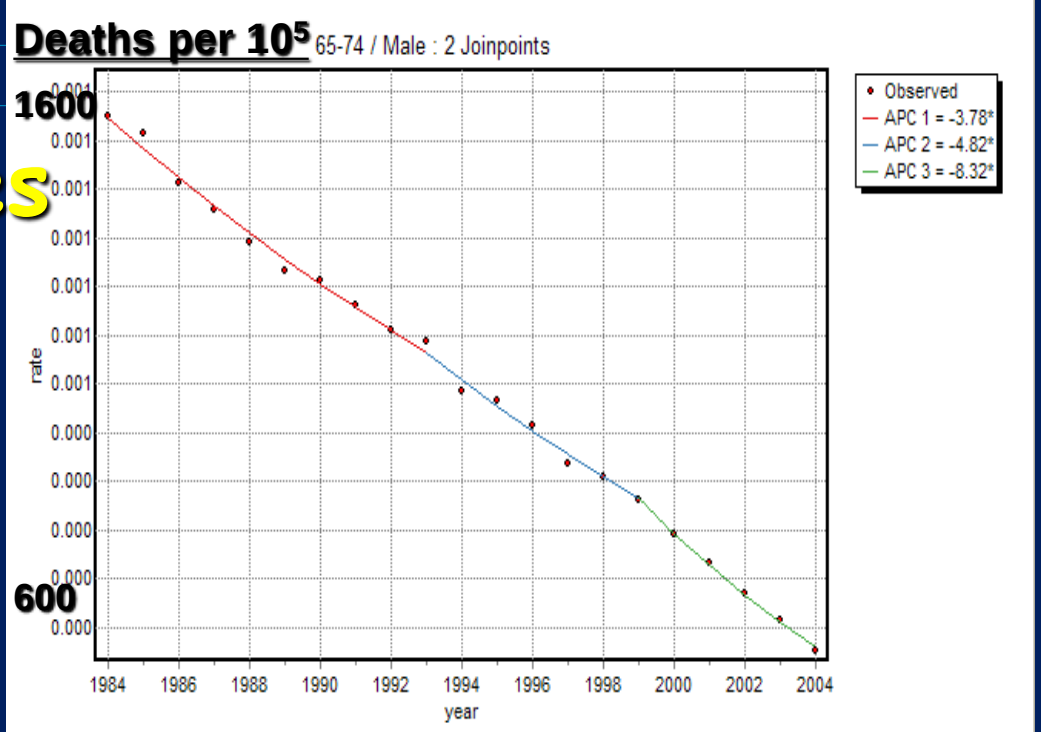
Men 65 – 74 years

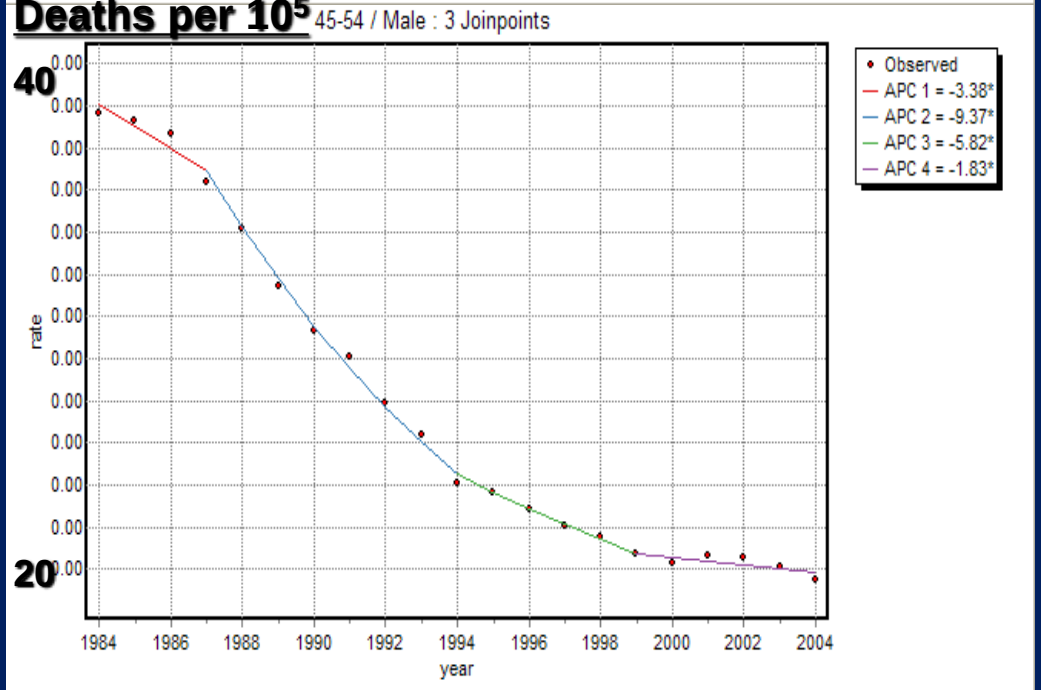
- JoinPoint Analysis
- 3 periods identified
- annual percent change increased

Rates Flattening in

Men 45-54 years

- 4 periods identified
- annual percent change decreased

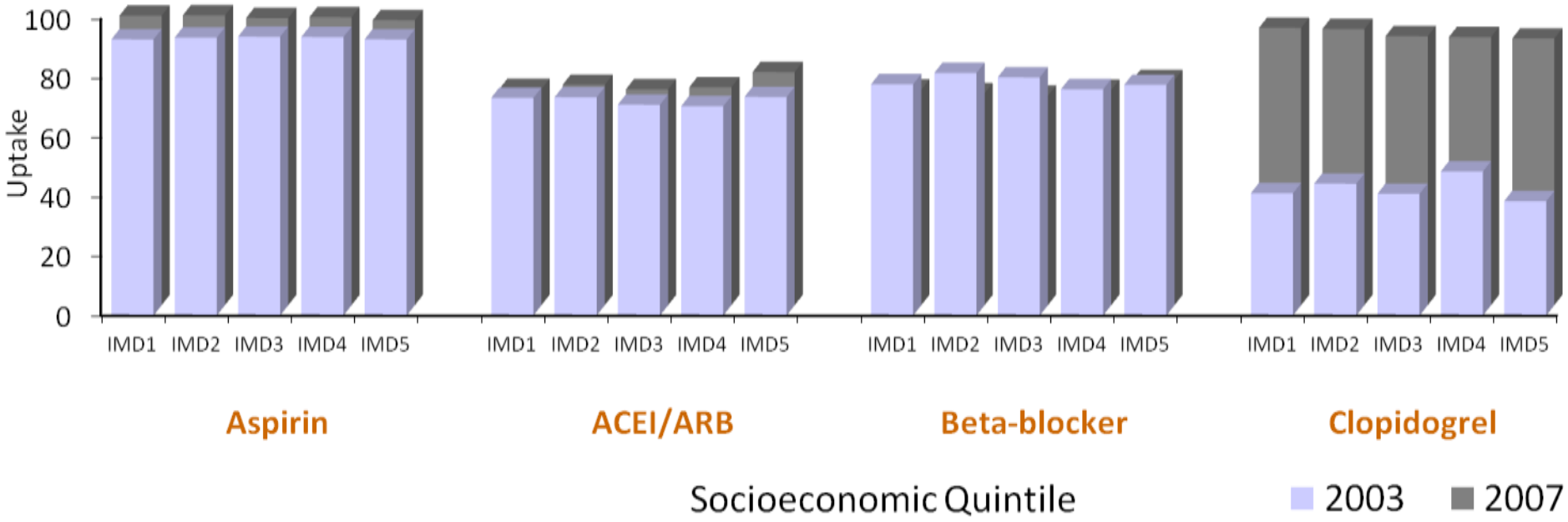




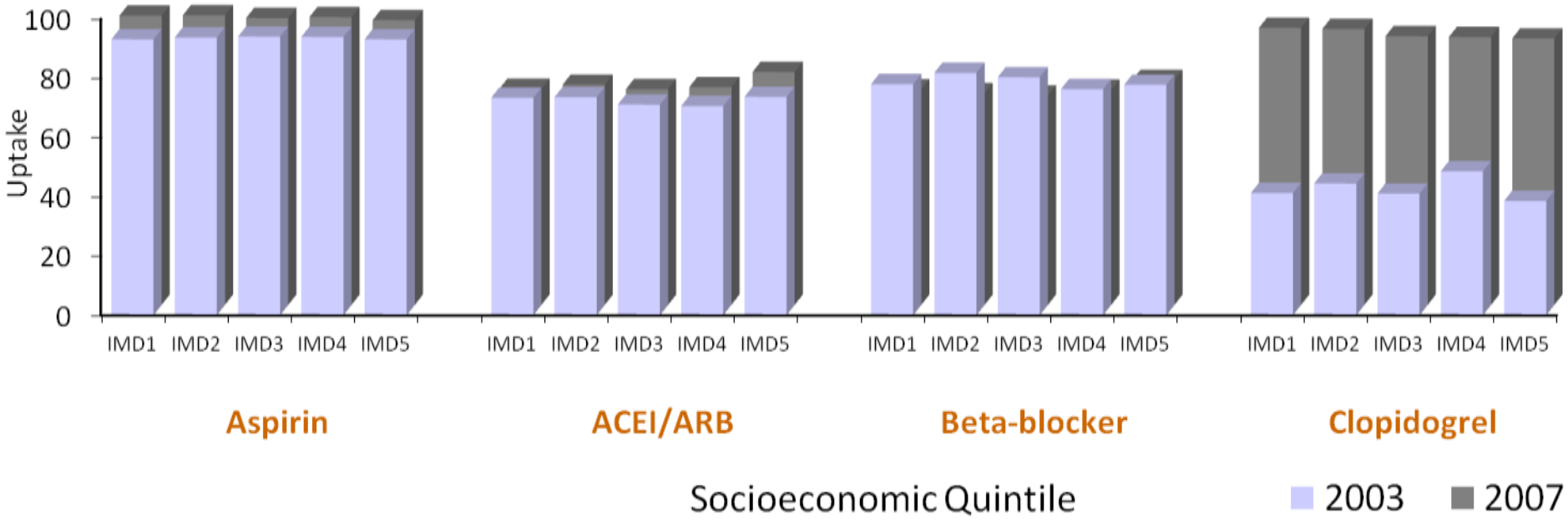
RESCAP-MED
Research Capacity for public health in the Mediterranean

Treatment trends 2000-2007

Myocardial infarction treatments
Trends & socioeconomic gradients



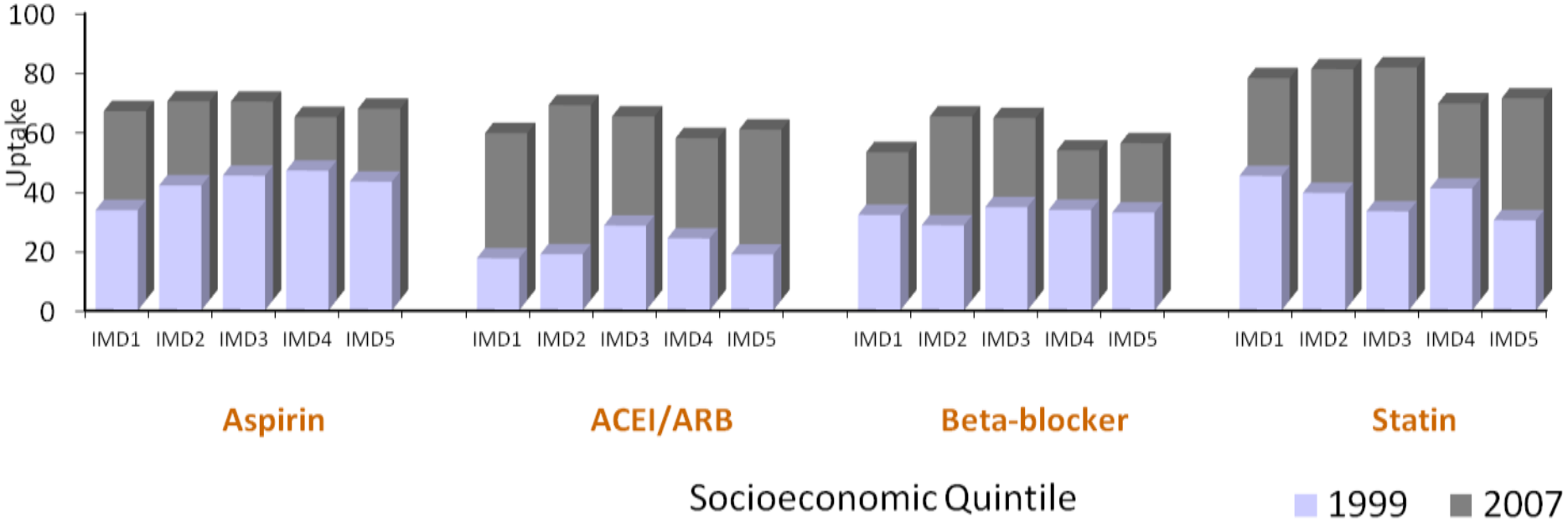
Myocardial infarction treatments
Trends & socioeconomic gradients



- **No socioeconomic gradients**
- **Most therapies already high uptake**
- **Clopidogrel uptake doubled**

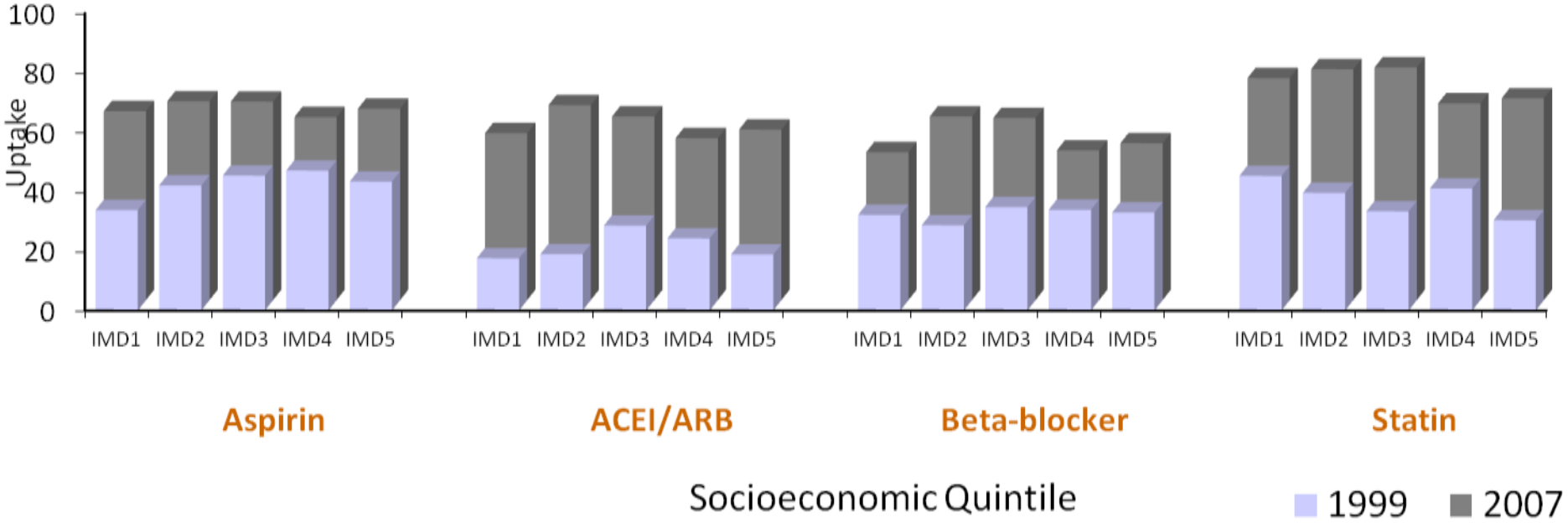
Secondary prevention

Trends & socioeconomic gradients



Secondary prevention

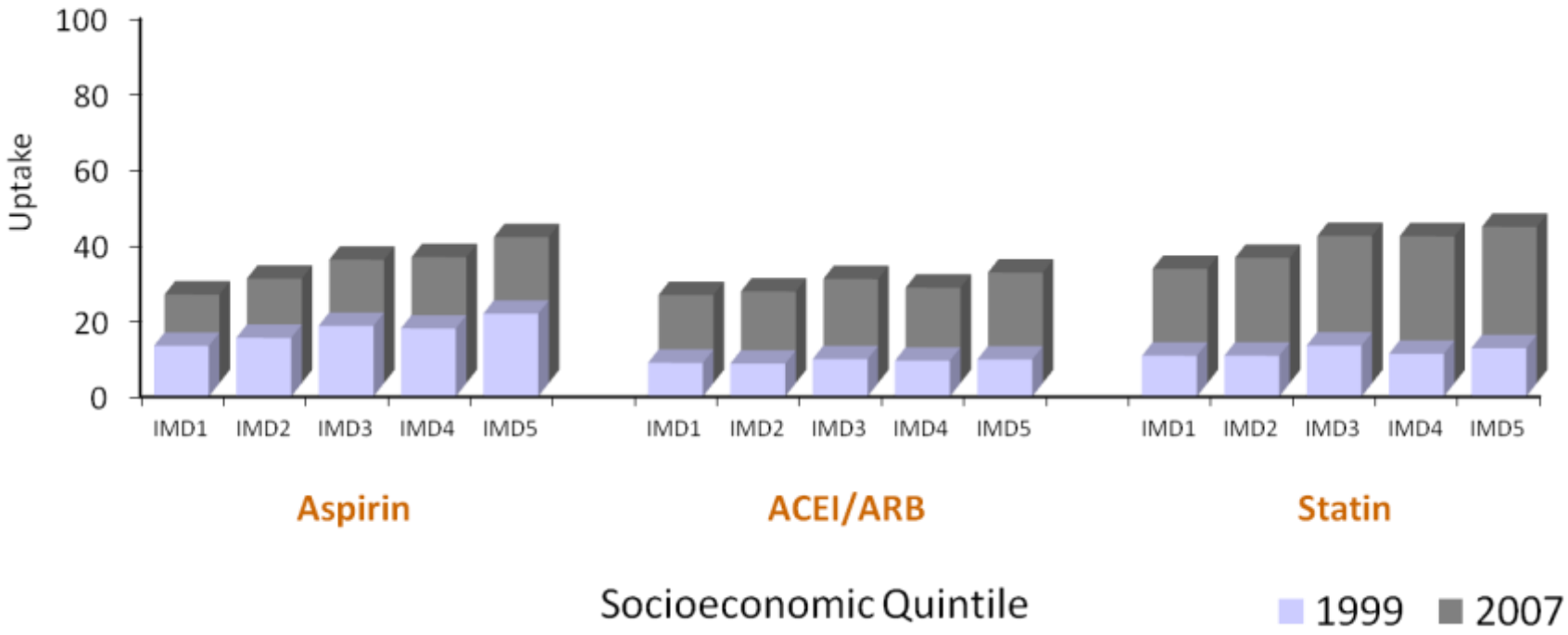
Trends & socioeconomic gradients



- **No socioeconomic gradients**
- **Overall treatment levels approximately doubled**
- **Absolute treatment uptake 60 to 70%**

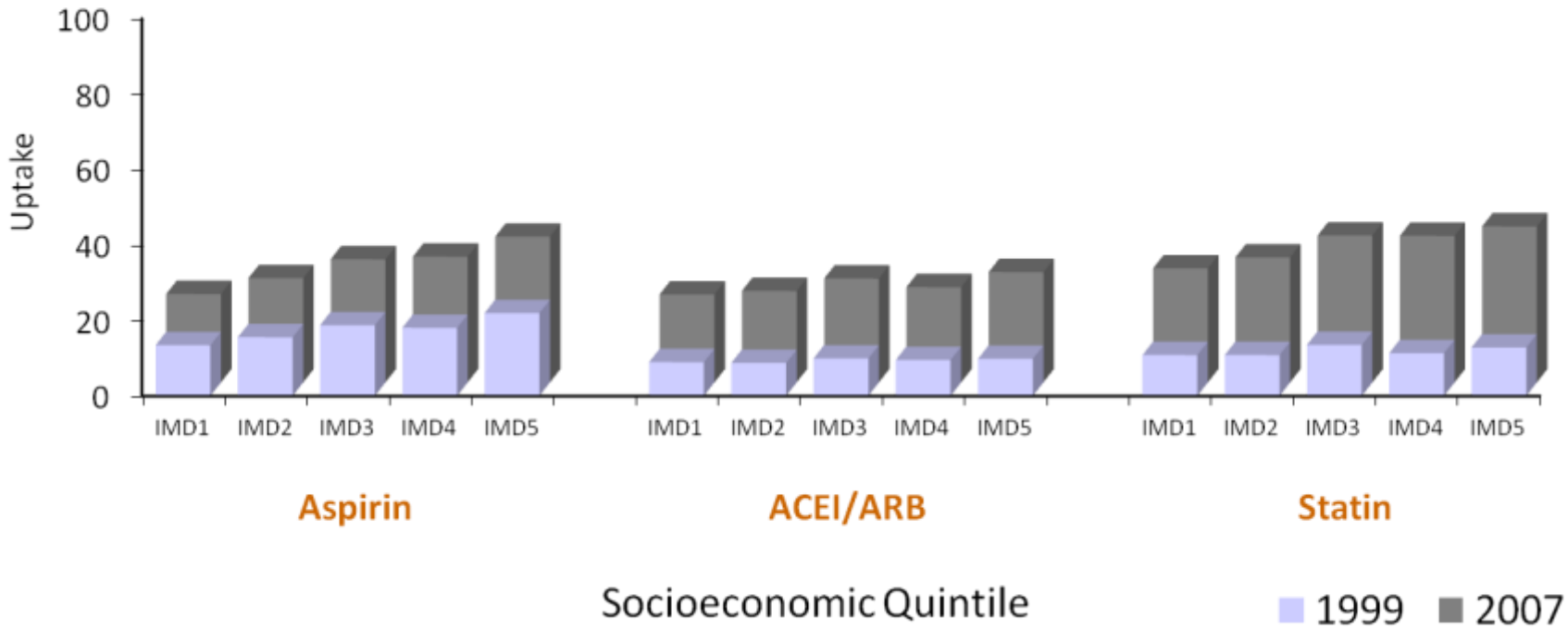
Chronic angina treatments

Trends & socioeconomic gradients



Chronic angina treatments

Trends & socioeconomic gradients



- **Socioeconomic gradients – greater uptake in most deprived**
- **Overall treatment levels approximately tripled**
- **Treatment levels lower than MI or secondary prevention**

Change in treatment: Statin & ACE-I/ARB uptake Men 55-74