

**A national achievement?  
Changes in inequalities in risk  
factors for cardiovascular  
disease in Australia**

**Alison Hayes and Philip Clarke**

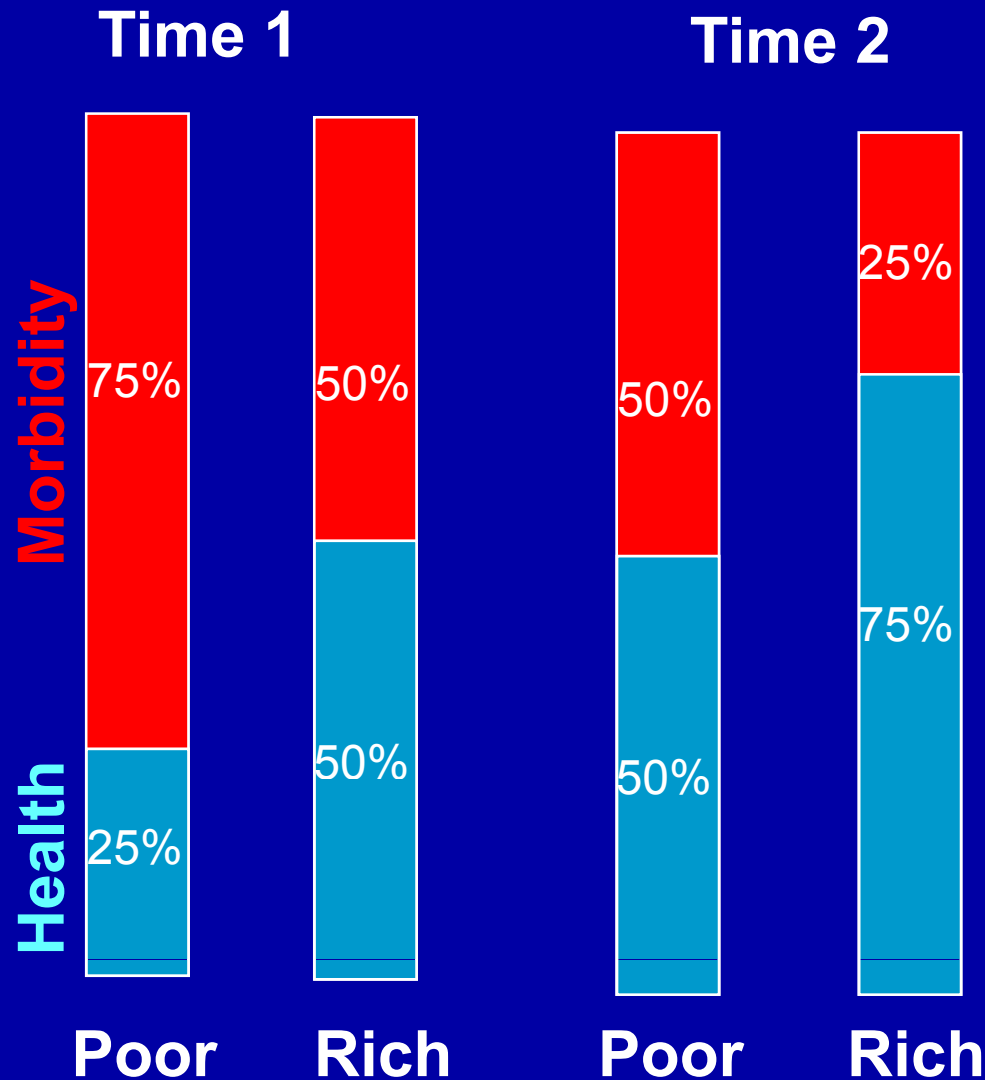
**School of Public Health  
University of Sydney**

# Structure of the seminar

- Background on inequality measures;
- Main focus on how to represent changes in inequalities and mean health;
- How are common cardiovascular risk factors distributed across income groups in Australia?
- Some examples from Australia using the 4 most recent National Health Surveys.
- Are cardiovascular risk factors improving at the expense of greater inequality towards the poor ?

**Health inequality?**

# Inequality comparisons



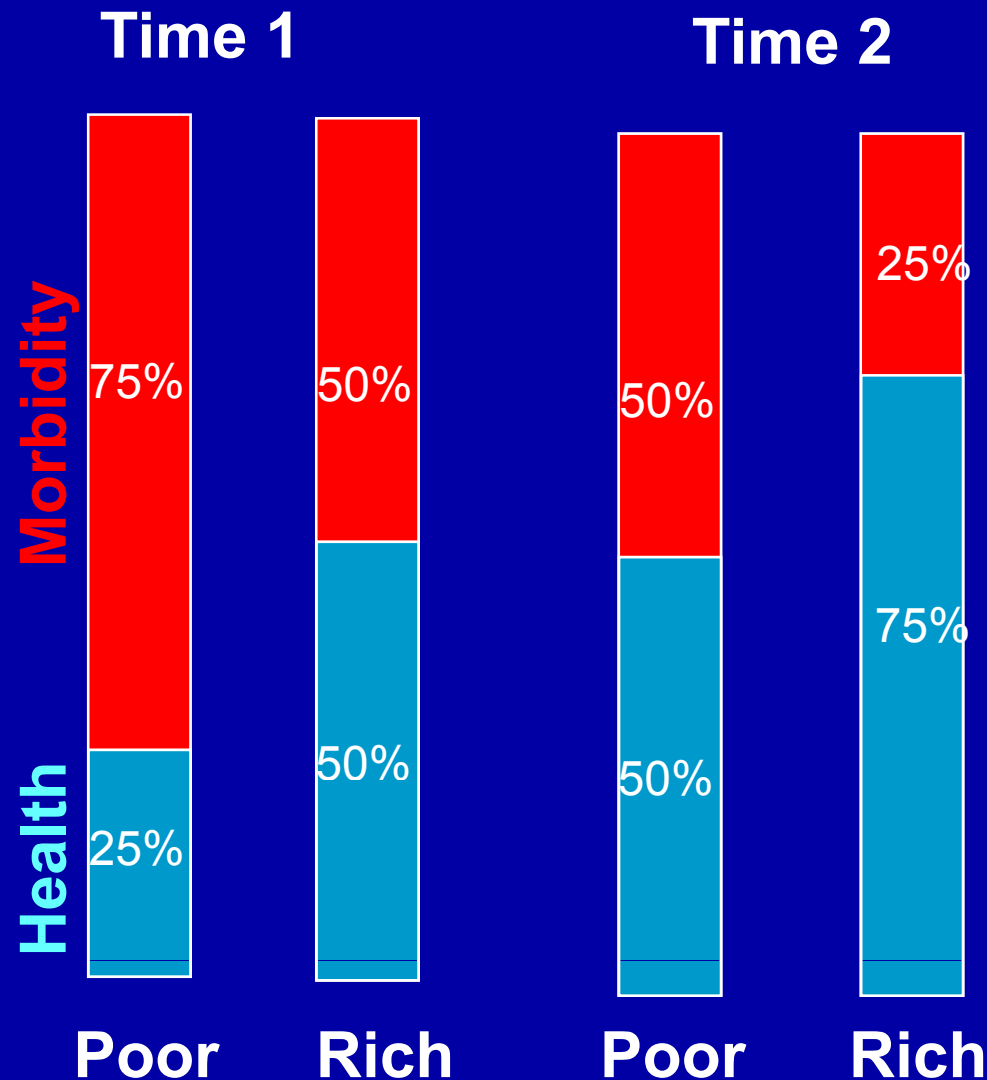
Have inequalities:

Decreased?

Remained the same?

Increased?

# Case for decreasing inequalities



Relative inequalities  
in "health"

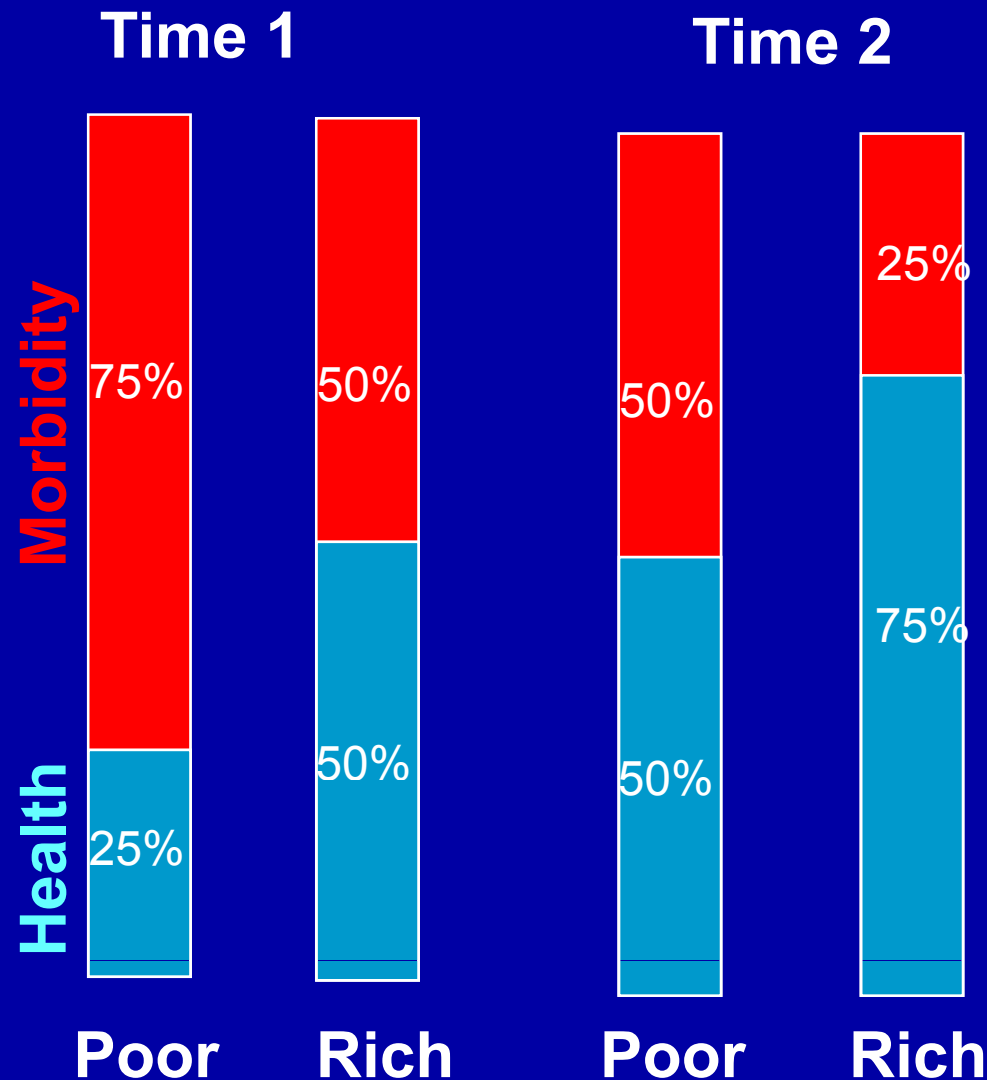
Ratio =  $\frac{\text{Health of Rich}}{\text{Health of Poor}}$

Time 1  $50\%/25\%=2$

Time 2  $75\%/50\%=1.5$

**Inequalities have  
decreased**

# Case for no change in inequalities



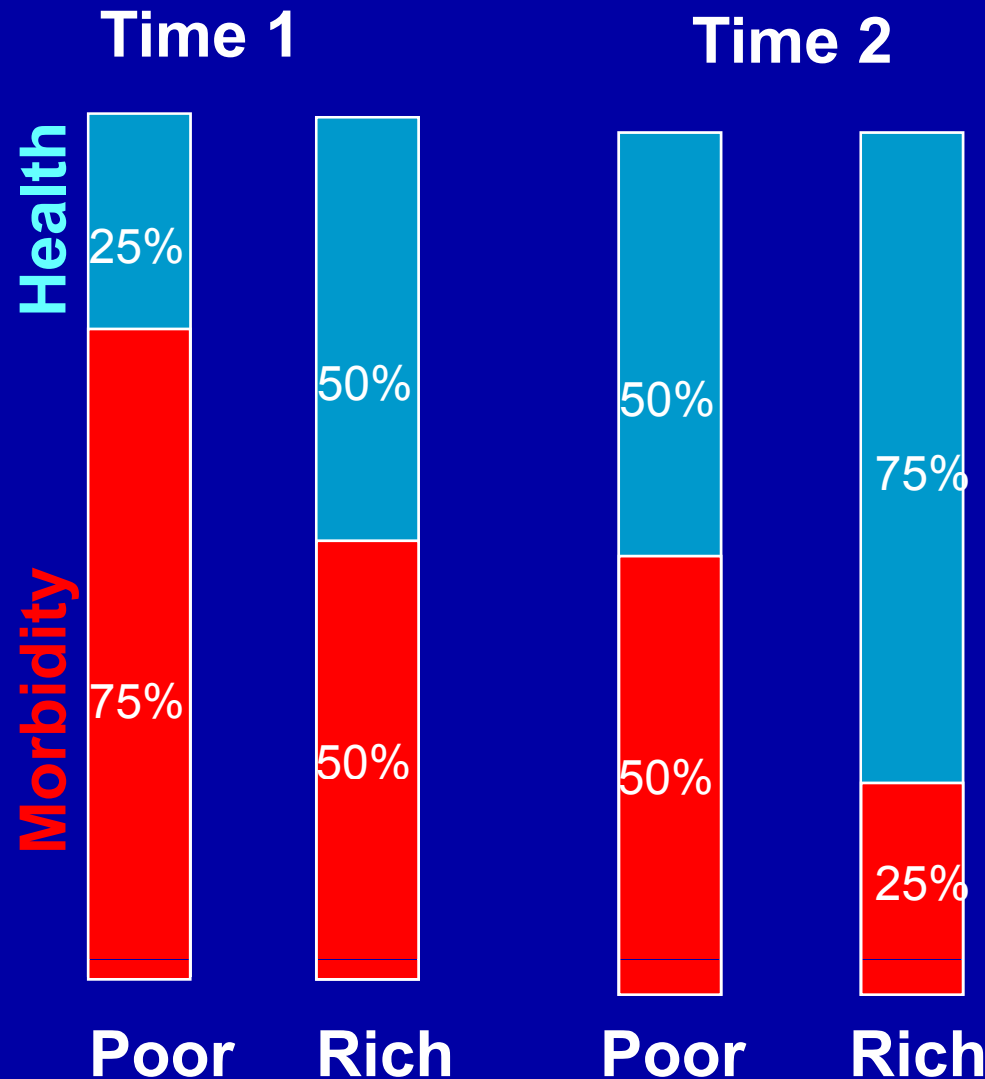
**Absolute inequalities  
in "health"**

**Time 1  $50\% - 25\% = 25\%$**

**Time 2  $75\% - 50\% = 25\%$**

**Inequalities have  
remained the same**

# Case for increasing inequalities



Relative inequalities  
in “morbidity”

$$\text{Ratio} = \frac{\text{Morbidity of Poor}}{\text{Morbidity of Rich}}$$

Time 1  $75\%/50\%=1.5$

Time 2  $50\%/25\%=2$

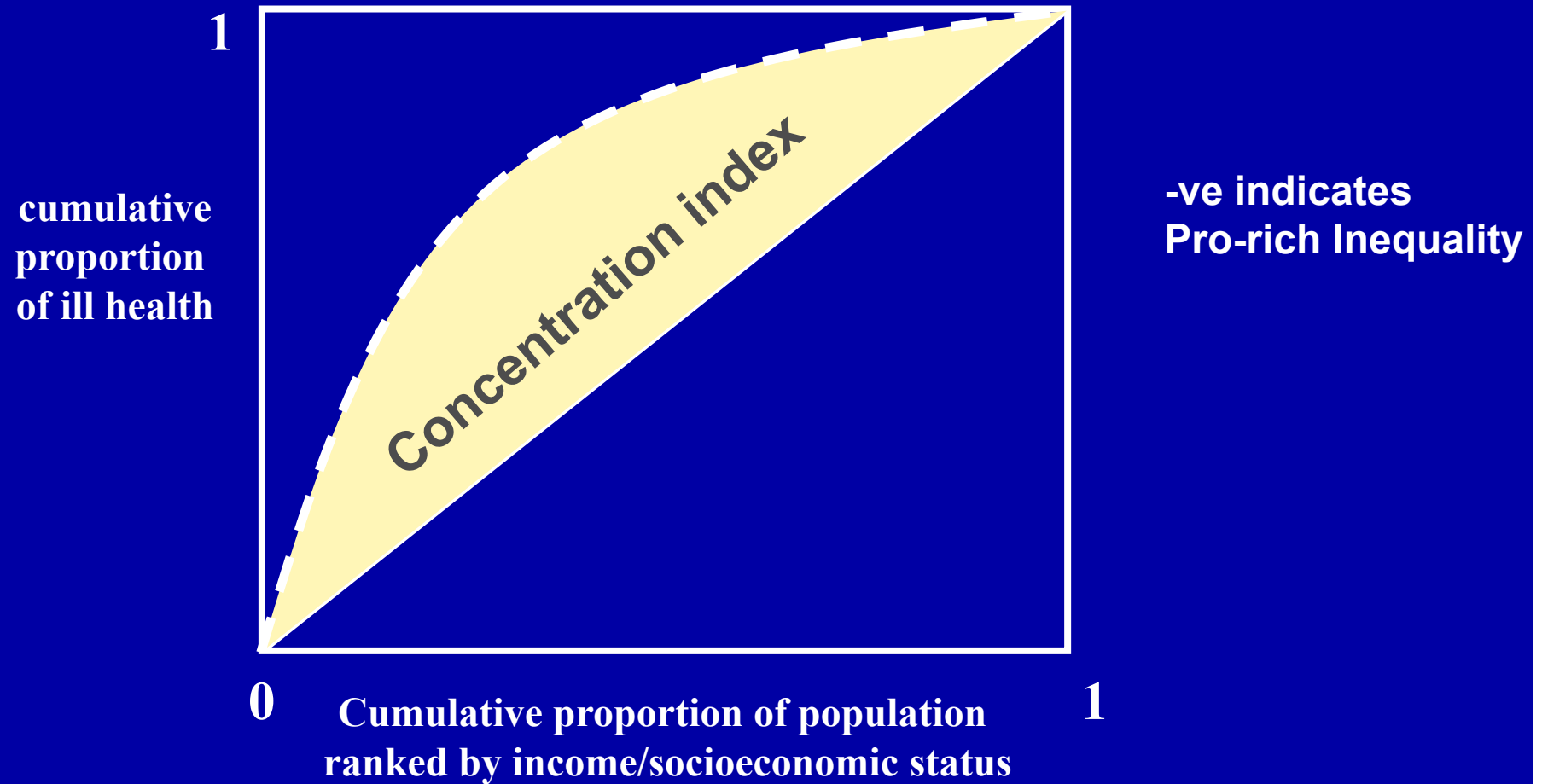
**Inequalities have  
Increased!**

# Reads like a script from “Yes Minister”

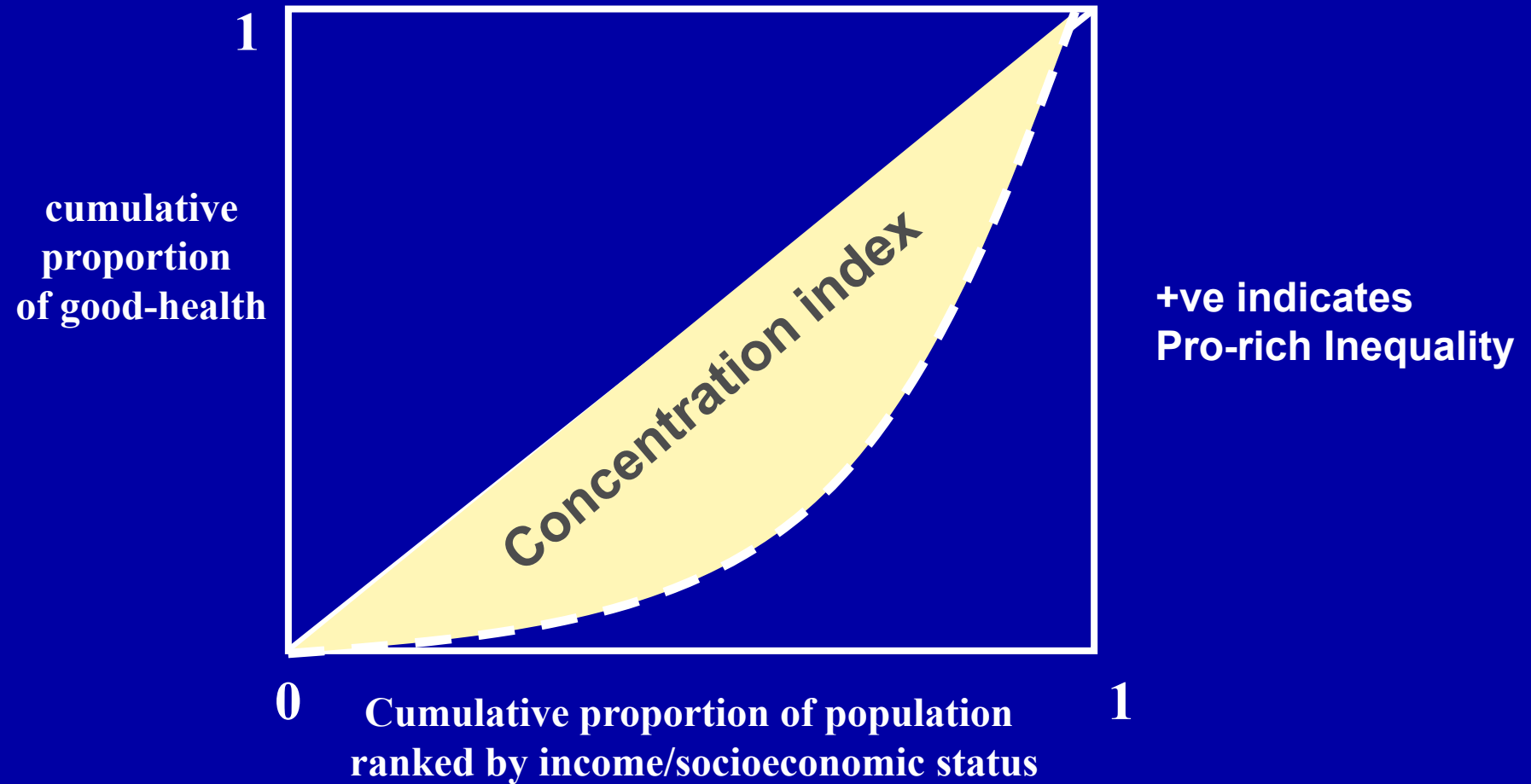


- Jim Hacker MP: “So Humphrey are health inequalities rising or declining?”
- Sir Humphrey: “Well Minister in terms of measures of morbidity, inequalities are increasing, but in terms of absolute inequalities they remain the same, and if instead we measure inequalities in terms of health they are actually declining.”

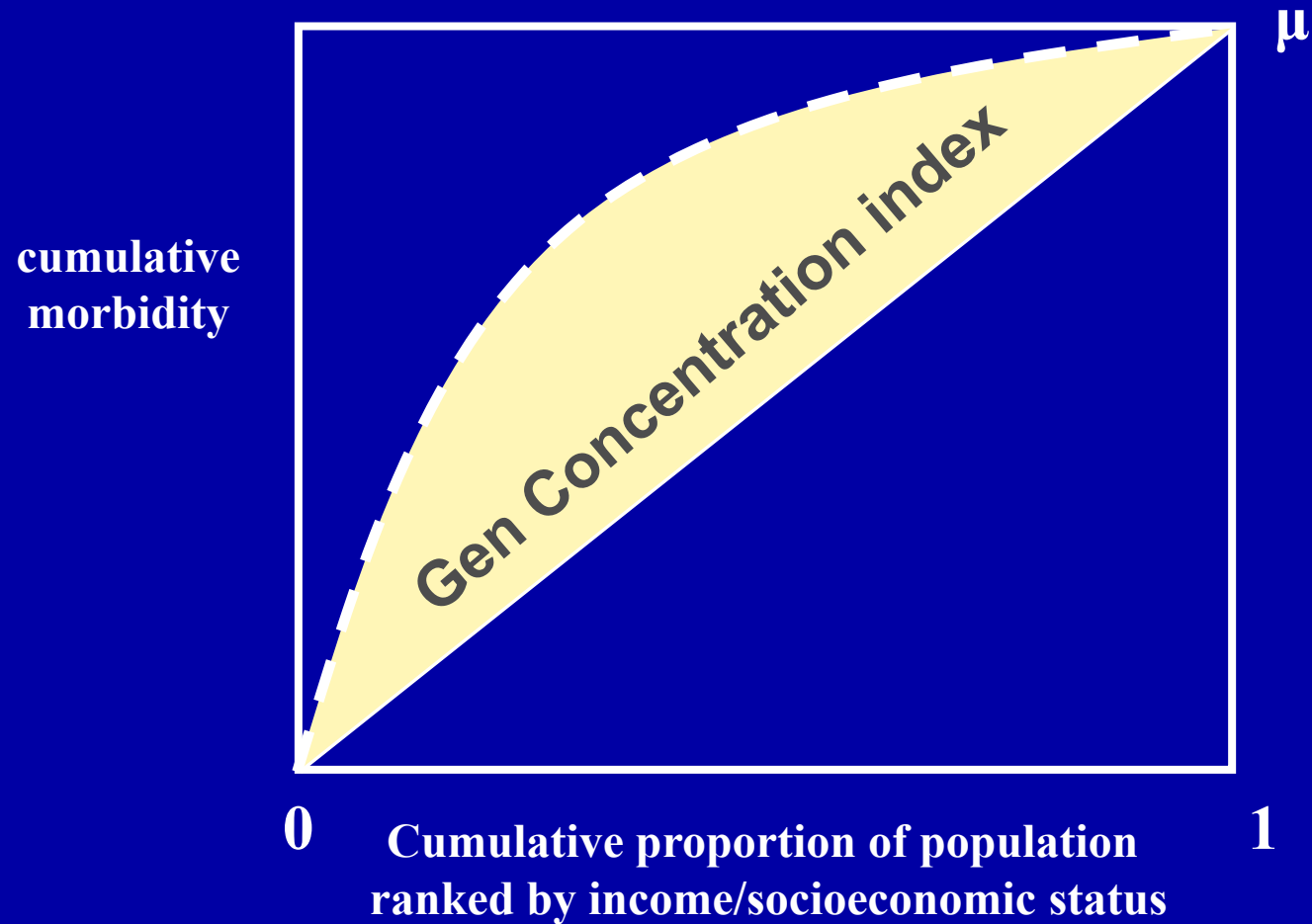
# Concentration curves



# Concentration curves



# Generalized concentration curves



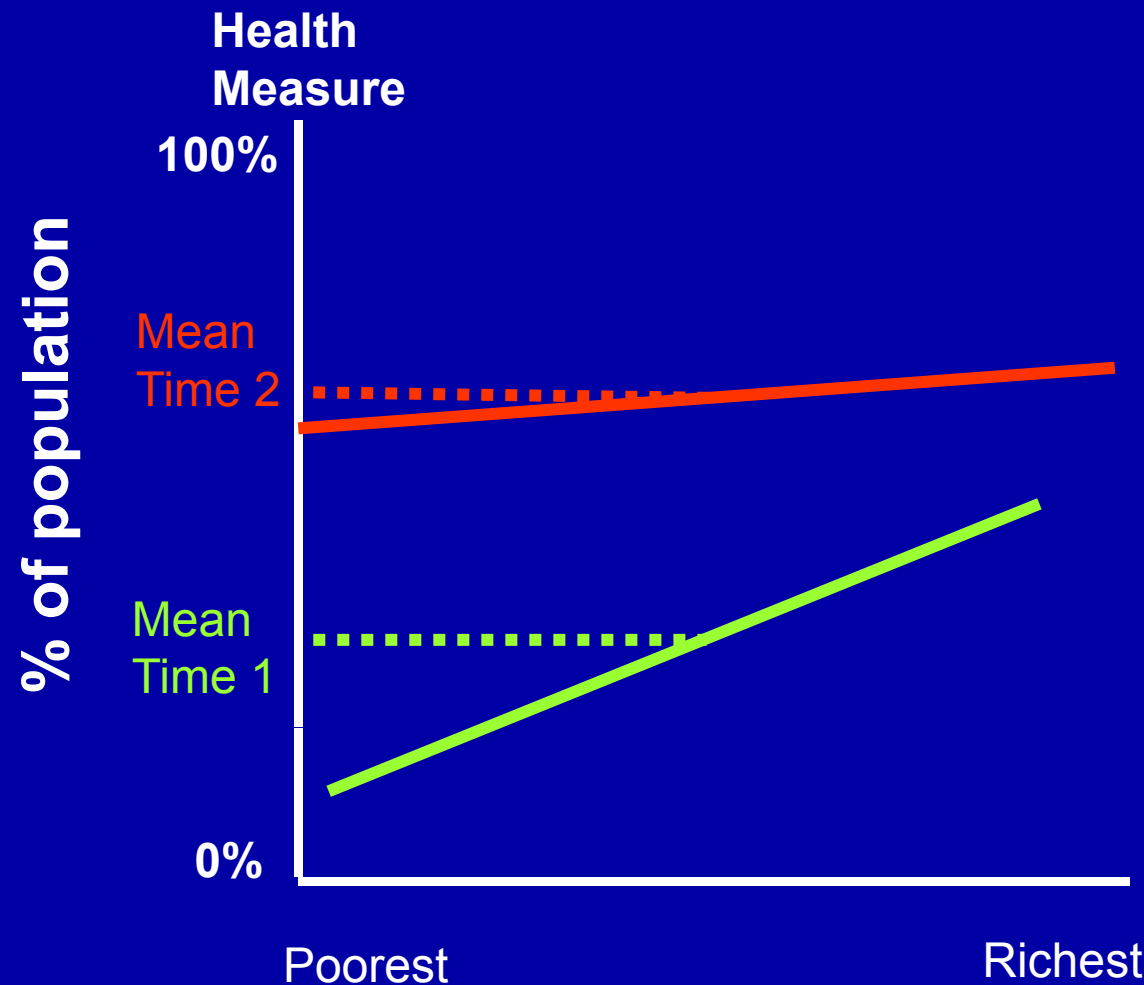
# Extended Concentration index

$$C = 1 - \frac{2}{n\mu} \sum_{i=1}^n y_i (1 - R_i)$$

$$C(v) = 1 - v(v-1) \int_0^1 (1-p)^{v-2} L(p) dp, v > 1$$

$$C(v) = 1 - \frac{v}{n\mu} \sum_{i=1}^n y_i (1 - R_i)^{v-1}$$

# How do we make meaningful comparisons across time?

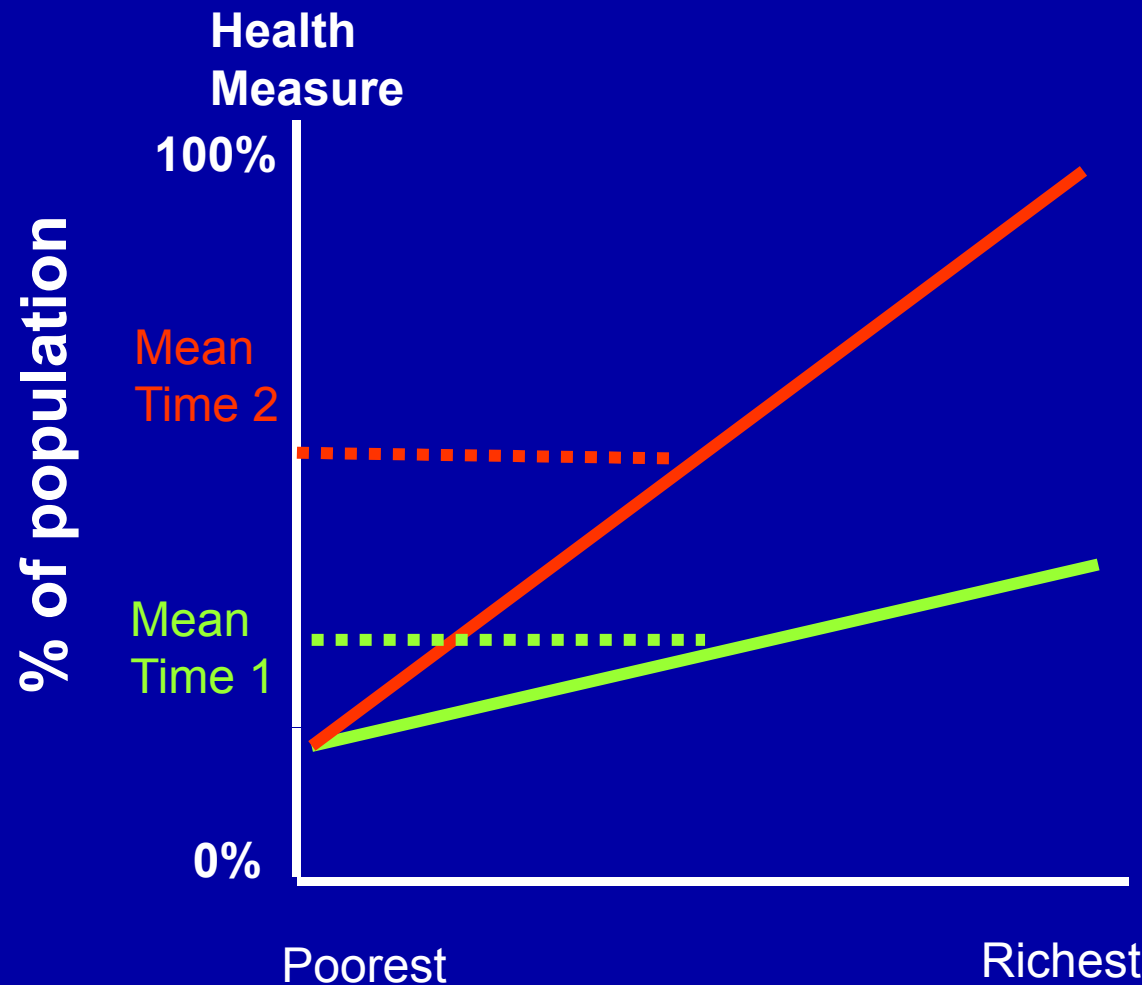


Average health has increased

Absolute and Relative inequalities have declined

Hard to argue things are not improving

# More difficult case



Average health has increased

Absolute inequalities ↑

Relative inequalities ↑

Hard to say if things are improving

# Achievement index

An index which combines mean level of health and level of relative inequalities

$$I(v) = \mu(1 - C(v)).$$

Increases in mean health will  
increase  $I(v)$

Higher inequality will  
decrease  $I(v)$

$$I(v) = 0.5 \times (1 - 0.2) = 0.4$$

Wagstaff (2002) Inequality aversion, health inequalities and health achievement JHE 21:627-641

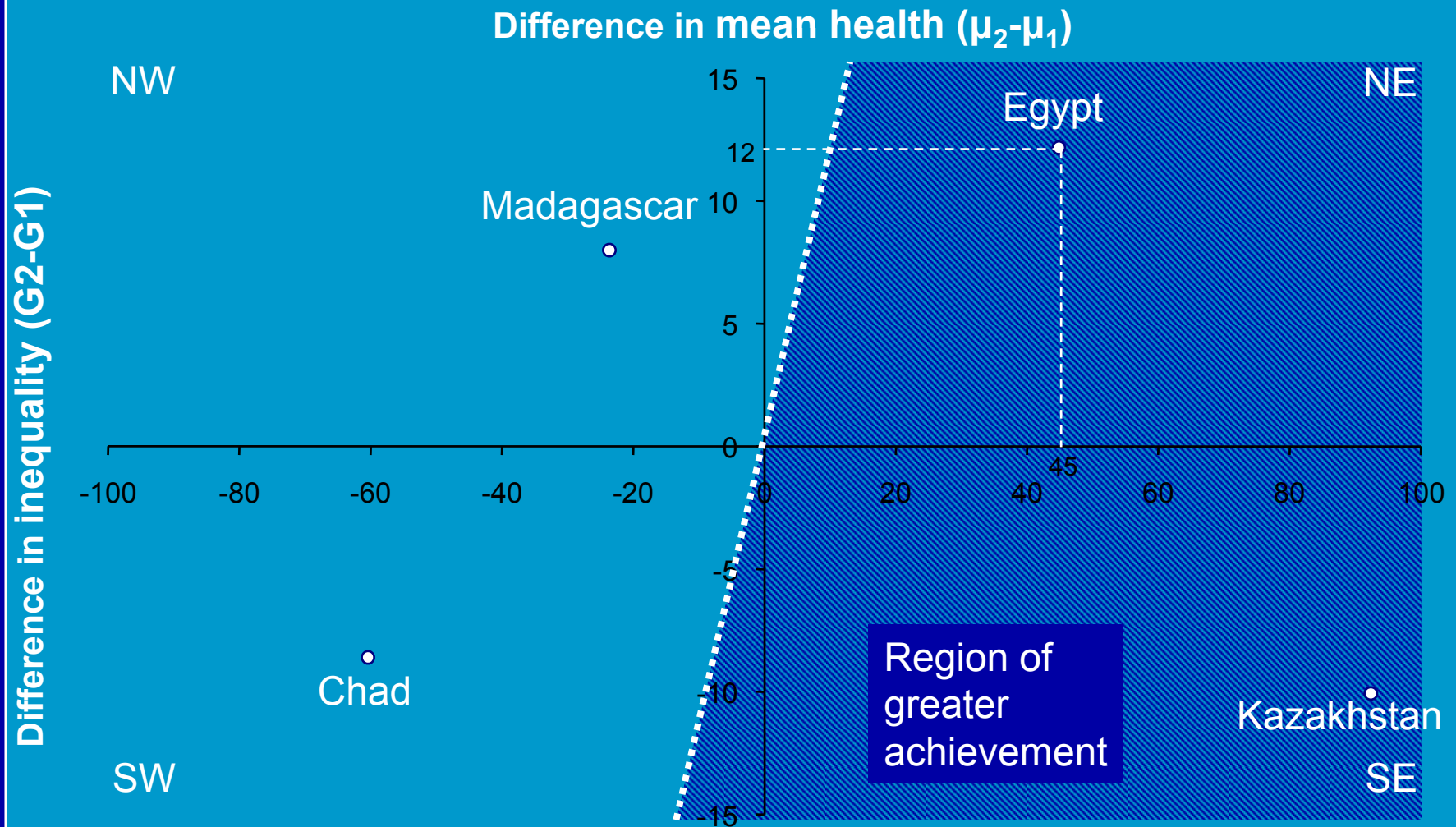
# Change in Achievement

$$I(v) = \mu(1 - C(v))$$

$$I_2 > I_1$$

$$\mu_2 - \mu_2 C_2 > \mu_1 - \mu_1 C_1$$

$$\mu_2 - \mu_1 > \mu_2 C_2 - \mu_1 C_1$$



Incremental health achievement plane relative to Haiti

# Cardiovascular risk in Australia

- How are common cardiovascular risk factors distributed across income groups in Australia?
- Are inequalities in these risk factors increasing or decreasing over time?

# NHS survey population

- Individuals participating in the last four ABS National Health Surveys, conducted in:
  - 1989-90, 1995, 2001, 2004-5.
  - N=54,241, 53,828, 26,862, 25,906
- Expanded surveys available on-line from 2001 via the remote access data laboratory (RADL)
- Urban and rural areas throughout all states and territories
- Non-institutionalized residential population;
- Collects self-reported information on health status, health behavior, health use (mainly over previous 2 weeks)
- Demographic and socio-economic factors, e.g. self-reported household income

<b>Survey Year</b>	<b>1989</b>	<b>1995</b>	<b>2001</b>	<b>2005</b>
<b>N</b>	<b>34,078</b>	<b>15,713</b>	<b>13,167</b>	<b>15,004</b>
<b>% female</b>	<b>50.9</b>	<b>50.4</b>	<b>52.8</b>	<b>51.2</b>
<b>% over 50 years</b>	<b>33.9</b>	<b>32.7</b>	<b>40.2</b>	<b>39.9</b>
<b>Risk factors % (age-sex standardised in brackets)</b>				
<b>High blood pressure</b>	<b>20.4 (20.5)</b>	<b>15.0 (14.5)</b>	<b>14.8 (12.9)</b>	<b>15.4 (13.8)</b>
<b>No exercise</b>	<b>35.9 (35.7)</b>	<b>33.1 (32.4)</b>	<b>29.6 (29.2)</b>	<b>33.2 (33.7)</b>
<b>Smoker</b>	<b>28.2 (29.1)</b>	<b>24.1 (25.0)</b>	<b>22.5 (24.5)</b>	<b>22.8 (25.6)</b>
<b>Diabetes</b>	<b>2.5 (2.3)</b>	<b>3.0 (3.0)</b>	<b>4.7 (4.2)</b>	<b>5.1 (4.6)</b>
<b>High cholesterol</b>	<b>10.9 (10.9)</b>	<b>7.3 (7.7)</b>	<b>9.4 (7.8)</b>	<b>10.2 (9.1)</b>
<b>Heart disease</b>	<b>5.0 (4.8)</b>	<b>4.2 (4.6)</b>	<b>2.8 (2.2)</b>	<b>2.1 (1.8)</b>
<b>Overweight or obese</b>	<b>39.0 (38.4)</b>	<b>44.9 (43.5)</b>	<b>52.2 (49.8)</b>	<b>55.0 (53.2)</b>

# Calculation of equivalent household income (OECD)

$$I_E = \frac{I_H}{S_I}$$

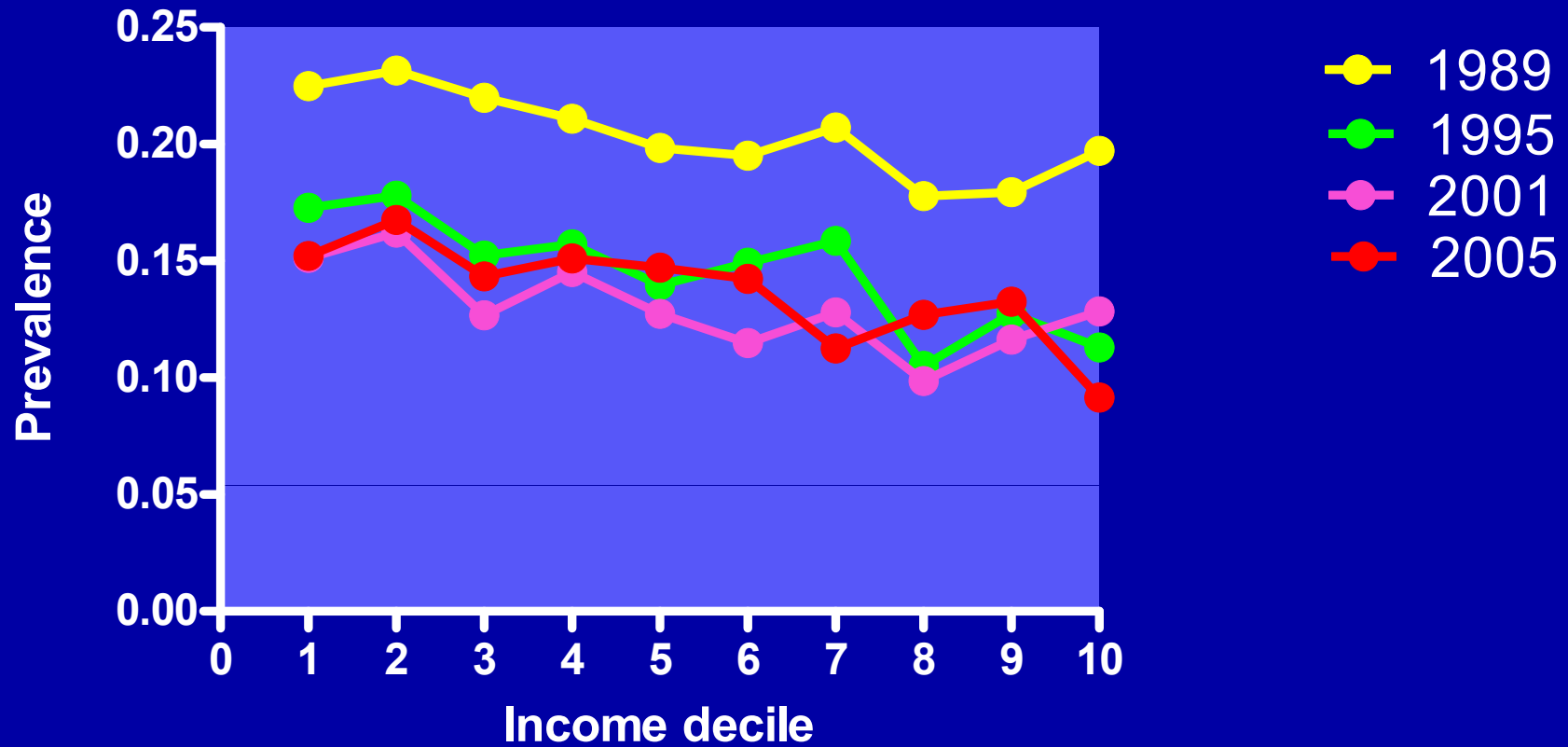
Equivalence scale,  $S_I = 0.5 + 0.5 * \text{adults} + 0.3 * \text{children}$

e.g. for a 1 adult household,  $S_I = 1$  and equivalent income is the same as household income.

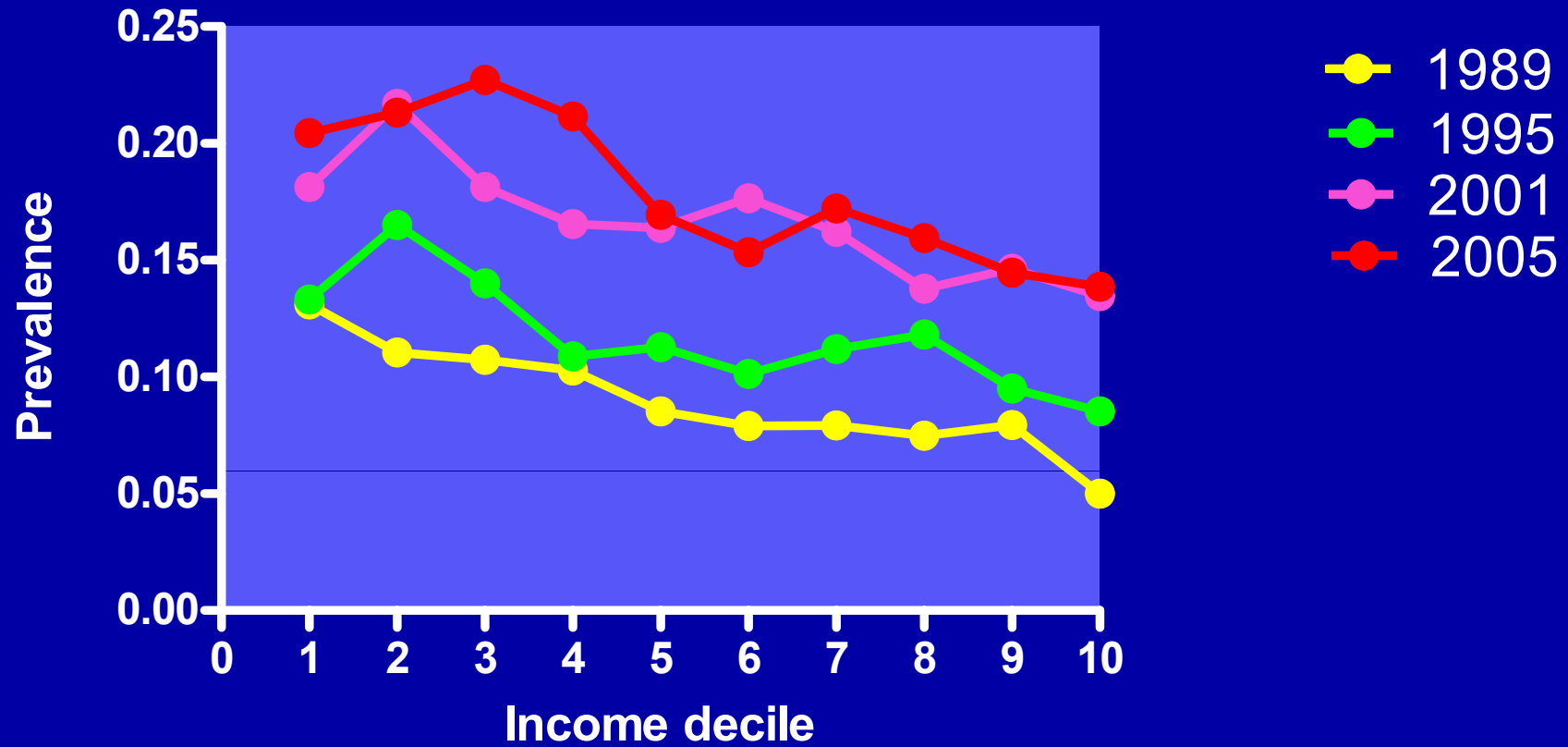
For a household with 2 adults,  $S_I = 1.5$

For a household with 2 adults and 2 children,  $S_I = 2.1$

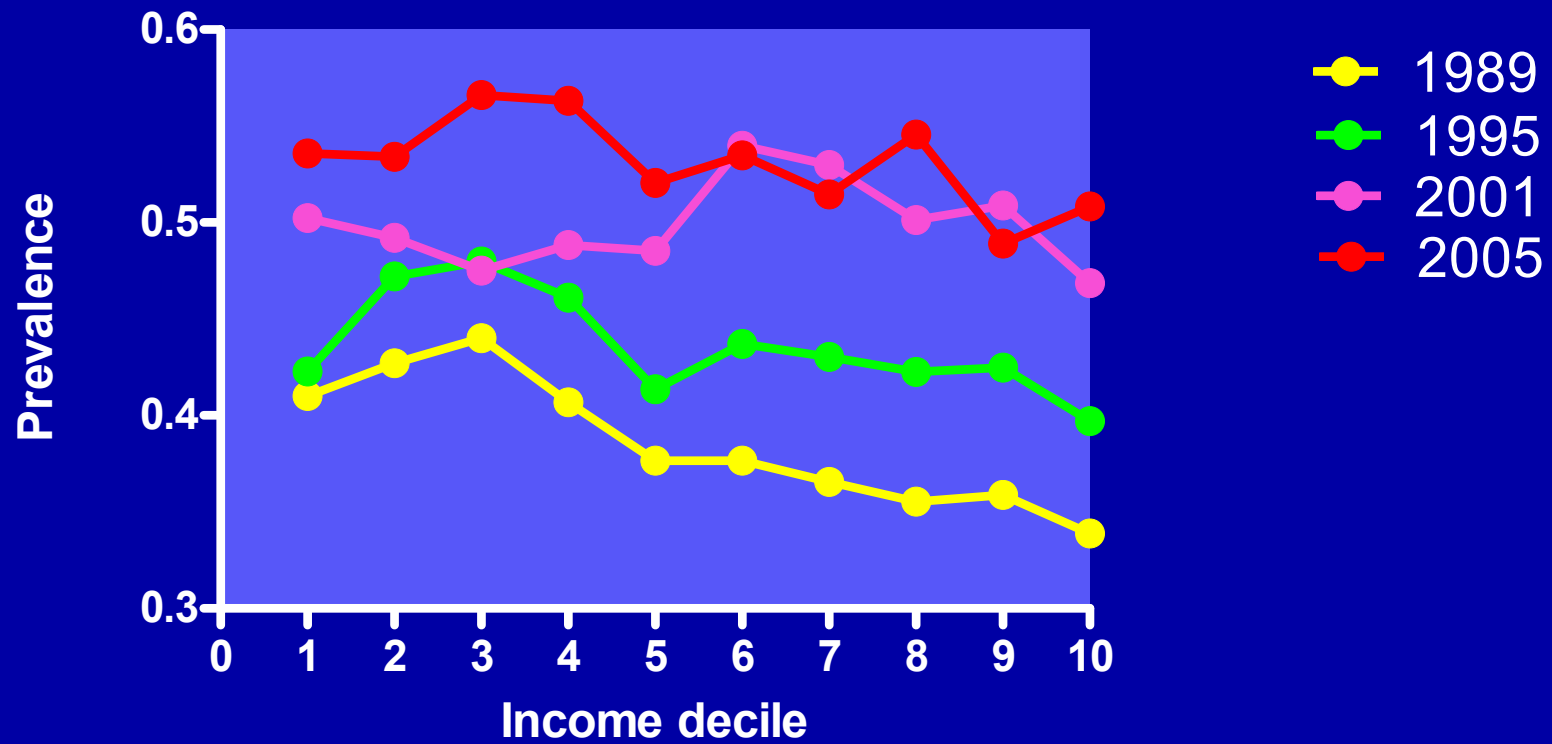
## High Blood pressure



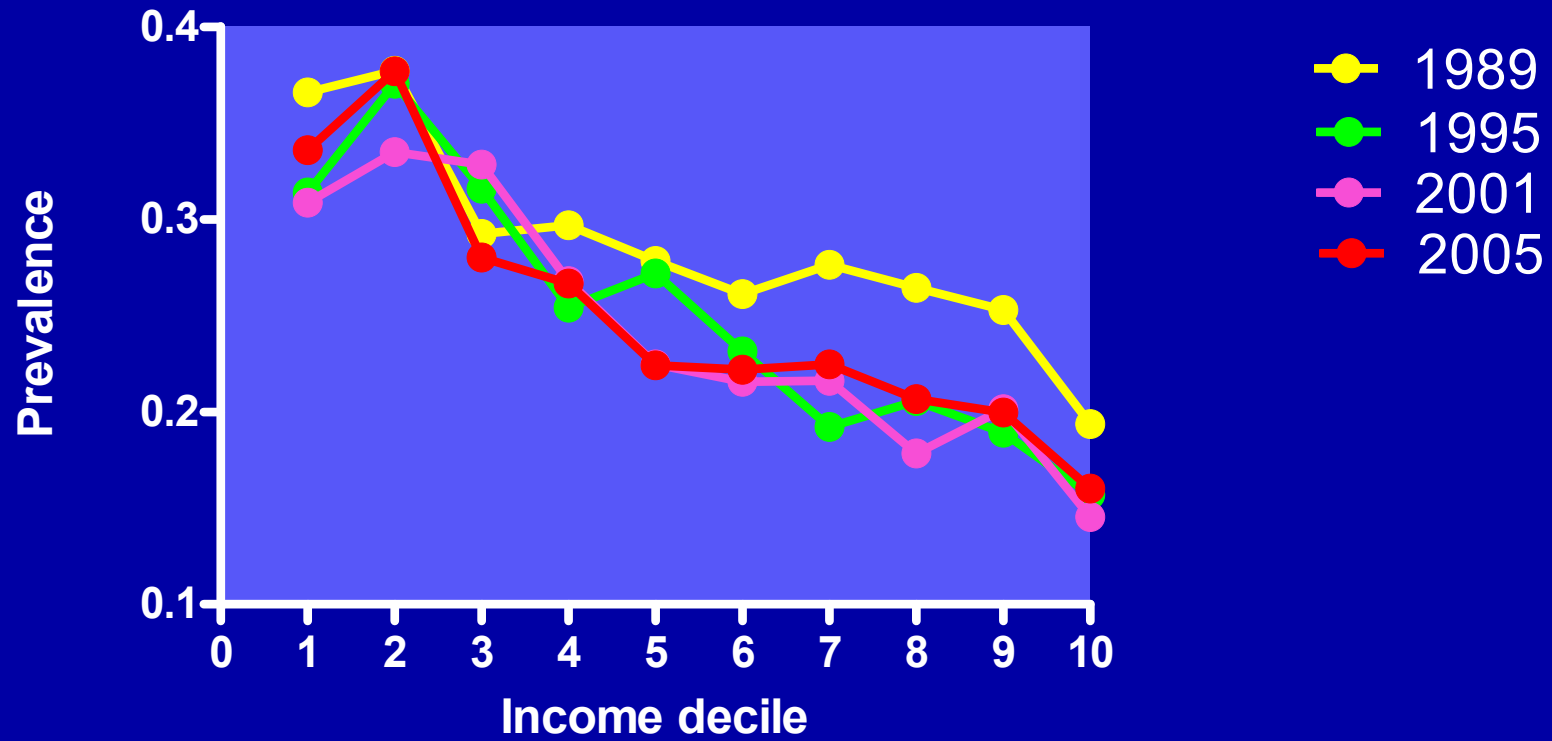
# Obesity



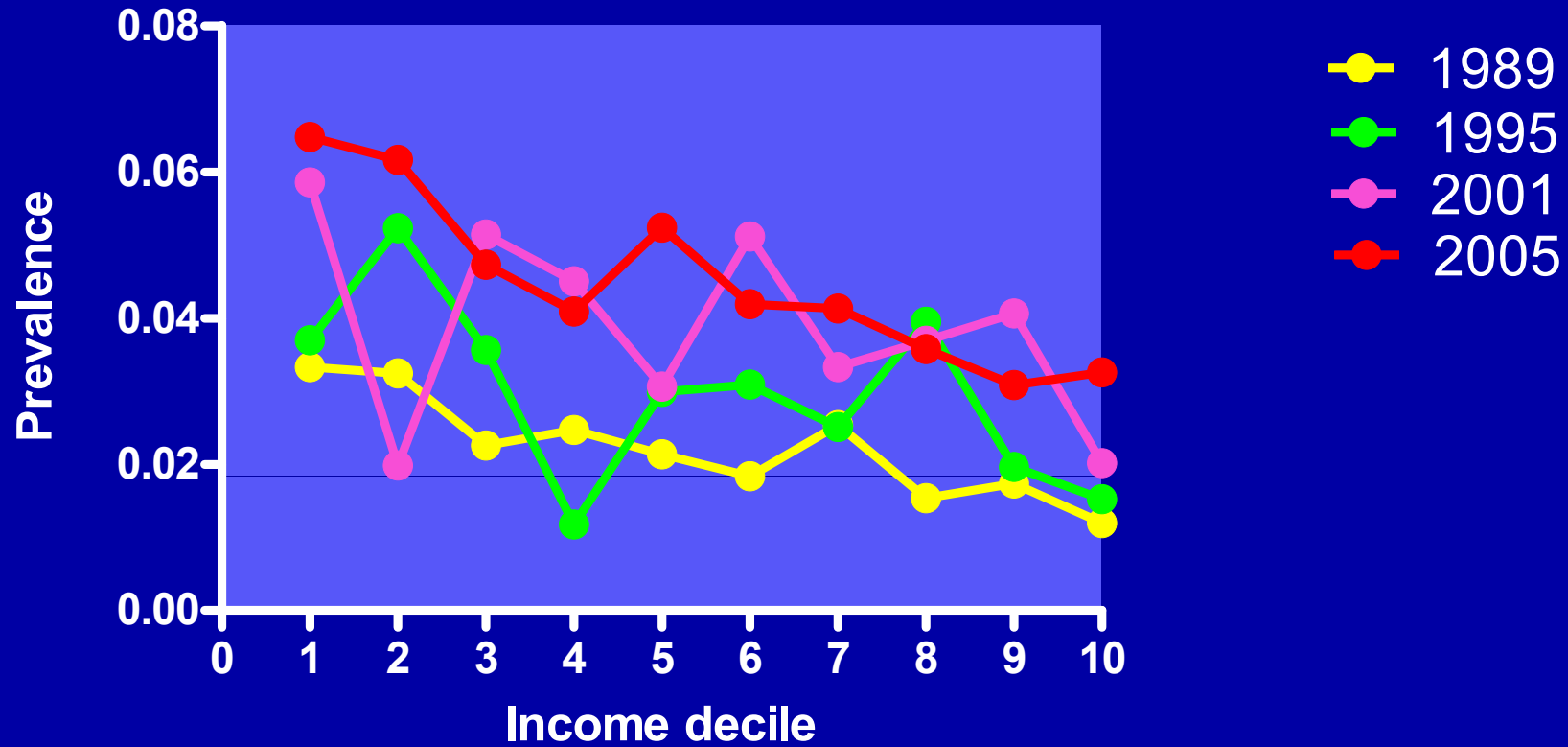
# Overweight or obese



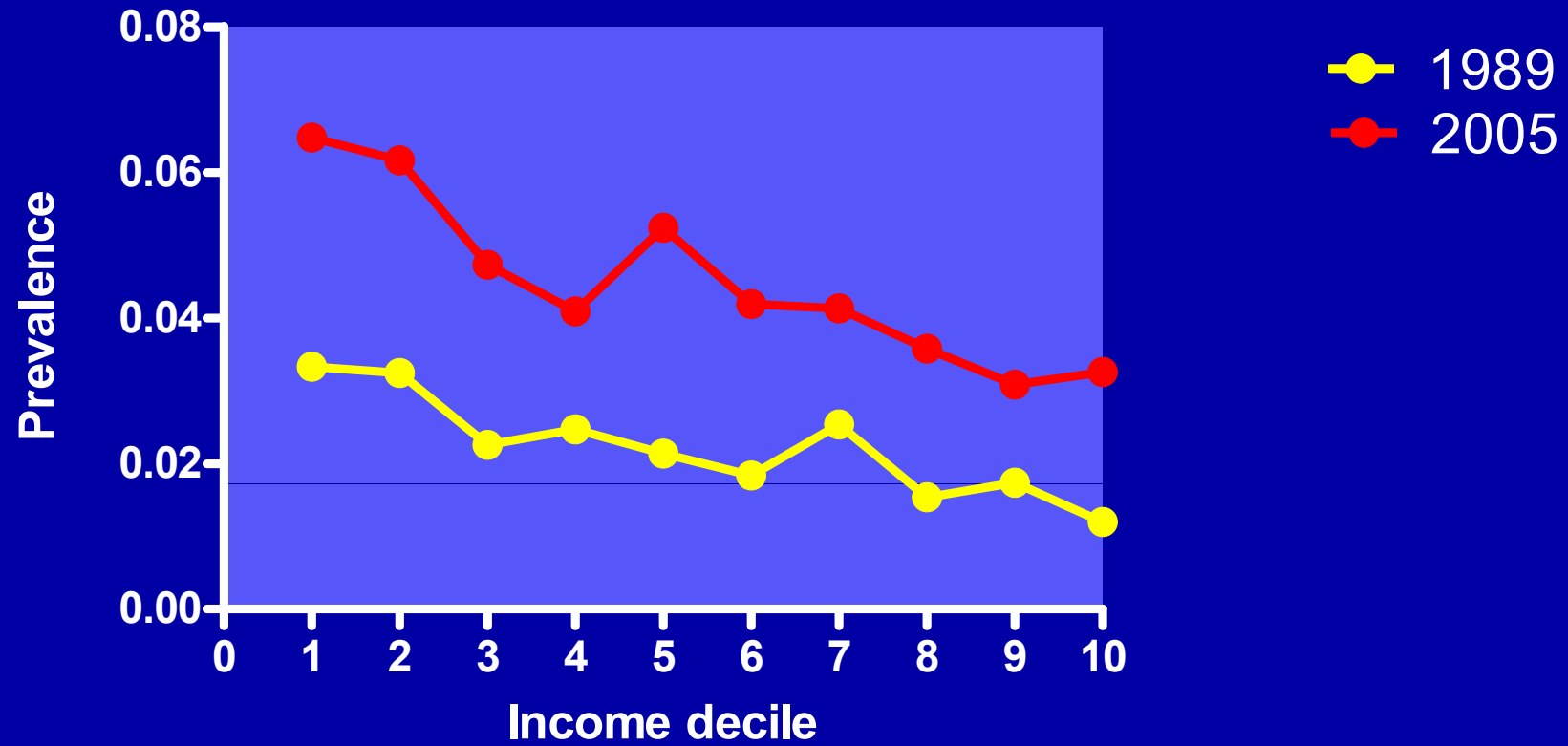
# Smoking



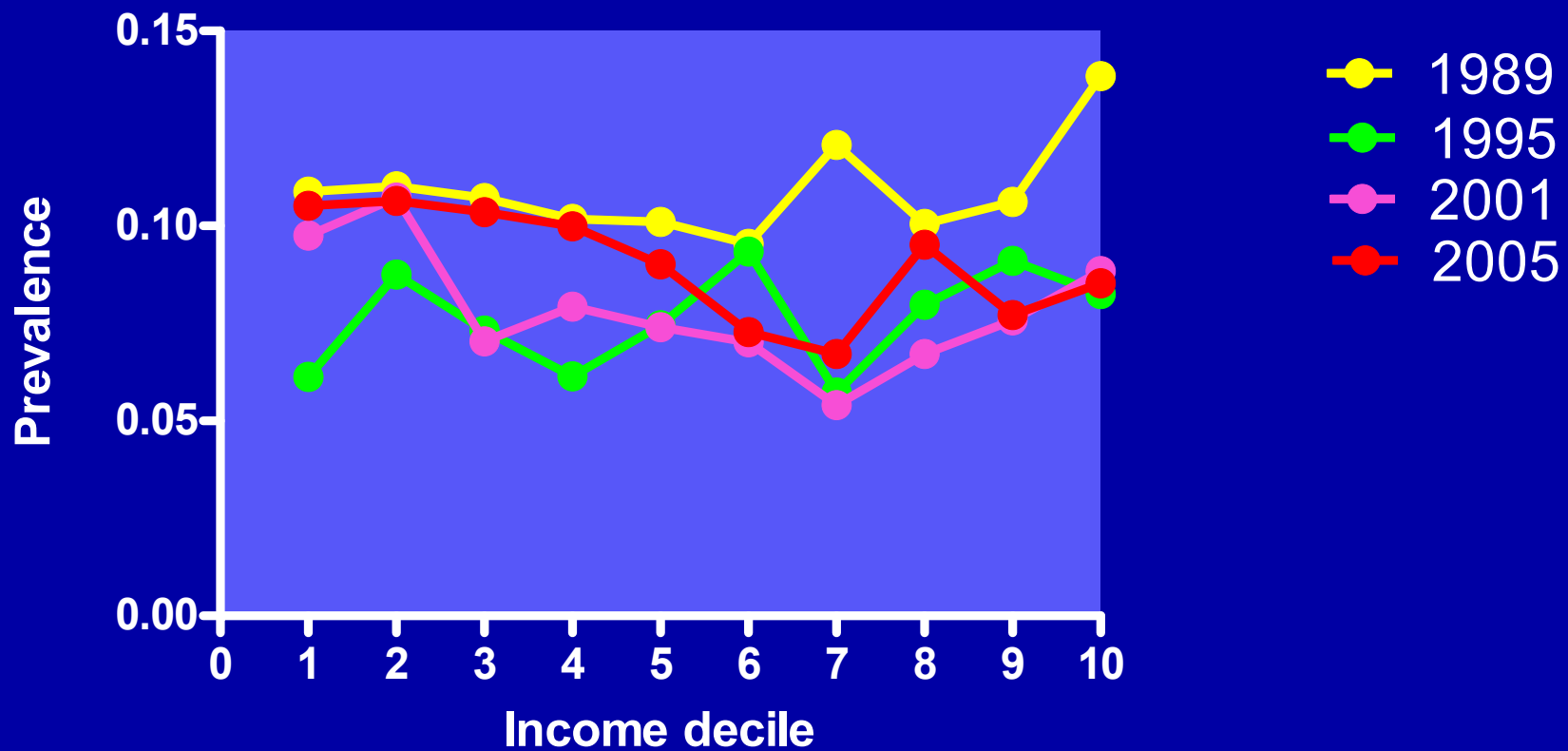
# Diabetes



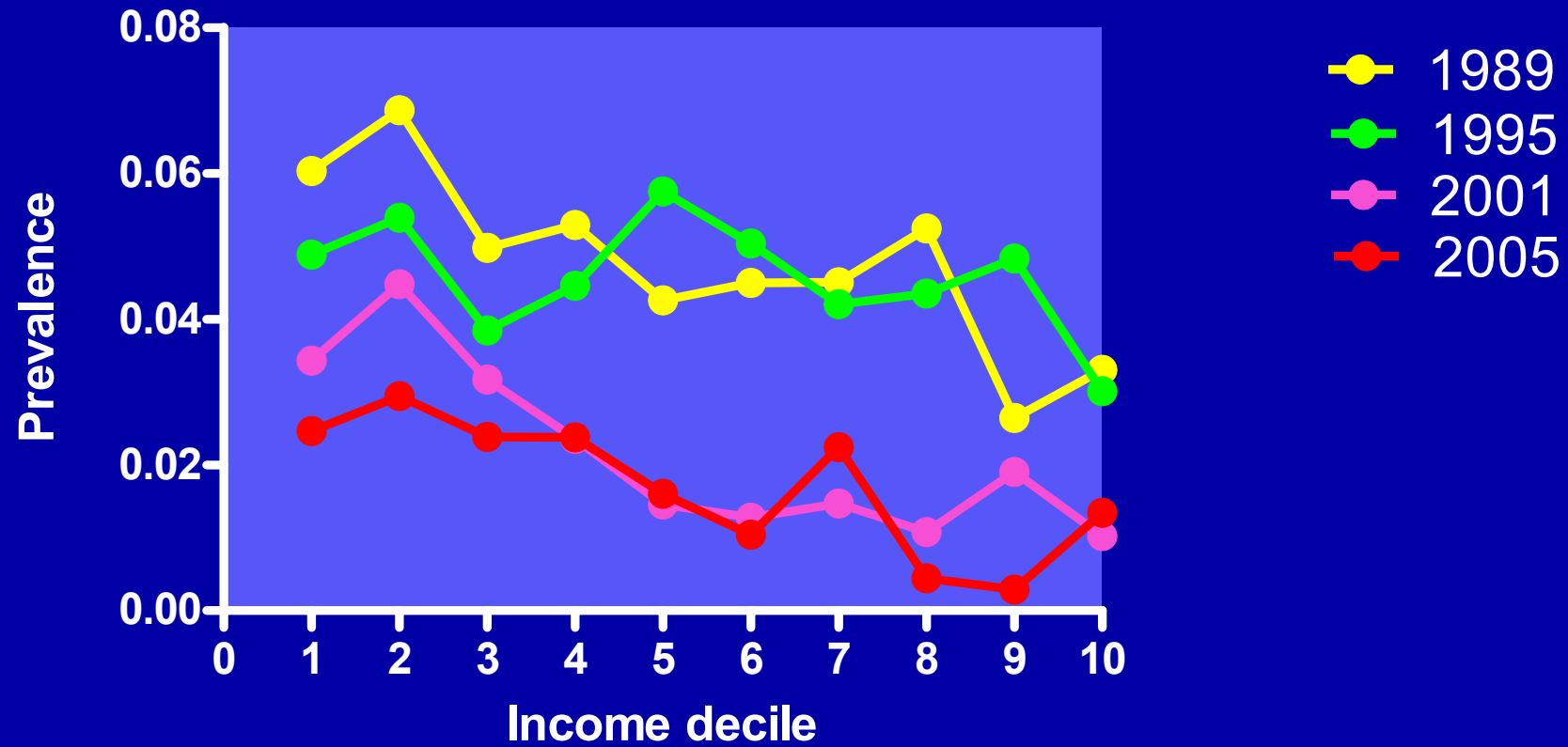
# Diabetes



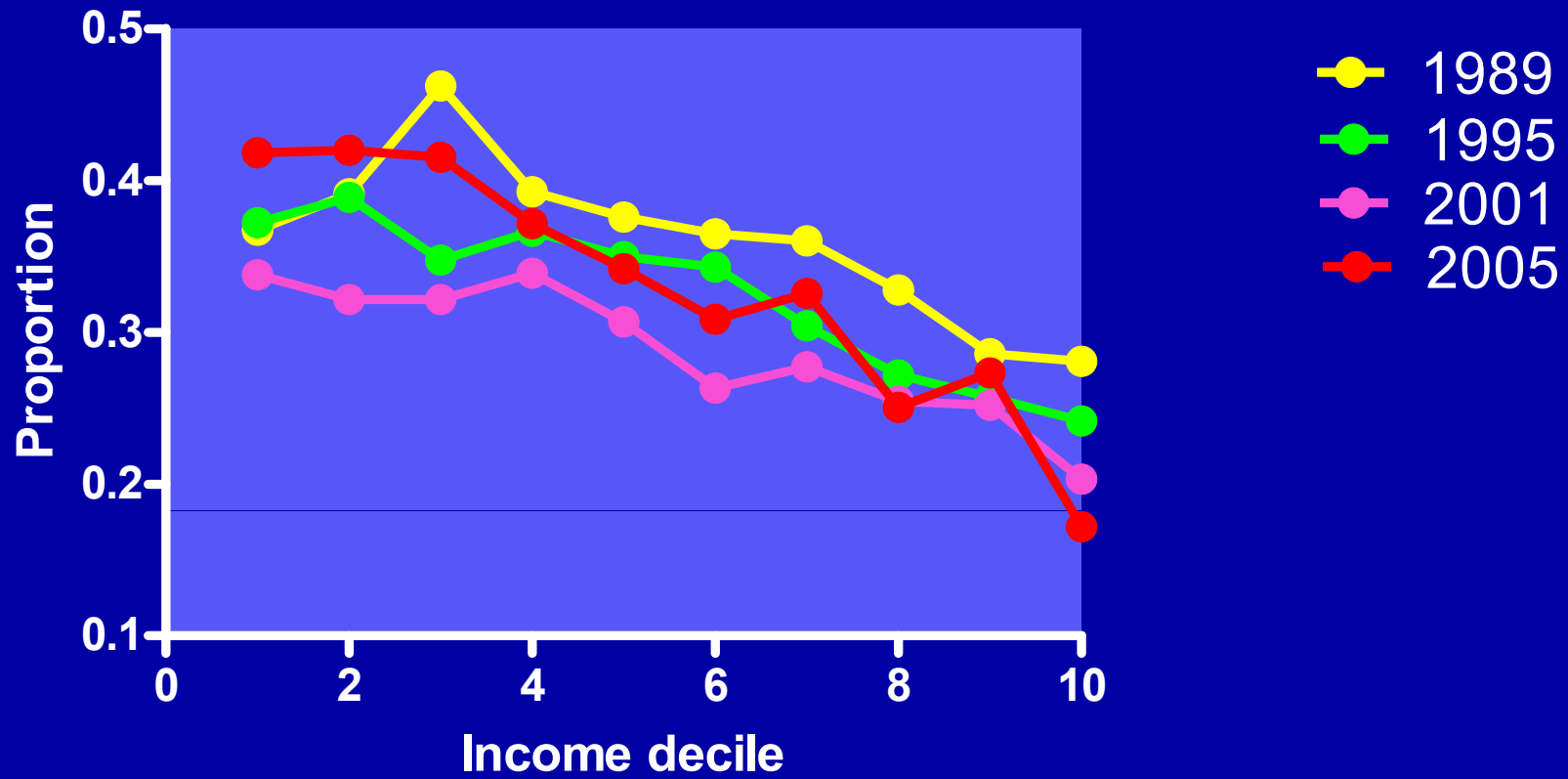
# High cholesterol

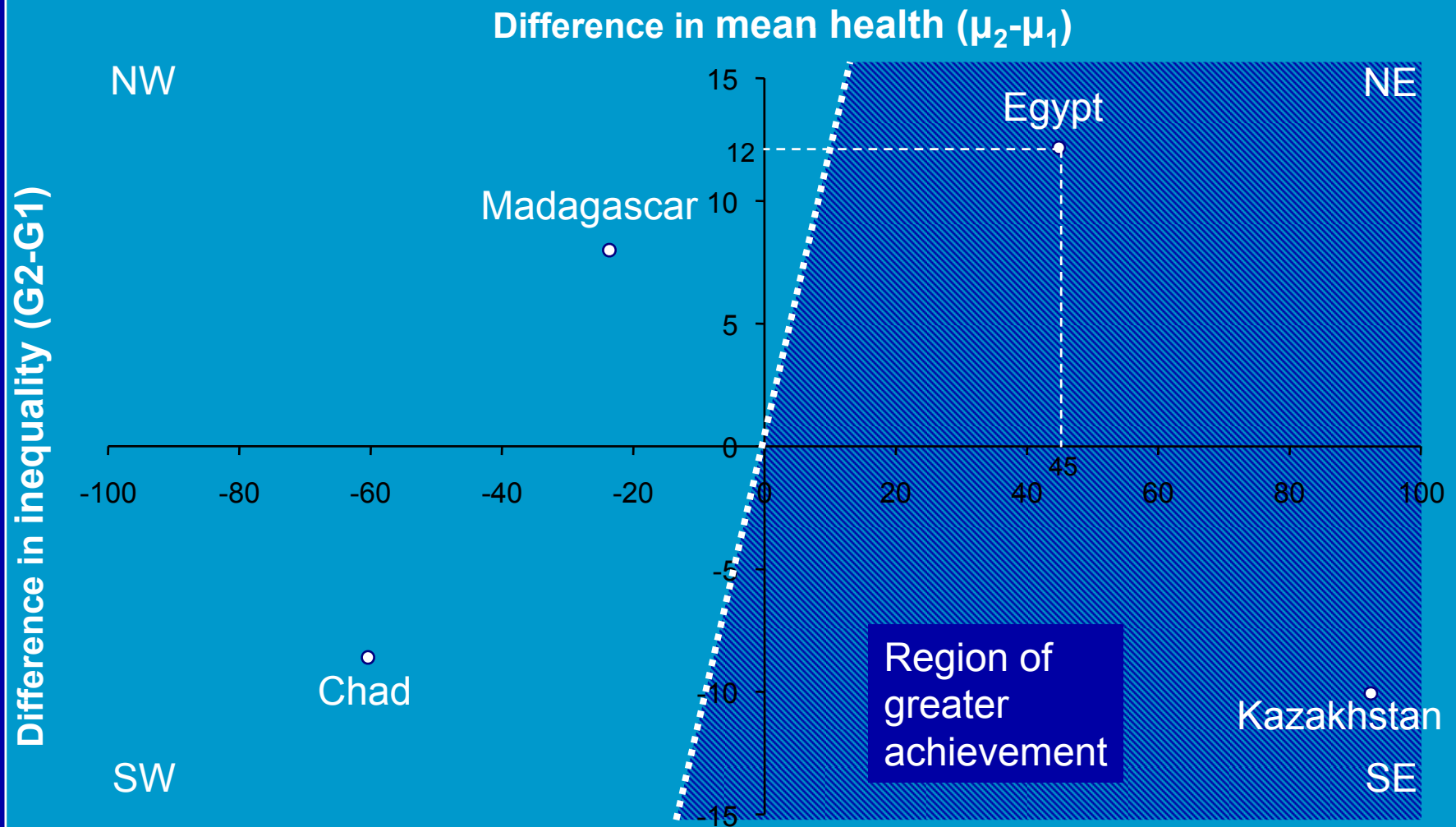


# Heart disease



# No exercise

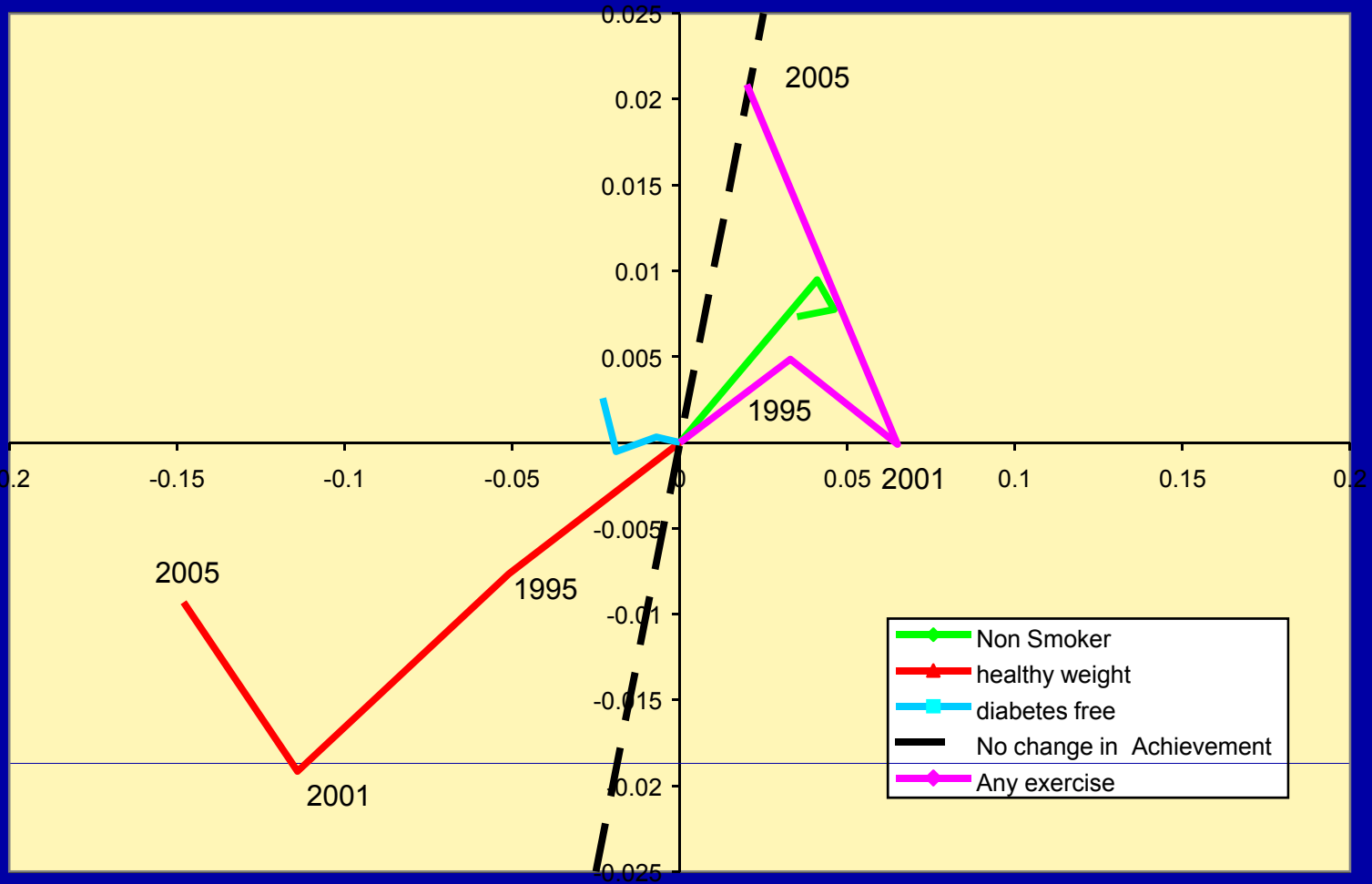




Incremental health achievement plane relative to Haiti

# Incremental achievement plane for population health parameters

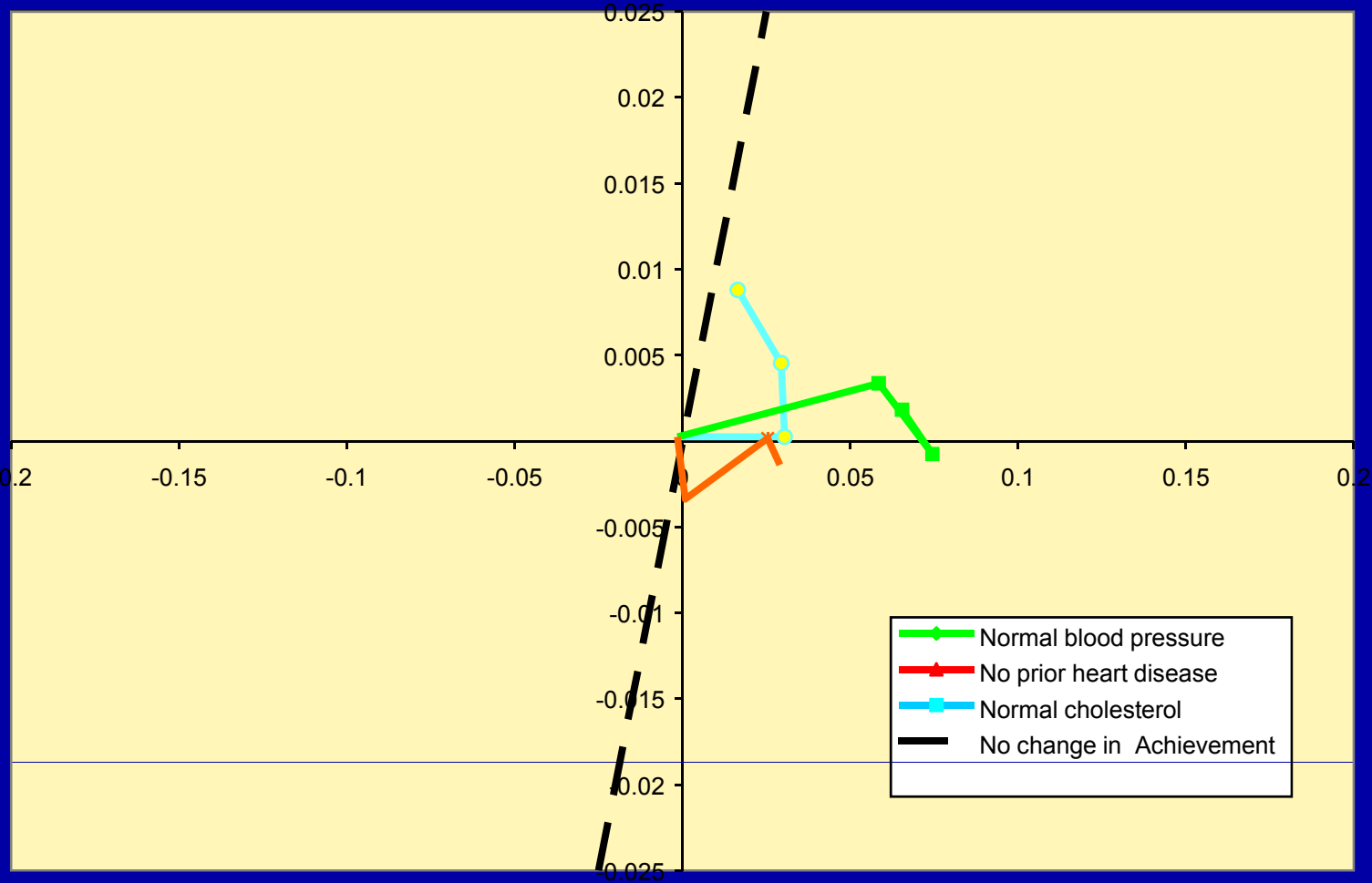
Change in generalised concentration index  
 $G_2 - G_1$



Difference in mean health since 1989 ( $\mu_2 - \mu_1$ )

# Incremental achievement plane for population health parameters

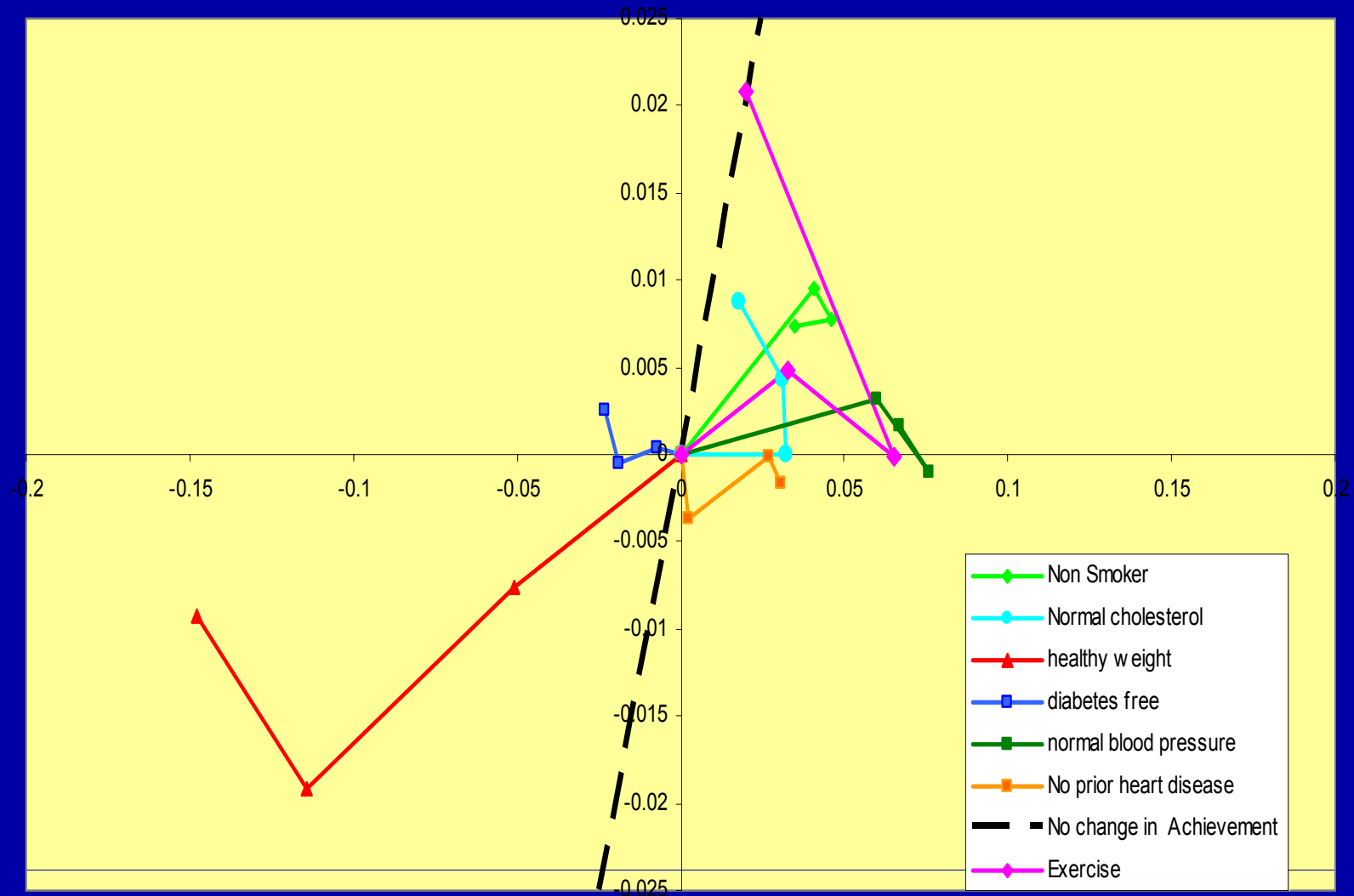
Change in generalised concentration index  
G2-G1



Difference in mean health since 1989 ( $\mu_2 - \mu_1$ )

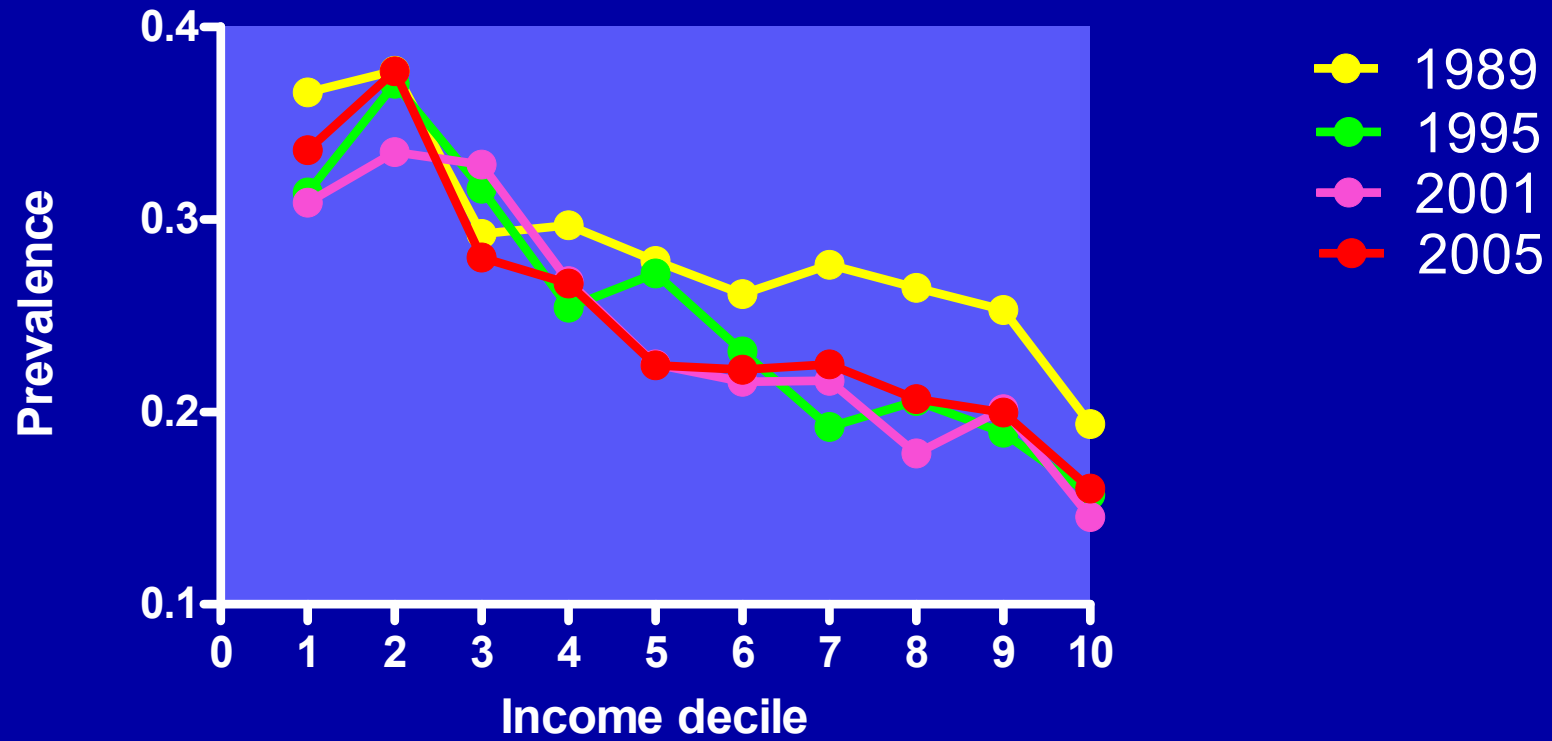
# Incremental achievement plane for population health parameters

Change in generalised concentration index  $G_2-G_1$



Difference in mean health since 1989 ( $\mu_2 - \mu_1$ )

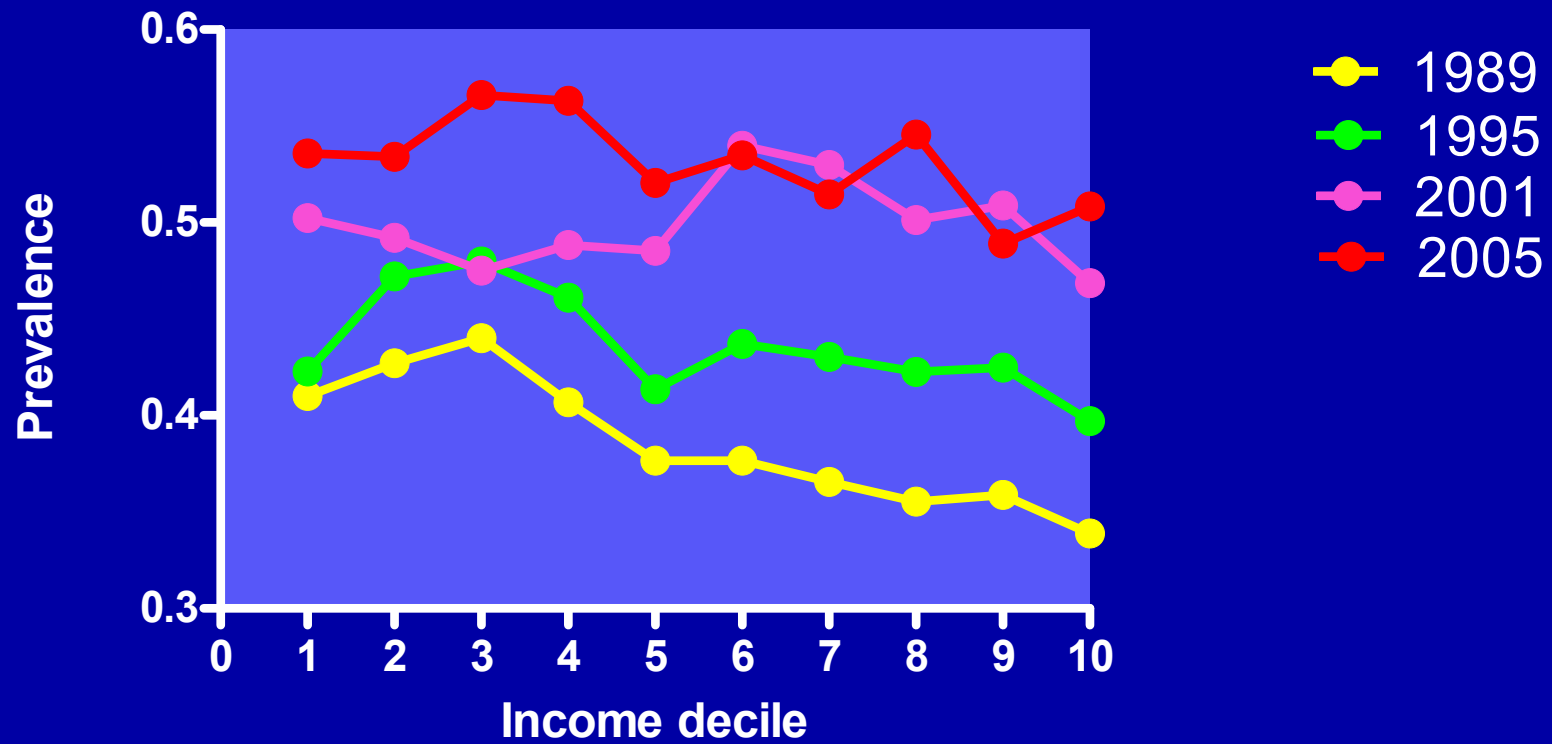
# Smoking



# Measuring achievement: smoking

Survey year	Mean	CI <sub>m</sub>	CI <sub>h</sub>	$\mu$ CI <sub>m</sub>	$\mu$ CI <sub>h</sub>	AI <sub>h</sub>	AI <sub>m</sub>
1989	0.291	-0.098	0.04	-0.0285	0.0285	0.6805	0.3195
1995	0.25	-0.152	0.051	-0.038	0.038	0.712	0.288
2001	0.245	-0.148	0.048	-0.0363	0.0363	0.7187	0.2813
2005	0.256	-0.14	0.048	-0.0358	0.0358	0.7082	0.2918

# Overweight or obese



# Overweight & obese

Survey year	Mean	CI <sub>m</sub>	CI <sub>h</sub>	$\mu$ CI <sub>m</sub>	$\mu$ CI <sub>h</sub>	AI <sub>h</sub>	AI <sub>m</sub>
1989	0.384	-0.046	0.029	-0.0177	0.0177	0.5984	0.4016
1995	0.435	-0.023	0.018	-0.01	0.01	0.555	0.445
2001	0.498	0.003	-0.003	0.0015	-0.0015	0.5035	0.4965
2005	0.532	-0.0157	0.018	-0.0084	0.0084	0.4596	0.4404

# AI for BMI>25 in 2001

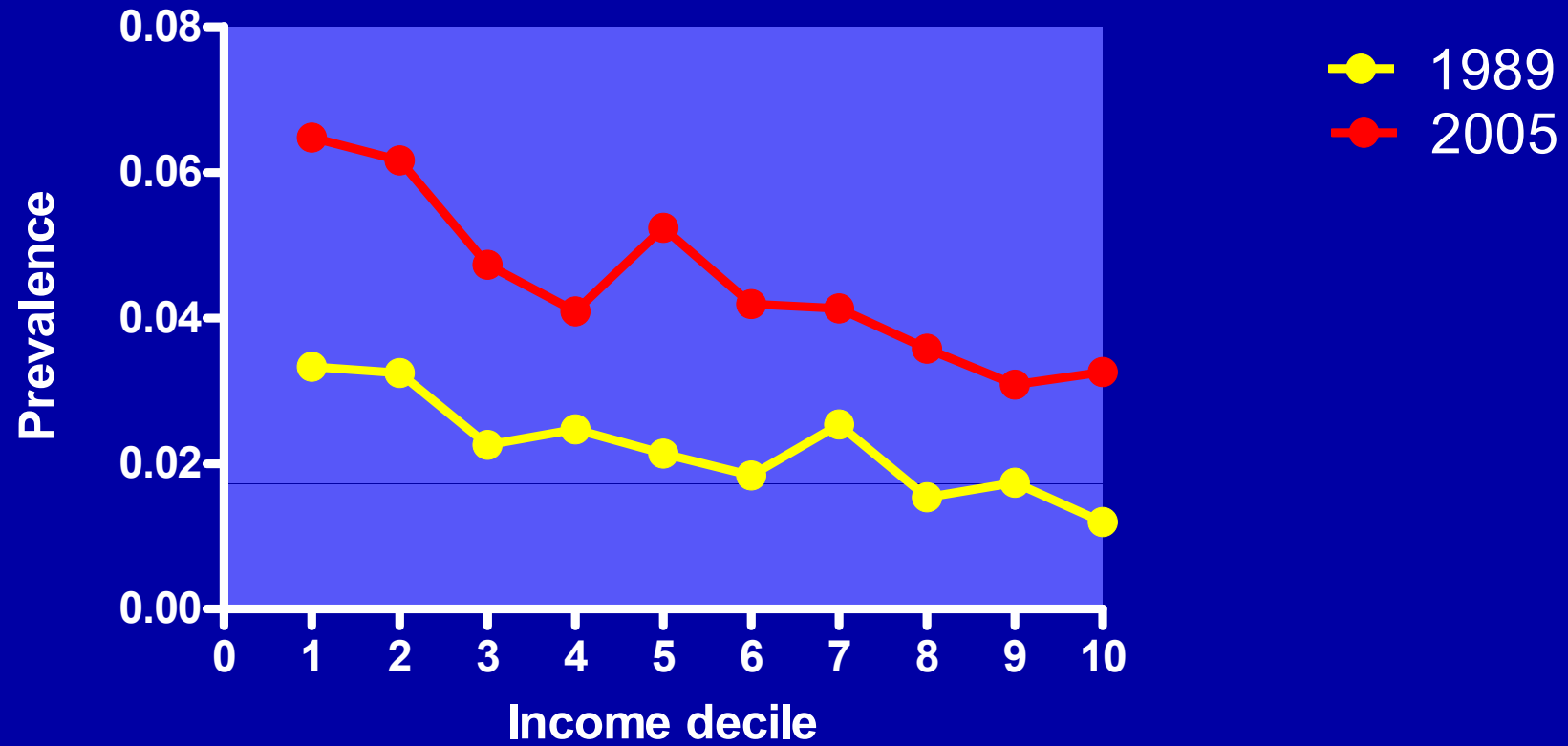
$$I(v) = \mu(1 - C(v))$$

$$I(2) = 0.498 * [1 - (-0.0015)]$$



Inequality favouring the poor contributes to higher health achievement!

# Diabetes



# Diabetes

Survey year	Mean	CI <sub>m</sub>	CI <sub>h</sub>	$\mu$ CI <sub>m</sub>	$\mu$ CI <sub>h</sub>	AI <sub>h</sub>	AI <sub>m</sub>
1989	.023	-.158	.0037	-.0036	.0036	0.9734	0.0266
1995	.03	-.132	.0041	-.004	.004	0.9660	0.034
2001	.042	-.074	.0119	-.006	.006	0.9466	0.0534
2005	.046	-.135	.0065	-.0062	.0062	0.9478	0.0522

# Summary - methodology

- Assessment of whether inequalities increasing or decreasing may depend on methodology
- Achievement index is dominated by the mean
- Achievement plane is a visual way of summarising changes in health and inequality

# Summary

- Inequalities in all risk factors in all surveys favour the rich except prevalence of overweight/obese in 2001
- Achievement plane is a visual way of summarising changes in prevalence and inequality
- Improvements in blood pressure and heart disease have been accompanied by decreasing inequality, but improvements in cholesterol, exercise, and smoking over the last 16 years have benefited the rich more than the poor
- Diabetes increasing and inequality also increasing – ie. becoming more concentrated in the poor.
- Prevalence of obesity/overweight is increasing, but inequalities are declining

	<b>Mean risk and CI for health</b>	<b>Mean risk and CI for ill-health</b>	<b>Achievement plane</b>
<b>Improving health Decreasing inequality</b>	heart disease		heart disease
<b>Improving health Increasing inequality</b>	blood pressure Smoking exercise	blood pressure smoking heart disease	blood pressure smoking high cholesterol
<b>Worsening health Decreasing inequality</b>	overweight / obese	overweight / obese diabetes	overweight / obese
<b>Worsening health Increasing inequality</b>	diabetes high cholesterol	high cholesterol	diabetes