Use Slopes to Track the "Fundamental Cause" of Group Disparities in Health

Linda S. Gottfredson
University of Delaware
Newark, DE 19716 USA

International Society for Intelligence Research
Madrid, December 19, 2009

“Fundamental cause”

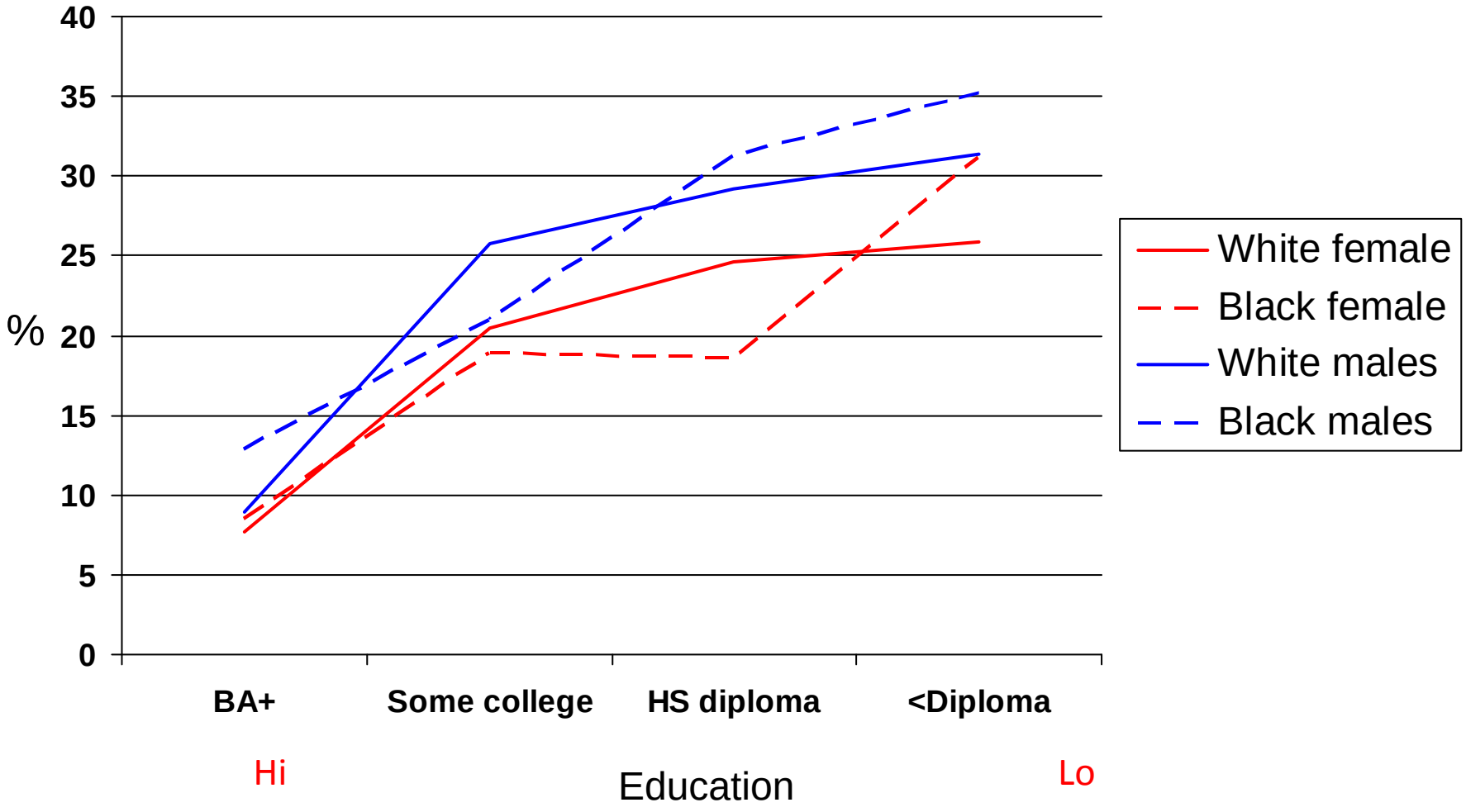
- The relation between social class and health is so general (cannot be explained by income, access to care, etc.) that there must be a highly generalizable “fundamental cause”

g as the "fundamental cause"

- Hypothesis:
  - group differences in *g* are the fundamental cause of group differences in health
- Common "disproof:"
  - "If correct…one might have expected the relation between IQ and mortality to act through known risk factors. This does not appear to be the case. In fact, a recent analysis…shows that this relationship is abolished when education and income are in the same model" (Marmot & Kivimaki, 2009)

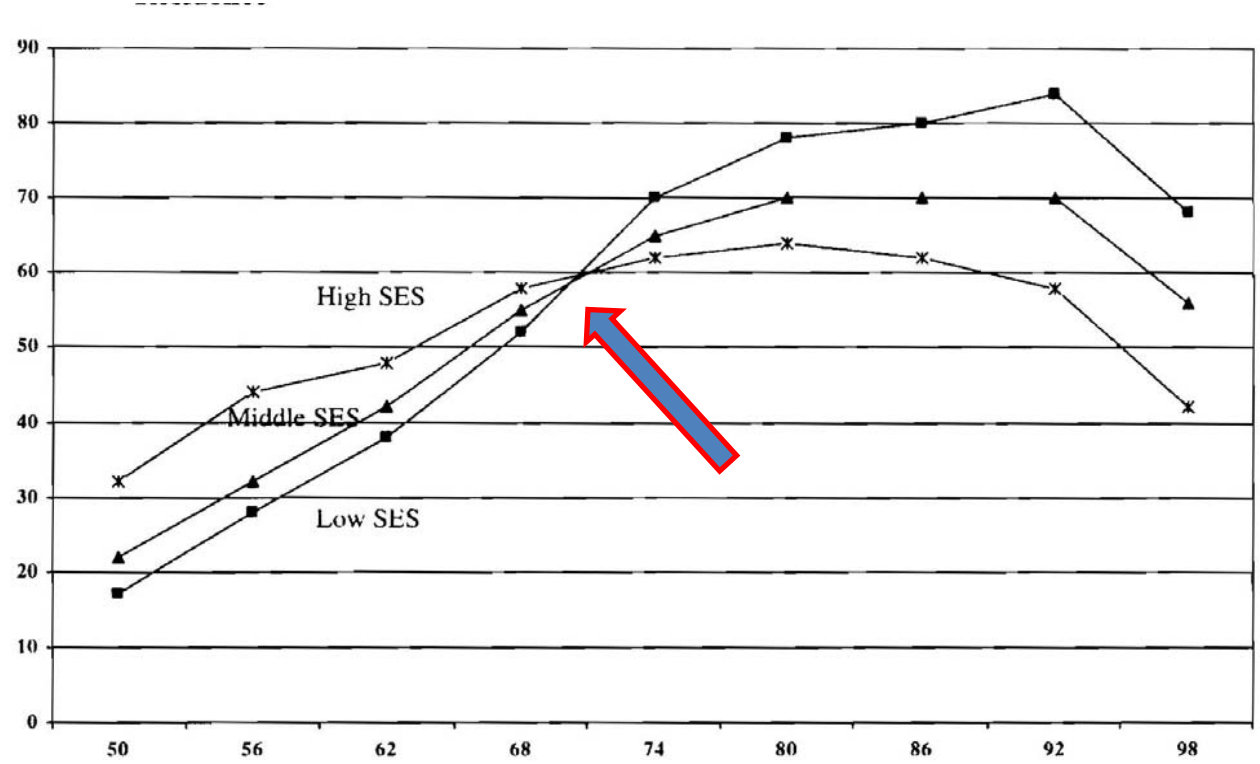
Example: Disparities in health behavior by education; all races & sexes: % who smoke, 2006 (age adjusted)

(CDC, Health in the United States, 2008, Table 64)



Lung cancer mortality, Men 25-64, 1950-1998 by social class of county, USA

(age adjusted)



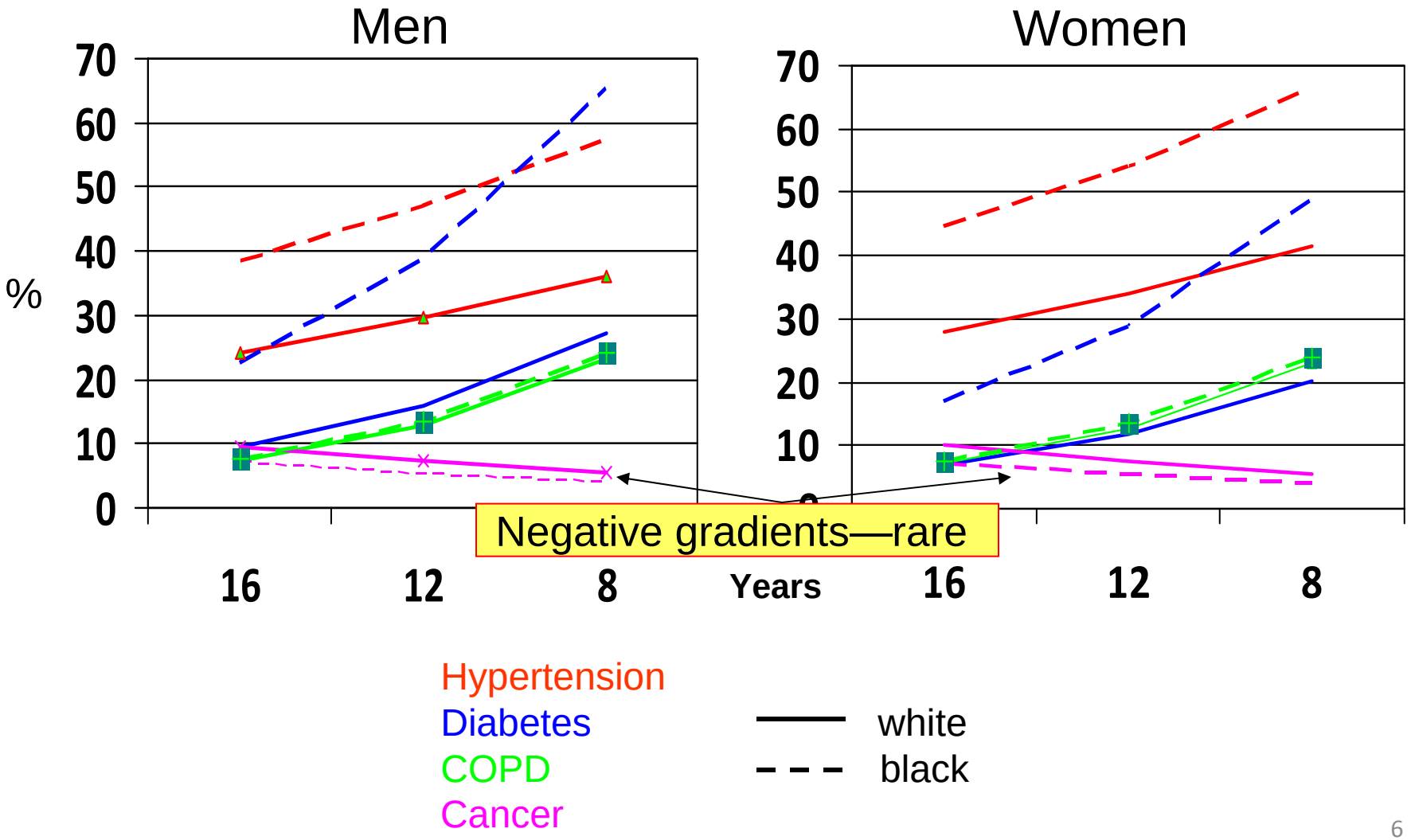
From Singh et al. 2002 *Journal of the National Cancer Institute*

Gradients sometimes flip over

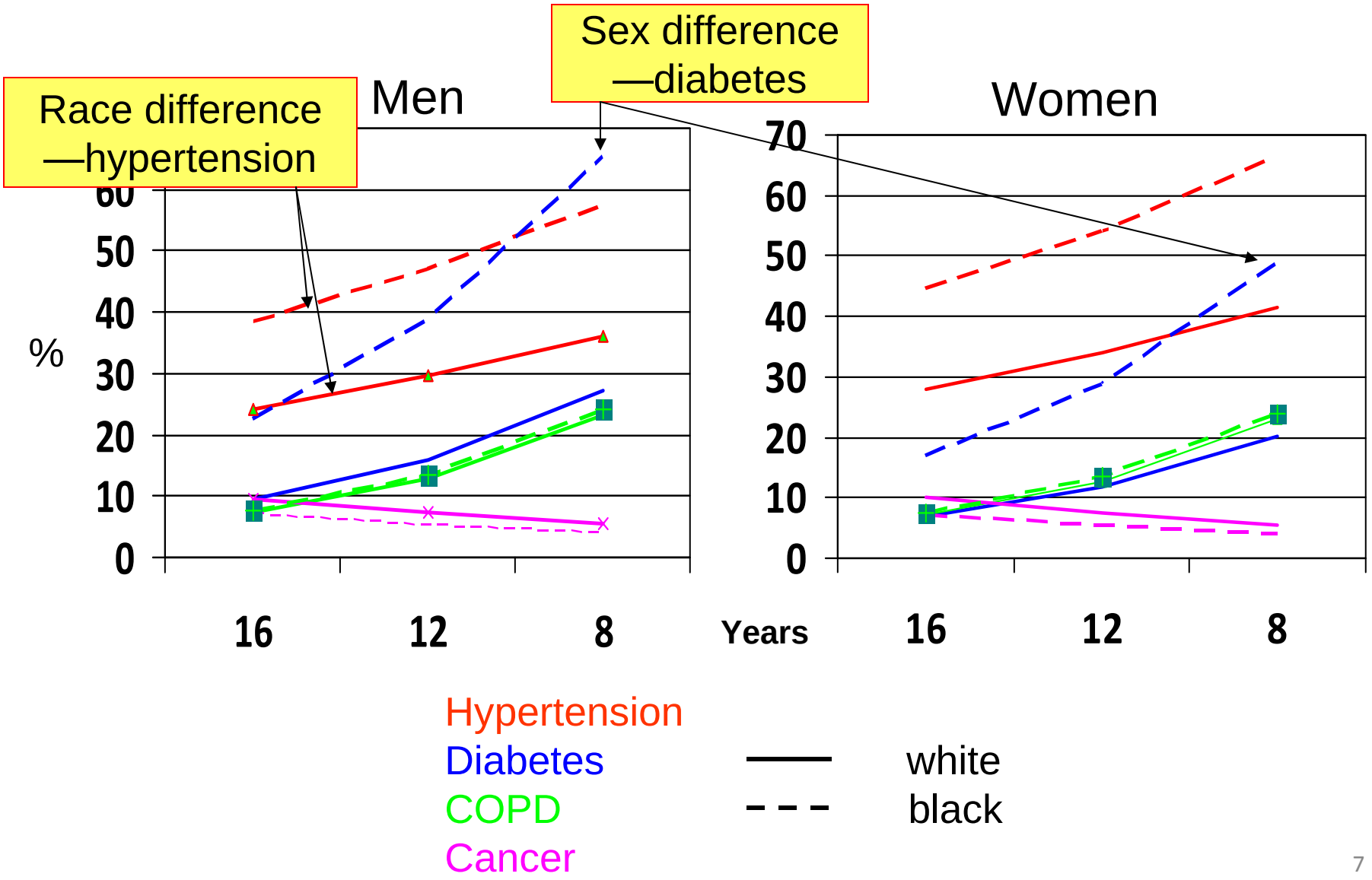
Typical health disparities by education; in all races & sexes:

% of non-ill 51-year-olds expected to have this chronic illness by age 63

(USA, ages 51-61 in 1992; Hayward et al, 2000)

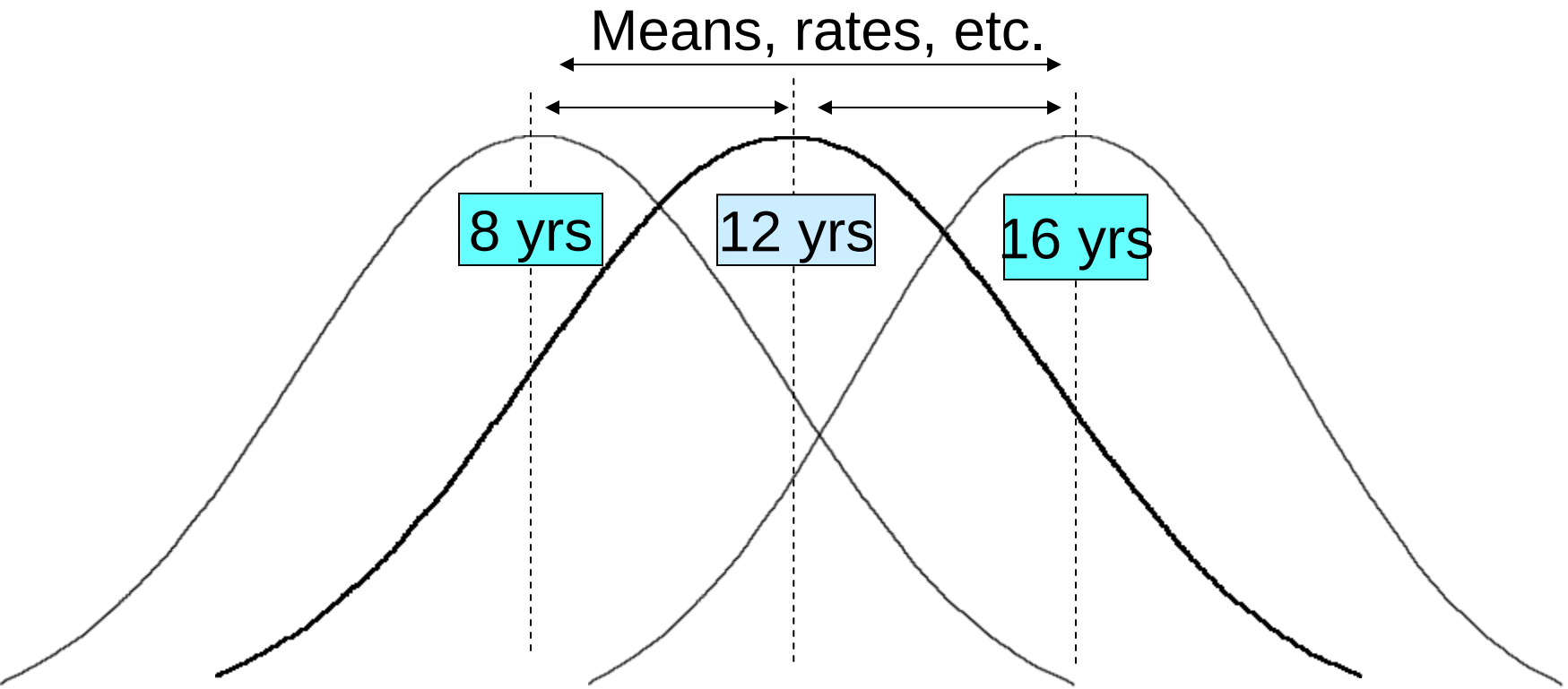


Common policy goal : All gradients flat



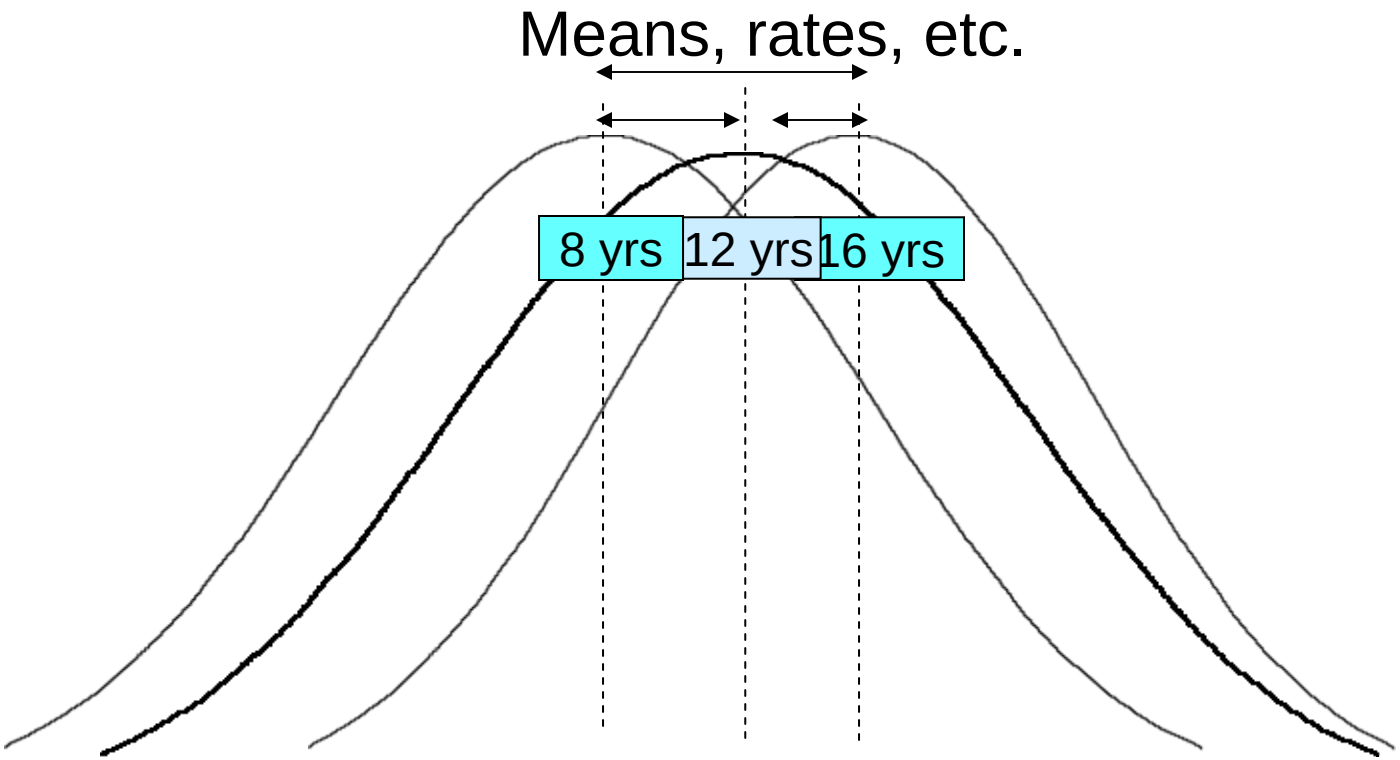
“Disparity” = group differences on health outcome X

“Explaining” between-group variation



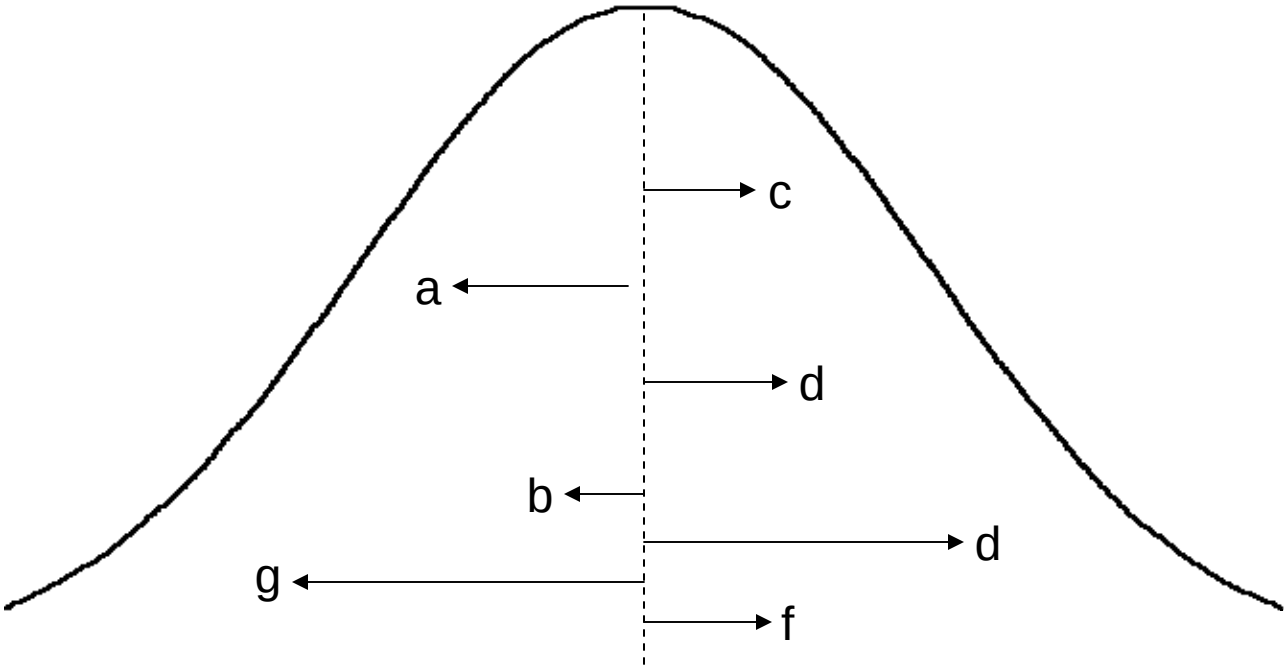
“Disparity” = group differences on health outcome X

“Explaining” between-group variation



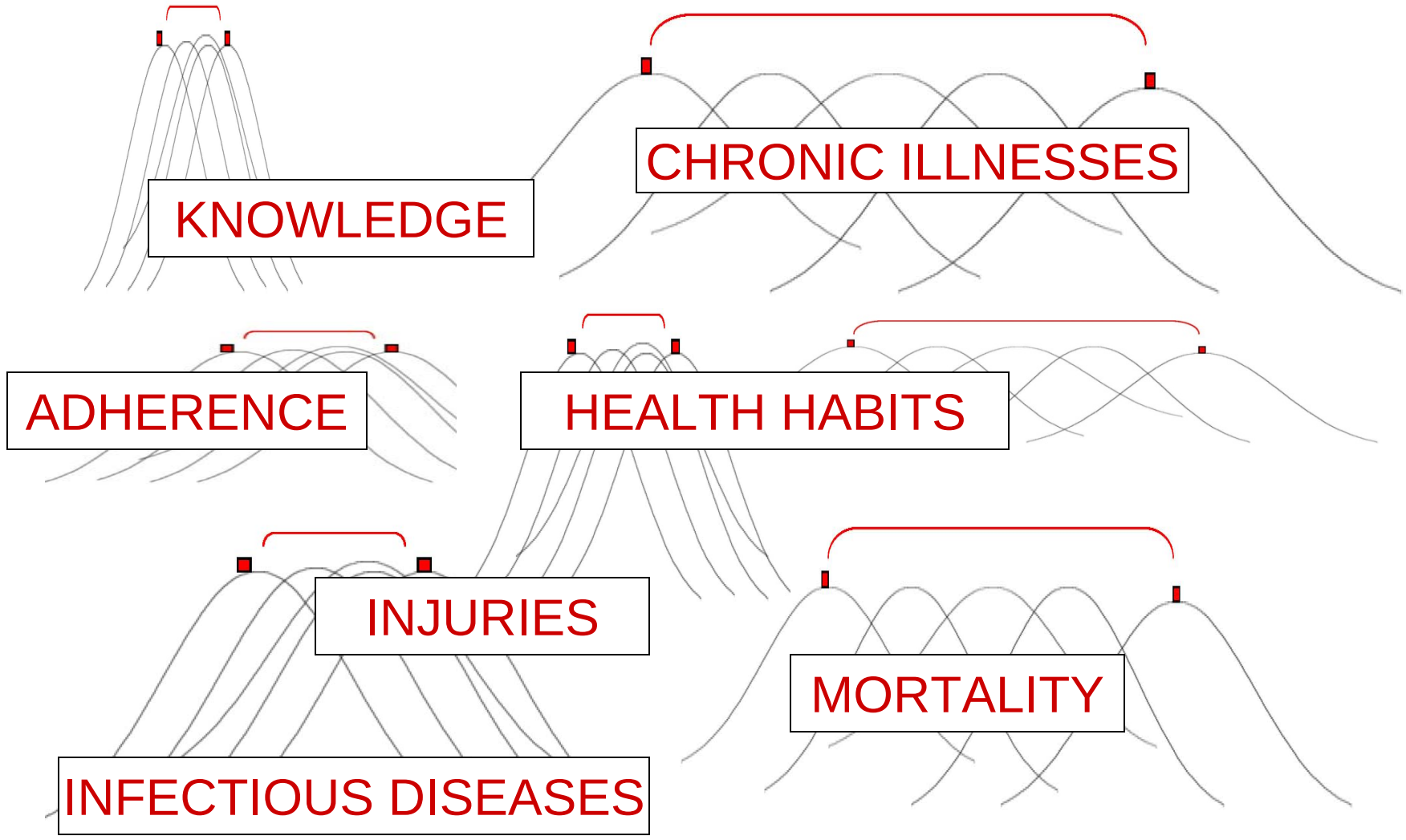
This is **not** about individual differences in health

Not “explaining” within-group variation



Within-group and between-group variance
may arise from different mix of causes

Many families of health disparities



Example 1

(Erikson & Torssander, 2008)

Mortality in Sweden, 1991-2003

Among all individuals ages 30-59 in 1990

So– born 1930-1960; still alive 1990

died ~ ages 31-73 (N ~ 130,000 deaths)

Social class = occupational level (1-6)

Universal health care

Ethnically homogeneous

} Removes 2 common sources of variance in disparities

Whole cohort (not sample)

Uniform classification of deaths

} Reduces error variance

Broad categories of death 1991-2003, Sweden

Social class disparities among individuals ages 30-59 in 1990

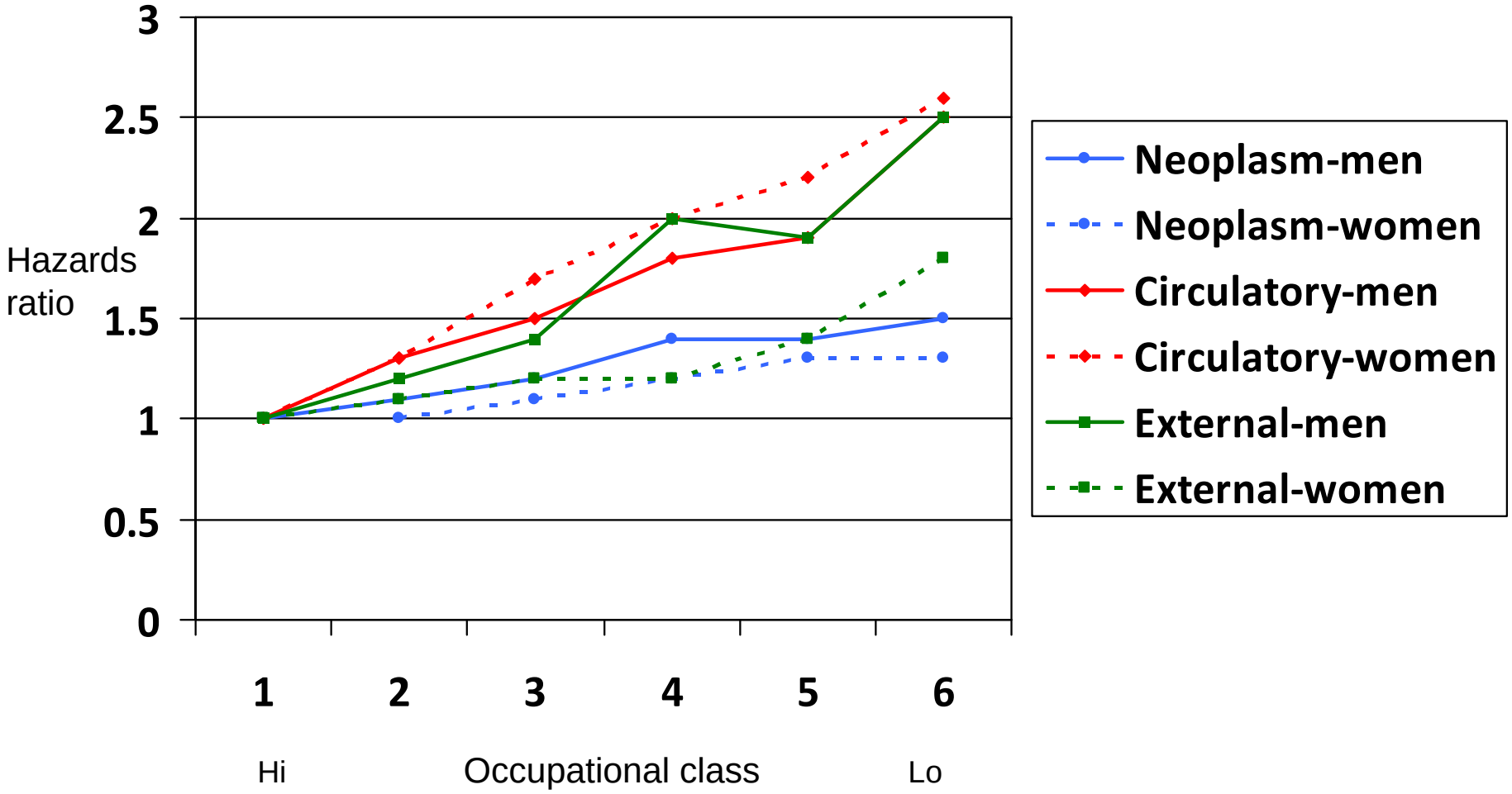
(Erikson & Torssander, 2008)

Causes *(selected)*	***Men*** *(N=80,040)*							***Women*** *(N=49,654)*						
	Hazards ratios by social class					***%***		***Hazards ratios by social class***					***%***	
	2	***3***	***4***	***5***	***6 (lo)***			***2***	***3***	***4***	***5***	***6 (lo)***		
Neoplasms	1.1	1.2	1.4	1.4	1.5	35		1.0	1.1	1.2	1.3	1.3	58	
Infections	1.3	1.4	1.4	1.1	2.2	1		1.2	1.8	1.9	2.0	2.3	1	
Nervous system	1.1	1.2	1.4	2.1	2.2	2		1.0	1.1	1.3	1.6	1.5	2	
Circulatory	1.3	1.5	1.8	1.9	2.5	35		1.3	1.7	2.0	2.2	2.6	19	
Musculoskeletal	1.9	2.0	1.7	3.2	2.6	<1		1.3	2.5	2.5	2.0	2.0	1	
External	1.2	1.4	2.0	1.9	2.5	13		1.1	1.2	1.2	1.4	1.8	8	
Respiratory	1.2	1.6	2.3	2.9	3.0	3		1.4	1.9	2.4	2.4	3.0	4	
Endocrine	1.3	1.8	1.9	3.9	3.1	2		1.3	2.0	2.6	3.1	3.7	2	
Mental/behav	1.4	1.7	3.8	3.1	5.3	2		1.1	1.7	1.7	2.4	2.9	1	
TOTAL	**1.2**	**1.4**	**1.7**	**1.8**	**2.1**	**100**		**1.1**	**1.3**	**1.4**	**1.6**	**1.7**	**100**	

1=Higher managerial/professional, **2**=lower managerial/professional, **3**= intermediate,
4=lower supervisory/skilled manual, **5**=routine non-manual, **6**=unskilled manual

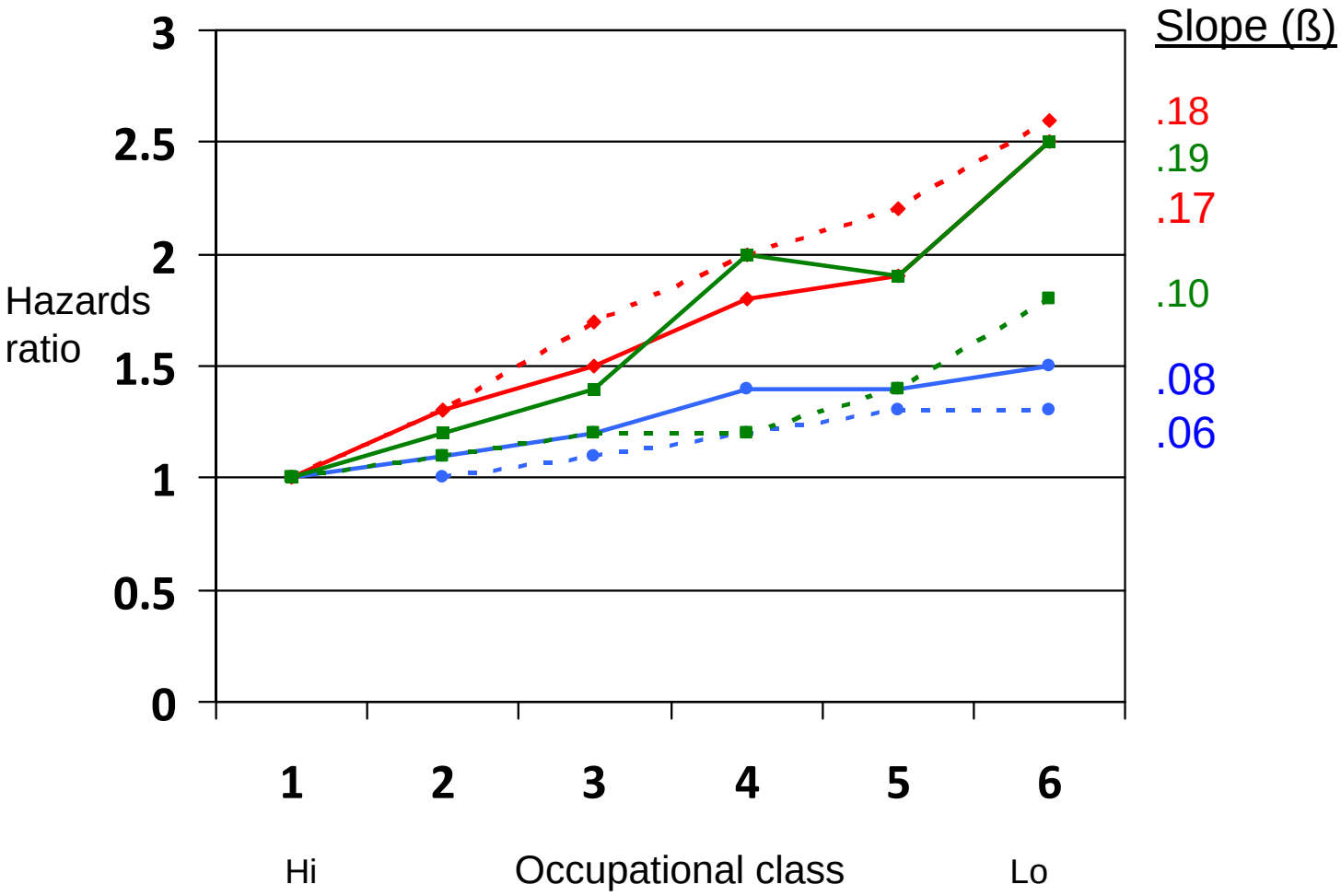
Three major causes of death 1991-2003, Sweden

Social class gradients for individuals ages 30-59 in 1990



Three major causes of death 1991-2003, Sweden

Social class gradients for individuals ages 30-59 in 1990



Causes of death 1991-2003, Sweden

Social class disparities among individuals ages 30-59 in 1990

(Erikson & Torssander, 2008)

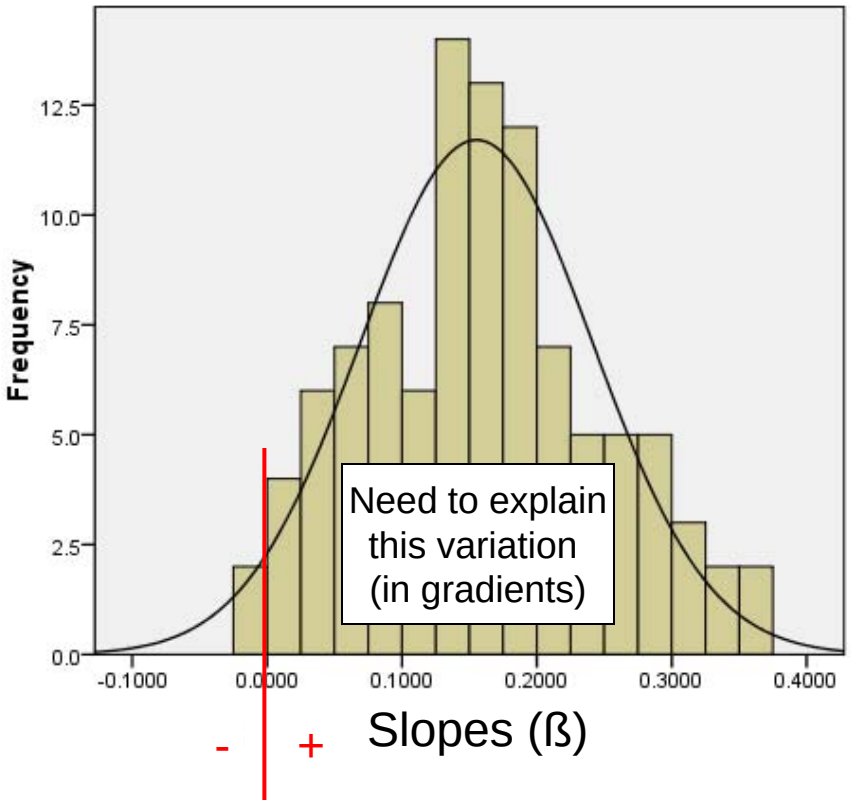
Slopes = linear regression of HRs on class categories

Causes *(selected)*	***Men*** *(N=80,040)*							***Women*** *(N=49,654)*						
	Hazards ratios by social class					***%***	***Slope (ß)***	***Hazards ratios by social class***					***%***	***Slope (ß)***
	2	***3***	***4***	***5***	***6 (lo)***			***2***	***3***	***4***	***5***	***6 (lo)***		
Neoplasms	1.1	1.2	1.4	1.4	1.5	35	.08	1.0	1.1	1.2	1.3	1.3	58	.06
Infections	1.3	1.4	1.4	1.1	2.2	1	.10	1.2	1.8	1.9	2.0	2.3	1	.17
Nervous system	1.1	1.2	1.4	2.1	2.2	2	.16	1.0	1.1	1.3	1.6	1.5	2	.10
Circulatory	1.3	1.5	1.8	1.9	2.5	35	.17	1.3	1.7	2.0	2.2	2.6	19	.18
Musculoskeletal	1.9	2.0	1.7	3.2	2.6	<1	.17	1.3	2.5	2.5	2.0	2.0	1	.14
External	1.2	1.4	2.0	1.9	2.5	13	.19	1.1	1.2	1.2	1.4	1.8	8	.10
Respiratory	1.2	1.6	2.3	2.9	3.0	3	.24	1.4	1.9	2.4	2.4	3.0	4	.21
Endocrine	1.3	1.8	1.9	3.9	3.1	2	.25	1.3	2.0	2.6	3.1	3.7	2	.26
Mental/behavioral	1.4	1.7	3.8	3.1	5.3	2	.33	1.1	1.7	1.7	2.4	2.9	1	.22
TOTAL	**1.2**	**1.4**	**1.7**	**1.8**	**2.1**	**100**	**.15**	**1.1**	**1.3**	**1.4**	**1.6**	**1.7**	**100**	**.10**

1=Higher managerial/professional, **2**=lower managerial/professional, **3**= intermediate,
4=lower supervisory/skilled manual, **5**=routine non-manual, **6**=unskilled manual

Distribution of all 101 class-mortality slopes (50 men, 51 women)

NOT independent (includes broad categories plus high-volume sub-categories)



Mean = .16
SD = .09

But recall population—

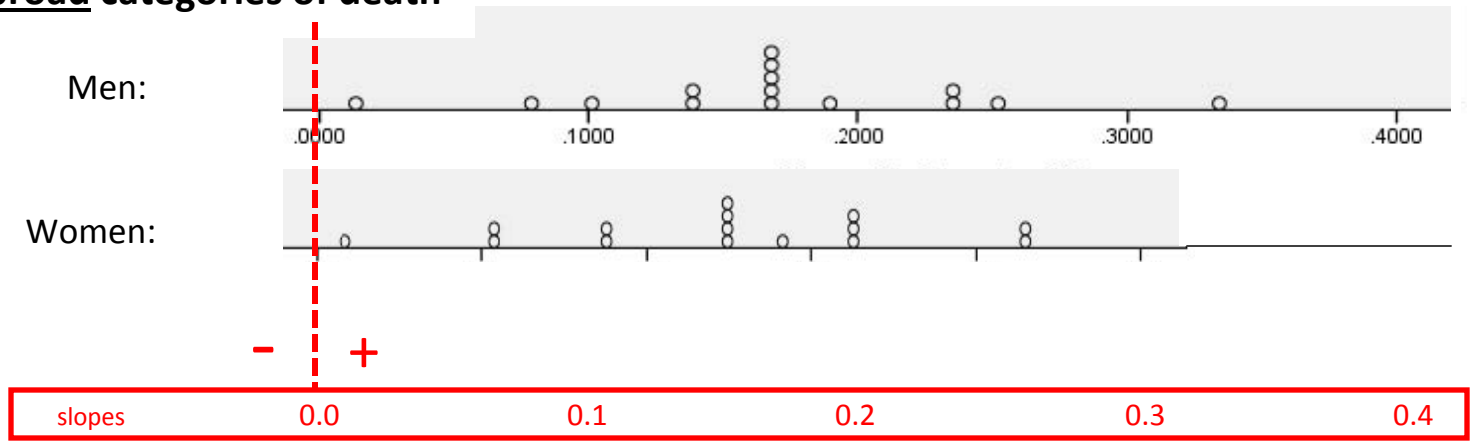
- Universal health care
- Ethnically homogeneous
- Cohort born 1930-1960
- Died ~ ages 31-73

Distribution of class-mortality slopes

Ages 30-59 in 1990, died 1991-2003, Sweden

Variability in size of gradients across causes

15 broad categories of death

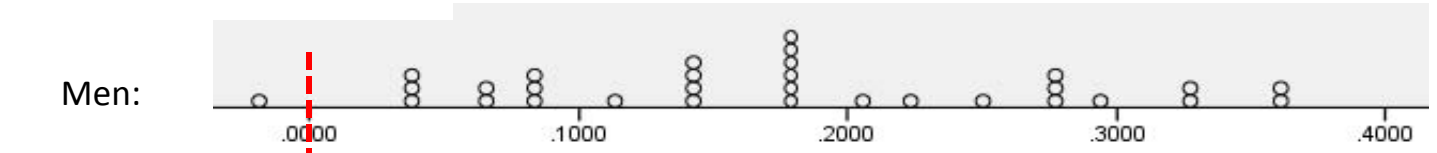


Distribution of class-mortality slopes

Ages 30-59 in 1990, died 1991-2003, Sweden

More variability across specific causes

35 specific causes of death



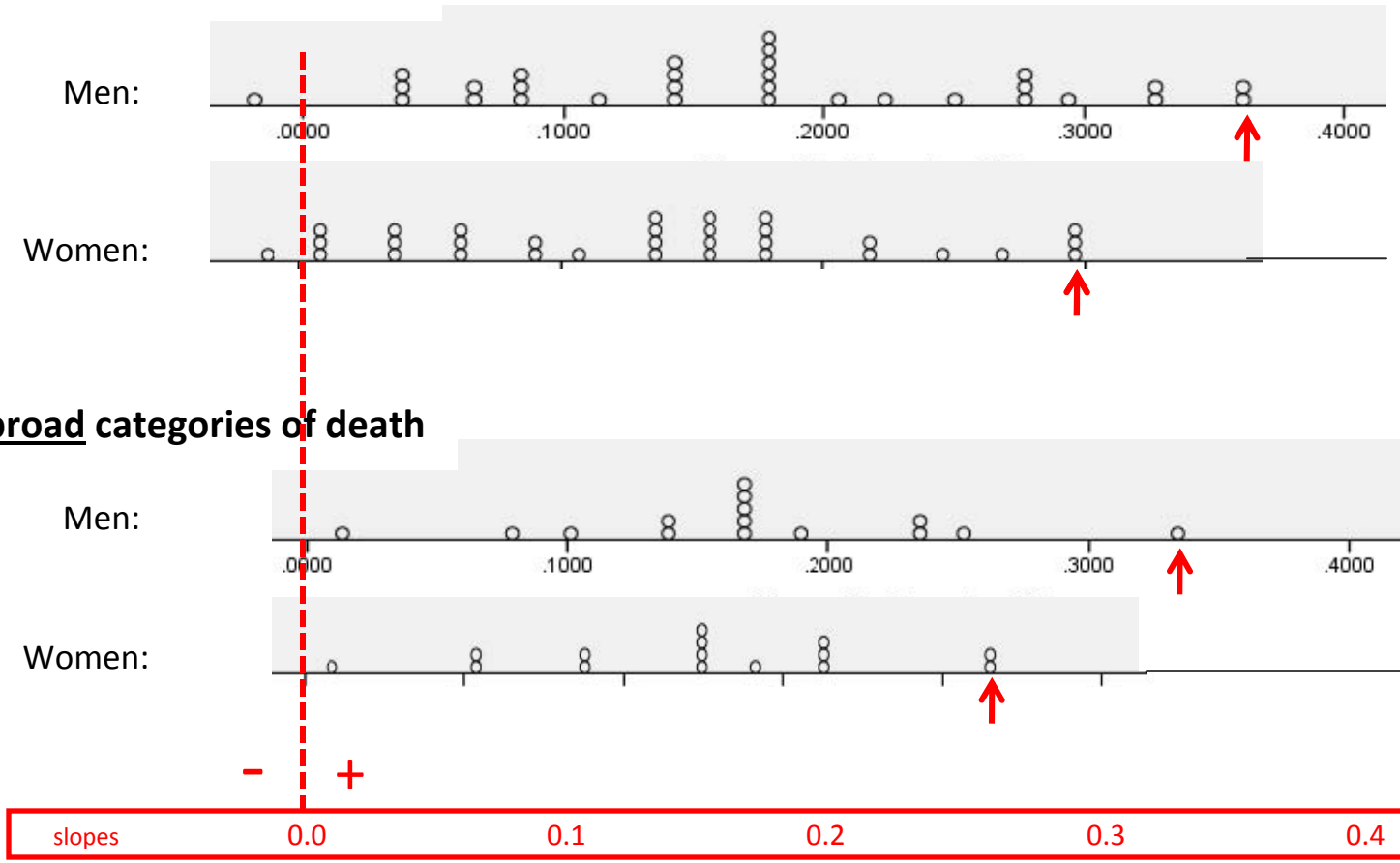
15 broad categories of death

Distribution of class-mortality slopes

Ages 30-59 in 1990, died 1991-2003, Sweden

Sex differences in class gradients

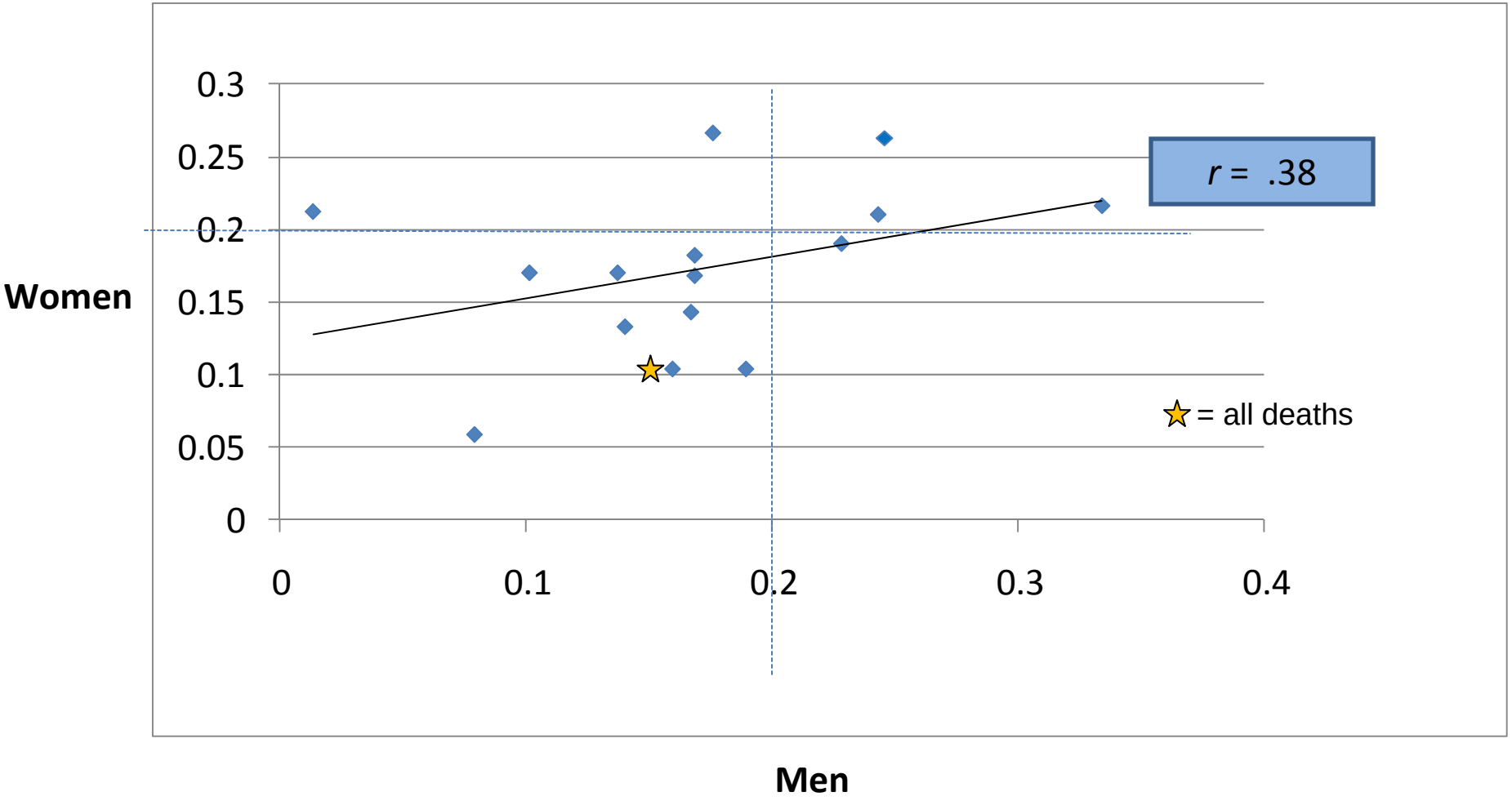
35 specific causes of death



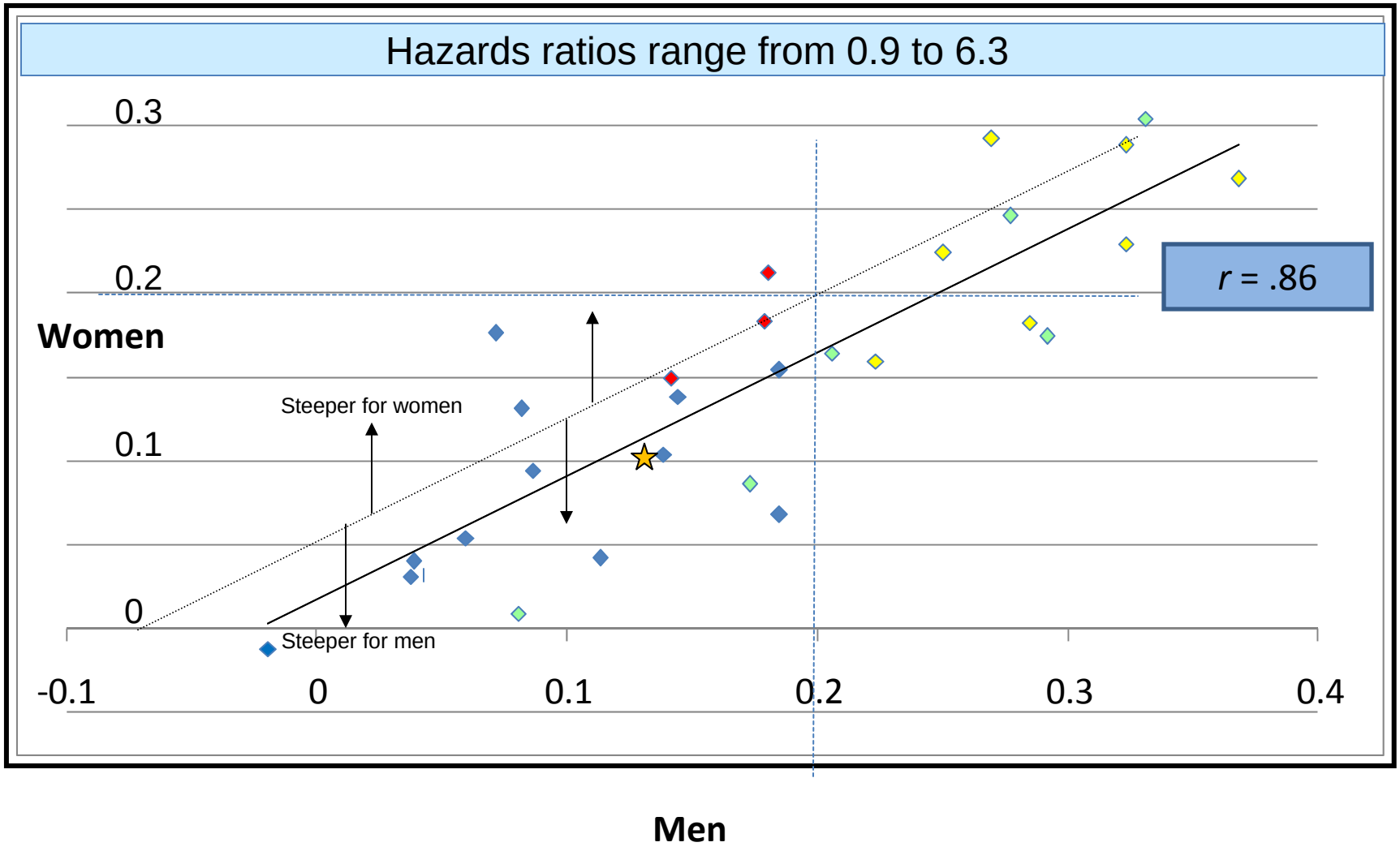
	Mean	SD
35 specific causes of death		
Men:	0.17	0.10
Women:	0.14	0.09
15 broad categories of death		
Men:	0.17	0.08
Women:	0.17	0.06

Plot of slopes for men vs. women, broad categories of death

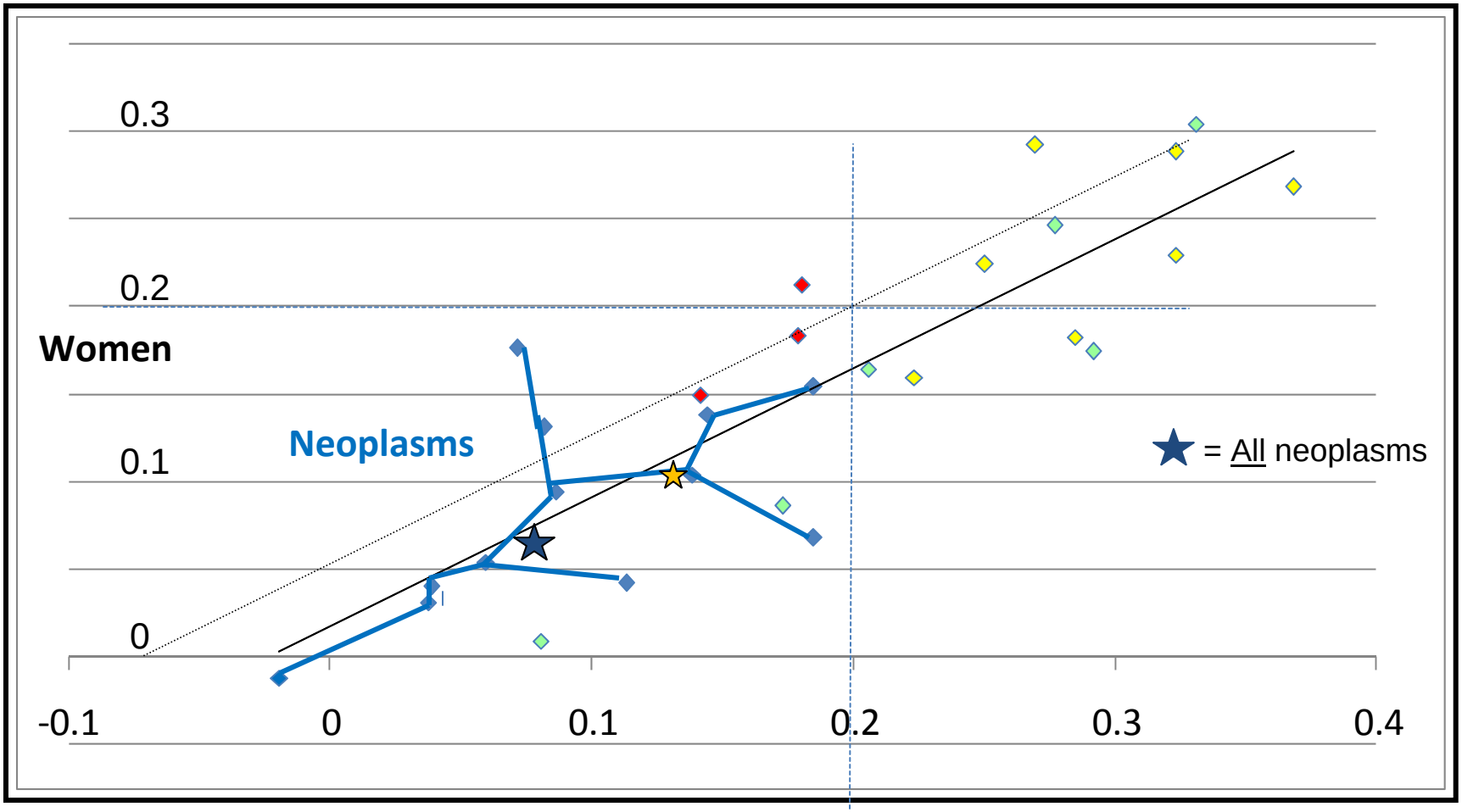
Hazards ratios range from 1.3 to 5.3



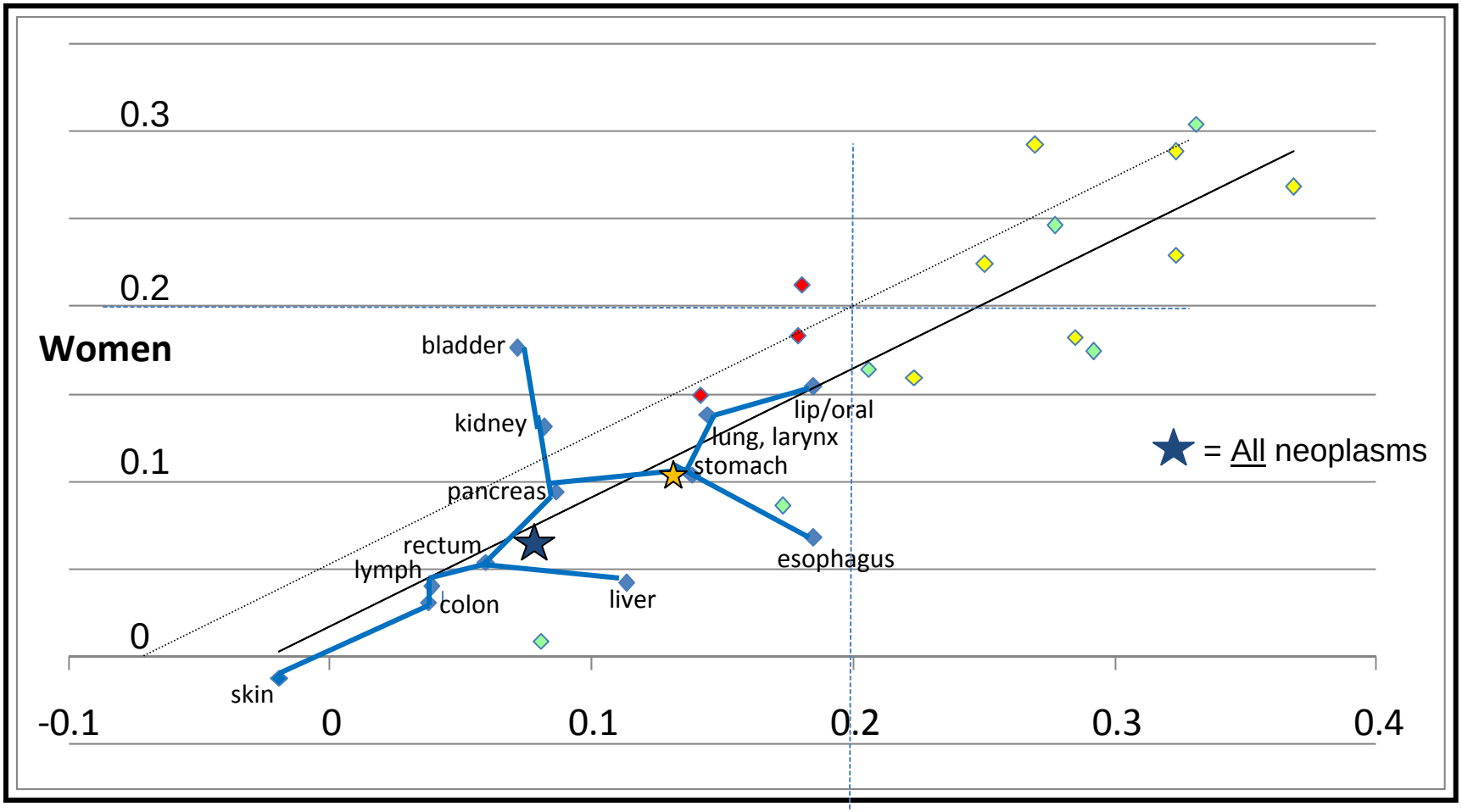
Plot of slopes for men vs. women, specific categories of death (where N > 100, each sex)

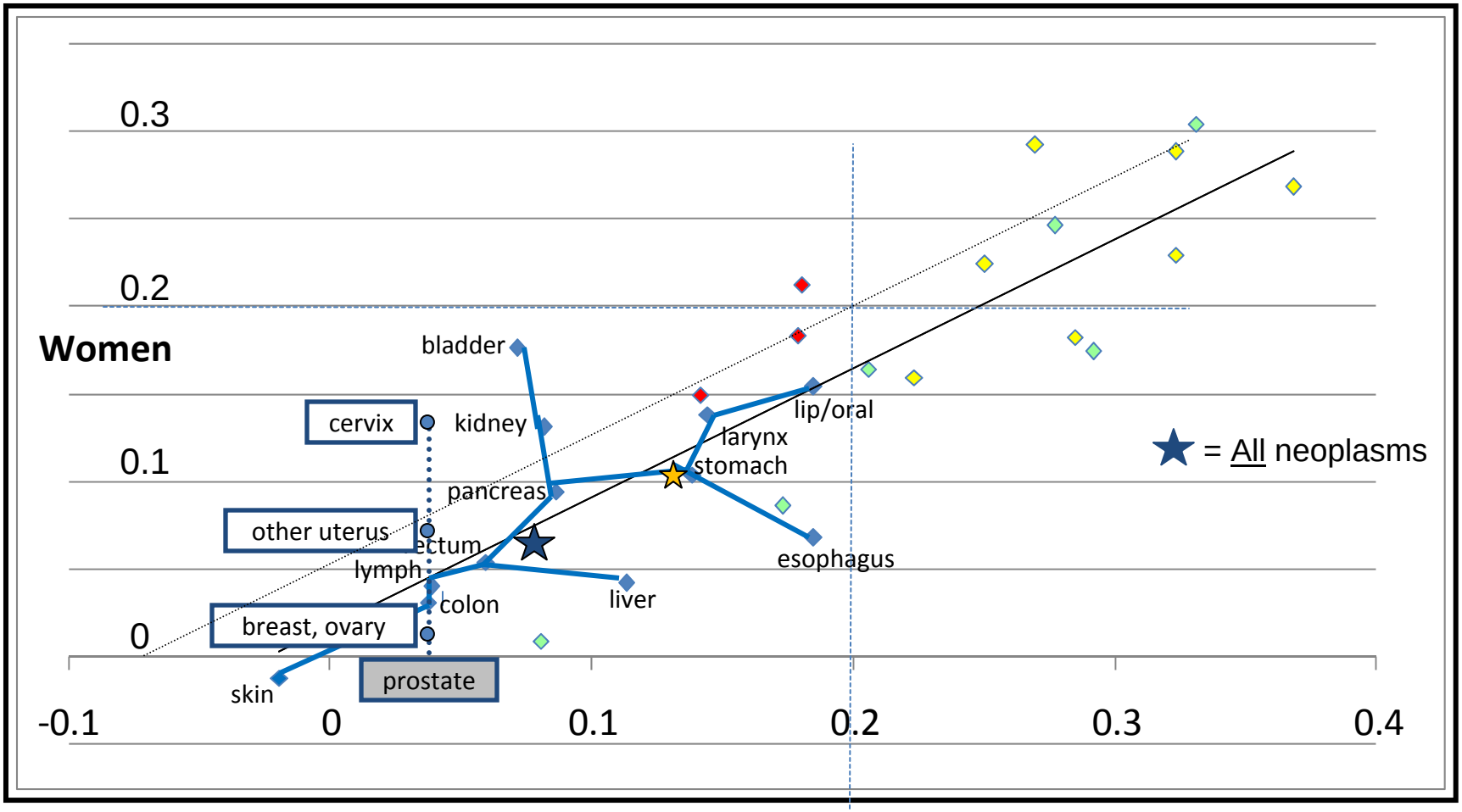


Class gradients: Specific neoplasms

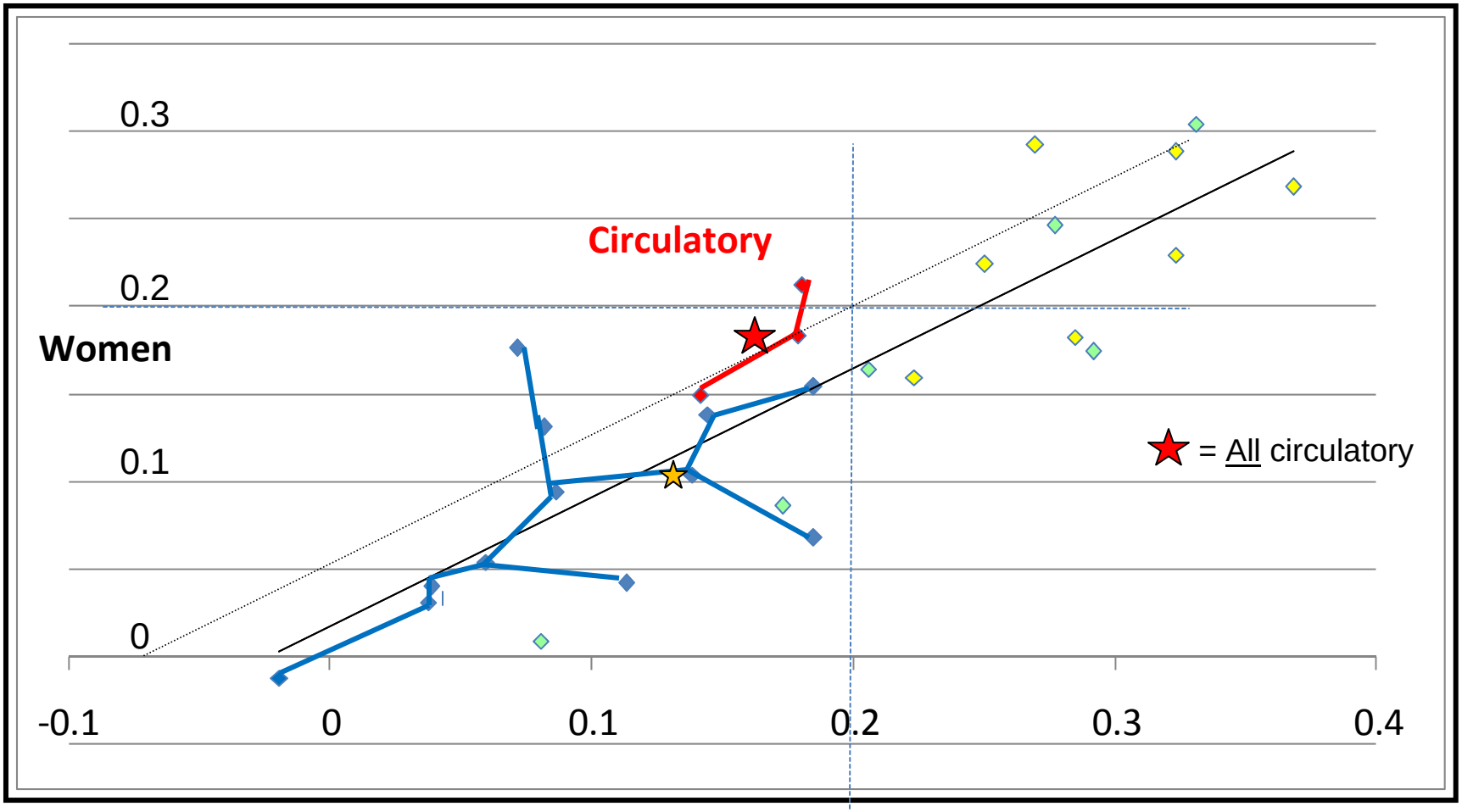


Class gradients: Specific neoplasms



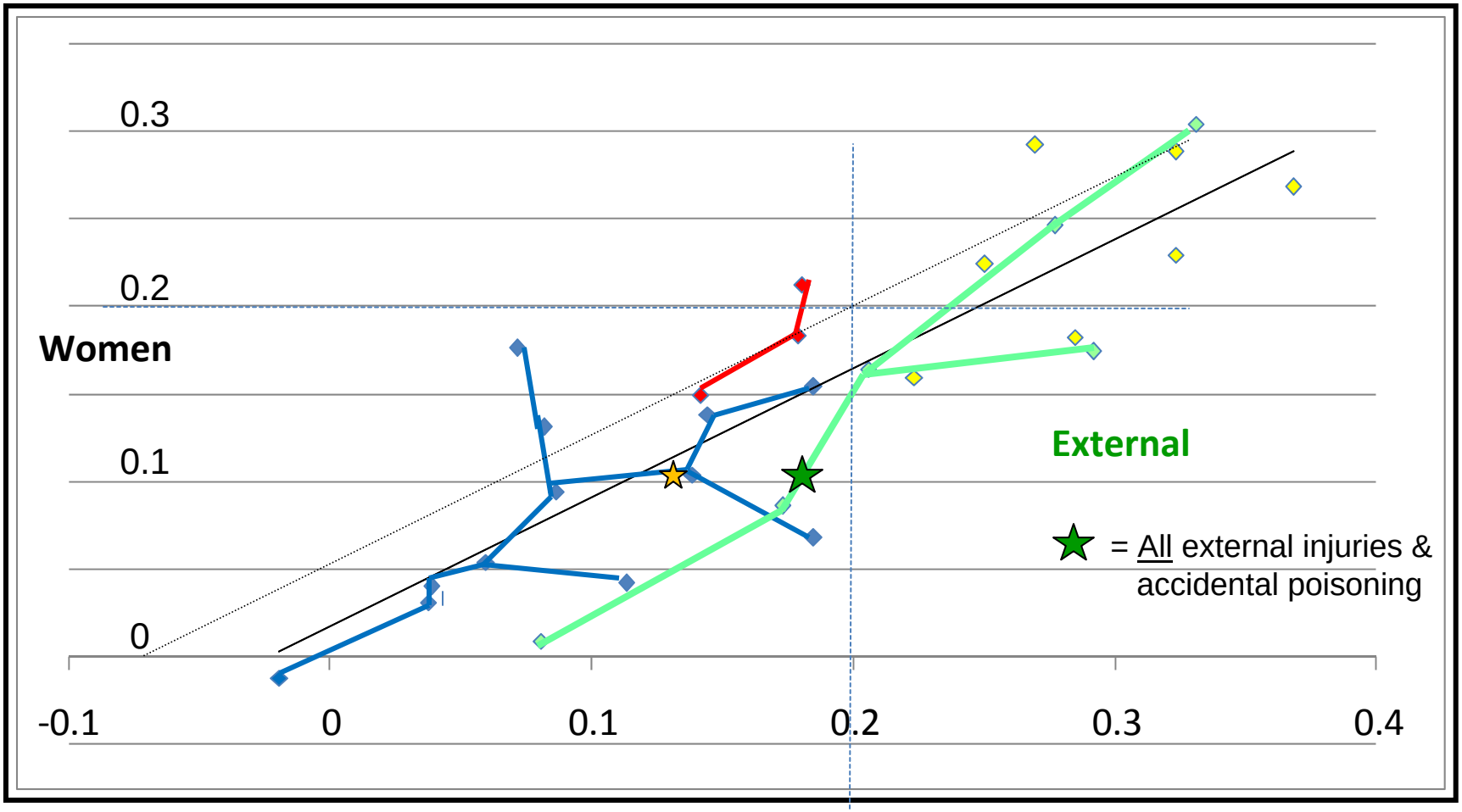

0.3
0.2
0.1
0
Women
bladder
cervix
kidney
lip/oral
larynx
stomach
pancreas
other uterus
ectum
lymph
esophagus
liver
colon
breast, ovary
prostate
skin
= All neoplasms
-0.1
0
0.1
0.2
0.3
0.4
Men

Class gradients: Specific circulatory causes

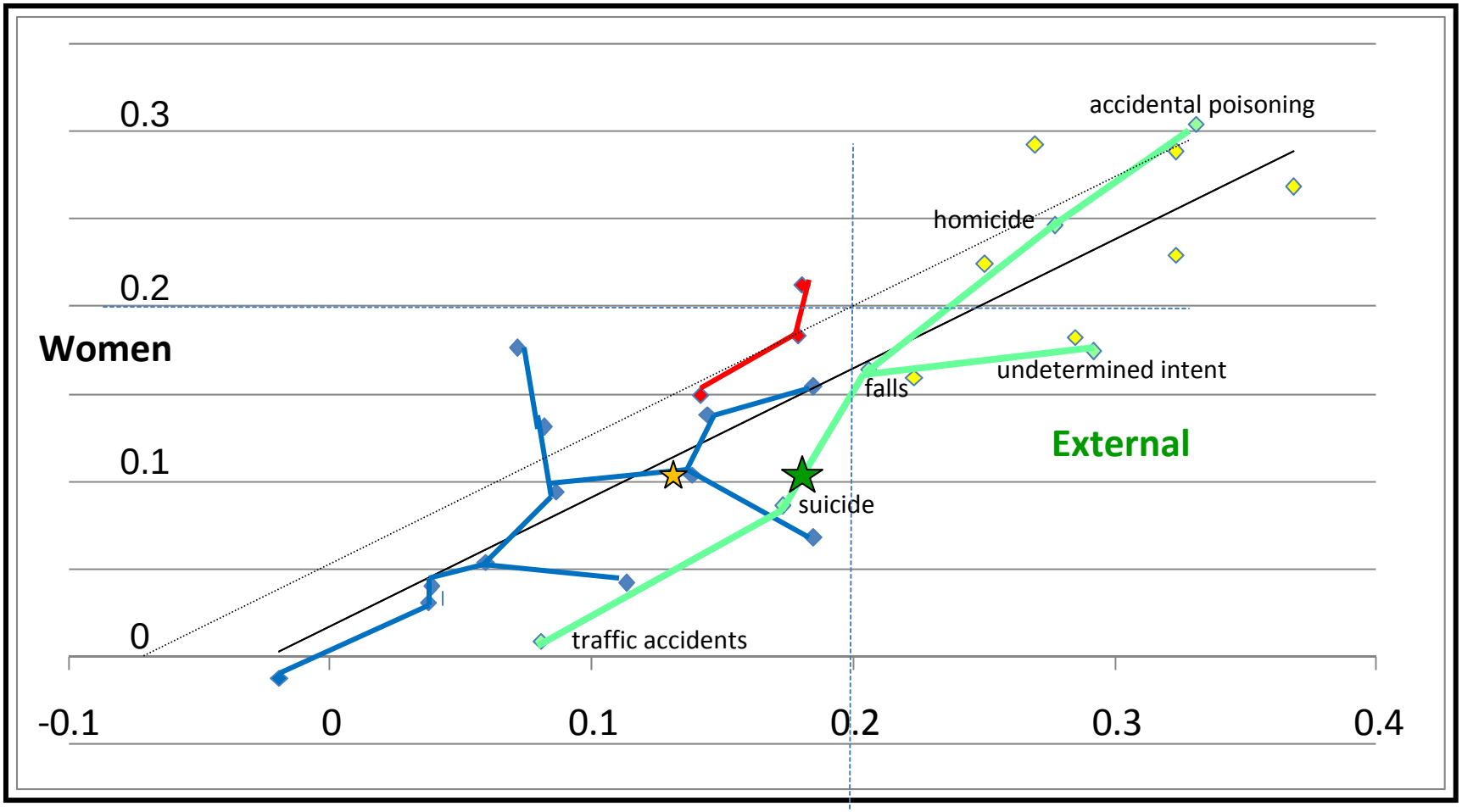


Class gradients: Specific circulatory causes

Class gradients: Specific external causes



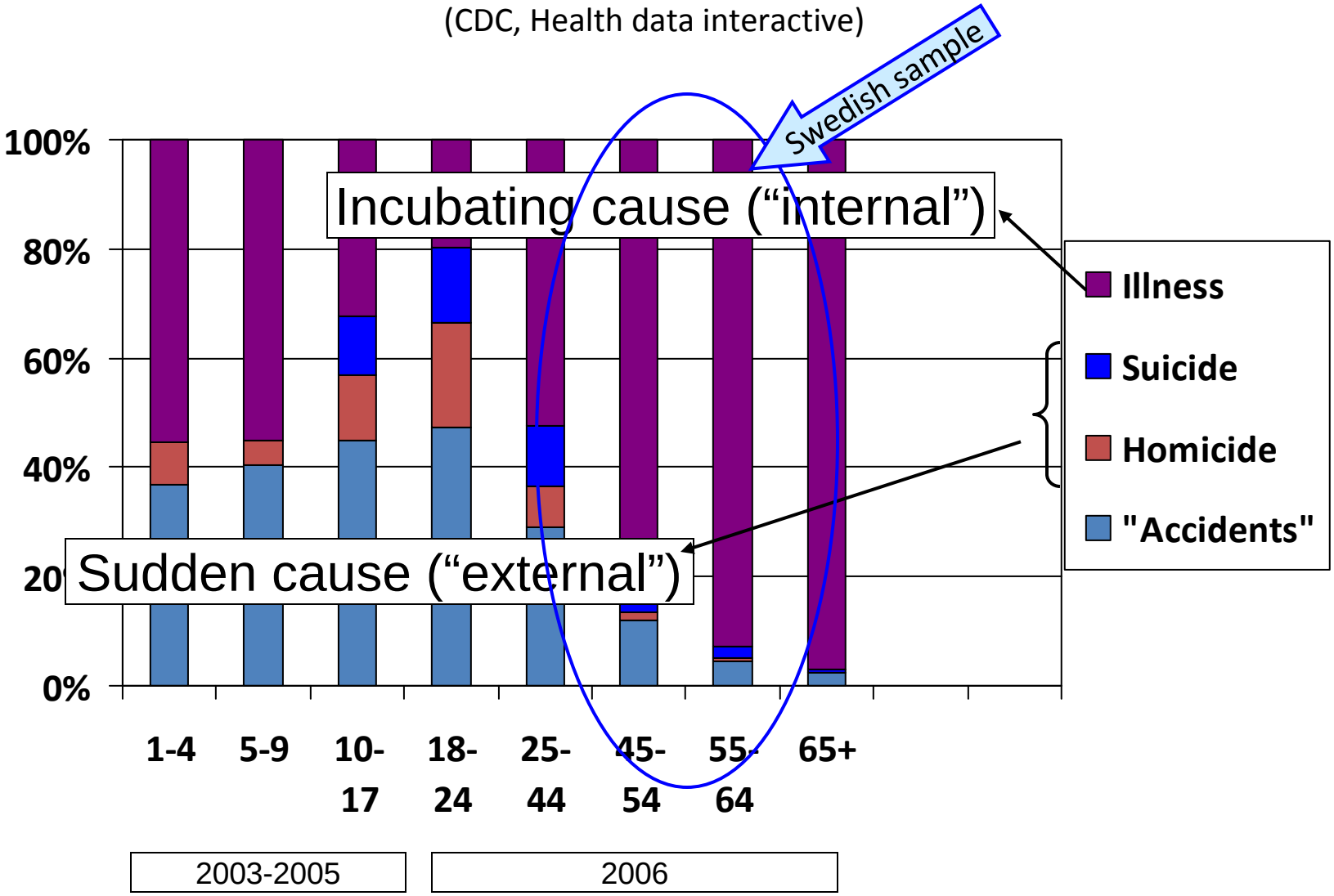
Class gradients: Specific external causes



Age of sample matters

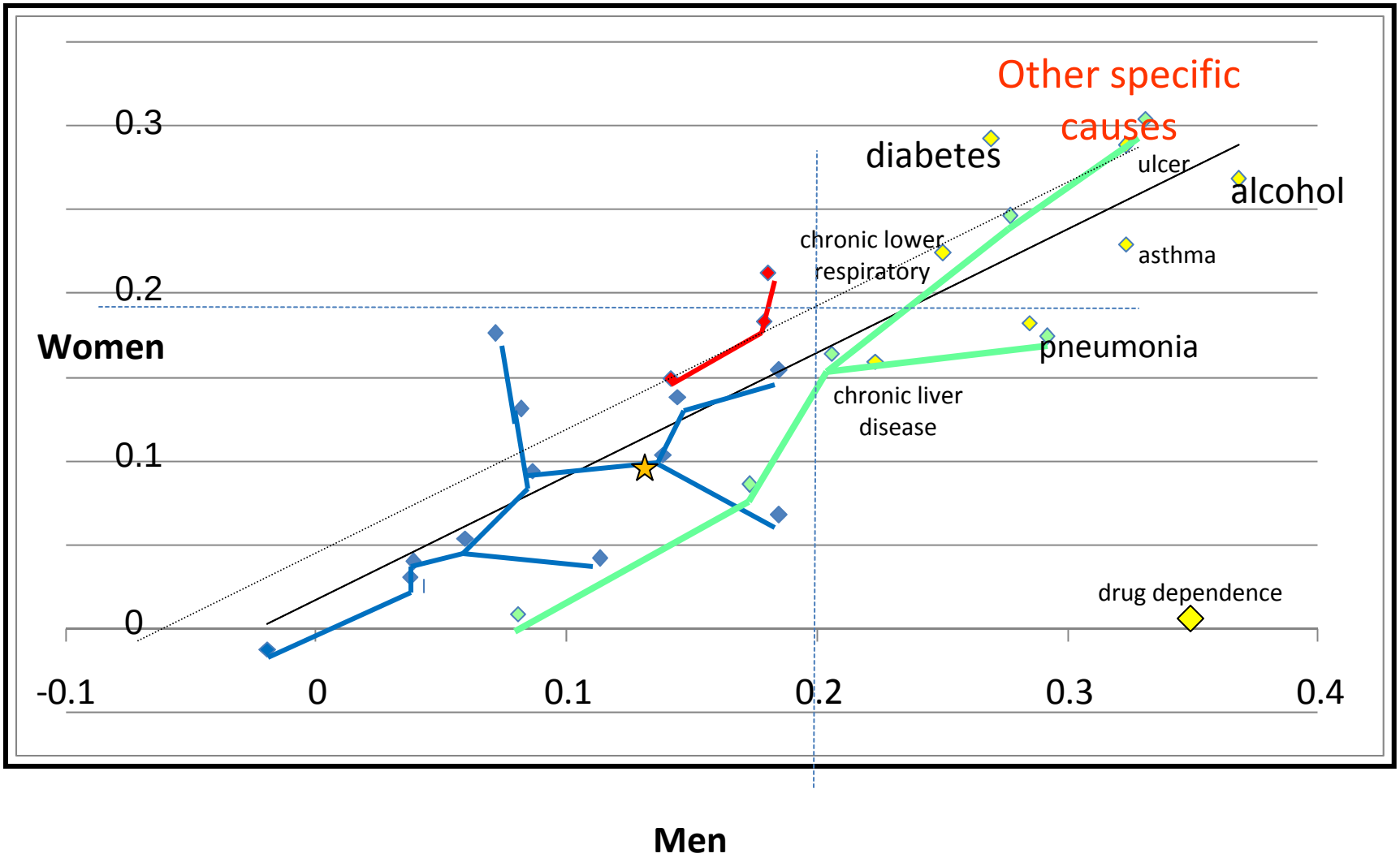
Causes of death differ by age: males in USA

(CDC, Health data interactive)



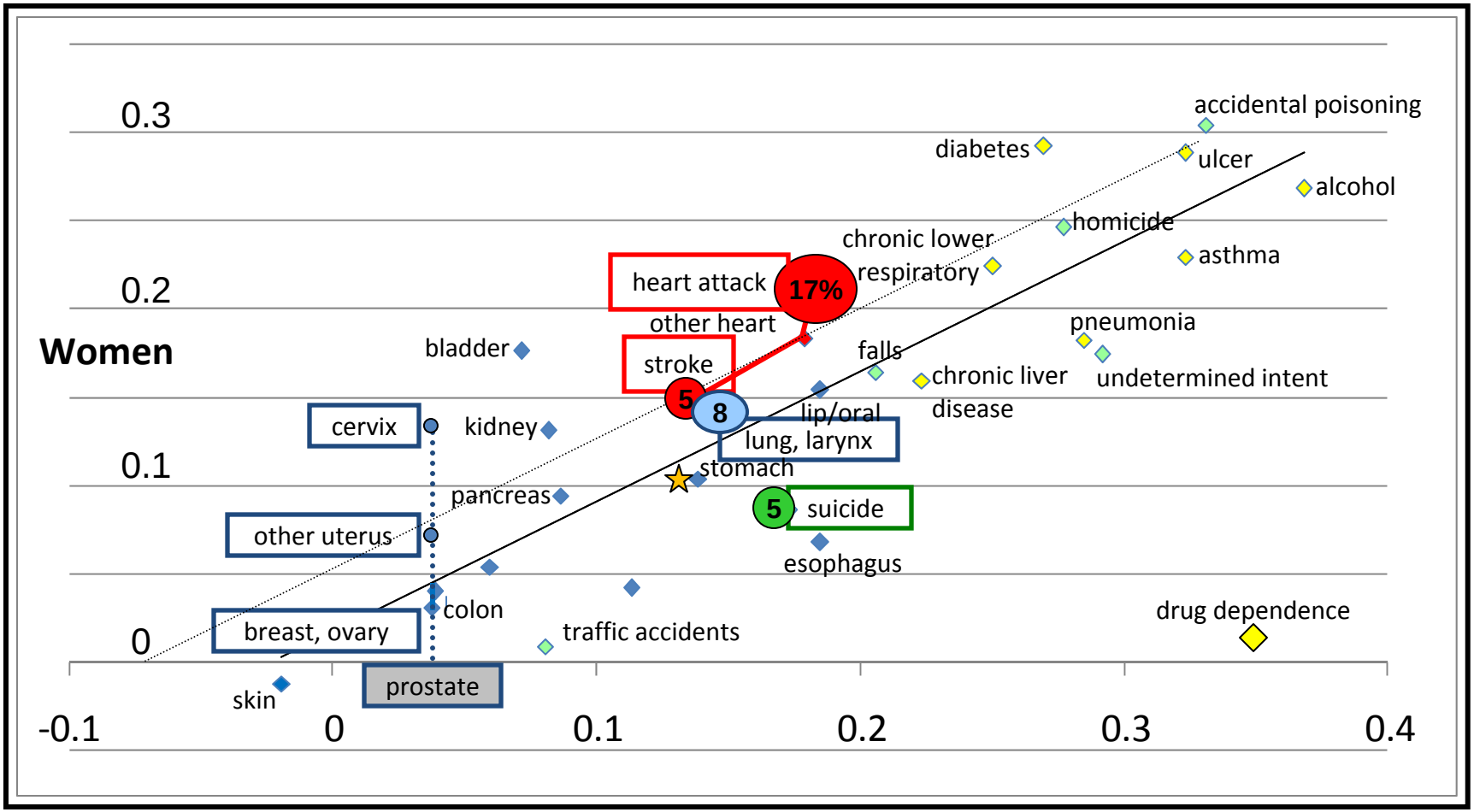
Specific causes in other broad categories

(digestive, endocrine, mental, respiratory)



Most frequent specific internal causes of death:

All are “entirely preventable” by patient (Eurostat report)



Example 2

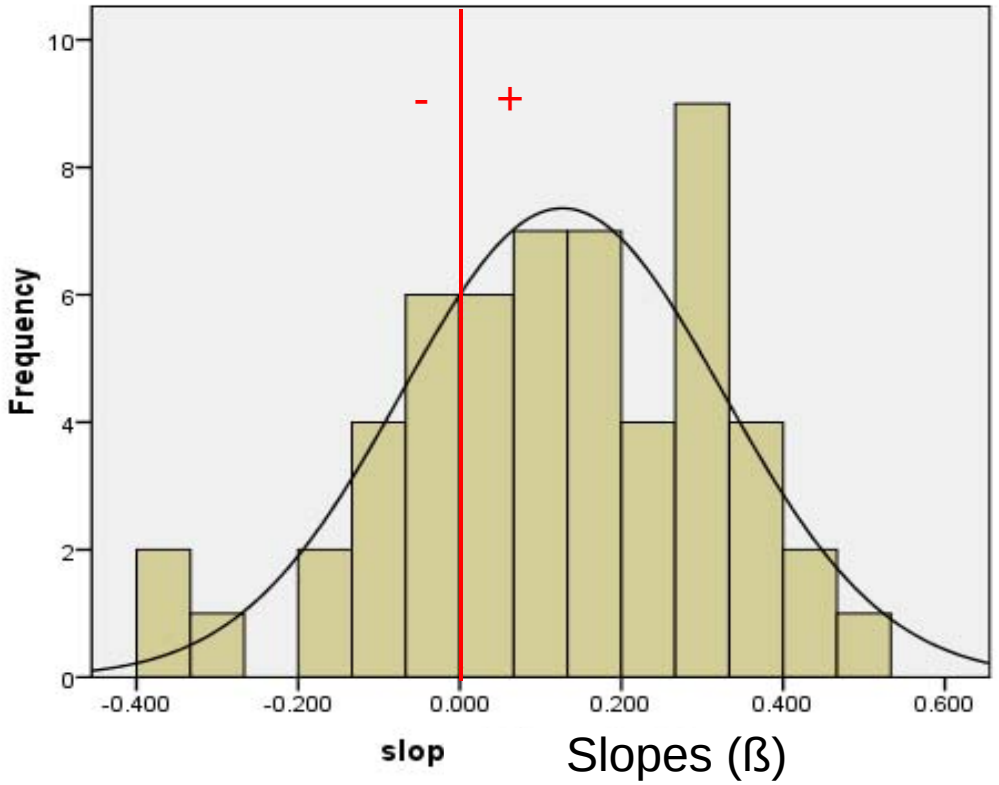
(Gottfredson, 2004)

Mortality in US, 1980-1986
All ages
External causes only
Social class = neighborhood income level (1-6)

Differential access to health care
Ethnically diverse

Class-mortality gradients, for 55 specific external causes, US population, 1980-1986

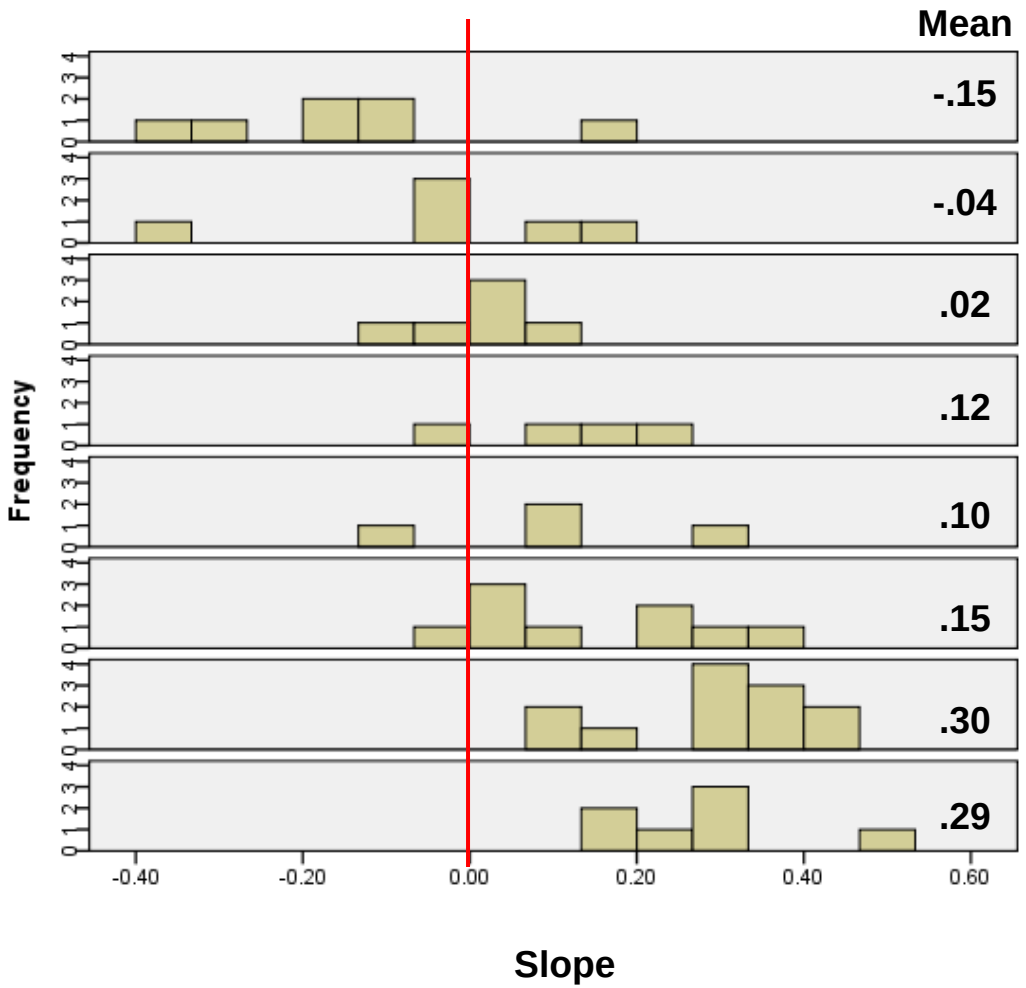
classes = 6 levels of neighborhood income



Mean = .12
SD = .20

Class-mortality gradients, by general type of external cause, US population, 1980-1986

classes = 6 levels of neighborhood income



Suicide

Drugs, alcohol, poisons

Falls

elderly

Homicide

Undetermined intent: firearm, poison

Vehicles/pedestrian, drowning

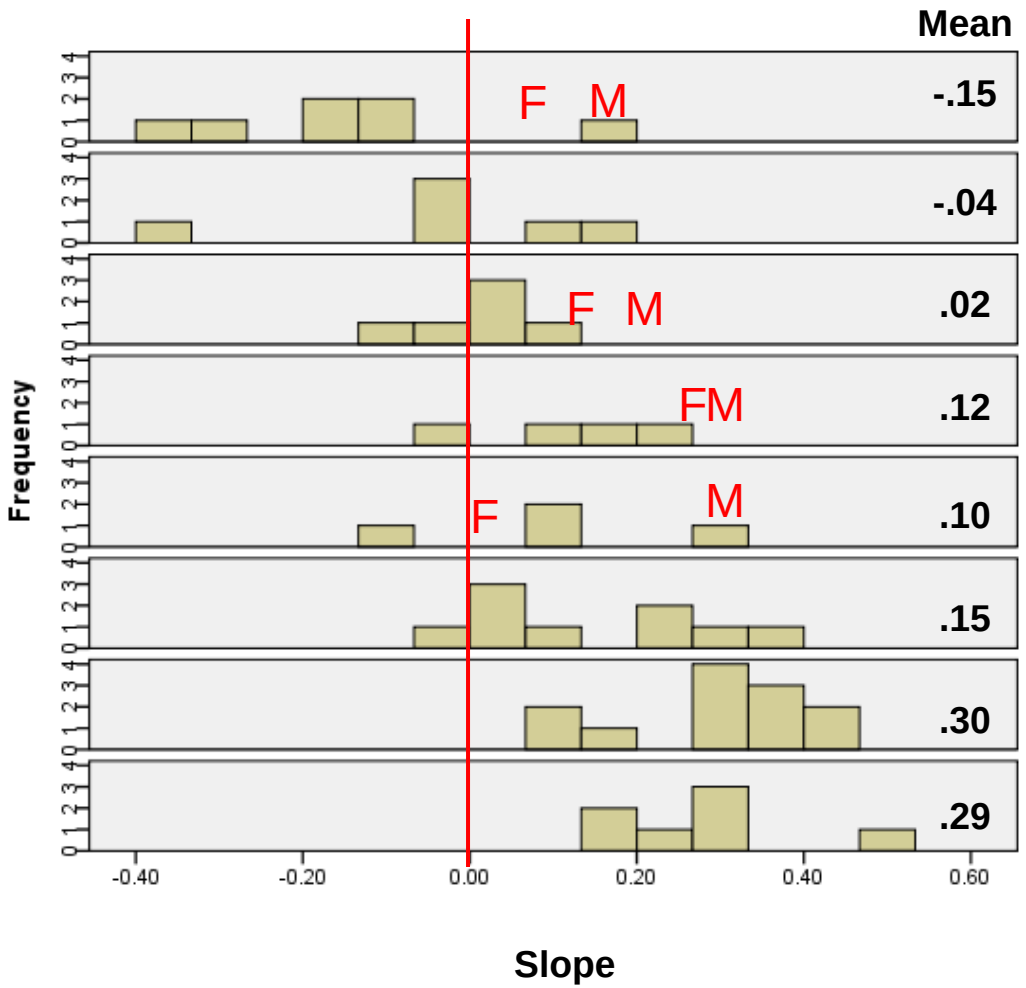
Burns, cold, choke, neglect, firearm

Cut, crushed, machines, electric

Working-age men

Class-mortality gradients, by general type of external cause, US population, 1980-1986

classes = 6 levels of neighborhood income



Suicide

Drugs, alcohol, poisons

Falls

Homicide

Undetermined intent: firearm, poison

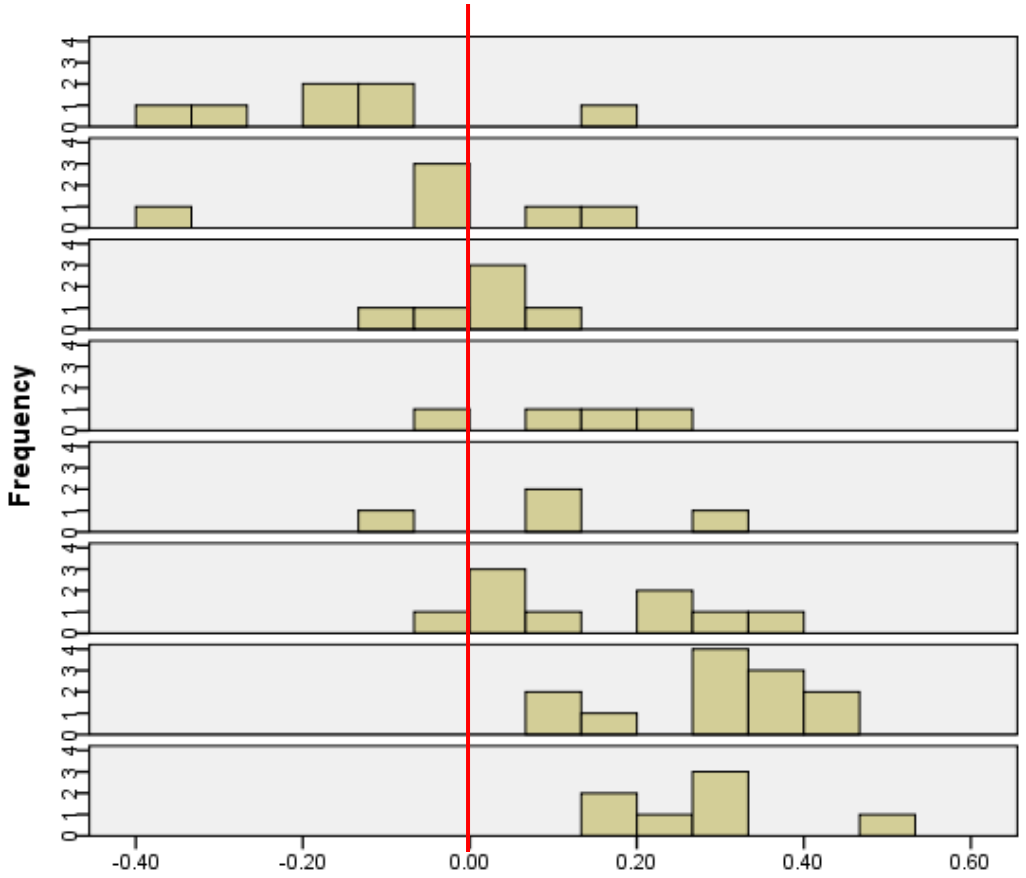
Vehicles/pedestrian, drowning

Burns, cold, choke, neglect, firearm

Cut, crushed, machines, electric

F, M = Swedish mean slopes

Source of hypotheses I:
Migration of slopes over time and cohorts



Changes in:

Options & information:

- preventability (don't smoke)
- detection (pap smear)
- controllability (diet, insulin)

Population composition:

- age
- cohort
- ethnicity

Meta-analysis of slopes

Source of hypotheses II: *g* theory + epidemiological perspective

Predictors		Distribution of:
Host exposure	Passive	
(hazards) ☆	Active	Personal choice
Host susceptibility	Biological	
☆	Cognitive	*g* (or surrogates)
Vector burden	Biological	
(virulence) ☆	Cognitive	Task complexity
☆ Statistical artifacts	Sampling error	
	Measurement error	
	Restriction in range	

Thank you