

Monitoring Health Inequalities by SES: Lessons from Scotland

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John Frank, Director;
Scottish Collaboration for Public Health
Research & Policy, Edinburgh (www.scphrp.ac.uk)
Chair, Public Health Research and Policy,
University of Edinburgh;
Professor Emeritus, University of Toronto.

How are we monitoring health status and inequalities over time?

- In report after report, across almost all developed nations, the great majority of health outcomes monitored at the population level are based on:
 - Mortality statistics, often summarized across all ages as life expectancy and sometimes combined with quality-of-life/morbidity data, as “health expectancy” – our most holistic routine measure of population health status
 - Routinely collected birth outcomes, especially birth-weight, gestational age, and combinations thereof
 - Hospitalization rates, usually by cause (often affected by small-area-variation due to health-care factors, independent of disease burden)
 - Cancer – and, rarely, other (apart from notifiable infections’) – disease incidence, ideally from multi-source registries
 - Self-reported survey data –e.g. self-assessed health status, smoking, height & weight, activity levels, food intake, etc. (“warts and all” – some cultural framing occurs; e.g. self-assessed health status in Newfoundland!)

Overarching Questions:

- 1) Are Scottish health inequalities by socio-economic status -- *some of the steepest in all of Europe* (see slides to follow) -- as measured by these international standard indicators, moving in the right direction?
- 2) If not, why not? Could it be partly because these routinely collected health statistics are now in fact rather *insensitive indicators of health inequalities, inherently difficult to budge in less than a human generation* (i.e. with feasible policy and program interventions, once they reach present levels)?
- 3) What sort of broader indicators, of *health and function in the "healthy" population*, might be more amenable to demonstrating in achieving *equitable health improvement "within a decade"*?

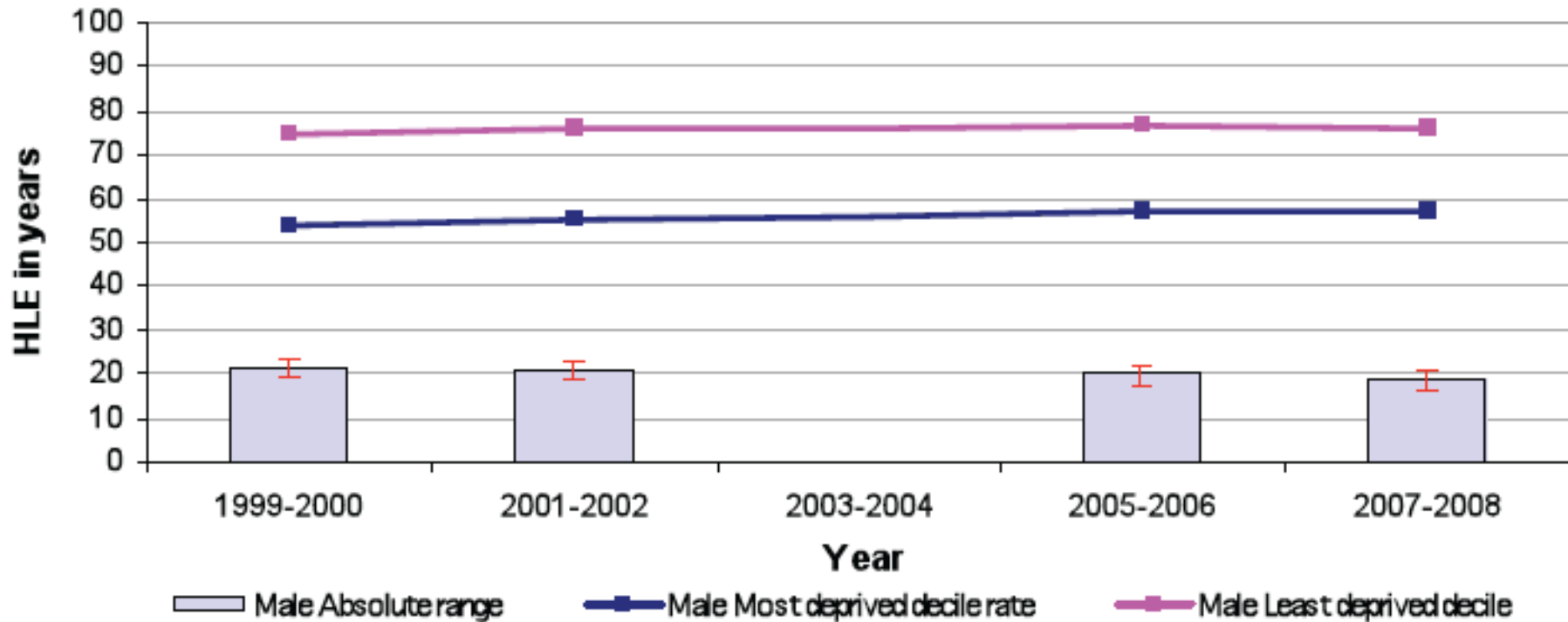
Scottish HI Indicators in Current Use

- Recent Scottish analyses of health inequalities' time-trends and patterns, by SES, over the last decade or more, are among the most statistically sophisticated in the world – BUT...
- The rich-poor gaps in about a dozen key Scottish health outcomes appear, over the last dozen years, to be frozen in time (virtually static)...
- While one might conclude – and there is some truth in this – that insufficient policy and program effort has gone into actually reducing the “rich-poor” and “educated-uneducated” gaps in Scottish society, there are compelling reasons to believe that the population health indicators currently in use in Scotland aren't very responsive to *any feasible PH* interventions likely to be actually carried out.

[Frank J and Haw S. *The Milbank Quarterly* 2011;89 (4):658-93.]

Absolute Range: Healthy Life Expectancy (Males)

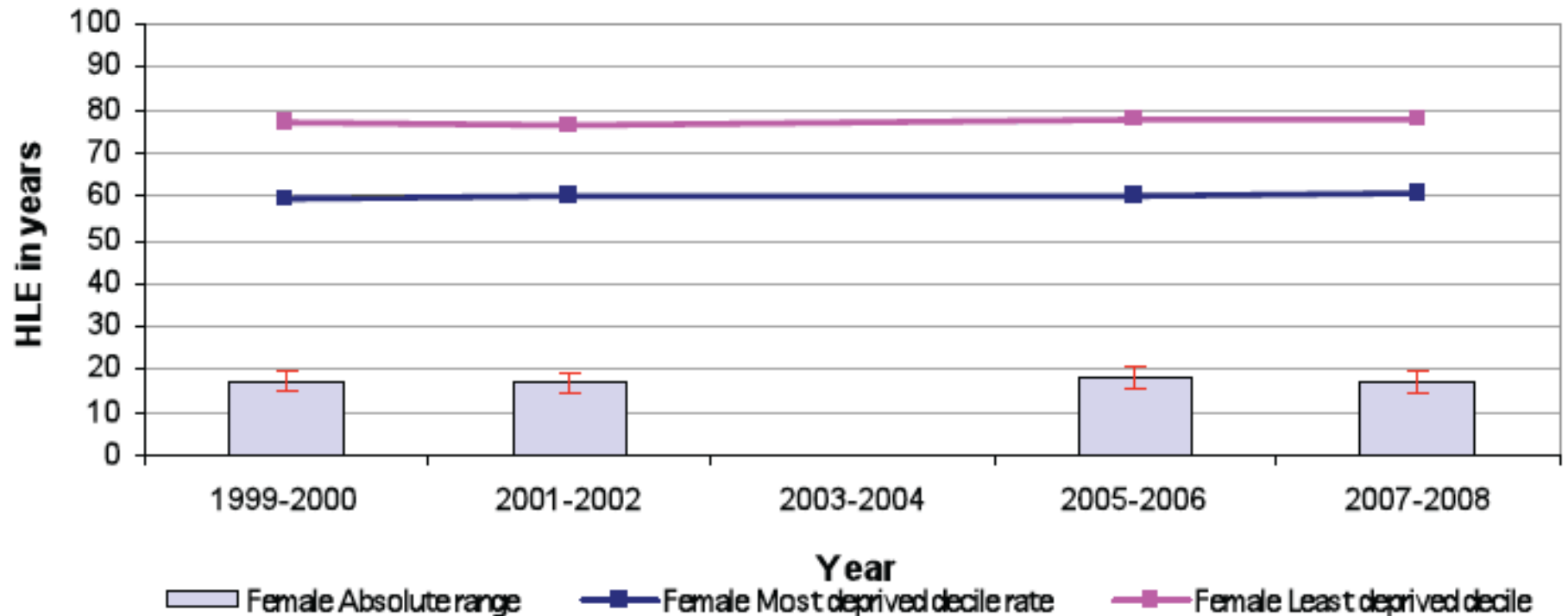
Absolute range: Healthy Life Expectancy - Males - Scotland 1999/2000-2007/2008 [Data not available for 2003/2004]



Source: Scottish Government Health Analytical Services (2010) Long-term monitoring of health inequalities

Absolute Range: Healthy Life Expectancy (Females)

Absolute range: Healthy Life Expectancy - Females - Scotland 1999/2000-2007/2008 [Data not available for 2003/2004]

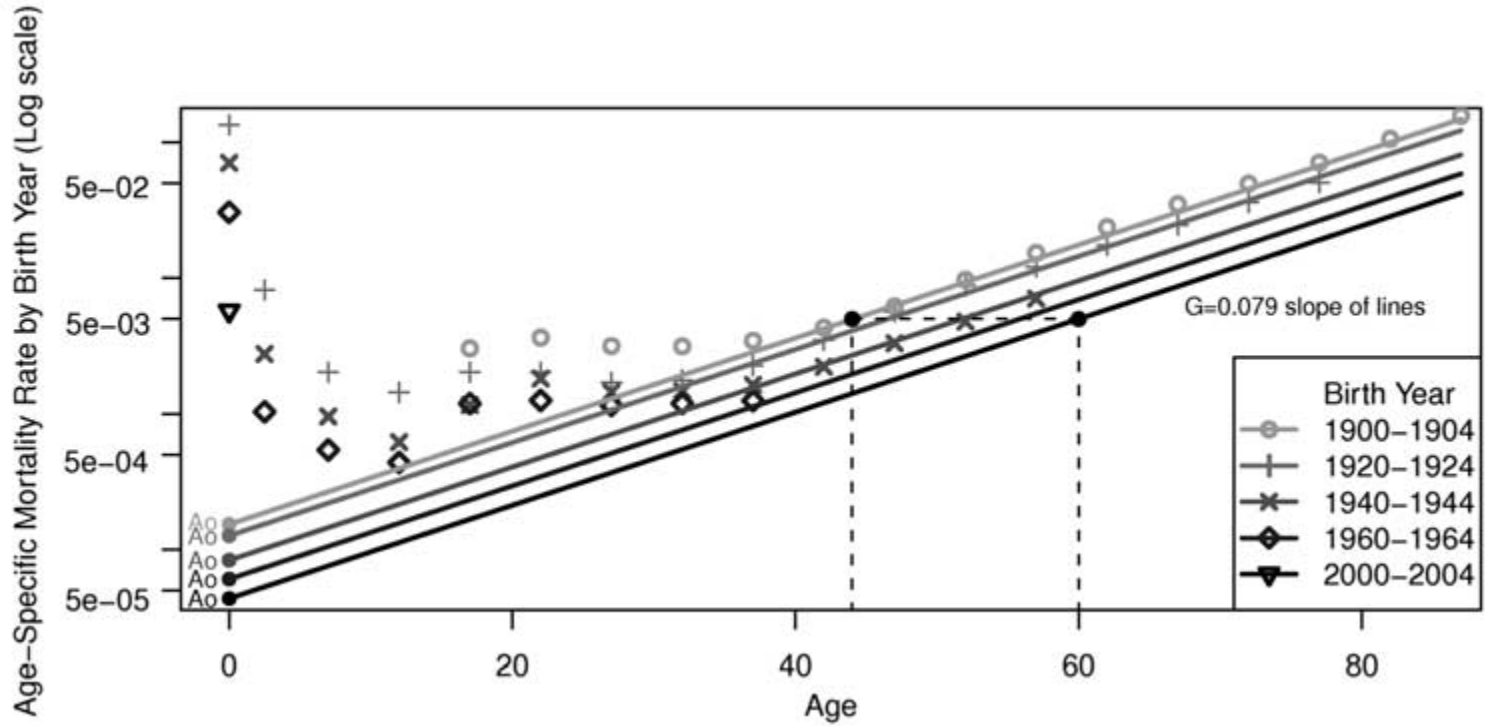


Source: Scottish Government Health Analytical Services (2010) Long-term monitoring of health inequalities

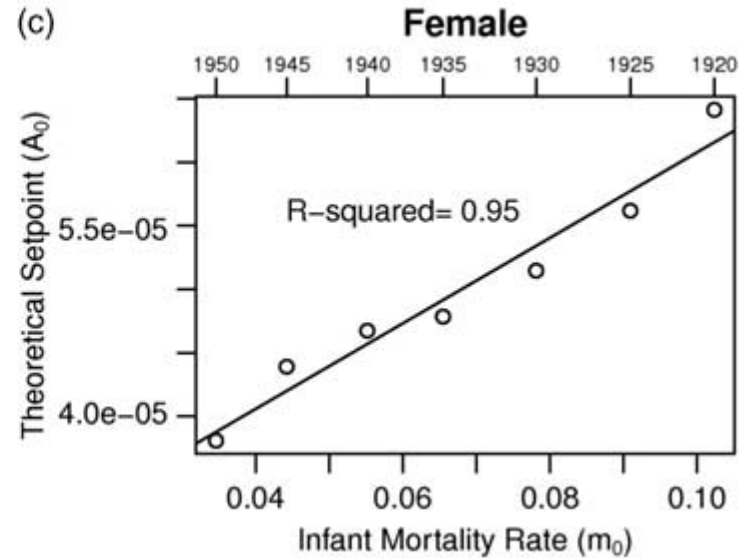
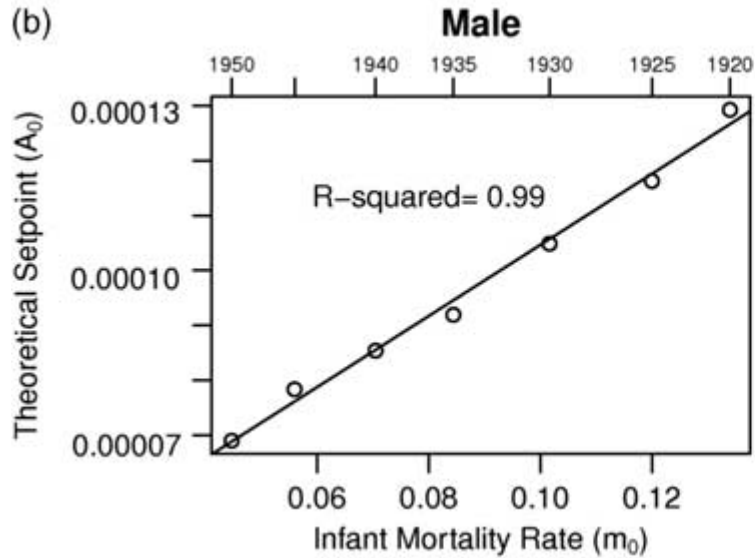
Criticism: major causes of mortality – and many other routinely collected health outcomes -- are no longer “sensitive to change”, in the short run

- Conventional wisdom among epidemiologists: “Improved medical care – and indeed most deliberate health policies and programs – at least in developed countries, now only reduce broad categories of mortality rather slowly, and all-cause mortality very slowly.”
 - Life expectancy, and even all-cause mortality rates, seem subject to “*epidemiological momentum / inertia*”: they are hard to shift quickly, especially when deaths occur mostly among the elderly, where chronic disease – developed over a lifetime of habitual risk-factor exposures -- and competing risks -- matter!
 - The life-course epidemiological perspective, and the work of David Barker et al. further suggest that “embedding” of early life exposures and experiences has a very long reach, impacting late-life health and mortality – so that living conditions one average lifetime ago can act to *damp* current policies’ and programs’ progress on late-life mortality.

(a)



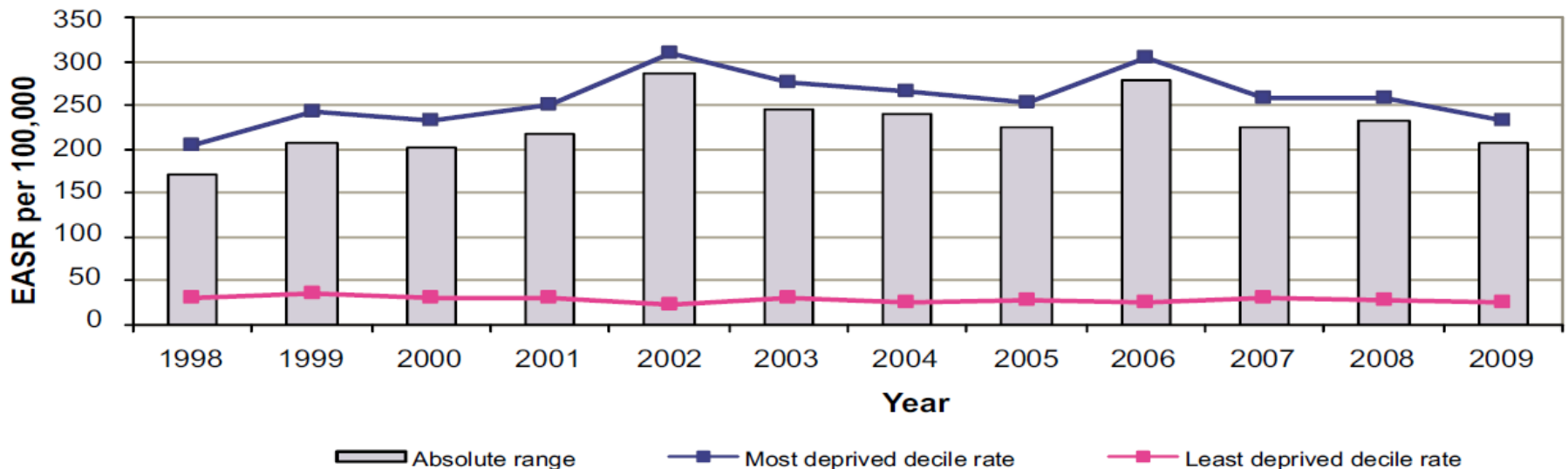
Source: Meza R et al. J Dev. Orig. Hlth. Dis. 2001 doi: 10.107/S2040174410000218



Source: Meza R et al. J Dev. Orig. Hlth. Dis. 2001 doi: 10.1017/S2040174410000218

Absolute Range: Alcohol-Related Mortality 45-74y – Scotland 1998-2008 (European Age-Standardised Rates per 100,000)

**Figure 11: Absolute range: Alcohol related mortality 45-74y, Scotland 1998-2009
(European age-standardised rates per 100,000)**

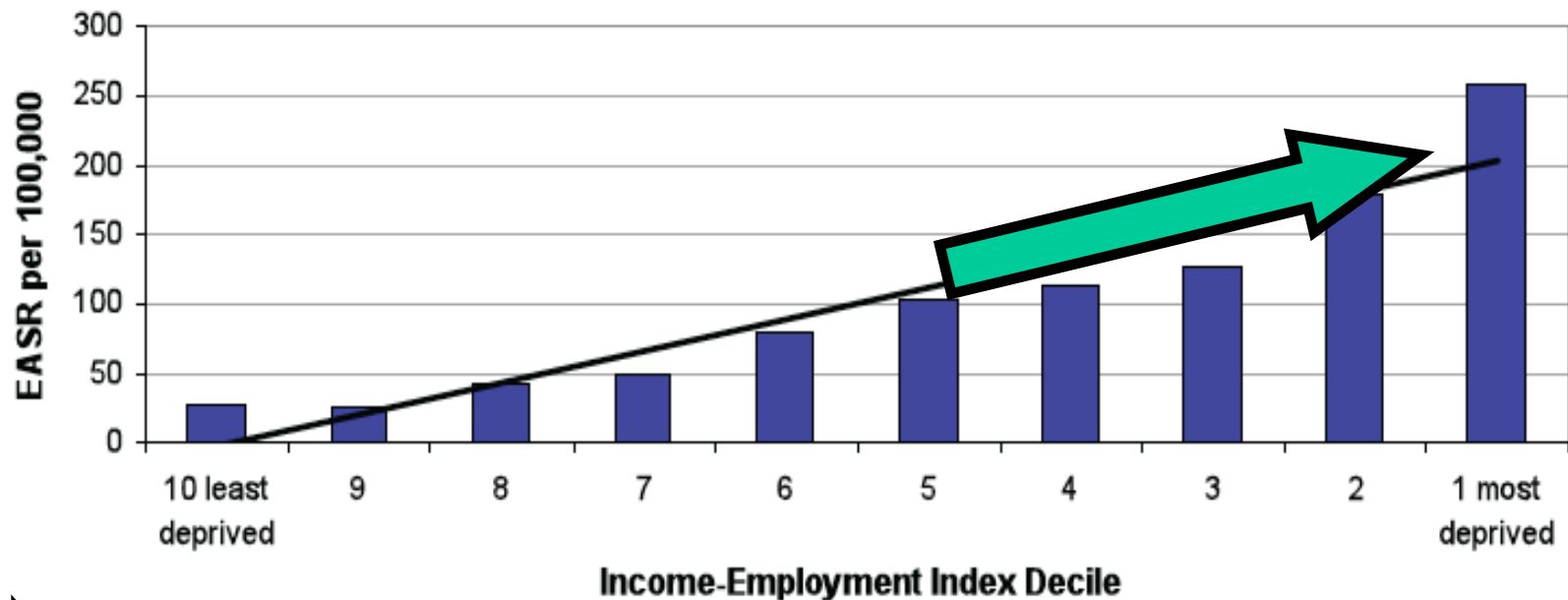


Question: Are the poorest drinkers dying more often, or are more heavy drinkers just dying in the poorest places (after losing house and job)??

Source: Annual Report of the CMO, Scotland. The Scottish Government & NHS Scotland, Edinburgh. 2011.

“SES Dose-Response Relationship”: Alcohol-Related Mortality and SIMD of Residence (*at death*)

Alcohol related mortality amongst those aged 45-74y by Income-Employment Index: Scotland 2008
(European Age-Standardised Rates per 100,000)



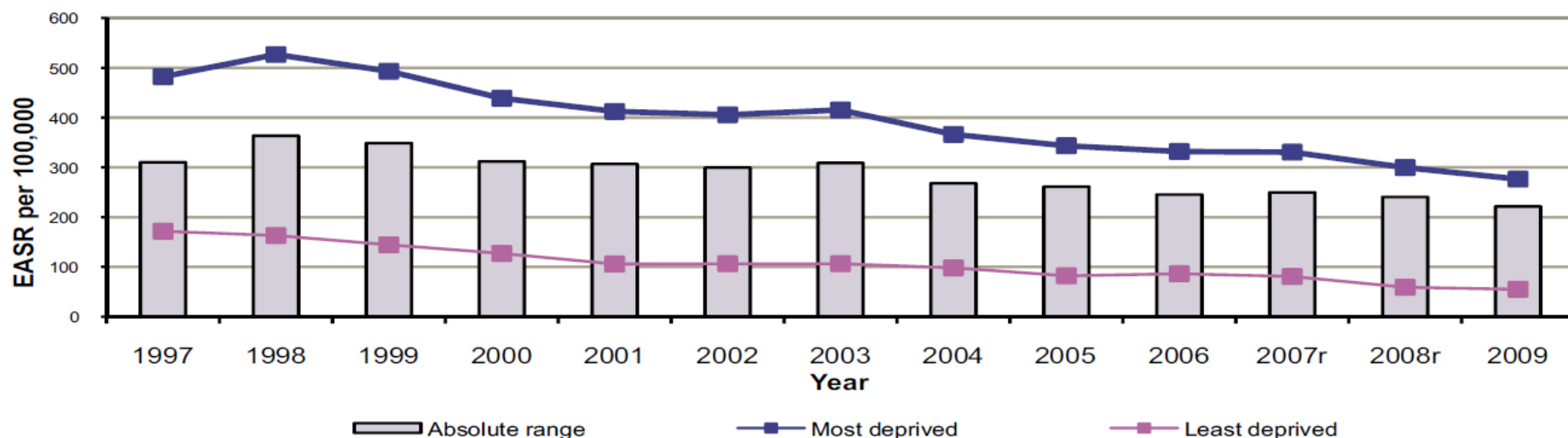
➔ Might the poorest have *artificially* worse rates, based on post-codes of “residence,” through *reverse causation*?

Source: Scottish Government Health Analytical Services (2010) Long-term monitoring of health inequalities

Absolute Range: CHD Mortality, 45-74 years, Scotland 1997-2008

(European Age-Standardised Rates per 100,000)

Figure 8: Absolute range: CHD mortality 45-74 years, Scotland 1997-2009
(European age-standardised rates per 100,000)

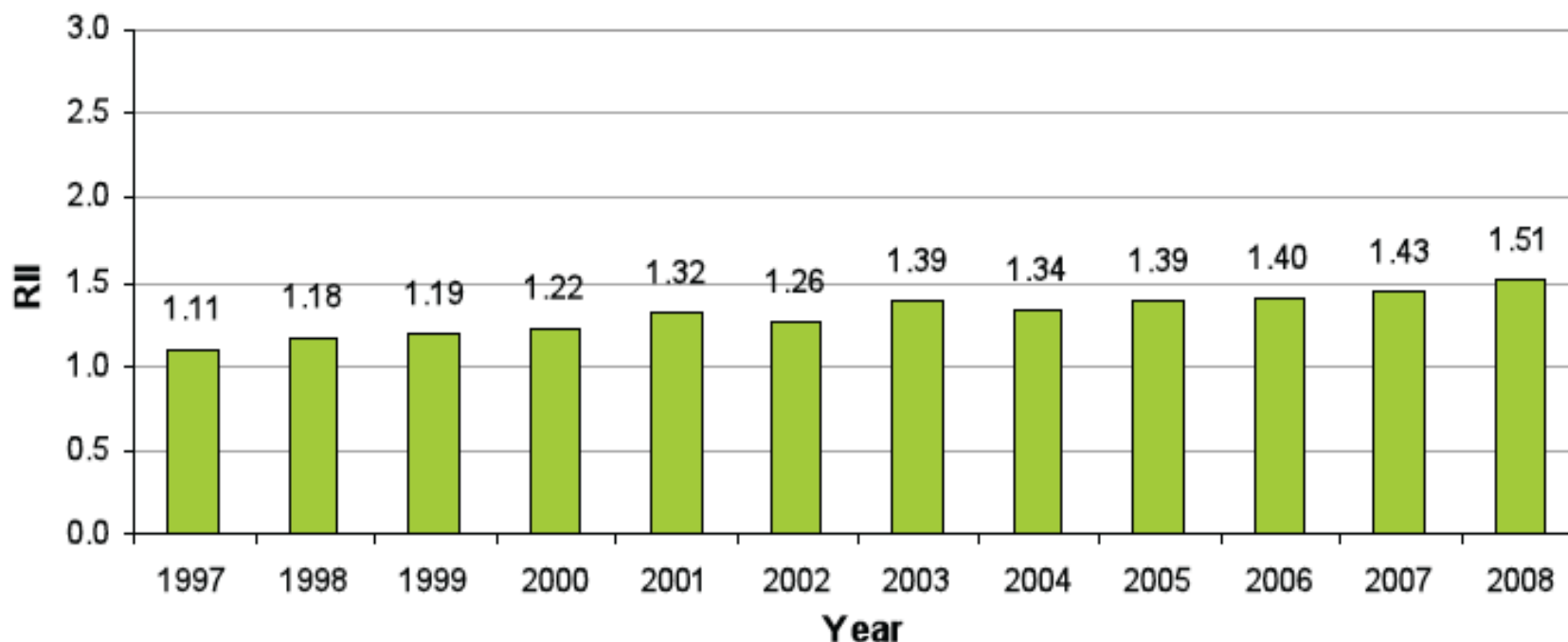


The cup is half-full: all SES group's rates have come down, equally. But the trend in the Relative Index of Inequality doesn't show that..

Source: Annual Report of the CMO, Scotland. The Scottish Government & NHS Scotland, Edinburgh. 2011.

The RII has steadily increased over time – illustrating a disadvantage of the RII (when adverse outcomes are improving)

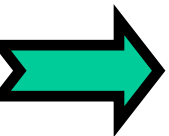
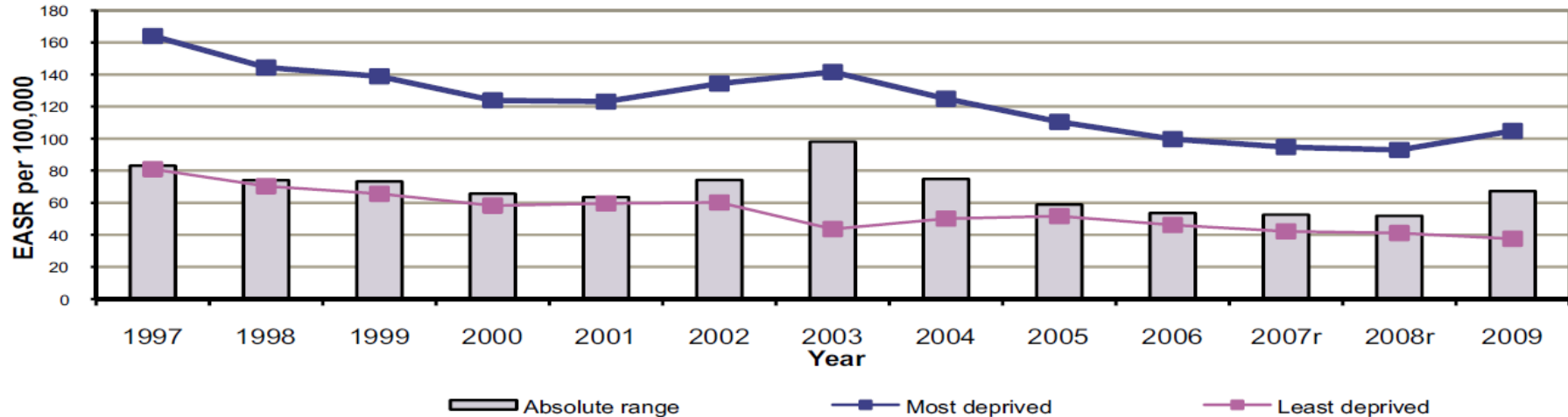
Relative Index of Inequality (RII): CHD mortality 45-74y - Scotland 1997-2008
(RII = SII divided by population mean rate)



SES gap not decreasing *proportionately* faster than overall rate: RII goes up over time – and the Minister is unhappy (“Why should our record look bad if things are improving?”)

Absolute range: First-ever hospital admissions for heart attack <75y – Scotland 1997-2008 – i.e. those “arriving alive”

Figure 7: Absolute range: Hospital admissions for heart attack <75y, Scotland 1997-2009 (European age-standardised rates per 100,000)



Something odd is happening here – why is the ratio of poorest- to richest-decile admitted-alive cases only about 2 or 3 to 1, when for deaths it is closer to 3.5 to 1? Which SES -group’s deaths are occurring before admission more often?

Source: Annual Report of the CMO, Scotland. The Scottish Government & NHS Scotland, Edinburgh. 2011.

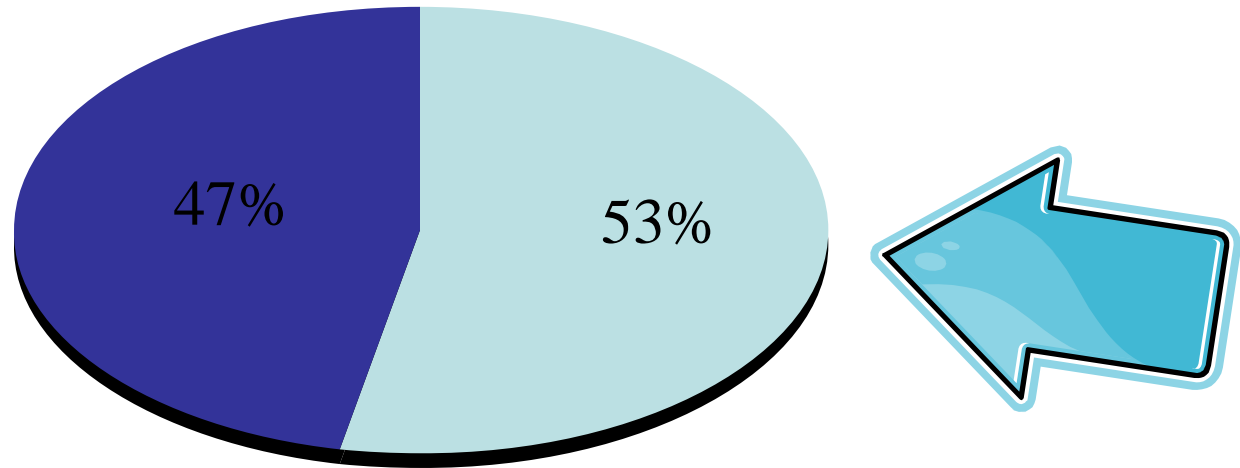
I.E. Why Might “AMI Arrived-Alive” Studies Show Artificially Small SES Gradients for CHD Hospital Admissions?

- All hospital-based studies omit a substantial fraction of “sudden deaths” dying before admission
- In Scotland, the MONICA Glasgow Study, with a population-based registry that included all CHD deaths (including sudden and untreated) *also* showed:
 - » Only 66% of “coronary death cases” aged 25-64 reached hospital and 2/3 of all deaths were out of hospital, with clear SES gradients in total and out-of hospital mortality, but none in the subset who reached hospital (Morrison et al BMJ 1997;314:541)

HOW FREQUENT IS "SCOTTISH SUDDEN DEATH"?

Total Burden of Incident CHD in Scotland, 2000-4

Sudden Deaths and AMI admissions

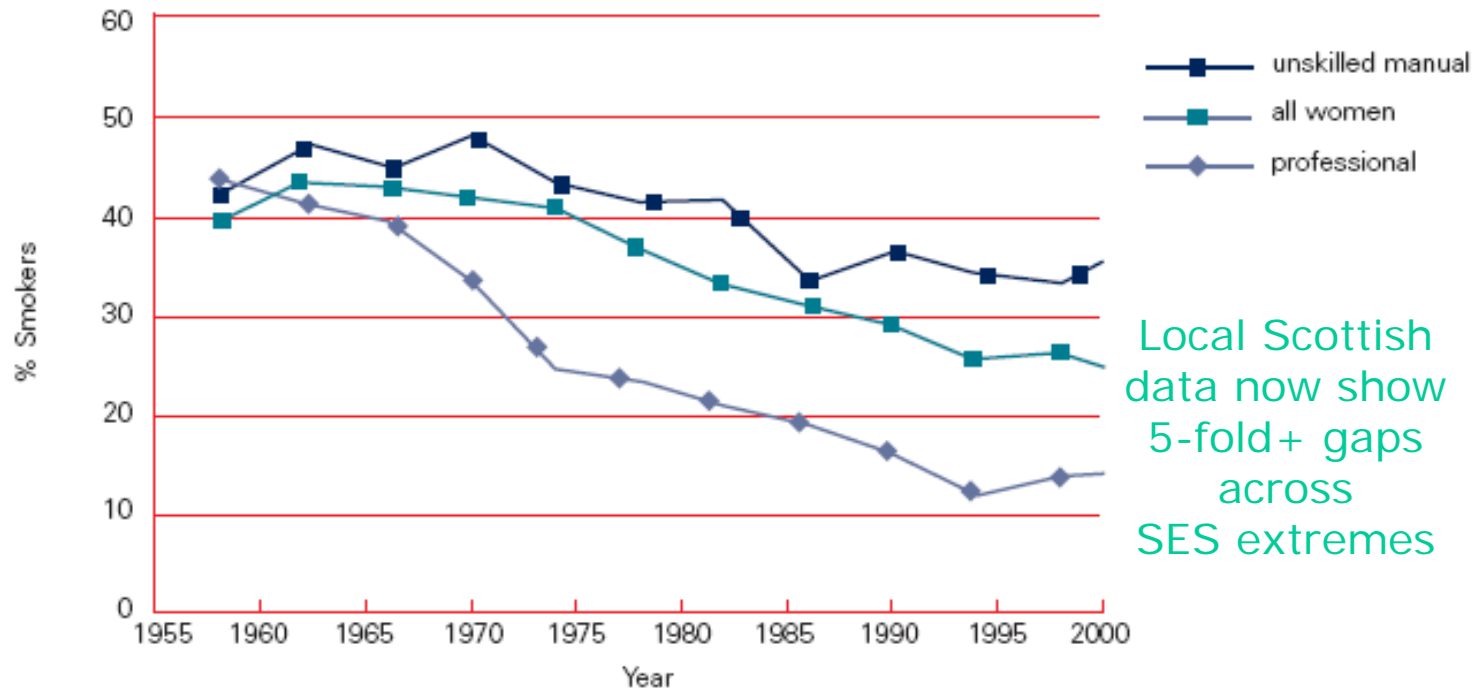


Of 93,701 incident AMI events, 50,075 (53%) resulted in death, of which **42,189 (84%) died within the first day** – ergo, surely prevention is at least as important as care?

Should there be a focused research program on sudden death here?

ONE POSSIBLE REASON FOR HIGHER SUDDEN CARDIAC DEATH RATES AMONG POOR SCOTS: TOBACCO EXPOSURE

Figure 3: Cigarette smoking among women aged 16 and over by socio-economic group 1958-2000, Britain



Source: Wald and Nicolaides – Bouman, 1993; Bridgewood et al, 2000

Smoking among the proportion of women who smoke has declined sharply but the gap in prevalence between poorer and better off groups is widening

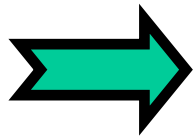
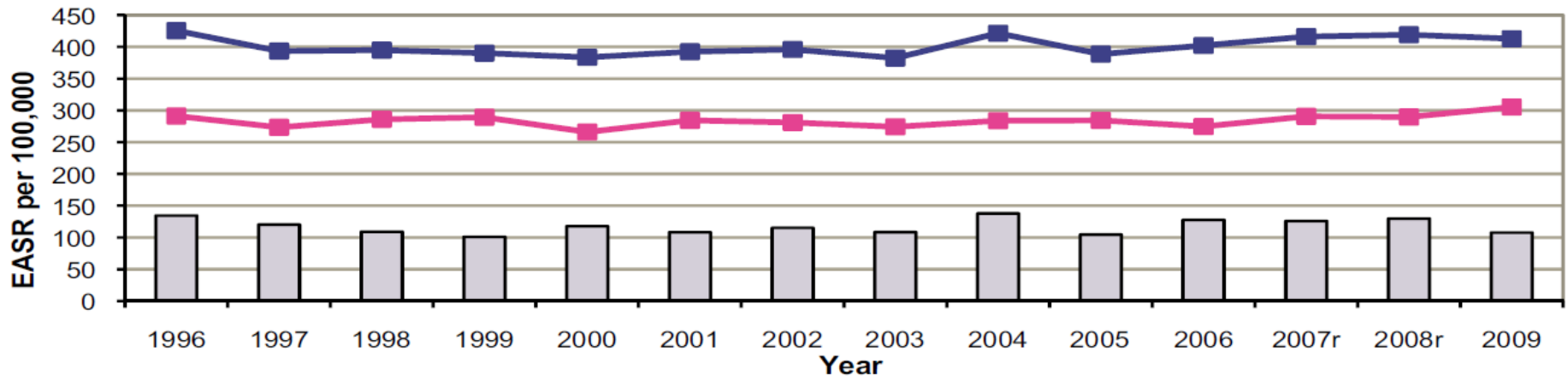
ESRC Seminar Series Mapping the public policy landscape

Developing the evidence base for tackling health inequalities and differential effects

Source: <http://www.esrcsocietytoday.ac.uk/ESRCInfoCentre>

Absolute Range: Cancer Incidence (all sites) <75y – Scotland 1996-2007

Figure 9: Absolute range: Cancer incidence <75y, Scotland 1996-2009
(European age-standardised rates per 100,000)

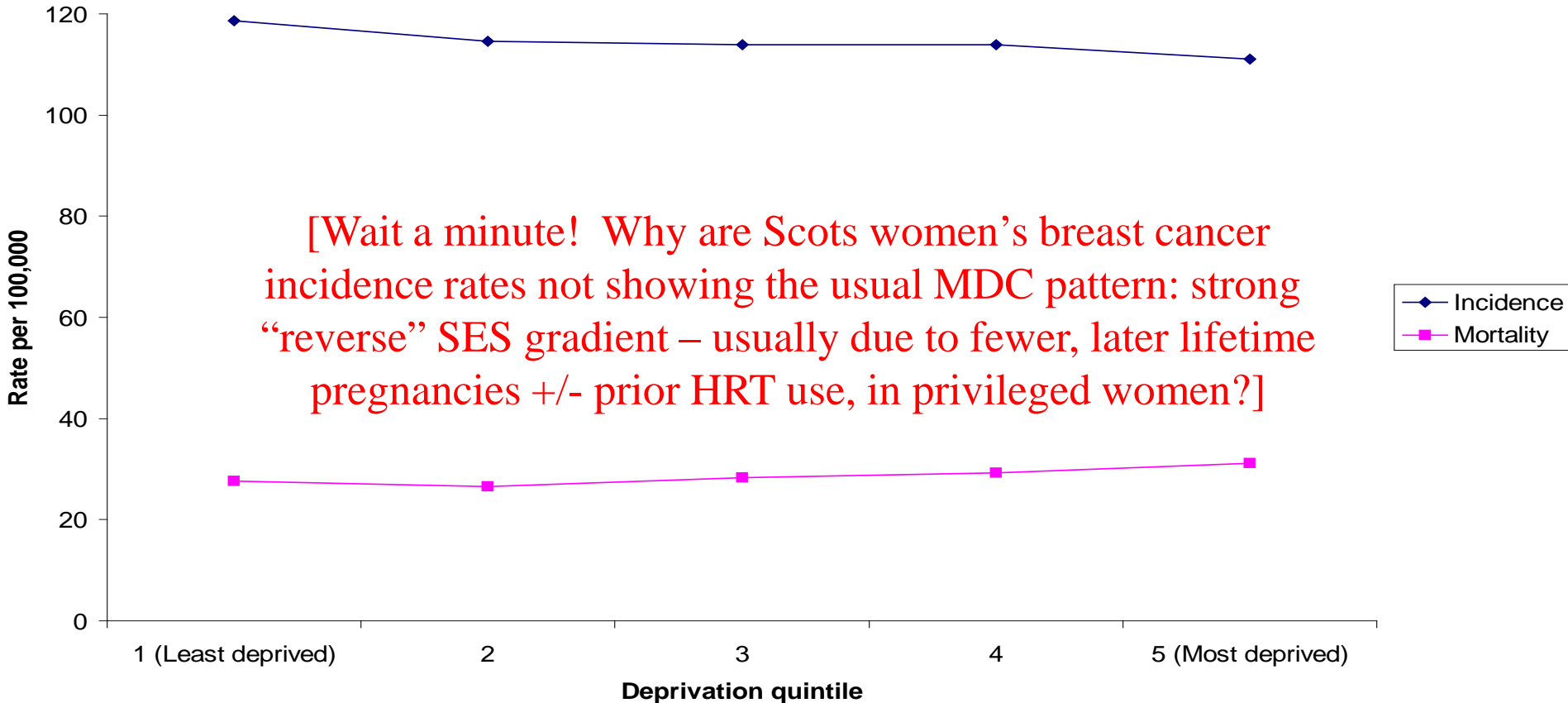


[NO PROGRESS OVERALL -- BUT DOES IT MAKE SENSE TO COMBINE ALL CANCERS IN ONE STATISTIC, WHEN THEY DIFFER SO WIDELY IN THEIR SES GRADIENTS' DIRECTION AND SHAPE?]

Source: Annual Report of the CMO, Scotland. The Scottish Government & NHS Scotland, Edinburgh. 2011.

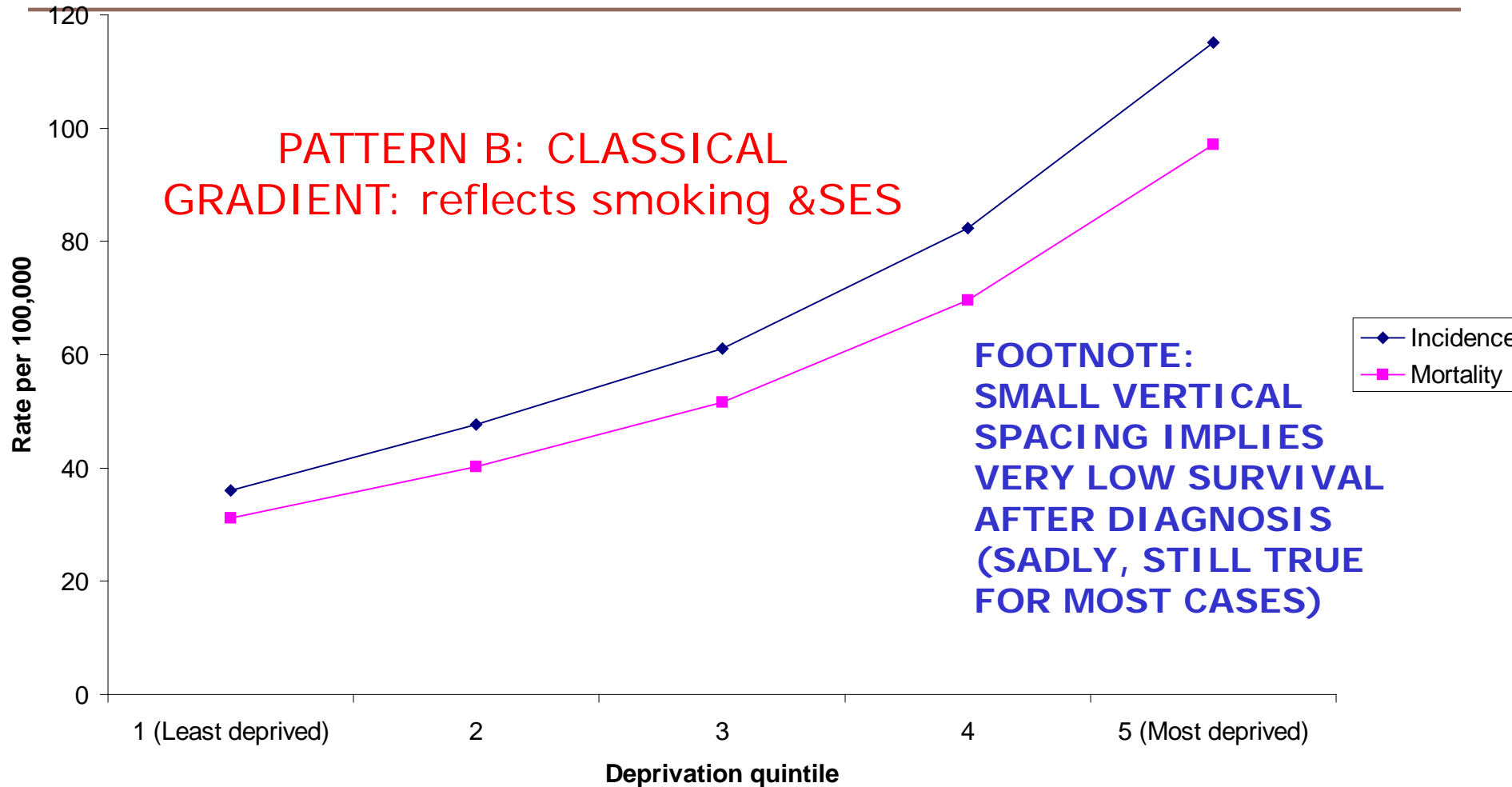
PATTERN A: ESSENTIALLY NO GRADIENT

Cancer of the female breast (ICD-10 C50)
Age-standardised incidence and mortality rates by SIMD 2006 deprivation quintile, females

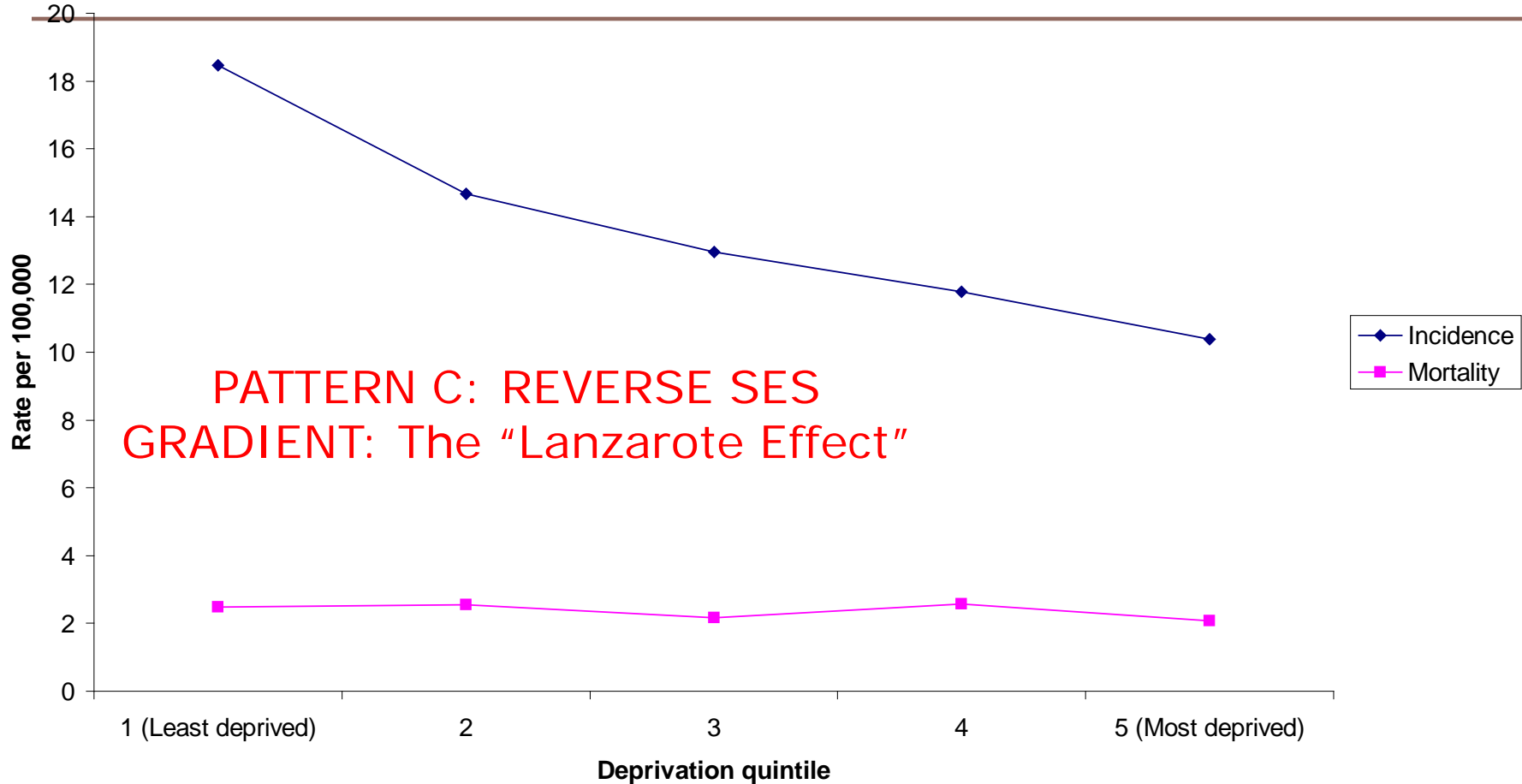


HINT: SES & smoking – higher primary and secondary (ETS exposure)?

Cancer of the trachea, bronchus and lung (ICD-10 C33-C34)
Age-standardised incidence and mortality rates by SIMD 2006 deprivation quintile, persons



Malignant melanoma of the skin (ICD-10 C43)
Age-standardised incidence and mortality rates by SIMD 2006 deprivation quintile, persons

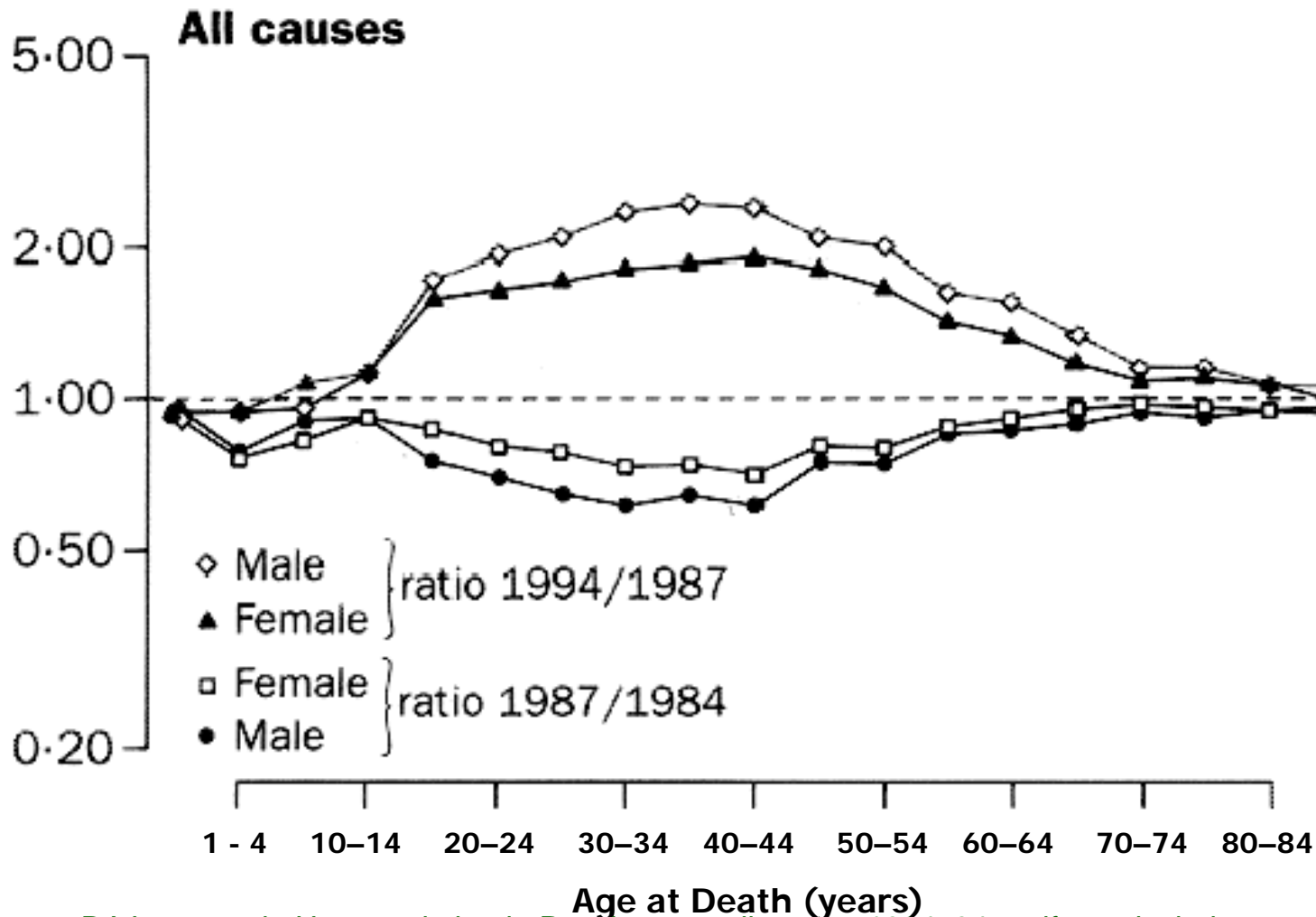


NOTE: rich/educated folks get it more often, but they pay no mortality penalty! Why?
HINT: What types of cases have the lowest mortality?

Aside: Is Cancer Relatively Non-Responsive to Massive Societal Change?

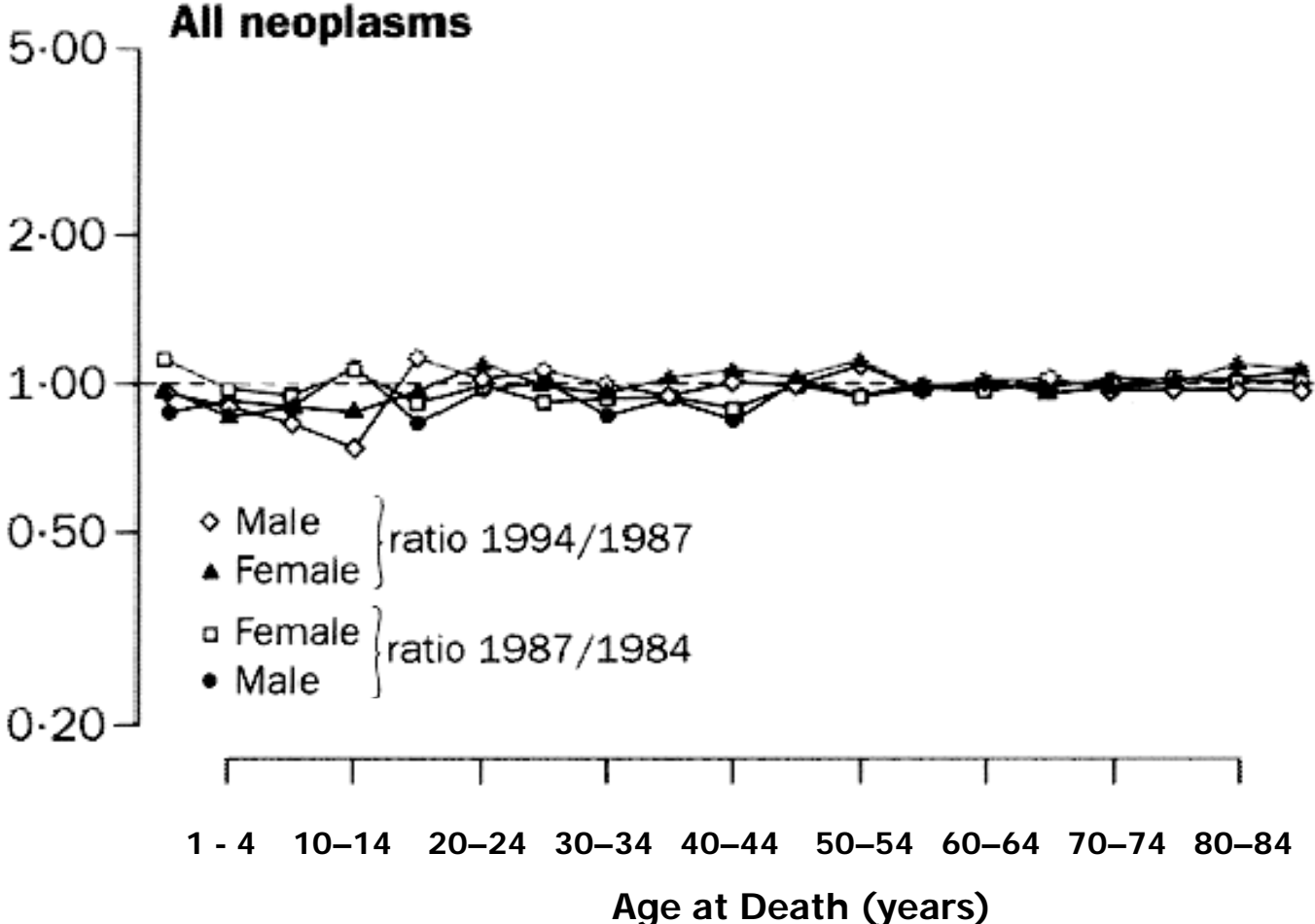
- Historical evidence from the economic collapse of the old Soviet Union, in the 1990s, strongly suggests that *epidemic* psychosocial stressors have no measurable impact on cancer mortality, but **ONLY** cancer mortality, *within the next few years' time* (although much of the societal change in this case was accompanied by much increased alcohol consumption, and so may not be typical of such crises)

All-Cause Mortality, USSR, 1984-94



DA Leon et al. Huge variation in Russian mortality rates 1984-94: artifact, alcohol, or what? *Lancet* 1997; 350: 383-88

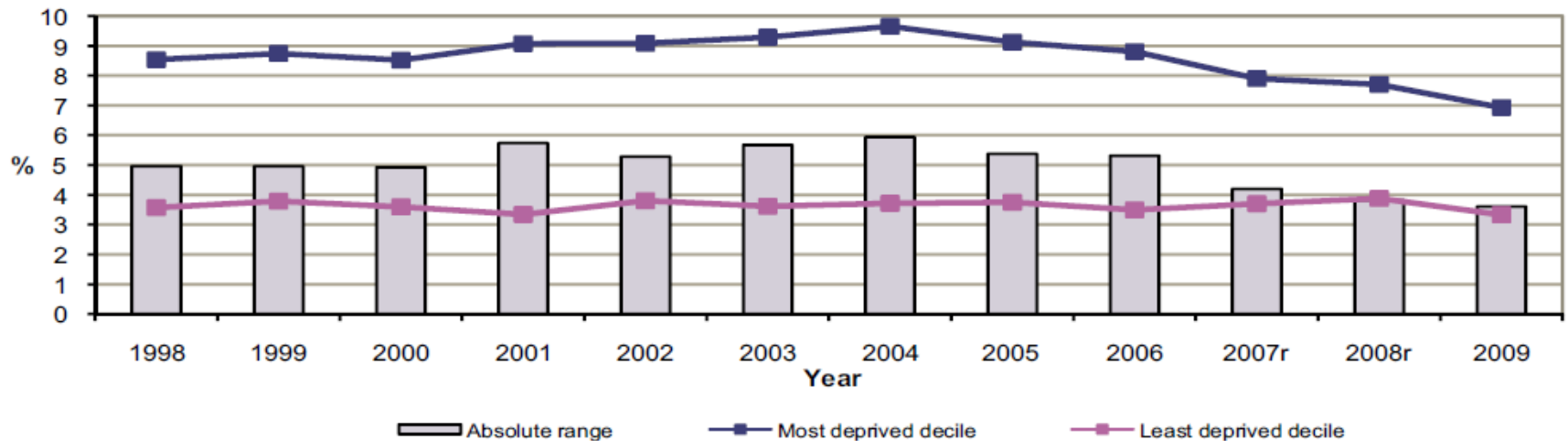
All Cancer Mortality, USSR, 1984-94



DA Leon et al. Huge variation in Russian mortality rates 1984-94: artifact, alcohol, or what? *Lancet* 1997; 350: 383-88

What about early-life disparities? – the curious case of LBW (=prevalence at birth: <2500 g.)

Figure 6: Absolute range: Low birthweight babies, Scotland 1998-2009 (as a percentage of all live singleton births)



Q: How to explain the complete plateau-ing of high-SES LBW rates? A: LBW= (SGA +true Pre-Term) Births, and these are moving in opposite directions int'l'y, so LBW now very stable.

Source: Annual Report of the CMO, Scotland. The Scottish Government & NHS Scotland, Edinburgh. 2011.

Improving Perinatal Health Indicators (e.g. for monitoring health inequalities)

- There are two opposing secular trends in birth-weight in developed countries, at differing BW ranges, for differing reasons:

a) increased LBW induction/caesareans, resulting from modern OB management of foetal risk, in ever-older mothers (at higher SES levels) or continuing patterns of high-risk, such as low age and smoking (in lower SES mothers) leading to higher LBW rates, *at 32-34 weeks*;

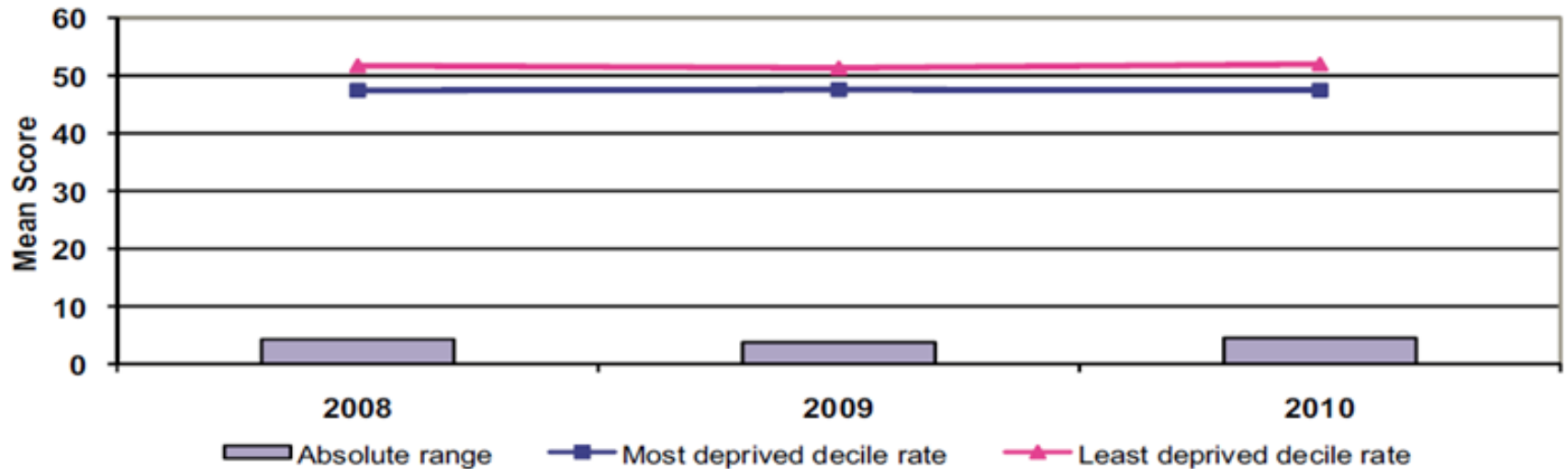
b) long-term secular trends towards heavier *full-term* babies, likely due to changing maternal anthropometry/nutritional status (Kramer MS et al. Why are babies getting bigger? Temporal trends in foetal growth and its determinants. J Pediatr 2002;141:538-9.)

All these phenomena vary by SES -- so "crude" LBW rates/trends by SES are almost un-interpretable

- Given the modern insensitivity-to-change of crude LBW rates, most countries have moved to using "weight for gestational age" – but this requires integrating gestational age from antenatal ultrasound into birth records that include weight – not routine yet in Scotland.

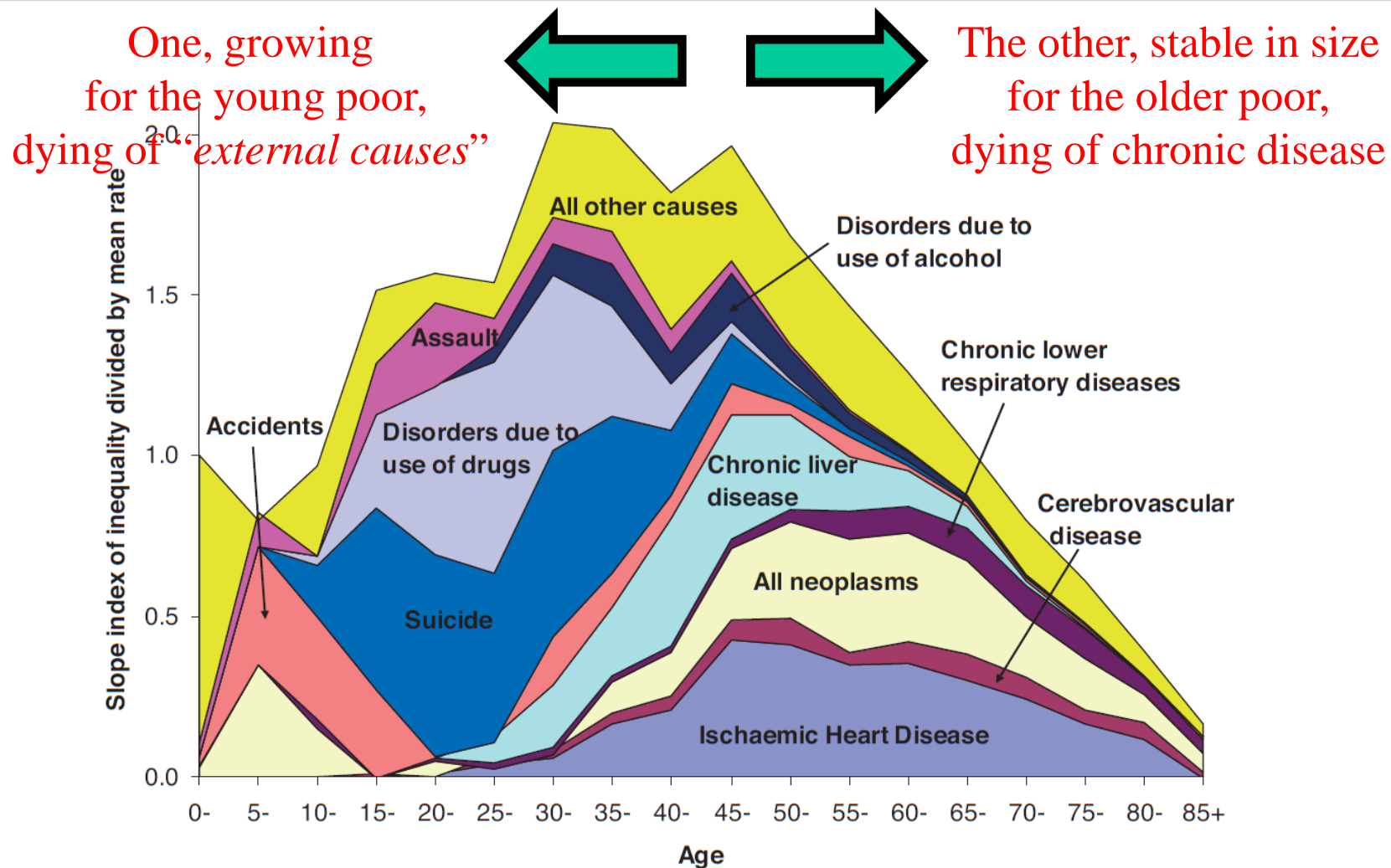
What about more functional indices of wellbeing in the entire population (e.g. from surveys)?

Figure 5: Absolute range: Mean WEMWBS score, Scotland 2008-2010



Time will tell how “sensitive to change” this is, but it is surely unpromising that extreme interdecile gap = only 10% of popⁿ mean [Recall Newfoundlanders’ self-assessed health status: also Celts!]

Age specific contribution to inequalities of specific causes of death, across SIMD quintiles (Scots men 2000-02): "Two Scots Graveyards"



SOURCE: Leyland et al. (2007) MRC SPHSU, Glasgow.

How Do Scotland's Inequalities Compare to the EU's When Individually-Assigned SES is Analysed? New **All-Cause Mortality** Results from Scottish Longitudinal Study -- Popham & Boyle, 2010 -- commissioned by SCPHRP)

SES
"x" =

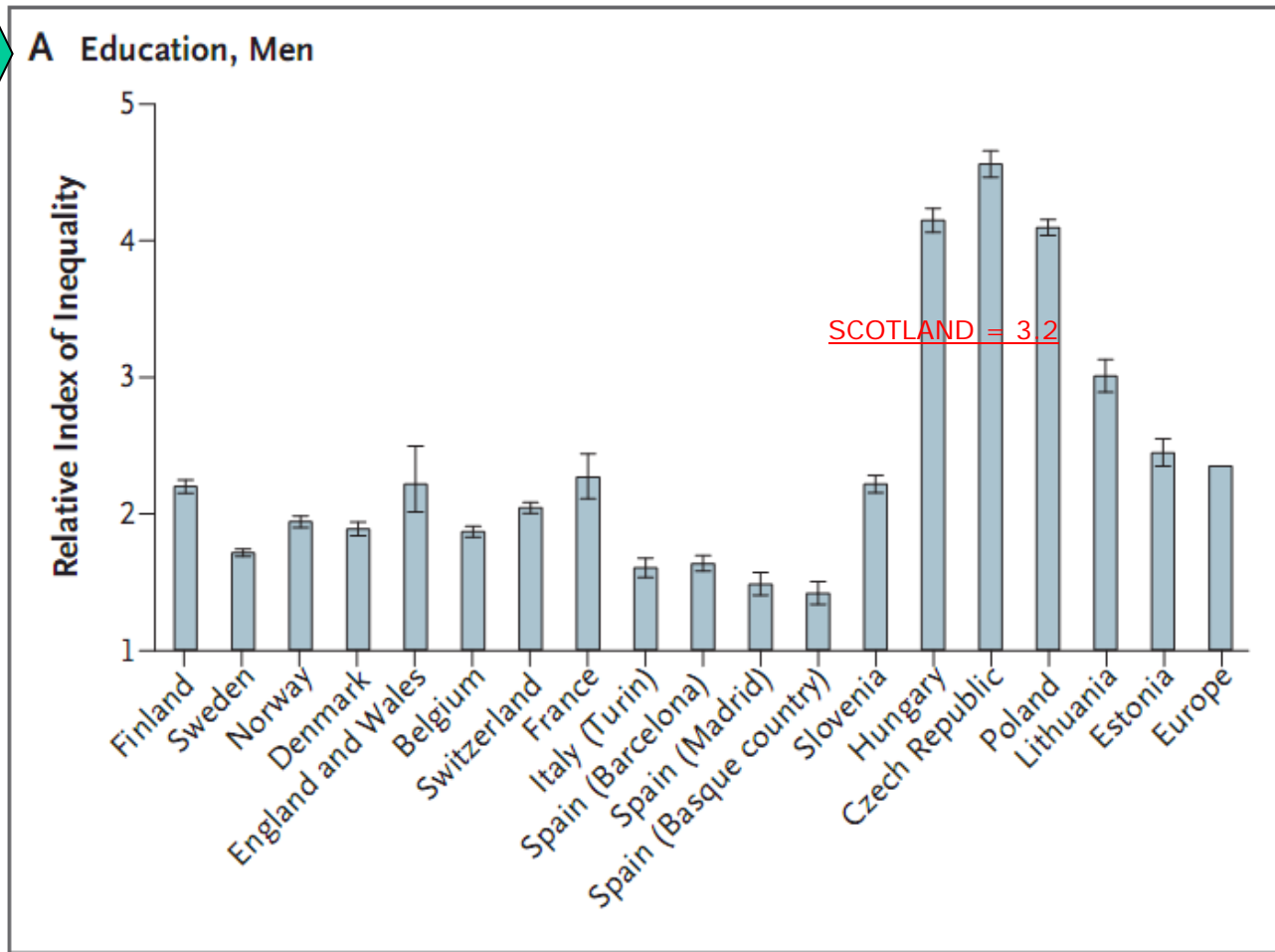
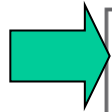


Figure 1 The Scottish education relative index of inequality (red line) for all-cause mortality in men 1991 to 1999 plotted against results for Europe (from Mackenbach *et al.* 2008)

New SLS All-Cause Mortality Results from Popham & Boyle (2010) commissioned by SCPHRP -- cont)

SES
"X" =

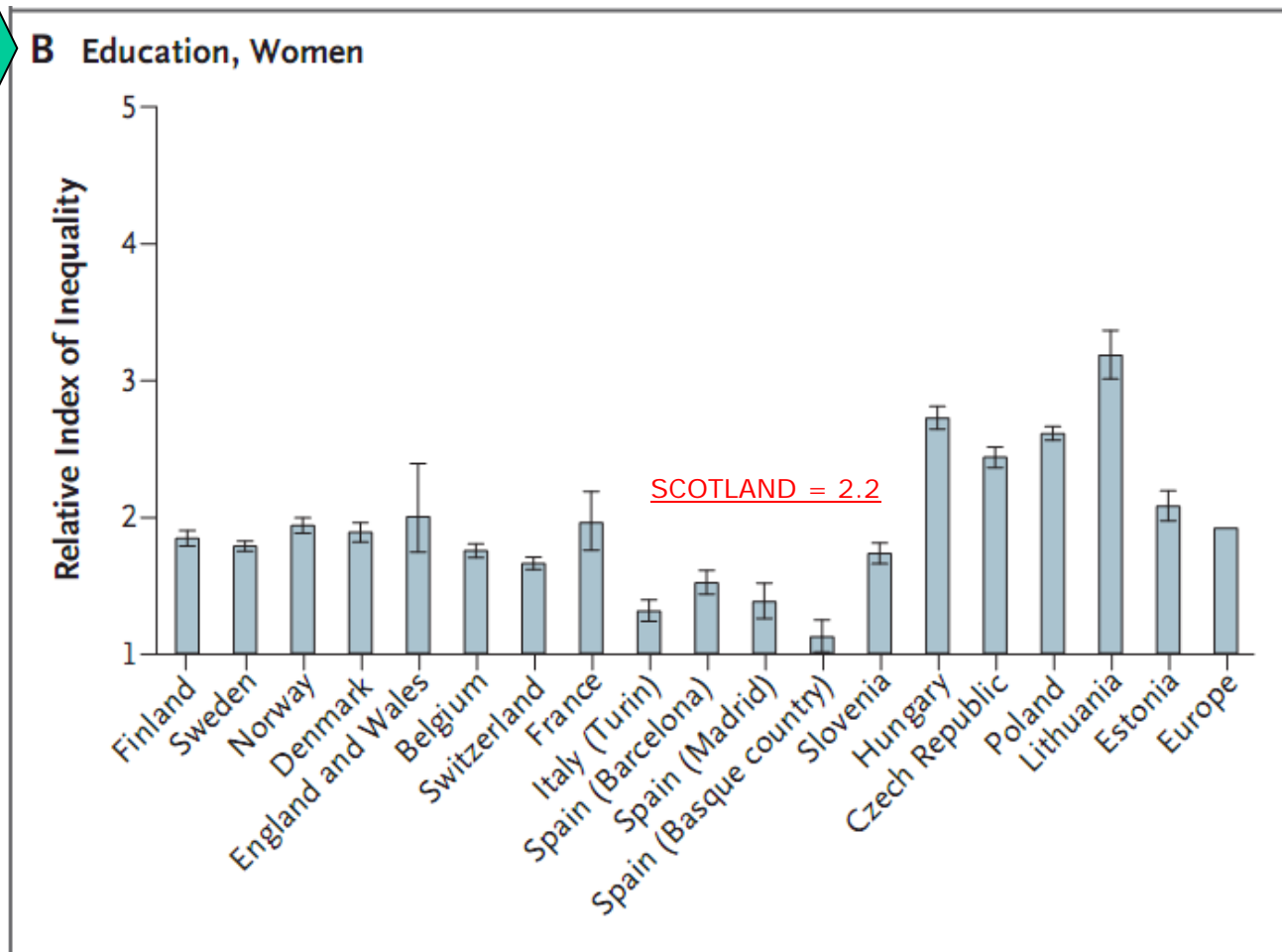
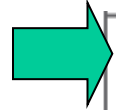


Figure 2 The Scottish education relative index of inequality (red line) for women 1991 to 1999 plotted against results for Europe -- from Mackenbach *et al.* 2008

New SLS All-Cause Mortality Results from Popham & Boyle (2010) commissioned by SCPHRP – cont'd

SES
"x" =

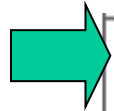


Figure 3 The Scottish occupational class relative index of inequality (red line) for men (aged 30 to 59) 1991 to 1999 plotted against results for Europe -- from Mackenbach *et al.* 2008

New SLS (2003) $y = S.R.G.H.$ Results (Popham & Boyle 2010 -- commissioned by SCPHRP, cont'd)

SES "x" =

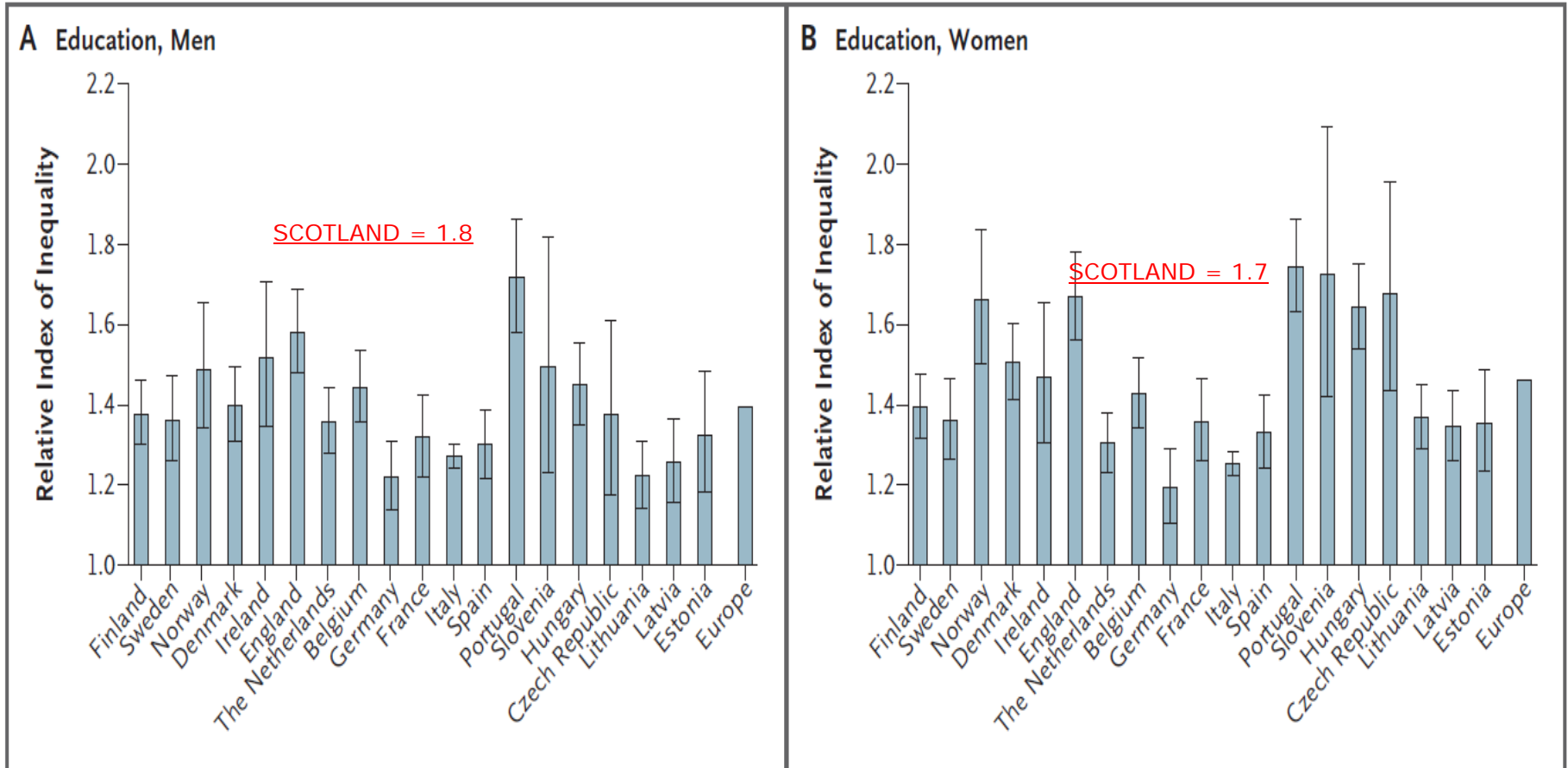


Figure 8 The Scottish education relative index of inequality (red line) for self rated general health plotted against results for Europe -- from Mackenbach *et al.* 2008

New SLS (2003) Y= Smoking/Obesity Results (Popham & Boyle 2010 -- commissioned by SCPHRP – cont'd)

SES "x" = EDUCATION

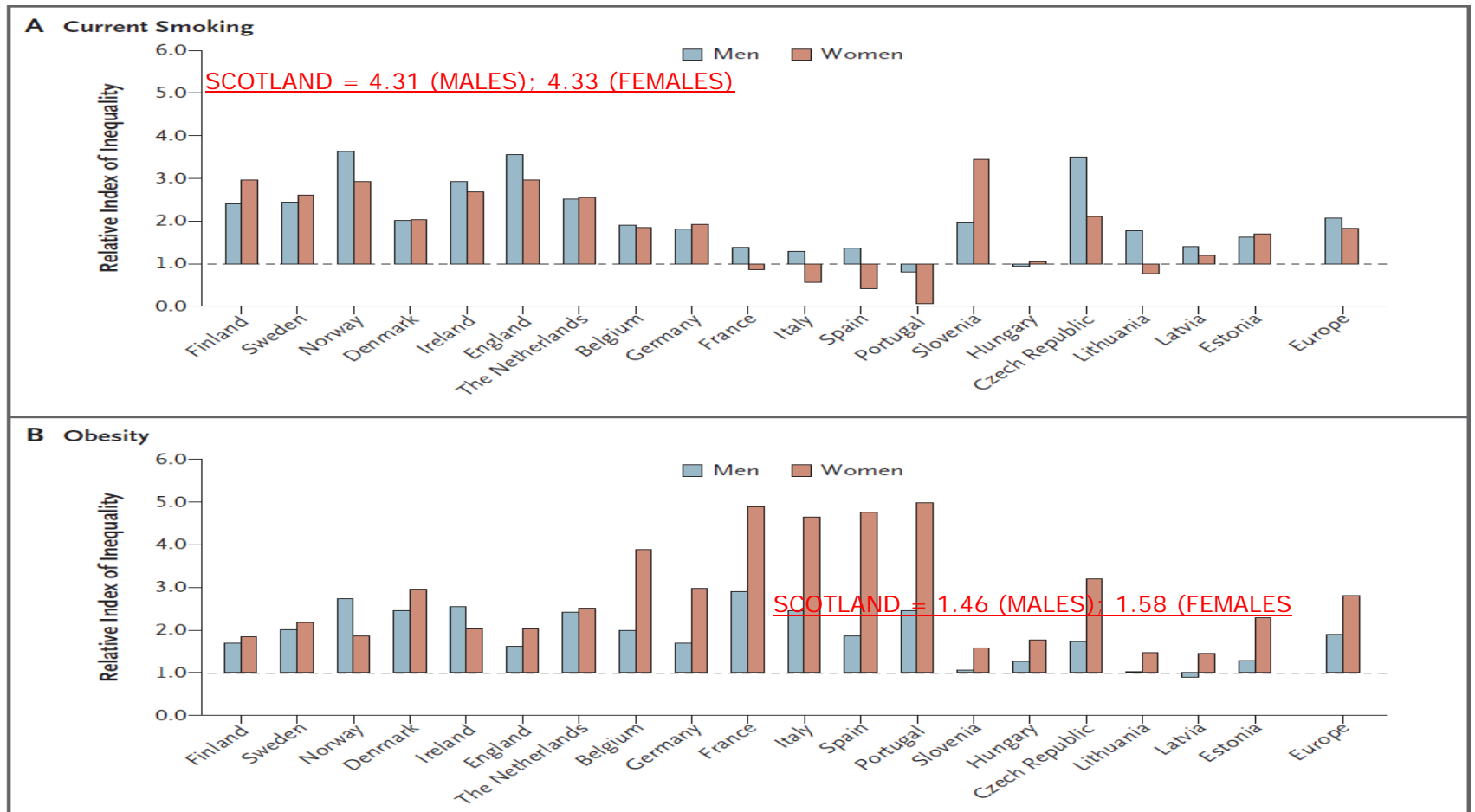
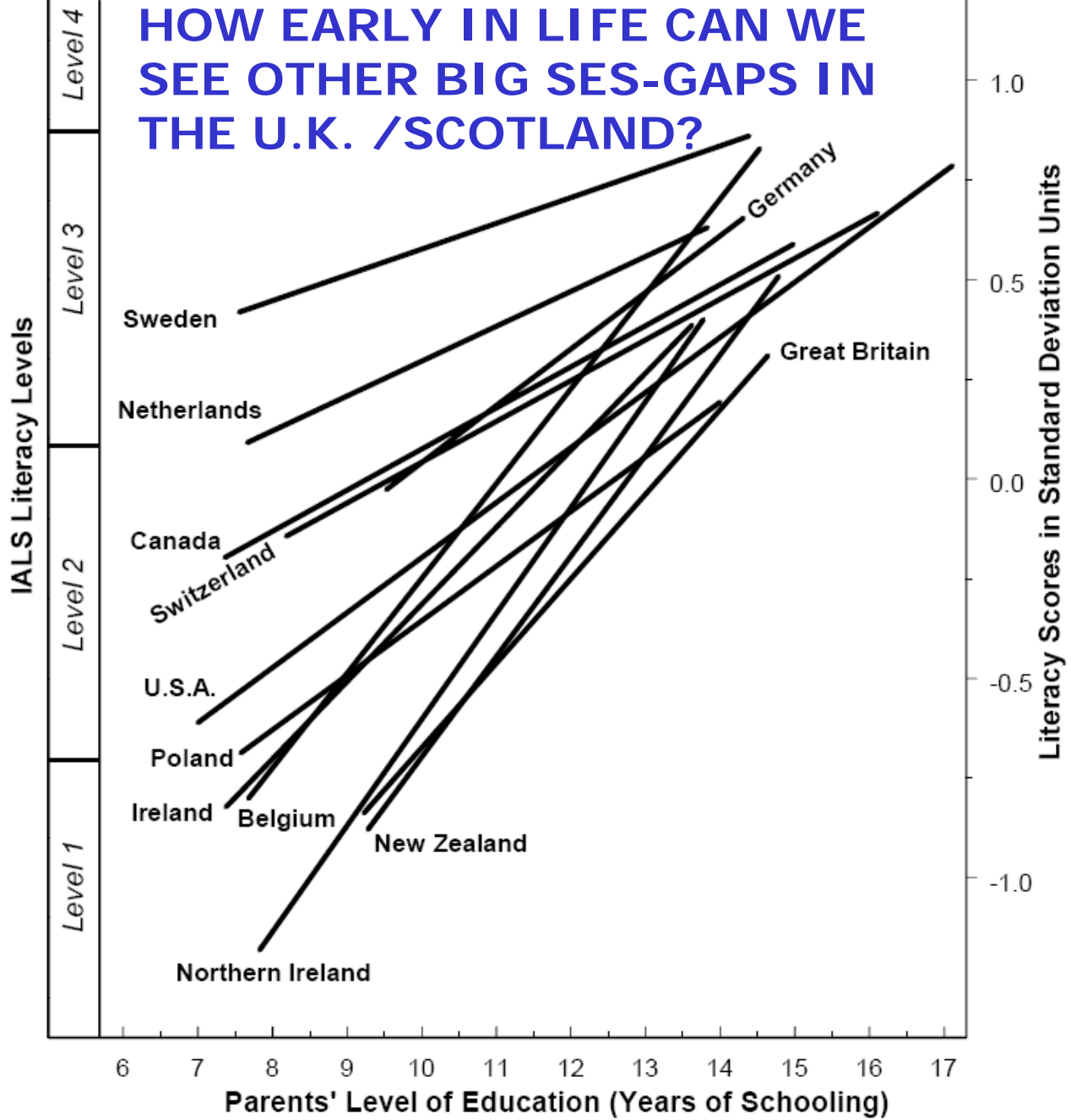


Figure 9 The Scottish education relative index of inequality (red line) for current smoking and obesity plotted against results for Europe from Mackenbach *et al.* 2008

HOW EARLY IN LIFE CAN WE SEE OTHER BIG SES-GAPS IN THE U.K. /SCOTLAND?



Literacy Scores for Youth Aged 16-25 years (Statistics Canada & the OECD, 1995). *Source:* Sloat E, Willms JD. The International Adult Literacy Survey.

Scotland: Media reports December 2009

“Fifth of Scots have poor literacy”

- **The BBC:**

<http://news.bbc.co.uk/1/hi/scotland/8393805.stm>

“Literacy report shows Russell there really is a crisis in education”

- **The Scotsman:**

<http://news.scotsman.com/opinion/Literacy-report--shows-Russell.5883656.jp>

“Zero-tolerance approach to poor literacy needed, experts say”

- **The Herald:**

<http://www.heraldscotland.com/news/education/zero-tolerance-approach-to-poor-literacy-needed-experts-say-1.989347>

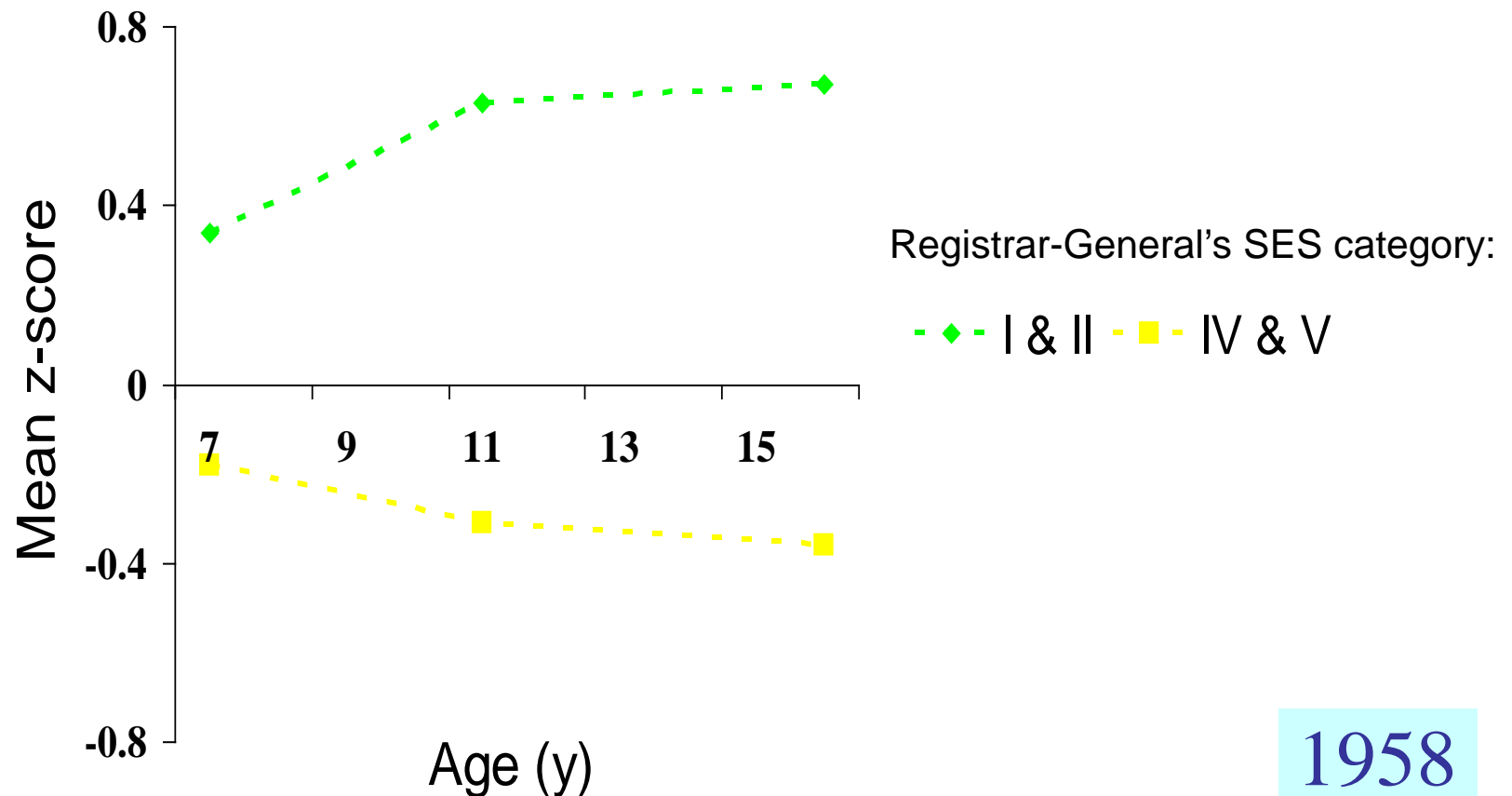
Scottish Education & Social Disadvantage

- “While individuals may defy this trend, no school in a deprived area is able to record a similar level of success to that achieved by almost all schools in the most affluent areas.”¹
- “...but the gaps between them (schools) are far less important than differences between students. In Scotland, **who you are** is far more important than **what school you attend.**”²

1. Literacy Commission. A Vision for Scotland: The Report and Final Recommendations of the Literacy Commission. Scottish Labour, December 2009. <http://www.scottishlabour.org.uk/literacy>
2. OECD. Quality and Equity of Schooling in Scotland. Paris: OECD, 2007.

Cognitive Development* (7-16y) & Social Origins in the 1958 British Birth Cohort – How Ordinary Schooling Makes The Gradient Worse

(Because it starts too late in childhood, when privileged children already have a huge head-start! Should we blame the schools?)



So, if marked (and relatively unchanging) health inequalities are evident in Scotland by teen-age life, what's going on?

- Educational attainment inequalities are also relatively large in Scotland – and may be getting larger (recent PISA results)
- Some children are not only being “left behind” – their “developmental health” never catches up, *because they start school too late, and their “home learning environments” aren’t good*
- The construction of an “underclass” starts early in life...and the glass ceiling of adult illiteracy/innumeracy hits fast...

What Might Be More Sensitive EARLY and REVERSIBLE Indicators Of SES Inequalities in Health and Function, Over the Life-Course?

Given the “prompt sensitivity to feasible change” of *early* childhood cognitive and educational outcomes across social classes, and their strong predictive power for lifelong function and health, what might a robust ROUTINE surveillance system for such “upstream” indicators look like?

[AN EXAMPLE FROM THE HUMAN EARLY LEARNING PARTNERSHIP – THE BRITISH COLUMBIA KINDERGARTNERS’ READINESS-TO-LEARN SURVEILLANCE SYSTEM: www.earlylearning.ubc.ca]

A Useful New Child Development Outcome from HELP (Human Early Learning Partnership) at the University of British Columbia, Vancouver, B.C.

“The Early Child Development (ECD) Mapping Project involves implementation of the Early Development Instrument (EDI) in British Columbia (Canada) school districts, to assess the *aggregate* state of human development, at the Kindergarten level, in *local* sequential birth cohorts.

Kindergarten teachers in B.C. began to collect EDI data triennially in 1999/2000, using one day of paid time on each wave. As of March 2004, all 59 school districts in B.C. had collected EDI data, which is fed back to all communities within the year.”

A Big Step Forward in Population-Based Monitoring of Child Function: The Early Development Instrument (EDI)

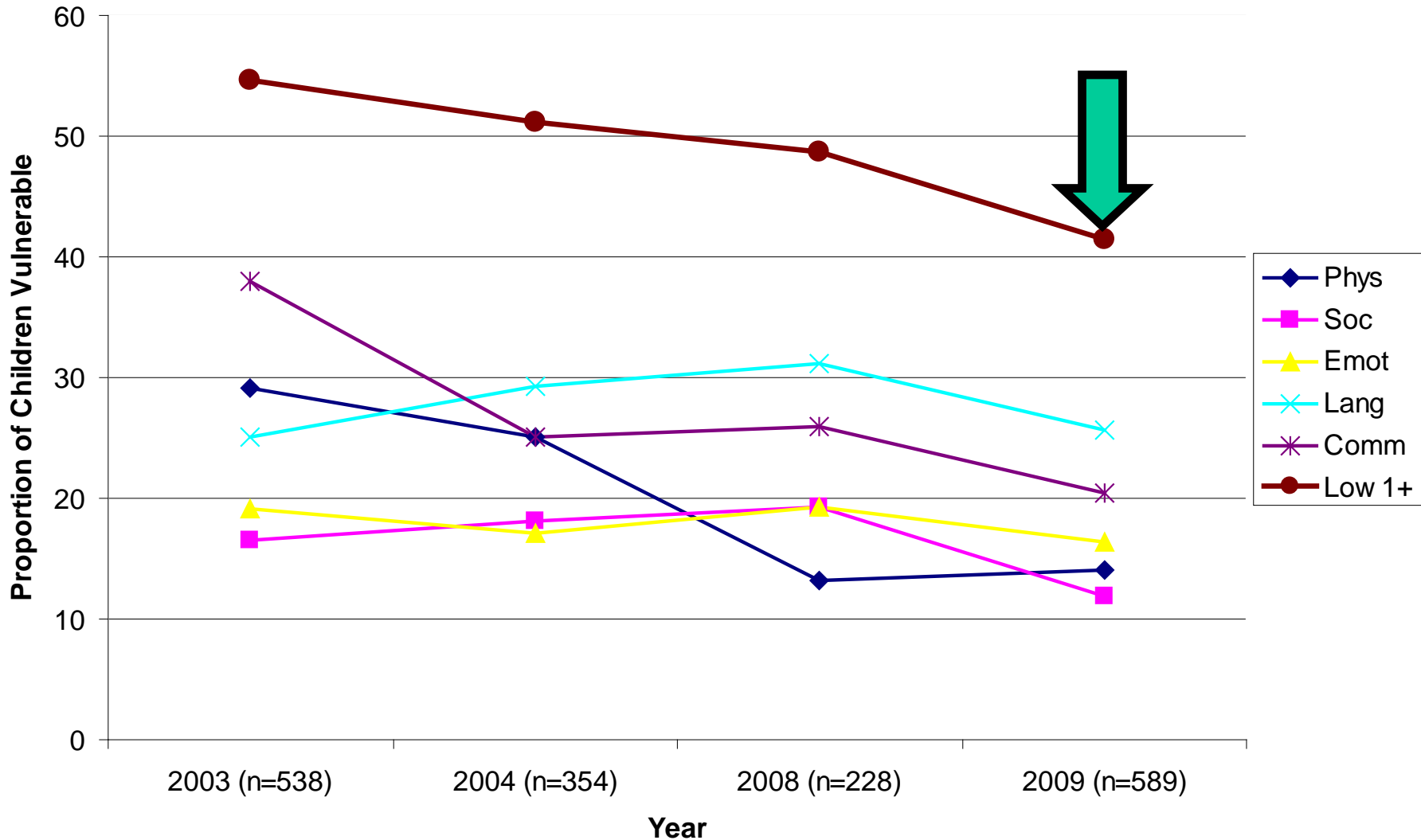
The EDI, filled out by the teacher gathers classroom-level data on five critical areas (or subscales) of children's development, in the first months of kindergarten, that predict longer-term school, and thus life, success:

- ❖ Physical health and well-being
- ❖ Social competence
- ❖ Emotional maturity
- ❖ Language and cognitive development
- ❖ Communication skills and general knowledge.

AND IT CAN BE CHANGED IN <6 YRS!

IN MIRRABOOKA (PERTH) AUSTRALIA, INTENSIVE LOCAL ECD PROGRAM DEVELOPMENT REDUCED EDI VULNERABILITY BY 25%

Mirraboooka C4C - Change in AEDI Results from 2003-2009



TO SUM UP:

- Many if not most current population health indicators, based mostly on natality, mortality, and hospitalization statistics, are **inadequately “sensitive”/responsive to feasible 5-to-10-year policy initiatives** to reduce health inequalities, especially those directed at early life – which have the most promise for large, efficient effects from relatively feasible preschool early child development programmes.
- To substantially improve our national health surveillance system will require more comprehensive **record-linkage**, especially across the public service sectors, across “virtual cohorts” of different ages.
- Ideally, one could then anonymously construct a **“Human Misery Index”** that summed up the descriptive epidemiology, including SES gradients, for all households with one or more members who experienced, in a given year, any of the following:
 - a serious health event or “crossed a key disability threshold”
 - a significant criminal justice or child welfare event
 - entry into social welfare or disability payments, or loss of work
 - forced eviction from housing
 - a failure in the school system
 - your choice of any other administratively routinely collected indicator of human suffering!

Implementing such measurements will require MUCH collective effort!

How to Reach Us

John Frank

john.frank@hgu.mrc.ac.uk

Ruth Jepson

ruth.jepson@hgu.mrc.ac.uk

Sam Bain (PA)

samantha.bain@hgu.mrc.ac.uk

SCPHRP Fellows

Helen Frost

helen.frost@hgu.mrc.ac.uk

Rosemary Geddes

rosemary.geddes@hgu.mrc.ac.uk

Caroline Jackson

caroline.jackson@hgu.mrc.ac.uk

John Mooney

john.mooney@hgu.mrc.ac.uk