

# 'Excess' mortality in Scotland: towards an understanding?

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# Topics

- What do we mean by 'excess' mortality?
- Quantifying the excess:
  - results of new national analyses
- Understanding the excess:
  - synthesising the evidence
- Why this matters
- (As always, a lot of graphs...)

# Scottish 'excess' mortality

- Higher mortality observed in Scotland (compared to elsewhere in the UK) *over and above* that explained by differences in socio-economic deprivation
- NB Poverty and deprivation (and underlying/related factors e.g. deindustrialisation) main drivers of poor health in any society
- But higher mortality still observed in Scotland after taking deprivation & poverty into account
- (Excess also referred to as the 'Scottish Effect' (but not in this presentation...))

# Research examples

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- Popham F., Boyle P.J. Is there a 'Scottish effect' for mortality? Prospective observational study of census linkage studies. *Journal of Public Health*; pp. 1–6; doi:10.1093/pubmed/fdr023.
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# Research examples

Journal of Public Health  
doi:10.1093/pubmed/rdi002

Vol. 27, No. 2, pp. 199–204  
Advance Access Publication 17 March 2005

## Why is mortality higher in Scotland than in England and Wales? Decreasing influence of socioeconomic deprivation between 1981 and 2001 supports the existence of a 'Scottish Effect'

P. Hanlon, R. S. Lawder, D. Buchanan, A. Redpath, D. Walsh, R. Wood, M. Bain, D. H. Brewster and J. Chalmers

### Abstract

**Objectives** To determine the degree to which changing patterns of deprivation in Scotland and the rest of Great Britain between 1981 and 2001 explain Scotland's higher mortality rates over that period.

**Design** Cross-sectional analyses using population and mortality data from around the 1981, 1991 and 2001 censuses.

**Setting** Great Britain (GB).

**Participants** Populations of Great Britain enumerated in the 1981, 1991 and 2001 censuses.

**Main outcome measures** Carstairs deprivation scores derived for wards (England and Wales) and postcode sectors (Scotland). Mortality rates adjusted for age, sex and deprivation decile.

**Results** Between 1981 and 2001 Scotland became less deprived relative to the rest of Great Britain. Age and sex standardized all-cause mortality rates decreased by approximately 25% across Great Britain, including Scotland but mortality rates were on average 12% higher in Scotland in 1981 rising to 15% higher in 2001. While over 80% of the excess mortality in 1981 could be explained by differences in deprivation profile, less than half the excess could be explained in 1991 and 2001. After adjusting for age, sex and deprivation, excess mortality in Scotland rose from 4.7% (95% CI: 3.9% to 5.4%) in 1981 to 7.9% (95% CI: 7.2% to 8.7%) in 1991 and 8.2% (95% CI: 7.4% to 9.0%) in 2001. All deprivation deciles showed excess indicating that populations in Scotland living in areas of comparable deprivation to populations in the rest of Great Britain always had higher mortality rates. By 2001 the largest excesses were found in the most deprived areas in Scotland with a 17% higher mortality rate in the most deprived decile compared to similarly deprived areas in England and Wales. Excess mortality in Scotland has increased most among males aged <65 years.

**Conclusions** Scotland's relative mortality disadvantage compared to the rest of Great Britain, after allowing for deprivation, is worsening. By 1991 measures of deprivation no longer explained most of the excess mortality in Scotland and the unexplained excess has persisted during the 1990s. More research is required to understand what is causing this 'Scottish effect'.

**Keywords:** deprivation, inequalities in health, mortality

### Introduction

The stimulus for this study was the observation that standardized mortality ratios for Scotland relative to England and Wales had risen during the 1980s and that the rise was particularly large for middle-aged men.<sup>1</sup> Since life expectancy was improving in both populations, this widening gap represented a relative rather than absolute decline for the Scottish population but its size and speed of change suggested the need for further investigation. Historically, Scotland's poorer health has been attributed to higher levels of deprivation<sup>2</sup> but more recent analysis<sup>3</sup> appeared to show that, by the early 1990s, deprivation was accounting for less of Scotland's excess mortality, a phenomenon that was called the 'Scottish Effect'.<sup>4</sup> The purpose of this study is, therefore, to determine the degree to which changing patterns of deprivation in Scotland and the rest of Great Britain between 1981 and 2001 explain Scotland's higher mortality rates over this period.

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- Scotland compared to England & Wales
- Controlled for differences in *area-based* deprivation
- Scottish all-cause mortality 8% higher than England & Wales c.2001
- Higher cause-specific 'excesses' e.g. cerebrovascular disease: 24%; lung cancer: 25%; suicide: 49%

# Research examples

JECH Online First, published on September 12, 2014 as 10.1136/jech-2014-204185  
Research report

**OPEN ACCESS**

## Explaining the excess mortality in Scotland compared with England: pooling of 18 cohort studies

Gerry McCartney,<sup>1</sup> Tom C Russ,<sup>2,3,4</sup> David Walsh,<sup>5</sup> Jim Lewsey,<sup>6</sup> Michael Smith,<sup>7</sup> George Davey Smith,<sup>8</sup> Emmanouil Stamatakis,<sup>9,10</sup> G David Batty<sup>9</sup>

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/jech-2014-204185>).

For numbered affiliations see end of article.

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**ABSTRACT**  
**Background** Mortality in Scotland is higher than in the rest of west and central Europe and is improving more slowly. Relative to England and Wales, the excess is only partially explained by area deprivation. We tested the extent to which sociodemographic, behavioural, anthropometric and biological factors explain the higher mortality in Scotland compared with England.  
**Methods** Pooled data from 18 nationally representative cohort studies comprising the Health Survey for England (HSE) and the Scottish Health Survey (SHS). Cox regression analysis was used to quantify the excess mortality risk in Scotland relative to England with adjustment for baseline characteristics.  
**Results** A total of 193 873 participants with a mean of 9.6 years follow-up gave rise to 21 345 deaths. The age-adjusted and sex-adjusted all-cause mortality HR for Scottish respondents compared with English respondents was 1.40 (95% CI 1.34 to 1.47), which attenuated to 1.29 (95% CI 1.23 to 1.36) with the addition of the baseline socioeconomic and behavioural characteristics. Cause-specific mortality HRs attenuated only marginally to 1.43 (95% CI 1.28 to 1.60) for ischaemic heart disease, 1.37 (95% CI 1.15 to 1.63) for stroke, 1.41 (95% CI 1.30 to 1.53) for all causes, 3.43 (95% CI 1.85 to 6.36) for illicit drug-related poisoning and 4.64 (95% CI 3.55 to 6.05) for alcohol-related mortality. The excess was greatest among young adults (16–44 years) and was observed across all occupational social classes with the greatest excess in the unskilled group.  
**Conclusions** Only a quarter of the excess mortality among Scottish respondents could be explained by the available baseline risk factors. Greater understanding is required on the lived experience of poverty, the role of social support, and the historical, environmental, cultural and political influences on health in Scotland.

**INTRODUCTION**  
The population of Scotland has experienced higher mortality rates than the rest of the UK since the 1920s, and improved more slowly than the rest of continental Europe since the 1950s.<sup>1–3</sup> Initially, this was largely ascribed to higher mortality from cardiovascular disease (CVD), stroke and cancer. However, this pattern of cause-specific deaths changed around 1980 with a rise in rates of violent,<sup>4</sup> drug-related and suicide deaths.<sup>5</sup> With an accompanying increase in rates of alcohol-related deaths over subsequent decades, the mortality pattern now has parallels to that observed in eastern Europe.<sup>6–8</sup>

Relative to England and Wales, mortality rates in Scotland were 129% higher in 1981, increasing to 15% higher in 2001. The proportion of this excess, which could be explained by area-based socioeconomic deprivation, declined from 62% to 47% during the same period. Individual measures of socioeconomic status revealed similar findings for coronary heart disease.<sup>9</sup> This apparently inexplicable excess mortality, over and above that explained by area deprivation, has been dubbed the ‘Scottish Effect’.<sup>8</sup>

There is therefore a need to explain why Scotland experiences higher rates of mortality than the rest of west and central Europe, why area deprivation is increasingly less able to explain the excess in comparison to England and Wales and why inequalities in mortality within Scotland are relatively higher.<sup>9–11</sup> To date, there have been at least 17 hypotheses suggested to explain these phenomena,<sup>12–19</sup> but the investigation of many of these has been limited by a lack of comparable individual data linked to health outcomes, and where these data have been available, they may not be generalisable.<sup>19</sup> Although it is clear that some health behaviours are implicated in the higher mortality (particularly alcohol<sup>15</sup> and illicit drugs<sup>16</sup>), the prevalence of many others are relatively similar in Scotland to other areas.<sup>17–18</sup> This has raised the possibility that other factors may be an important explanation.<sup>19</sup> Furthermore, simple explanations that include only health behaviours, without some understanding of the ‘causes of the causes’ are insufficient, and so hypotheses relating to deindustrialisation, unemployment, economic and social policy<sup>20–21</sup> (not least the neoliberal approach seen in the UK) have been proposed.<sup>1–12–18–22–23</sup> Further research is therefore required in order to design policy and practice with the aim of alleviating the human suffering associated with the higher mortality rates.

Major population health surveys conducted from the mid-1990s in Scotland and England, whose respondents have been linked to subsequent cause-specific mortality, have created powerful, well-characterised cohort studies which draw on random population samples.<sup>24–27</sup> Much of the data collected in the health surveys are directly comparable and there have now been a sufficient number of deaths to facilitate comparative pooled analyses of mortality in England and Scotland. Thus, this study aims to ascertain the extent to which any of the baseline risk factors explain the higher mortality in Scotland, beginning with social position,

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- Scottish Health Surveys & Health Surveys for England (1994-2008)
- Controlled for differences in *individual* SES...
- ... and behavioural risk factors (e.g. smoking, alcohol consumption, diet, physical activity)...
- ...and biological risk factors (e.g. BMI, blood pressure, lung function)
- 29% higher mortality in Scottish sample



# Research examples

PUBLIC HEALTH 124 (2010) 487–495

available at www.sciencedirect.com

Public Health

journal homepage: www.elsevier.com/locate/PUHEALTH

Original Research

**It's not 'just deprivation': Why do equally deprived UK cities experience different health outcomes?**

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 'Scottish effect'

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SUMMARY

**Background:** The link between deprivation and health is well established. However, recent research has highlighted the existence of a 'Scottish effect', a term used to describe the higher levels of poor health experienced in Scotland over and above that explained by socio-economic circumstances. Evidence of this 'excess' being concentrated in West Central Scotland has led to discussion of a more specific 'Glasgow effect'. However, within the UK, Glasgow is not alone in experiencing relatively high levels of poor health and deprivation; Liverpool and Manchester are two other cities which also stand out in this regard. Previous analyses of this 'effect' were also constrained by limitations of data and geography.

**Objectives:** To establish whether there is evidence of a so-called 'Glasgow effect': (1) even when compared with its two most similar and comparable UK cities; and (2) when based on a more robust and spatially sensitive measure of deprivation than was previously available to researchers.

**Study design and methods:** Rates of 'income deprivation' (a measure very highly correlated with the main UK indices of multiple deprivation) were calculated for small areas (average population size: 1600) in Glasgow, Liverpool and Manchester. All-cause and cause-specific standardized mortality ratios were calculated for Glasgow relative to Liverpool and Manchester, standardizing for age, gender and income deprivation decile. In addition, a range of historical census and mortality data were analysed.

**Results:** The deprivation profiles of Glasgow, Liverpool and Manchester are almost identical. Despite this, premature deaths in Glasgow are more than 30% higher, with all deaths approximately 15% higher. This 'excess' mortality is seen across virtually the entire population: all ages (except the very young), both males and females, in deprived and non-deprived neighbourhoods. For premature mortality, standardized mortality ratios tended to be higher for the more deprived areas (particularly among males), and approximately half of 'excess' deaths under 65 years of age were directly related to alcohol and drugs. Analyses of historical data suggest that it is unlikely that the deprivation profile of Glasgow has changed significantly relative to Liverpool and Manchester in recent decades; however,

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 doi:10.1016/j.puhe.2010.02.006

- Glasgow compared to Liverpool & Manchester (2003-07)
- Controlled for differences in *area deprivation*
- Very similar deprivation profiles in 3 cities...
- ...and similar everything else
- Premature mortality 30% higher in Glasgow
- (Deaths at all ages almost 15% higher)

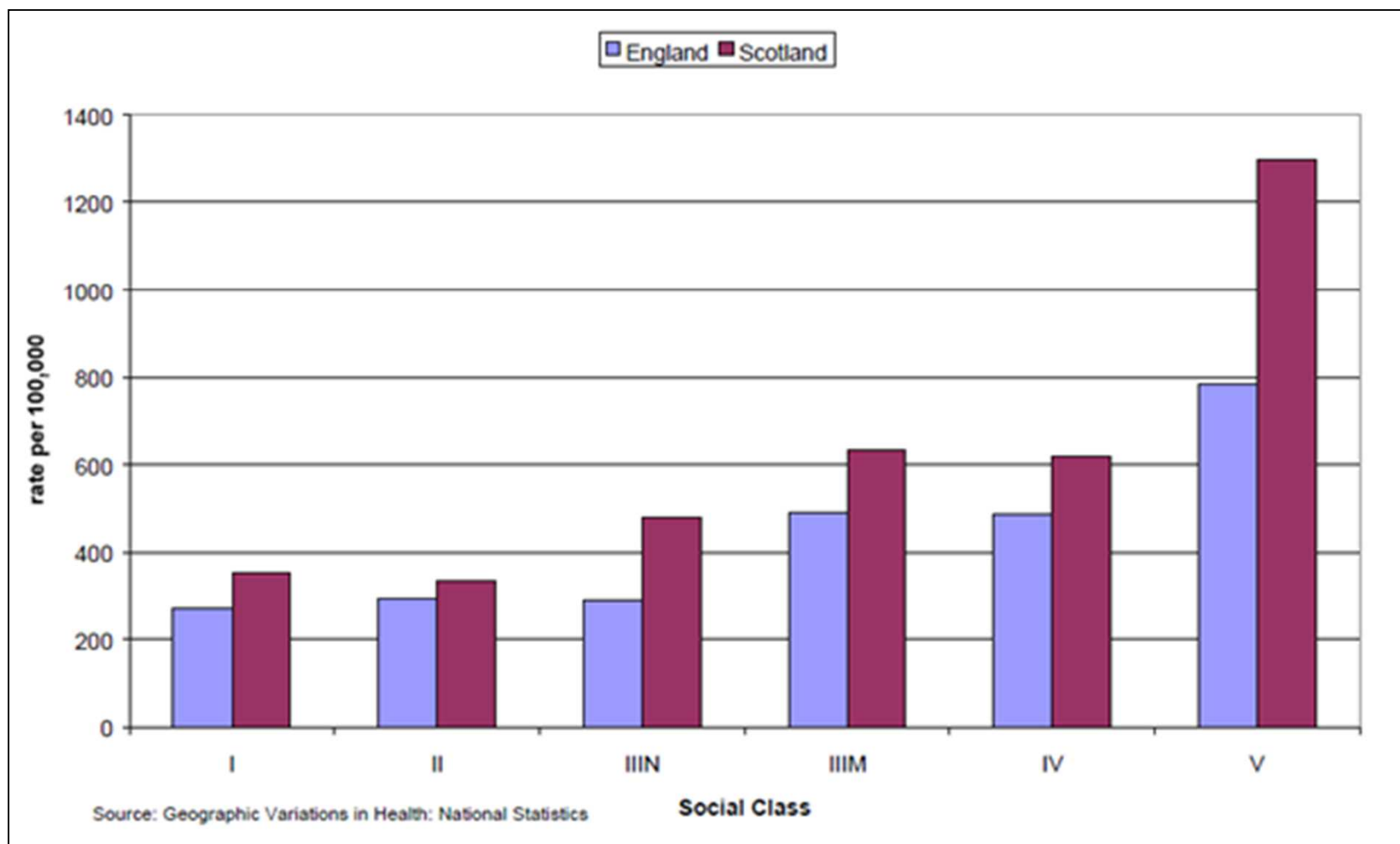
# Common themes of research into Scottish 'excess' mortality

- Excess increasing over time
- Excess shown irrespective of measures of poverty/SES used
- Seen for many different causes of death
- Persists after controlling for individual health behaviours (smoking etc)
- Ubiquitous in Scotland, but greatest in and around West Central Scotland conurbation (esp. Glasgow)
- Affects all social classes, but highest among comparisons of poorest



# Premature mortality by social class

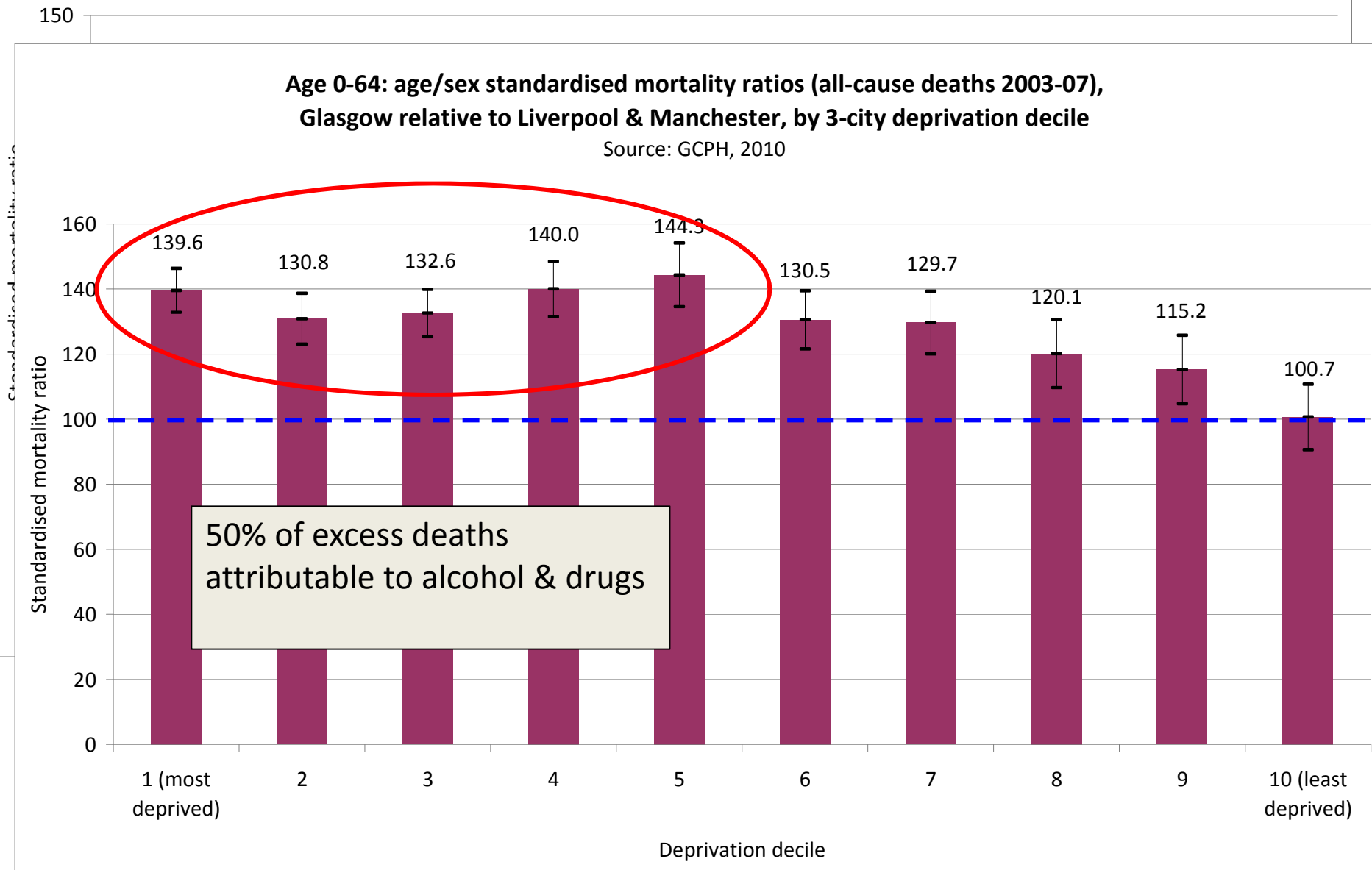
Age-standardised all-cause mortality rates by Social Class, England and Scotland, males aged 20-64, 1991-93



(Source: Scottish Executive, 1993 (from data originally presented by Uren et al, 2001))

**Age/sex standardised mortality ratios (all-cause deaths 2003-07),  
Glasgow relative to Liverpool & Manchester, by 3-city deprivation decile**

Source: GCPH, 2010



**Age 0-64: age/sex standardised mortality ratios (all-cause deaths 2003-07),  
Glasgow relative to Liverpool & Manchester, by 3-city deprivation decile**

Source: GCPH, 2010

# New national analyses

- Undertaken
- Comparative
- Scotland co
- Updating p
- Uses origin
- deprivation
- ...but expan
- 'challenges
- Comparin
- Different

Journal of Public Health  
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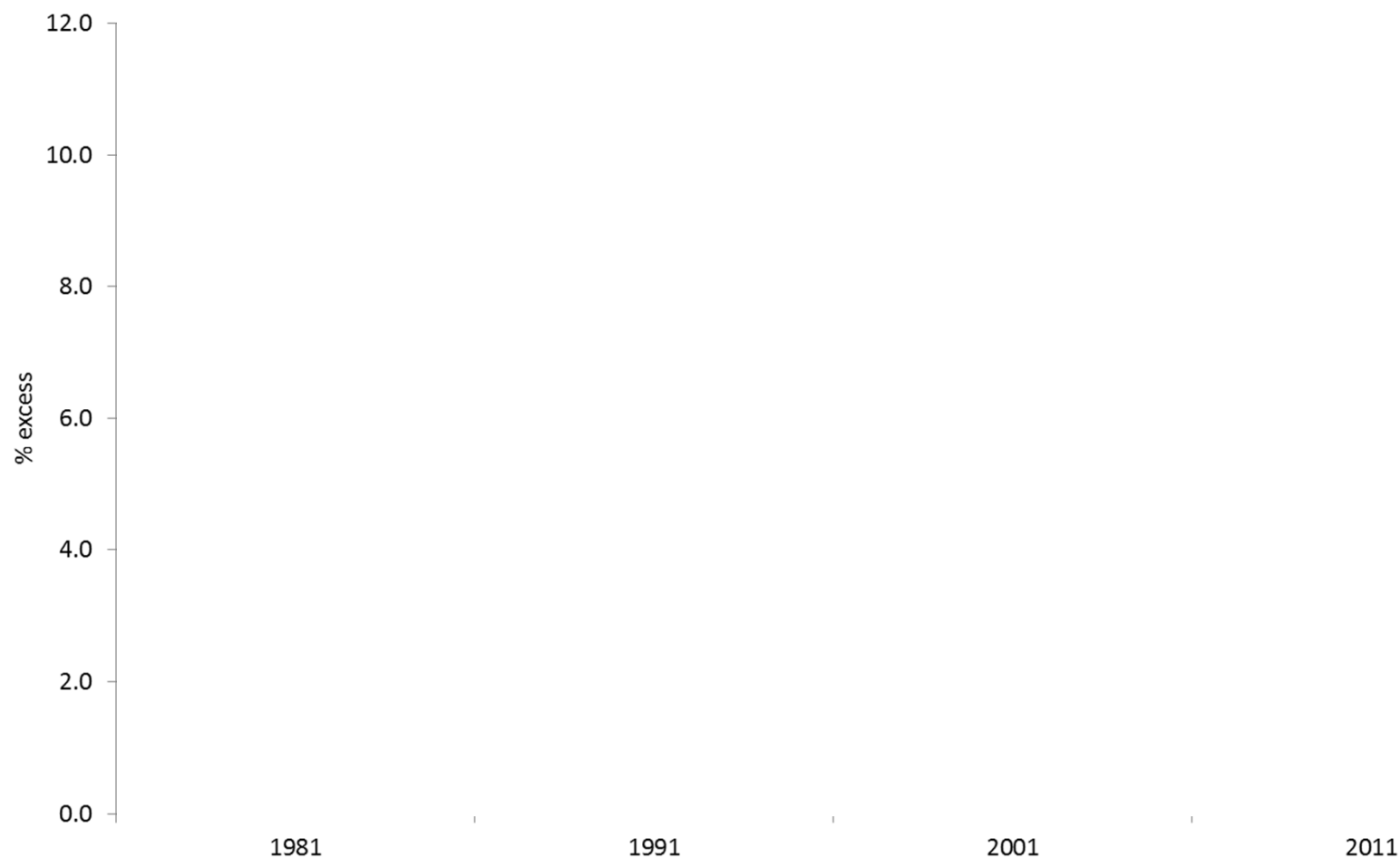
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Scotland  
and mortality in  
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1981-2011  
Carstairs  
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deprivation  
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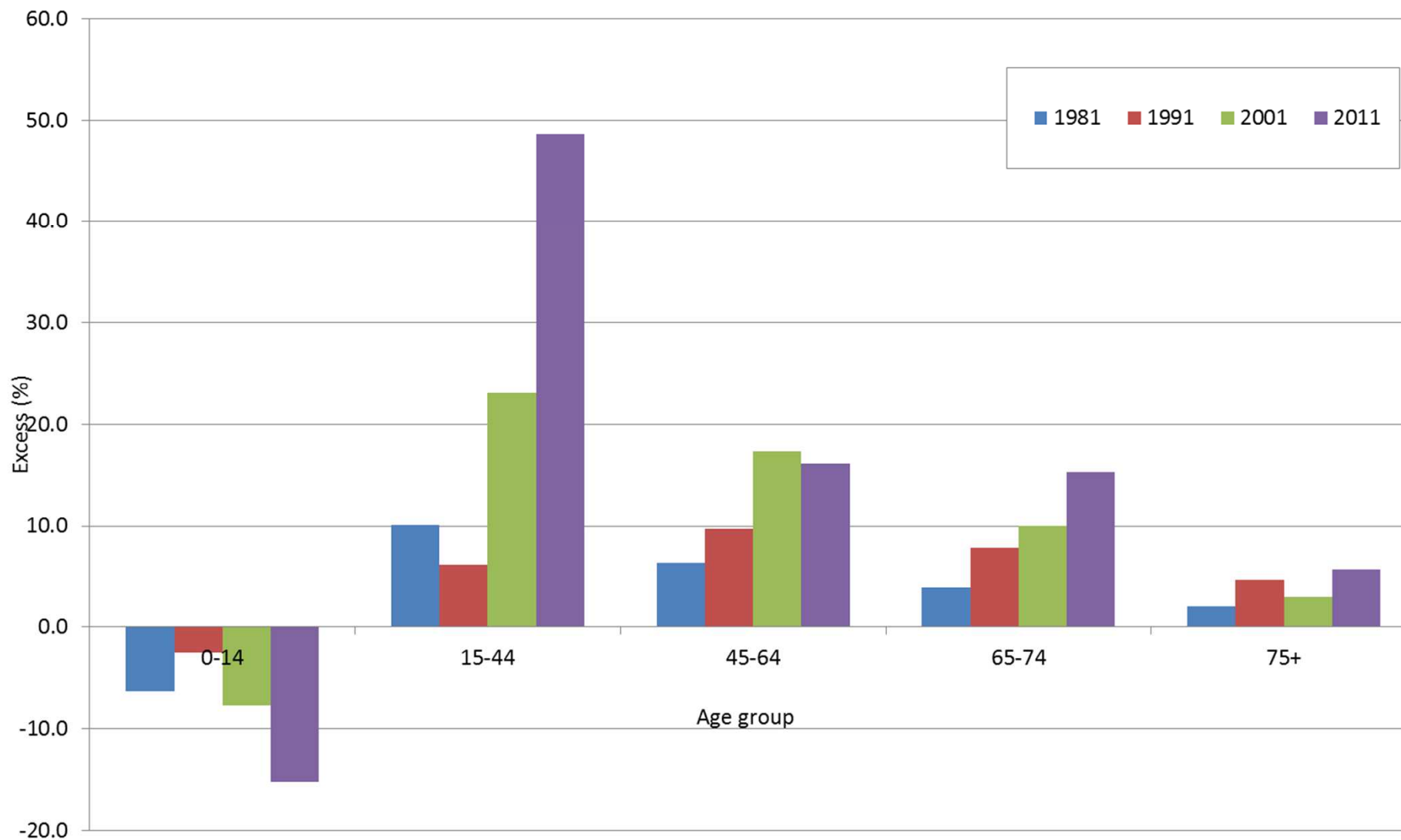
# 'Excess' mortality by year

**Excess mortality (%), Scotland relative to England & Wales, 1981-2011:  
mortality rates directly standardised by age, sex and Carstairs deprivation  
decile**



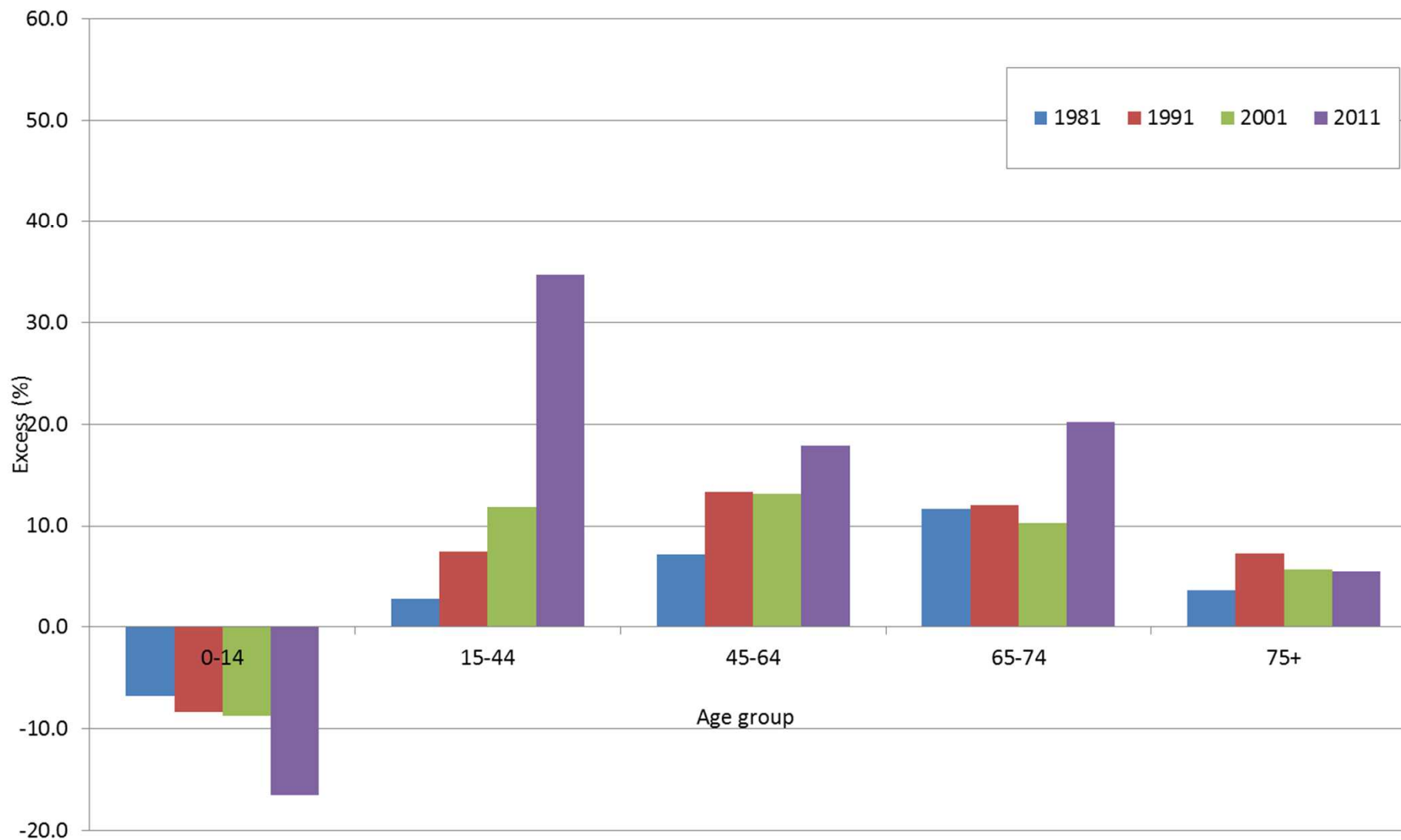
# By age and year - males

Scottish excess mortality by age group, 1981-2011, MALES



# By age and year - females

Scottish excess mortality by age group, 1981-2011, FEMALES





## Cerebrovascular Disease

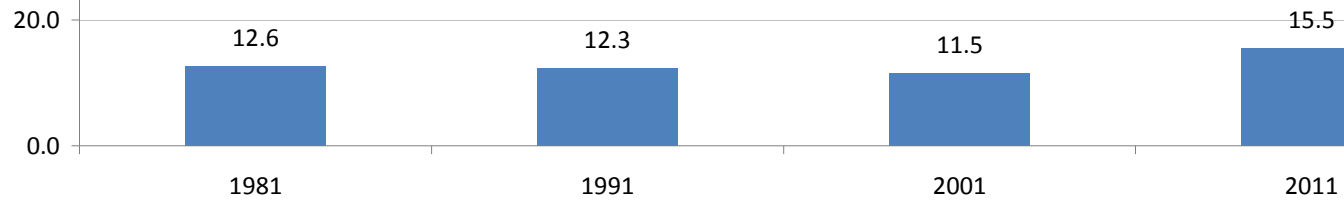
120.0  
100.0  
80.0  
60.0  
40.0  
20.0  
0.0

Excess (%)

## Ischaemic Heart Disease

120.0  
100.0  
80.0  
60.0  
40.0  
20.0  
0.0

Excess (%)



### External causes

120.0

100.0

Excess (%)

### Alcohol related deaths

120.0

100.0

Excess (%)

### Intentional self-harm and events of undetermined intent

120.0

100.0

Excess (%)

0.0

1981

1991

2001

2011

107.8

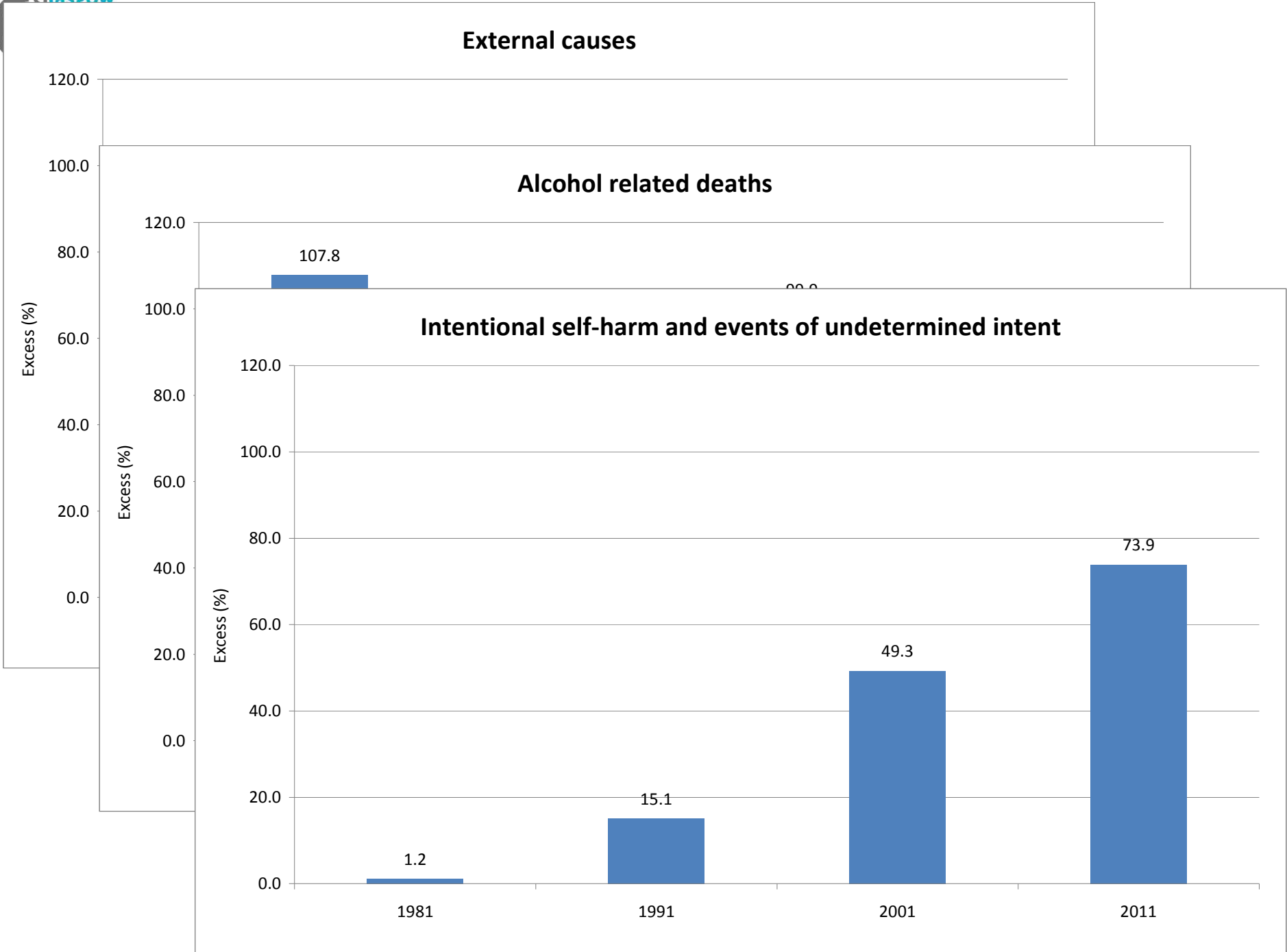
88.8

1.2

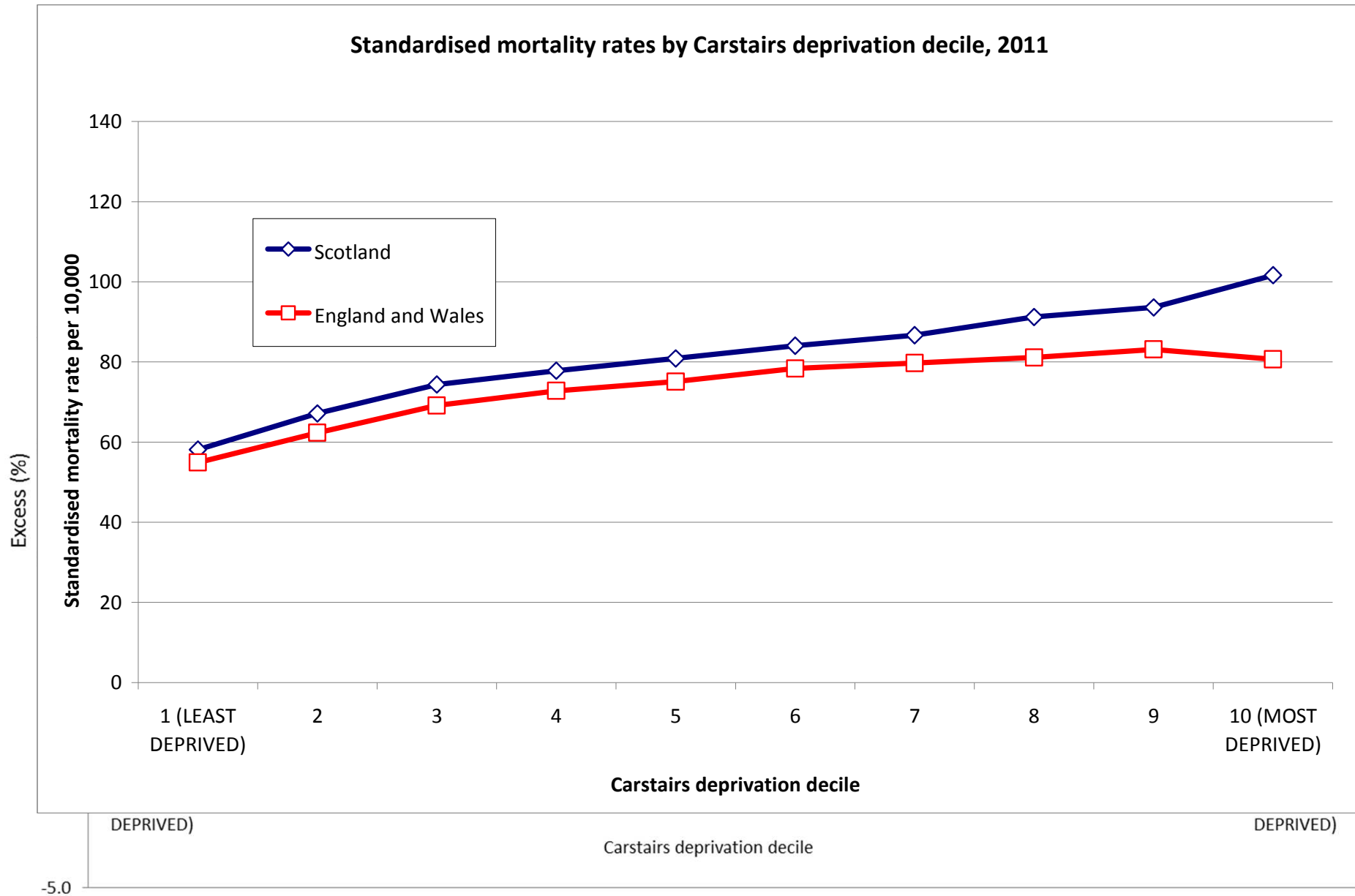
15.1

49.3

73.9



# By deprivation decile



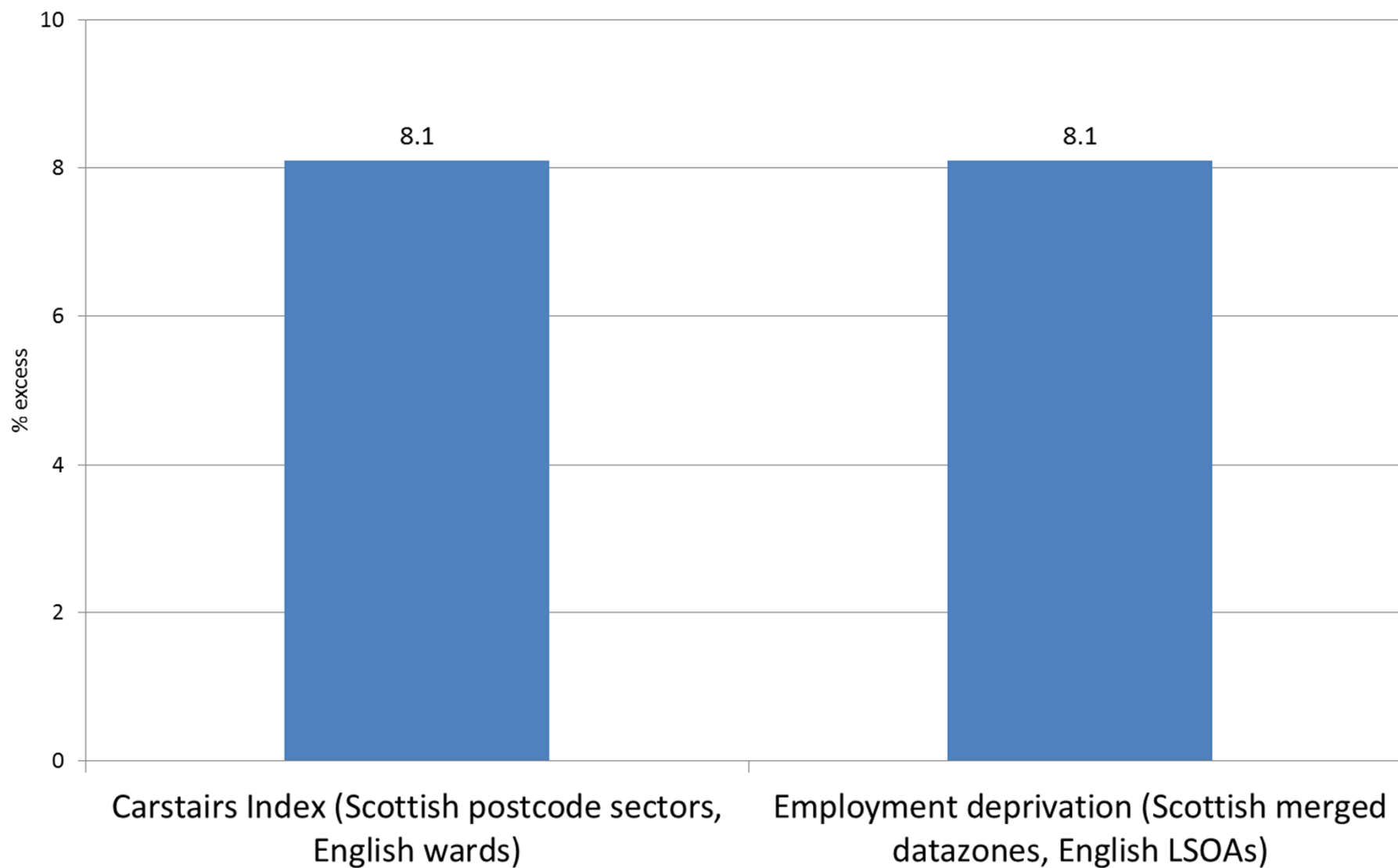
# Anorak alert!



- Use of better (smaller), more spatially sensitive geographical units (ave. pop size 1,500 in Scotland and England)
- Use of ‘better’ measures of deprivation (e.g. ‘employment deprivation’ from SIMD – applied to both Scottish and English geographical units)

# Excess in 2001 (NB not 2011)

Scottish excess mortality (%), 2001



# What explains the excess? Synthesising the evidence



# Theories, theories, theories...

- Artefact
- Migration
- Political attack/effects
- Culture
- Deindustrialisation
- Income inequalities
- Social mobility
- Substance misuse cultures
- Alienation/anomie
- Family/parenting/early years
- Social capital
- (Health) services
- Patterning of deprivation
- Sectarianism
- Individual values (e.g. psychological outlook)
- Sense of coherence
- Behaviours
- Genetics
- The weather...

# Other proposed theories...

- Rainfall
- Irn Bru
- Broadband
- Water impurities
- A lack of runner beans
- Land contamination
- Abortions
- Submarines on the Clyde
- Low air pressure
- A general “curse”

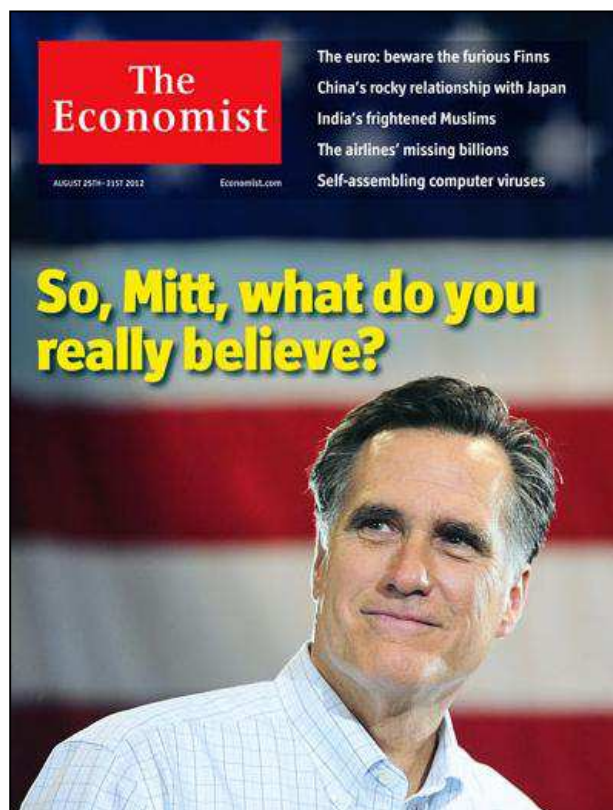
**Stop press** – this one just in:

**Fewer pet dogs per head of population in Scotland?**

# Other proposed theories...

- Lots of unhelpful theorising
- Lots of unhelpful media coverage...

# Other proposed theories...



“It is as if a malign vapour rises from the Clyde at night and settles in the lungs of sleeping Glaswegians”

The Economist. ‘No City for Old Men’. August 2012

# Let's be sensible

- No fewer than 17 (17!) separate hypotheses assessed in 2011/12 report/journal paper
- Categorised as 'upstream', 'midstream' and 'downstream' hypotheses (alongside 'artefact' and 'genetic')...
- ...(Reflecting public health understanding of the social determinants of health and the importance of structural factors)
- Synthesis of most likely causes/causal pathways attempted
- Hindered by gaps in data/knowledge



# ...evidence

**Exploring Glasgow**  
Results of a three-city study  
David Walsh, Gerry McCartney

**Poverty, parents and early years and three cities**

Glasgow Centre for Population Health

**Investigating the impact of deprivation on health**

Glasgow Centre for Population Health

**RESEARCH ARTICLE**  
**Vitamin D and mortality: a systematic review**  
Lynne Rush<sup>1\*</sup>, Gerry McCartney<sup>2</sup>, David Walsh<sup>3</sup>

**Abstract**  
**Background:** All-cause mortality in Liverpool and Manchester. We investigated the association with premature mortality via a systematic review.  
**Methods:** Medline, EMBASE, Web of Science, February 2012 for relevant studies.  
**Results:** Nine studies were included in the meta-analysis. The pooled hazard ratio for all-cause mortality was 1.19 (95% CI 1.12-1.27) after adjusting for available confounders. In an age-stratified analysis, the association was stronger in older individuals and the relationship between vitamin D deficiency and all-cause mortality was stronger in confounders (or using randomised trials).  
**Keywords:** Vitamin D, 25(OH)D, Premature mortality

**Background**  
The extent to which vitamin D deficiency is important in explaining morbidity and mortality has recently been a focus for research. Vitamin D for bone health and the prevention of falls is well-established; however, observational studies show that low levels are also associated with increased risk of chronic diseases including cardiovascular disease, cancer, type II diabetes and multiple sclerosis. Four meta-analyses of observational studies have found an association with increased mortality [9-12]. Most of the populations in these studies were elderly, limiting applicability to younger populations. It is also possible that the association between vitamin D and mortality seen in observational studies is due to confounding with, for example, physical activity causing both

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And lots more e.g..

- Impact of local policy/ practice (UWS)
- Alcohol harm (Deborah Shipton, GCPH)
- Drugs harm (Liverpool John Moores)
- Qualitative research (Pete Seaman, GCPH)
- Changes in deprivation patterning (Joanna Stewart, GU)
- And others (see GCPH website for more details)

- 
- Diet
- Systematic review



# Synthesising the evidence

- Synthesis will be based on:
  - Reviewing/updating hypotheses and associated evidence
  - Creating causal models using the more plausible hypotheses
  - Testing and iterating causal models against ability to explain all observed phenomena
  - Identifying assumptions and remaining research questions
- Joint research: GCPH & NHS Health Scotland
- Timescale: for completion summer 2015 (honest..)

# Trying to make sense of Scottish excess mortality

1. It's horribly complicated...
2. The solution will be equally complex and multi-factorial
3. Lots (and lots and lots) of theories have been proposed – lots (and lots and lots) seem very unlikely...
4. We have a sophisticated understanding of the determinants of health. They apply to population health across the globe. The globe includes Scotland and Glasgow.
5. Historical factors likely to play a part

# Clues from work undertaken to date

1. Different (combinations of) factors affecting different populations
2. Available measures of poverty don't capture essence of living in deprived circumstances in Glasgow/Scotland – evidenced by:
  - Proven/profound links between poverty and health
  - Causes of death linked to the excess
  - Hints from other data sets
3. Importance of history
  - E.g. scale of urban change in cities
  - National and local political decisions
4. Likely to be protective factors operating in other cities

# Why this matters

- I thought this was obvious but...
- This matters because of scale
  - E.g. 11% higher mortality nationally (Scotland v E&W)
  - 30% higher premature mortality in Glasgow compared to England's two poorest and sickest cities
  - Equates to many thousands 'excess' deaths
- **This matters because of the human cost**
- This matters because of the excess is increasing over time
- This matters because of its relevance to the scale of health inequalities in Scotland

# 'Excess' mortality in Scotland: towards an understanding?

David Walsh

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