
This is the author’s final accepted version.

There may be differences between this version and the published version. You are advised to consult the publisher’s version if you wish to cite from it.

http://eprints.gla.ac.uk/143722/

Deposited on: 07 July 2017

Enlighten – Research publications by members of the University of Glasgow
http://eprints.gla.ac.uk33640
Do differences in religious affiliation explain high levels of excess mortality in the UK?

Kevin Ralston¹, David Walsh², Zhiqiang Feng³, Chris Dibben⁴, Gerry McCartney⁵, Dermot O’Reilly⁶

1. Research Fellow, National Centre for Research Methods, University of Edinburgh, Room 4.13 Chrystal Macmillan Building, George Square, 15a, Edinburgh, EH8 9LD

2. Public Health Programme Manager, Glasgow Centre for Population Health, Olympia Building, 2-16 Orr Street, Bridgeton Cross, Glasgow G40 2QH, Scotland. Tel: 0141 330 2793

3. Senior Lecturer, School of Geosciences, University of Edinburgh, G04, Drummond Library, Surgeon’s Square, Drummond Street, Edinburgh EH8 9XP

4. Chair in Health Geography, University of Edinburgh, Geography Building, Drummond Street, Edinburgh EH8 9XP

5. Consultant in Public Health and Head of the Public Health Observatory team, NHS Health Scotland, Glasgow, Scotland

6. Clinical Senior Lecturer, School of Medicine, Dentistry and Biomedical Sciences, Queen’s University Belfast, University Road, Belfast BT7 1NN, Northern Ireland

Correspondence to: david.walsh.2@glasgow.ac.uk

Keywords: excess mortality, suicide, religion, social capital, UK
Abstract

Background

High levels of mortality not explained by differences in socio-economic status (SES) have been observed for Scotland and its largest city, Glasgow, compared to elsewhere in the UK. Previous cross-sectional research highlighted potentially relevant differences in social capital, including religious social capital (the benefits of social participation in organised religion). The aim of this study was to use longitudinal data to assess whether religious affiliation (as measured in UK censuses) attenuated the high levels of Scottish excess mortality.

Methods

The study used the Scottish Longitudinal Study (SLS) and the ONS Longitudinal Study of England and Wales. Risk of all-cause mortality (2001-2010) was compared between 35-74 year-old residents of Scotland and England & Wales, and between Glasgow and Liverpool/Manchester, using Poisson regression. Models adjusted for age, gender, SES, and religious affiliation. Similar country-based analyses were undertaken for suicide.

Results

After adjustment for age, gender and SES, all-cause mortality was 9% higher in Scotland than in England & Wales, and 27% higher in Glasgow than in Liverpool or Manchester. Religious affiliation was notably lower across Scotland; but, its inclusion in the models did not attenuate the level of Scottish excess all-cause mortality, and only marginally lowered the differences in risk of suicide.

Conclusions
Differences in religious affiliation do not explain the higher mortality rates in Scotland compared to the rest of the UK. However, it is possible that other aspects of religion such as religiosity or religious participation which were not assessed here may still be important.

(246 words)
INTRODUCTION

Despite the well-established links between poverty and poor health, a body of recent research has highlighted high levels of ‘excess’ mortality (i.e. after taking into account differences in socio-economic circumstances) in Scotland compared to elsewhere in the UK\(^1\)\(^-\)\(^\text{13}\). This has been observed in analyses employing both area-based, and individual, measures of socio-economic status (SES), and even when controlling for differences in behavioural (e.g. smoking, diet) and biological (e.g. body mass index, blood pressure) risk factors. For example, analysis of Scottish and English census-based longitudinal data by Popham & Boyle showed that after adjustment for individual SES, mortality among 35-74 year-old resident Scots was 17% higher than those in England & Wales\(^3\). City-based analyses have also demonstrated high levels of such ‘excess’ mortality for Glasgow (Scotland’s largest city) compared with Liverpool and Manchester in England\(^9\): despite similar deprivation profiles, premature mortality in Glasgow was shown to be 30% higher.

A range of hypotheses have been proposed to explain these high levels of excess mortality\(^12\). This includes differences in ‘social capital’, given the evidence linking lower levels of social capital to higher mortality\(^14\)\(^-\)\(^25\). This has been supported by recent cross-sectional analyses which showed differences in aspects of social capital (trust, reciprocity, social participation) between Glasgow and Liverpool and Manchester\(^26, 27\). Those analyses additionally highlighted much lower levels of religious affiliation in the Scottish city. This is relevant because of the research evidence around religious social capital: the benefits of social participation in organised religion. Religious social capital has been confirmed as a ‘valid construct’\(^28\), and there is a considerable amount of evidence of the beneficial impact of religious participation on a number of different health outcomes. The latter include many different aspects of mental and physical health\(^29\) and, importantly for this study, mortality: a ‘meta-analytic’ review of the evidence in 2000 suggested that higher levels of religious
attendance were associated with almost 30% lower all-cause mortality compared to those with lower levels of participation\textsuperscript{30}. Other reviews have confirmed this association, and although highlighting caveats associated with some of the studies, they have shown that the significantly lower mortality is not explained by important demographic and socio-economic potential confounders\textsuperscript{31, 32}. For example, one study suggested that only 15-20% of the association between religious participation and mortality was accounted for by such confounding\textsuperscript{32, 33}. Recent evidence has also emerged of an independent association between religious involvement and cellular ageing\textsuperscript{34}.

Separate research has suggested an important role for religion in impacting specifically on suicide mortality\textsuperscript{35-37}. Suicide has been shown to make a considerable contribution to the high levels of excess mortality observed both Scotland and Glasgow\textsuperscript{6,9,13}.

The aim of this study was to use longitudinal data to assess whether religious affiliation (as well as living alone, another census-based potential proxy for social capital) attenuates the high levels of excess mortality in Scotland (compared to England & Wales) and in Glasgow (compared to Liverpool and Manchester).

**METHODS**

The analyses replicated, and expanded on, the previous research by Popham and Boyle cited above\textsuperscript{3}. We used the Scottish Longitudinal Study (SLS)\textsuperscript{38} (a 5.3% sample of the Scottish census linked to death registrations) and the Office for National Statistics Longitudinal Study of England and Wales (ONS LS)\textsuperscript{39} (a 1% sample of the English and Welsh Census, also linked to individual mortality records). Data were again limited to 35-74 year-olds (an age group associated with high levels of Scottish excess mortality), born in England and in the ONS LS at 2001, or born in Scotland and in the SLS at 2001. Four measures of SES were used; housing tenure, access to a car/van, economic activity and educational attainment.
Individuals were followed from 2001 to the end of 2010. E-DataSHIELD methodology, which combines analysis from discrete sources into a ‘joint fit’ \(^{40,41}\), was applied to analyse data: both the LS and SLS are ‘restricted access’ datasets and cannot be removed from site.

E-DataSHIELD is an approach which allows combined analysis of separate datasets where strict security access prevents these data being pooled. DataSHIELD, for Generalised Linear Models, uses iteratively reweighted least squares to produce a ‘joint fit’ while sharing only the information matrix and score vectors associated with the separate analyses (LS and SLS), producing models identical to those fitted on complete data \(^{42}\). Within E-DataSHIELD, the limited summary statistics obtained from the separate analyses are transferred by email and then summed within each iteration of the reweighted least squares method. The combined result is then returned, and the process repeated until model convergence is achieved (i.e. when results are obtained identical to those which would have resulted from analyses of pooled data) \(^{43}\).

Poisson regression was used to compare age and sex standardised all-cause mortality rates between Scotland and England & Wales, and then, separately, between Glasgow and Liverpool and Manchester. Models were run adjusting for age and sex only, and then for age, sex, SES and proxies for social capital (religious affiliation, ‘living alone’). The full list of independent variables (and their categories) is shown in Table 1.

Additional models were run to examine mortality from suicide (including events of undetermined intent, and defined by ICD10 codes X60-X84, Y10-Y34) for Scotland vs. England & Wales only (due to the small number of outcomes).

Data were prepared using Stata 13 and E-DataSHIELD model fitting was undertaken using R routines available as a source file \(^{44}\).

[Table 1 about here]
RESULTS

Some 22.5% of the Scottish sample stated in 2001 they had no religious affiliation, compared to 12% of those living in England & Wales (Table 1). The equivalent figures for Glasgow, Liverpool and Manchester were, respectively, 20%, 6% and 14%.

Table 2 summarises the main sets of models. Adjusting for age and gender only, mortality was 24% higher (Incident Rate Ratio (IRR) 1.24, 95% CIs 1.22, 1.25) in Scotland than in England & Wales. After adjustment for housing tenure and car ownership, the excess reduced to 13% (a reduction of 46%). The inclusion of religious affiliation did not reduce the IRR further. Unlike religion, ‘living alone’ was significant in the model (at p<0.05 level), although it did not reduce the overall IRR for Scottish residents. After additional adjustment for educational attainment and economic activity, that excess fell further to 9% (IRR 1.09, 95% CI 1.06, 1.12).

The results for Glasgow compared to Liverpool and Manchester followed a similar pattern, although the excess mortality was considerably higher. After adjustment for age and gender only, mortality was 34% higher in the Scottish city. Adjusting for housing tenure and car ownership reduced the excess to 26% (IRR 1.26, 95% CI 1.11, 1.43), a reduction of 24%. Religious affiliation and ‘living alone’ did not attenuate the higher mortality further.

Table 3 displays the full, final models. This shows expected higher risks of mortality for particular sections of the population e.g. males compared to females, older compared to youngest, renters compared to home owners. Although it did not reduce the level of excess mortality in Scotland, in the three country model only, those ‘living alone’ were associated with 11% higher risk of mortality in the period compared to those not ‘living alone’.

[Table 2 about here]
Table 4 presents the results of the suicide models for Scotland compared to England & Wales. After adjustment for age and gender only, Scottish residents were associated with approximately 50% higher risk of mortality from suicide in the period analysed (IRR 1.50, 95% CIs 1.18, 1.90). This was reduced to 33% (IRR 1.33, 95% CI 1.05, 1.69) after inclusion of the housing tenure and car ownership variables. ‘Living alone’ was associated with a higher risk of suicide than those not ‘living alone’ (data not shown), but as Table 4 shows, this did not impact on the overall higher risk of mortality in Scotland. Inclusion of the religion variable only slightly attenuated the IRR for Scotland (from 1.33 (95% CIs 1.05, 1.69) to 1.30 (95% CIs 1.02, 1.66)). Additionally controlling for economic activity resulted in a further very slight reduction in risk (to 1.28 (95% CIs 1.00, 1.64)).

DISCUSSION

Overall findings and implications

The study provides further evidence of the high level of ‘excess’ mortality risk experienced in Scotland and in its largest city compared to elsewhere Great Britain. Furthermore it shows that these differences are not due to overall differences in levels of religious affiliation.

Strengths and weaknesses

The principal strengths of the study lie with the data sources: the combined sample size was in excess of 280,000 people and, being derived from census data, obviates the sampling bias associated with population surveys. Furthermore the longitudinal data allows a testing of the hypothesis that would not have been possible with other, cross-sectional, data. The eDataSHIELD methodology employed, enabling secure joint analysis of the physically
separated data, is the first of its kind within the field, and will pave the way for future pooled analyses of ONS LS and SLS data.

However, the principal weakness of the study also lies with the same data sources. The concept of ‘religious social capital’ relates to social participation, but the Census asks about religious affiliation rather than participation. This is an important distinction as, clearly, not everyone affiliating themselves with a particular religion will attend regular religious services. Indeed, the notion of religion as a ‘badge’ rather than necessarily a belief has been highlighted by a number of authors. Other limitations include the fact that the English and Welsh censuses, unlike their Scottish equivalent, do not distinguish between Christian religions, discussed further below.

Additional weaknesses in the study design include limiting outcomes to all-cause and suicide mortality only, and a lack of exploration of potential interactions between independent variables. These could be the focus of extended future analyses.

Relevance to other studies

Given some of the uncertainties discussed above, it is unclear whether the analyses presented here imply that religious social capital plays no part in explaining Scotland’s and Glasgow’s high levels of excess mortality, or whether instead inadequacies in measurement mean it may still be relevant.

There is convincing evidence of the role of religious participation in explaining differences in health status between populations. The causal pathways that those studies suggest are also highly plausible: greater social networks, support and integration; less association with damaging lifestyle factors through ‘social regulation’; and increased psychological resources and coping mechanisms. Religious participation has also been shown to encourage volunteering, itself a component of broader social participation with known links to better
health outcomes. It is of potential interest that previously highlighted differences in social capital between Glasgow, Liverpool and Manchester included both lower levels of volunteering and religious affiliation in Glasgow.

The uncertainty limitations with the census questions on religion is frustrating, as is both the inability to distinguish between different Christian religions and to examine suicide mortality at the city level. There is international evidence of lower suicide rates among those of Roman Catholic faith compared to Protestants (something of course also shown historically by Durkheim), and Dorling and Gunnell, commenting on research findings which highlighted lower than expected suicide rates in Liverpool and higher than expected rates in Glasgow, speculated that protective factors relating to religion (specifically high numbers of resident ‘practising or believing’ Catholics) and social integration might be operating in the English city. Proper investigation of this, however, would require measurement of religious participation rather than affiliation, and robust population-level data in this area are lacking. The few comparable data are from the British Social Attitudes Survey and the Scottish Social Attitude Survey: these suggest that among those belonging to a religion, there are similar levels of weekly and monthly attendance at religious services in Scotland compared to all Britain. However, those data also show similar levels of religious affiliation in Scotland and Britain, a finding contradicted by census data covering most of the population (as opposed to surveys of a few thousand individuals with an approximately 50% response rate). Furthermore, no such data on religious participation are available at the city level.

It is also notable that analysis of a similar census question on religious affiliation included in the Northern Ireland census showed no significant association with mortality from suicide.

That ‘living alone’ was associated with a higher risk of mortality across the pooled sample (Scotland, England & Wales) corresponds with results of a number of studies examining living arrangements and mortality.
The high levels of excess mortality observed in this study are also notable. The 9% excess for Scotland compared to England & Wales is lower than that observed by Popham & Boyle\(^3\) for the same age group (probably explained by the incorporation of additional socio-economic controls and differences in the sample and length of follow up period), but similar to that observed for all ages in analyses by Hanlon et al. for 2001 (8%)\(^1\) and Schofield et al. for 2011 (10%)\(^13\). The 27% higher mortality in Glasgow compared to Liverpool and Manchester is also comparable to the analyses based on area-based measures of income deprivation (30% higher mortality for age <65 years)\(^9\).

**Conclusions**

Despite previous evidence of an association between religious participation and mortality, adjustment for differences in stated religion did not impact on high levels of ‘excess’ mortality in Scotland compared to elsewhere in the UK. However, the extent to which this disproves the theory, or is simply a result of inadequate measurement, remains unclear.
What is already known on this subject?

- High levels of unexplained excess mortality (i.e. higher mortality once differences in poverty and deprivation have been taken into account) have been observed for Scotland, and in particular its largest city, Glasgow in comparison to elsewhere in the UK
- Religious participation has been shown to be associated with lower mortality
- Levels of affiliation are lower in Scotland compared to England & Wales, and in Glasgow compared to English comparator cities such as Liverpool and Manchester

What this study adds?

- Differences in religious affiliation between Scotland and England & Wales, and between Glasgow and the English comparator cities, do not attenuate the higher Scottish mortality risk
- New eDataSHIELD methodology has been shown to enable detailed analyses of UK census-based longitudinal data while maintaining high levels of data security and confidentiality.

ACKNOWLEDGEMENTS

The help provided by staff of the Longitudinal Studies Centre - Scotland (LSCS) is acknowledged. The LSCS is supported by the ESRC/JISC, the Scottish Funding Council, the Chief Scientist's Office and the Scottish Government.

We would like to acknowledge Dr Frank Popham, who graciously provided access to files and programs from his previous analyses.

The authors are responsible for the interpretation of the data. Census output is Crown copyright and is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.
The permission of the Office for National Statistics to use the Longitudinal Study is gratefully acknowledged, as is the help provided by staff of the Centre for Longitudinal Study Information & User Support (CeLSIUS). CeLSIUS is supported by the ESRC Census of Population Programme under project ES/K000365/1. The authors alone are responsible for the interpretation of the data.

This work contains statistical data from ONS which is Crown Copyright. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

DECLARATIONS

Funding: The analysis was funded by the Glasgow Centre for Population Health.

Contributions: DW originally conceived the study. The research questions and analysis plan were agreed by all authors. KR and ZF undertook analyses with support from CD and DW. DW drafted the manuscript. All authors provided substantial critical input to improve the manuscript and all authors approved the final draft.

Competing interests: None declared

Ethical approval: None required
<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>England &amp; Wales (n=191,304) (100%)</th>
<th>Scotland (n=92,369) (100%)</th>
<th>Glasgow (n=9,165) (100%)</th>
<th>Liverpool (n=1,692) (100%)</th>
<th>Manchester (n=1,091) (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female†</td>
<td>97,998 (51.2)</td>
<td>48,123 (52.1)</td>
<td>4,900 (53.5)</td>
<td>903 (53.4)</td>
<td>563 (51.6)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>93,306 (48.8)</td>
<td>44,246 (47.9)</td>
<td>4,265 (46.5)</td>
<td>789 (46.6)</td>
<td>528 (48.4)</td>
</tr>
<tr>
<td>Age</td>
<td>35-39 years†</td>
<td>31,413 (16.4)</td>
<td>15,075 (16.3)</td>
<td>1,705 (18.6)</td>
<td>273 (16.1)</td>
<td>223 (20.4)</td>
</tr>
<tr>
<td></td>
<td>40-44 years</td>
<td>27,845 (14.6)</td>
<td>14,416 (15.6)</td>
<td>1,560 (17.0)</td>
<td>280 (16.6)</td>
<td>155 (14.2)</td>
</tr>
<tr>
<td></td>
<td>45-49 years</td>
<td>25,344 (13.3)</td>
<td>13,224 (14.3)</td>
<td>1,253 (13.7)</td>
<td>252 (14.9)</td>
<td>132 (12.1)</td>
</tr>
<tr>
<td></td>
<td>50-54 years</td>
<td>28,387 (14.8)</td>
<td>13,298 (14.4)</td>
<td>1,115 (12.2)</td>
<td>230 (13.6)</td>
<td>151 (13.8)</td>
</tr>
<tr>
<td></td>
<td>55-59 years</td>
<td>23,627 (12.4)</td>
<td>11,152 (12.1)</td>
<td>987 (10.8)</td>
<td>176 (10.4)</td>
<td>119 (10.9)</td>
</tr>
<tr>
<td></td>
<td>60-64 years</td>
<td>20,018 (10.5)</td>
<td>9,887 (10.7)</td>
<td>940 (10.3)</td>
<td>161 (9.5)</td>
<td>100 (9.2)</td>
</tr>
<tr>
<td></td>
<td>65-69 years</td>
<td>18,352 (9.6)</td>
<td>8,679 (9.4)</td>
<td>888 (9.7)</td>
<td>176 (10.4)</td>
<td>116 (10.6)</td>
</tr>
<tr>
<td></td>
<td>70-74 years</td>
<td>16,318 (8.5)</td>
<td>6,638 (7.2)</td>
<td>717 (7.8)</td>
<td>144 (8.5)</td>
<td>95 (8.7)</td>
</tr>
<tr>
<td>Housing tenure</td>
<td>Owner-occupied†</td>
<td>156,435 (81.8)</td>
<td>69,422 (75.2)</td>
<td>5,607 (61.2)</td>
<td>1,154 (68.2)</td>
<td>646 (59.2)</td>
</tr>
<tr>
<td></td>
<td>Private rented</td>
<td>8,490 (4.4)</td>
<td>2,490 (2.7)</td>
<td>230 (2.5)</td>
<td>104 (6.2)</td>
<td>54 (5.0)</td>
</tr>
<tr>
<td></td>
<td>Social rented</td>
<td>26,379 (13.8)</td>
<td>20,457 (22.2)</td>
<td>3,328 (36.3)</td>
<td>434 (25.7)</td>
<td>391 (35.8)</td>
</tr>
<tr>
<td>Access to car/van</td>
<td>Access†</td>
<td>165,112 (86.3)</td>
<td>73,182 (79.2)</td>
<td>5,138 (56.1)</td>
<td>1,136 (67.1)</td>
<td>735 (67.4)</td>
</tr>
<tr>
<td></td>
<td>No access</td>
<td>26,192 (13.7)</td>
<td>19,187 (20.8)</td>
<td>4,027 (43.9)</td>
<td>556 (32.9)</td>
<td>356 (32.6)</td>
</tr>
<tr>
<td>Household</td>
<td>Not living alone†</td>
<td>164,431 (86.0)</td>
<td>78,016 (84.5)</td>
<td>6,968 (76.0)</td>
<td>1,364 (80.6)</td>
<td>846 (77.5)</td>
</tr>
<tr>
<td></td>
<td>Living alone</td>
<td>26,873 (14.1)</td>
<td>14,353 (15.5)</td>
<td>2,197 (24.0)</td>
<td>328 (19.4)</td>
<td>245 (22.5)</td>
</tr>
<tr>
<td>Variable</td>
<td>Category</td>
<td>England &amp; Wales (n=191,304) (100%)</td>
<td>Scotland (n=92,369) (100%)</td>
<td>Glasgow (n=9,165) (100%)</td>
<td>Liverpool (n=1,692) (100%)</td>
<td>Manchester (n=1,091) (100%)</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>-----------------------------------</td>
<td>---------------------------</td>
<td>-------------------------</td>
<td>---------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Religious affiliation</td>
<td>None†</td>
<td>22,500 (11.8)</td>
<td>22,738 (22.5)</td>
<td>1,834 (20.0)</td>
<td>102 (6.0)</td>
<td>148 (13.6)</td>
</tr>
<tr>
<td></td>
<td>Christian</td>
<td>166,271 (86.9)</td>
<td>71,157 (77.0)</td>
<td>7,260 (79.2)</td>
<td>1,573 (93.0)</td>
<td>910 (83.4)</td>
</tr>
<tr>
<td></td>
<td>Non-Christian</td>
<td>2,533 (1.3)</td>
<td>474 (0.5)</td>
<td>71 (0.8)</td>
<td>17 (1.0)</td>
<td>33 (3.0)</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>No qualification†</td>
<td>70,830 (37.0)</td>
<td>40,215 (43.5)</td>
<td>4,935 (53.9)</td>
<td>851 (50.3)</td>
<td>548 (50.2)</td>
</tr>
<tr>
<td></td>
<td>Qualifications &lt; NVQ4 level</td>
<td>87,936 (46.0)</td>
<td>30,425 (32.9)</td>
<td>2,539 (27.7)</td>
<td>657 (38.8)</td>
<td>378 (34.7)</td>
</tr>
<tr>
<td></td>
<td>Qualifications HNC/D and above</td>
<td>32,538 (17.0)</td>
<td>21,729 (23.5)</td>
<td>1,691 (18.5)</td>
<td>184 (10.9)</td>
<td>165 (15.1)</td>
</tr>
<tr>
<td>Economic activity</td>
<td>Employed†</td>
<td>117,194 (61.3)</td>
<td>54,330 (58.8)</td>
<td>4,294 (46.9)</td>
<td>804 (47.5)</td>
<td>566 (51.9)</td>
</tr>
<tr>
<td></td>
<td>Inactive other</td>
<td>4,507 (2.4)</td>
<td>2,897 (3.1)</td>
<td>479 (5.2)</td>
<td>73 (4.3)</td>
<td>41 (3.8)</td>
</tr>
<tr>
<td></td>
<td>Looking after home/family</td>
<td>11,471 (6.0)</td>
<td>4,895 (5.3)</td>
<td>574 (6.3)</td>
<td>136 (8.0)</td>
<td>65 (6.0)</td>
</tr>
<tr>
<td></td>
<td>Permanently sick</td>
<td>12,770 (6.7)</td>
<td>8,837 (9.6)</td>
<td>1,610 (17.6)</td>
<td>270 (16.0)</td>
<td>147 (13.5)</td>
</tr>
<tr>
<td></td>
<td>Retired</td>
<td>41,400 (21.6)</td>
<td>18,908 (20.5)</td>
<td>1,859 (20.3)</td>
<td>349 (20.6)</td>
<td>232 (21.3)</td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>3,962 (2.1)</td>
<td>2,502 (2.7)</td>
<td>349 (3.8)</td>
<td>60 (3.6)</td>
<td>40 (3.7)</td>
</tr>
</tbody>
</table>

† reference category

Source: ONS LS and SLS
### Excess mortality (all causes)

<table>
<thead>
<tr>
<th>Model</th>
<th>Scotland v England &amp; Wales</th>
<th>Glasgow v Liverpool &amp; Manchester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident Rate Ratio</td>
<td>(95% confidence intervals)</td>
<td>Incident Rate Ratio</td>
</tr>
<tr>
<td>Age + sex</td>
<td>1.24 (1.22-1.25)</td>
<td>1.34 (1.18-1.52)</td>
</tr>
<tr>
<td>Age + sex + tenure</td>
<td>1.16 (1.14-1.17)</td>
<td>1.31 (1.15-1.49)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership</td>
<td>1.13 (1.14-1.17)</td>
<td>1.26 (1.11-1.43)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone</td>
<td>1.13 (1.12-1.14)</td>
<td>1.26 (1.11-1.44)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone + religion</td>
<td>1.13 (1.12-1.15)</td>
<td>1.28 (1.13-1.46)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone + religion + education</td>
<td>1.13 (1.12-1.14)</td>
<td>1.29 (1.13-1.47)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone + religion + economic activity</td>
<td>1.09 (1.06-1.12)</td>
<td>1.27 (1.12-1.45)</td>
</tr>
</tbody>
</table>

Sample aged 35-74 and born (and resident) in Scotland and in the SLS census 2001, or born in England (and resident in England & Wales) and in the LS census 2001

Source: ONS LS and SLS

Table 2. Overview of results of Poisson regression modelling comparing all-cause mortality rates (1) for Scotland compared to England & Wales and (2) Glasgow compared to Liverpool & Manchester.
Table 3 Full results of final Poisson regression models comparing mortality rates (1) for Scotland compared to England & Wales and (2) Glasgow compared to Liverpool & Manchester.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Scotland, England &amp; Wales final model</th>
<th>Glasgow, Liverpool &amp; Manchester final model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N (%)</td>
<td>Regression coefficient/ IRR</td>
</tr>
<tr>
<td><strong>Country of residence</strong></td>
<td>England &amp; Wales†</td>
<td>191,304 (67.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scotland</td>
<td>92,369 (32.6)</td>
<td>0.09/1.09</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>Female†</td>
<td>146,121 (51.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>137,552 (48.5)</td>
<td>0.47/1.60</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>35-39 years†</td>
<td>46,488 (16.4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40-44 years</td>
<td>42,261 (14.9)</td>
<td>0.47/1.60</td>
</tr>
<tr>
<td></td>
<td>45-49 years</td>
<td>38,568 (13.6)</td>
<td>0.98/2.66</td>
</tr>
<tr>
<td></td>
<td>50-54 years</td>
<td>41,685 (14.7)</td>
<td>1.32/3.76</td>
</tr>
<tr>
<td></td>
<td>55-59 years</td>
<td>34,779 (12.3)</td>
<td>1.69/5.44</td>
</tr>
<tr>
<td></td>
<td>60-64 years</td>
<td>29,905 (10.5)</td>
<td>2.11/8.31</td>
</tr>
<tr>
<td></td>
<td>65-69 years</td>
<td>27,031 (9.5)</td>
<td>2.61/13.55</td>
</tr>
<tr>
<td></td>
<td>70-74 years</td>
<td>22,956 (8.1)</td>
<td>3.09/21.97</td>
</tr>
<tr>
<td><strong>Housing tenure</strong></td>
<td>Owner-occupied†</td>
<td>22,585 (79.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private rented</td>
<td>10,980 (3.9)</td>
<td>0.23/1.25</td>
</tr>
<tr>
<td></td>
<td>Social rented</td>
<td>46,836 (16.5)</td>
<td>0.33/1.39</td>
</tr>
<tr>
<td>Variable</td>
<td>Category</td>
<td>Scotland, England &amp; Wales final model</td>
<td>Glasgow, Liverpool &amp; Manchester final model</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------------</td>
<td>--------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N (%)</td>
<td>Regression coefficient/ IRR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>95% CIs</td>
</tr>
</tbody>
</table>
| Access to car/van        | Access†                   | 238294 (84.0)                        | 0.31/1.36                                  | 1.32-1.41
                                                      | 1.32-1.41
                                                      | ***                                  | 7009 (58.7)
                                                      | 0.35/1.42
                                                      | 1.26-1.60
                                                      | ***                                  |
|                          | No access                 | 45379 (16.0)                         | 0.11/1.11                                  | 1.08-1.15
                                                      | 1.08-1.15
                                                      | ***                                  | 4939 (41.3)
                                                      | 0.35/1.42
                                                      | 1.26-1.60
                                                      | ***                                  |
| Household                | Not living alone†         | 242447 (85.5)                        | 0.01/1.01                                  | 0.96-1.05
                                                      | 0.96-1.05
                                                      | ***                                  | 9178 (76.8)
                                                      | 0.15/1.16
                                                      | 0.98-1.36
                                                      | ***                                  |
|                          | Living alone              | 41226 (14.5)                         | -0.10/.91                                   | 0.78-1.06
                                                      | 0.78-1.06
                                                      | ***                                  | 2770 (23.2)
                                                      | -0.44/0.64
                                                      | 0.26-1.57
                                                      | ***                                  |
| Religious affiliation    | None†                     | 43,238 (15.2)                        | 0.10/0.91                                  | 0.88-0.91
                                                      | 0.88-0.91
                                                      | ***                                  | 2,084 (17.4)
                                                      | -0.01/0.99
                                                      | 0.86-1.14
                                                      | ***                                  |
|                          | Christian                 | 237,428 (83.7)                       | 0.25/0.78                                  | 0.75-0.82
                                                      | 0.75-0.82
                                                      | ***                                  | 9,743 (81.5)
                                                      | -0.26/0.77
                                                      | 0.63-0.94
                                                      | *                                   |
|                          | Non-Christian             | 3,007 (1.1)                          | -0.25/0.78                                  | 0.75-0.82
                                                      | 0.75-0.82
                                                      | ***                                  | 121 (1.0)
                                                      | -0.44/0.64
                                                      | 0.26-1.57
                                                      | ***                                  |
| Educational attainment   | No qualification†         | 111045 (39.1)                        | 0.57/1.77                                  | 1.64-1.92
                                                      | 1.64-1.92
                                                      | ***                                  | 6334 (53.0)
                                                      | 0.53/1.69
                                                      | 1.28-2.24
                                                      | ***                                  |
|                          | Qualifications < NVQ4 level | 118361 (41.7)                        | -0.13/0.88                                  | 0.85-0.91
                                                      | 0.85-0.91
                                                      | ***                                  | 3574 (29.9)
                                                      | -0.01/0.99
                                                      | 0.86-1.14
                                                      | ***                                  |
|                          | Qualifications HNC/D and above | 54267 (19.1)                        | -0.25/0.78                                  | 0.75-0.82
                                                      | 0.75-0.82
                                                      | ***                                  | 2040 (17.1)
                                                      | -0.26/0.77
                                                      | 0.63-0.94
                                                      | *                                   |
| Economic activity        | Employed†                 | 171524 (60.5)                        | 0.56/1.77                                  | 1.64-1.92
                                                      | 1.64-1.92
                                                      | ***                                  | 5664 (47.4)
                                                      | 0.53/1.69
                                                      | 1.28-2.24
                                                      | ***                                  |
|                          | Inactive other            | 7404 (2.6)                           | 0.57/1.77                                  | 1.64-1.92
                                                      | 1.64-1.92
                                                      | ***                                  | 593 (5.0)
                                                      | 0.53/1.69
                                                      | 1.28-2.24
<pre><code>                                                  | ***                                  |
</code></pre>
<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Scotland, England &amp; Wales final model</th>
<th>Glasgow, Liverpool &amp; Manchester final model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N (%)</td>
<td>Regression coefficient/ IRR</td>
</tr>
<tr>
<td>Looking after home/family</td>
<td>16366 (5.8)</td>
<td>16366 (5.8)</td>
<td>0.35/1.41</td>
</tr>
<tr>
<td>Permanently sick</td>
<td>21607 (7.6)</td>
<td>21607 (7.6)</td>
<td>1.12/3.06</td>
</tr>
<tr>
<td>Retired</td>
<td>60308 (21.3)</td>
<td>60308 (21.3)</td>
<td>0.34/1.41</td>
</tr>
<tr>
<td>Unemployed</td>
<td>6464 (2.3)</td>
<td>6464 (2.3)</td>
<td>0.50/1.65</td>
</tr>
</tbody>
</table>

† reference category

1. Significance level: *P<0.05; **P< 0.01; ***P <0.001

Source: ONS LS and SLS
<table>
<thead>
<tr>
<th>Model</th>
<th>Incident Rate Ratio</th>
<th>(95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age + sex</td>
<td>1.50</td>
<td>(1.18-1.90)</td>
</tr>
<tr>
<td>Age + sex + tenure</td>
<td>1.38</td>
<td>(1.09-1.76)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership</td>
<td>1.33</td>
<td>(1.05-1.69)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone</td>
<td>1.33</td>
<td>(1.05-1.69)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone + religion</td>
<td>1.30</td>
<td>(1.02-1.65)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone + religion + education</td>
<td>1.30</td>
<td>(1.02-1.66)</td>
</tr>
<tr>
<td>Age + sex + tenure + car ownership + living alone + religion + economic activity</td>
<td>1.28</td>
<td>(1.00-1.64)</td>
</tr>
</tbody>
</table>

Sample aged 35-74 and born (and resident) in Scotland and in the SLS census 2001, or born in England (and resident in England & Wales) and in the LS census 2001.

Source: ONS LS and SLS

Table 4. Overview of results of Poisson regression modelling comparing suicide mortality rates for suicide & undetermined intent for Scotland compared to England & Wales.
REFERENCES


Hyppä M.T., Mäki J. Why do Swedish-speaking Finns have longer active life? An area of social capital research. Health Promotion International 2001; 16(1): 55-64.


Walsh D., McCartney G., McCullough S., van der Pol M., Buchanan D., Jones R. Comparing levels of social capital in three northern post-industrial UK cities. Public Health 2015; 10.1016/j.puhe.2015.02.024


43 Raab, G.M., Dibben, C., Burton, P.: Running an analysis of combined data when the individual records cannot be combined: practical issues in secure computation. In: Statistical Data Confidentiality Work Session, UNECE, October 2015


57 Scottish Social Attitudes Survey data/website: 


