



## Short Report

# The Scottish excess in mortality compared to the English and Welsh. Is it a country of residence or country of birth excess?

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## ABSTRACT

Scotland has a higher mortality rate than England and Wales, which is only partially explained by differences in socio-economic deprivation. Within Scotland those born in England and Wales have a lower mortality rate than the Scottish born. Within England and Wales, Scottish born immigrants have a higher mortality rate than those born in England and Wales. These results raise the question of whether the greater Scottish mortality is a country of birth rather than a country of residence excess. Our analysis, around the 2001 Census, suggests that country of birth is more important than country of residence, indicating that early life factors may be important for the Scottish excess.

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## 1. Introduction

It is well established that the mortality rate in Scotland is higher than in neighbouring England and Wales (Hanlon et al., 2005). It is also known that those born in Scotland but living in England and Wales have a higher mortality rate than those born in England and Wales (Wild et al., 2007; Wild and McKeigue, 1997). Recently it has also been shown for the period around the 2001 Census that within Scotland those born in England and Wales (Scotland's largest immigrant group) have a lower mortality rate than the Scottish born (Fischbacher et al., 2007). These findings raise the question of whether the Scottish excess in mortality may actually be a country of birth excess rather than a country of residence excess. To date there has been no study jointly comparing mortality in both countries by country of birth and country of residence to test this hypothesis.

## 2. Methods

We obtained from the Office for National Statistics (ONS) in England and Wales and the General Register Office for Scotland (GROS) death registration counts and census population counts by combinations of country of birth and country of residence by 5-year age groups (up to 85 and then 85 and over) and sex. All aforementioned studies have also been based on such

death registration (numerator) and census population counts (denominator).

To describe the mortality differences separately and jointly by country of birth and country of residence, we used Poisson models with robust standard errors. We conducted analysis for those aged 25 and over using deaths from 2000 to 2002. We checked the consistency of these results with those for the working age (25–64) and post-working age (65 plus) populations. All models control for age and sex.

## 3. Results

Model A (Table 1) shows that, as expected, the risk of death is higher for those born in Scotland than for persons born in England and Wales. By country of current residence Model B shows those living in Scotland have a higher risk of death than those living in England. Jointly accounting for country of birth and residence sees a clear attenuation of the relative risk for country of residence rather than country of birth (Model C).

Model D groups country of residence and country of birth and confirms the increased mortality risk associated with being born in Scotland. There was a slight increased risk for the Scottish born living in Scotland compared to the Scottish born living in England and Wales, and a slightly reduced risk for the English and Welsh born if living in Scotland, compared to those living in England and Wales.

Similar patterns of results are seen for those aged 25–64 (Table 2) and 65 and over (Table 3). Although relative risks were

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**Table 1**  
Age and sex adjusted relative risk of death for those aged 25 and over by country of birth and residence.

2000–02	Model A	Model B	Model C	Model D
Born in England and Wales ( <i>n</i> =31,557,272)	1		1	
Born in Scotland ( <i>n</i> =3,741,507)	1.19 (1.12–1.26)		1.17 (1.11–1.24)	
Lives in England and Wales ( <i>n</i> =31,944,216)		1	1	
Lives in Scotland ( <i>n</i> =3,354,563)		1.17 (1.10–1.25)	1.02 (0.96–1.08)	
Born in England and Wales, lives in England and Wales ( <i>n</i> =31,225,017)				1
Born in England and Wales, lives in Scotland ( <i>n</i> =332,255)				0.95 (0.89–1.01)
Born in Scotland, lives in England and Wales ( <i>n</i> =719,199)				1.15 (1.07–1.22)
Born in Scotland, lives in Scotland ( <i>n</i> =3,022,308)				1.20 (1.12–1.29)

**Table 2**  
Age and sex adjusted relative risk of death for those aged 25–64 by country of birth and residence.

2000–02	Model A	Model B	Model C	Model D
Born in England and Wales ( <i>n</i> =24,056,510)	1		1	
Born in Scotland ( <i>n</i> =2,869,603)	1.41 (1.36–1.46)		1.37 (1.31–1.42)	
Lives in England and Wales ( <i>n</i> =24,343,497)		1	1	
Lives in Scotland ( <i>n</i> =2,582,616)		1.37 (1.30–1.43)	1.04 (0.99–1.09)	
Born in England and Wales, lives in England and Wales ( <i>n</i> =23,788,684)				1
Born in England and Wales, lives in Scotland ( <i>n</i> =267,826)				0.93 (0.88–0.98)
Born in Scotland, lives in England and Wales ( <i>n</i> =554,813)				1.32 (1.27–1.37)
Born in Scotland, lives in Scotland ( <i>n</i> =2,314,790)				1.43 (1.38–1.48)

**Table 3**  
Age and sex adjusted relative risk of death for those aged 65 and over by country of birth and residence.

2000–02	Model A	Model B	Model C	Model D
Born in England and Wales ( <i>n</i> =7,500,762)	1		1	
Born in Scotland ( <i>n</i> =871,904)	1.14 (1.07–1.22)		1.13 (1.07–1.20)	
Lives in England and Wales ( <i>n</i> =7,600,719)		1	1	
Lives in Scotland ( <i>n</i> =771,947)		1.13 (1.06–1.21)	1.01 (0.95–1.08)	
Born in England and Wales, lives in England and Wales ( <i>n</i> =7,436,333)				1
Born in England and Wales, lives in Scotland ( <i>n</i> =64,429)				0.95 (0.88–1.02)
Born in Scotland, lives in England and Wales ( <i>n</i> =164,386)				1.11 (1.04–1.19)
Born in Scotland, lives in Scotland ( <i>n</i> =707,518)				1.15 (1.07–1.24)

consistently higher for the 25–64-year olds this reflects their much lower absolute rate of death. This is because relative risks are not independent of the overall rate and will tend to be higher when the absolute rate is low(er) (Houweling et al., 2007). Absolute differences (not shown) were actually higher in the older age group.

#### 4. Discussion

Our results suggest that the Scottish excess is considerably more strongly related with country of birth than country of residence. There are at least two explanations for this. First, the results could be an artefact: it is well recognised that country of birth analyses that rely on data from two unlinked sources (death registration and census) may be subject to numerator/denominator bias (Marmot et al., 1984) and in this case we are comparing data across two contexts where there may be differences in this effect. However, while Scotland technically conducts its own census and has a separate vital registration system to England and Wales, there are strong similarities in practices; so there is unlikely to be any major bias due to differences across the two systems. Also, previous individual-level linked studies of country of birth mortality conducted in the UK have tended to produce similar patterns to those observed in unlinked studies, suggesting that such biases are generally not significant (Harding and Balarajan, 2001).

Second, if these results are not an artefact then they will be due to differences in the prevalence of mortality risk factors by country of birth. Previous comparative studies of mortality in Scotland and England, which did not account for country of birth, have focused on current socio-economic differences as an explanation for the Scottish excess, given the higher rates of deprivation in Scotland. The most recent study found that current differences in deprivation explain only a part of Scotland's higher mortality (Hanlon et al., 2005).

Using the published 2001 Census tables, we calculated the current deprivation situation for those aged 16 and over by the four combinations of country of birth and residence (the available census tables for country of birth only divided people 0–15, 16 to pension age and pension age and over, rather than 25 and over). We used the Carstairs score as our measure of deprivation and calculated it jointly for all three countries at the postcode sector level (in Scotland) and ward level (in England and Wales) as this was the deprivation score and geographical level used in the most recent study (Hanlon et al., 2005). Fig. 1 illustrates that within England and Wales those born in Scotland have a deprivation distribution and mean score (0.27) very similar to those born in England and Wales (0.41). Within Scotland, those born in Scotland had a higher (more deprived) mean deprivation score (2.24) than those born in England and Wales (0.85), which in turn was closer to that of those living in England and Wales. The same pattern of results was observed when the analysis was redone for those 16 to pension age only and pension age and over only. This analysis

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