Working paper

Country of birth and country of residence influences on self-reported health: a British analysis using individual-level data

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Introduction

Recent British censuses have included a question on self-reported 'limiting long-term illness' (LLTI). Many studies demonstrate that self-reported health is a powerful predictor of subsequent illness and mortality with self-rated health a commonly-used indicator of morbidity and a major input to local health profiles (Idler & Benyamini, 1997; Jordan, Ong & Croft, 2000; Kunst, Geurts & van den Berg, 1995; Lahelma, Manderbacka, Rahkonen & Karisto, 1994). Self-reported poor health and limiting long-term illness are found to be most strongly associated with general health perceptions, more serious health conditions (Manor, Matthews & Power, 2001) and physical limitations rather than psychological health (Cohen, Forbes & Garraway, 1995). The usefulness of self-reported health holds for different countries, different populations, question formulations and in terms of relationships with different outcome measures (Helweg-Larsen, Kjøller & Thoning, 2003) including all cause mortality and specific causes (Bentham, Eimermann, Haynes, Lovett & Brainard, 1995; Charlton, Wallace & White, 1994; Idler & Benyamini, 1997) as well as sickness benefits claims (Bambra & Norman, 2006; Norman & Bambra, 2007). A large body of work supports the validity of self-assessed health (Mitchell, 2005).

Where we live affects our health (Macintyre, Ellaway & Cummins, 2002; Tunstall, Shaw & Dorling, 2004) with strong relationships found between area-based measures of deprivation and mortality (Eames, Ben-Shlomo & Marmot, 1993; Senior, Williams & Higgs 2000), morbidity (Boyle, Gatrell & Duke-Williams, 1999) and specific health outcomes (Crombie, Kenicer, Smith & Tunstall-Pedoe, 1989). However, as Boyle, Norman and Rees (2002) point out, the environment most influential on people's health may not have been the conditions contemporary with disease diagnosis or death. Some authors consider place effects in the context of the life-course. Place of birth and socioeconomic conditions during childhood have been found to have a significant effect on subsequent health (Curtis, Southall, Congdon & Dodgeon, 2004; Osmond, Slattery & Barker, 1990; Kaplan & Salonen, 1991) with place of residence in middle age also influential (Ben-Shlomo & Smith, 1991; Blane, Hart, Davey Smith, Gillis, Hole & Hawthorne, 1996; Elford & Ben-Shlomo, 1997) and the relative importance of influences at different life stages found to vary by cause of death (Davey Smith, Hart, Blane, Gillis & Hawthorne, 1997). Any differences in findings may be because lag periods between contact with potential risk factors and subsequent health deterioration vary for different conditions (Polissar, 1980; Rogerson & Han, 2002).

The migration process is important when adopting a life course perspective on health . As we move between residential areas through our lives we experience different environmental and sociodemographic conditions and we meet a range of people against whom we may make comparisons when assessing our health. Migration has been shown to be selective by health status including age and distance dimensions (Bentham 1988; Findlay 1988). Health differences between migrants and between geographical areas can be attributed

to lifecourse disadvantage (Brimblecombe, Dorling & Shaw, 2000) with ill people, through lack of choice, drifting towards or becoming 'stuck' in deprived places (Boyle, Norman & Rees, 2002) and healthy people migrating into less deprived locations (Norman, Boyle & Rees 2005). Whilst international migrants tend to be relatively healthy (Bentham, 1988), Newbold (2005) notes a decline in immigrant self-reported health over time and suggests this may be due to changes in *perceived* rather than *real* health as health is re-evaluated relative to peers at a migrant's destination rather than relative to the origin population.

Evidence suggests that for different ethnic groups a single item measure of self-rated health status is valid (Chandola & Jenkinson, 2000). However, it is possible that people from different cultural backgrounds may report their health differently to other population sub-groups and from each other in different places and at different times. Since there is potential for self-assessment to be affected by subjective factors, apparent differences in health between areas and population sub-groups are perhaps due to varying interpretations of health (Bailis, Segall & Chipperfield, 2003) and, in terms of LLTI, of what may constitute a *limiting* and/or a *long-term* illness (Gooberman-Hill, Ayis & Ebrahim, 2003; Senior, 1998). Mitchell (2005) notes that self-reported poor health is influenced by expectation and comparison which themselves may be culturally determined. Whatever the health influence of 'culture' may be, significant differences have been found in self-reported morbidity by different sociodemographic groups in terms of gender and ethnicity (see Cavelaars, Kunst & Geurts, 1998; Curtis & Lawson, 2000; Franks, Gold & Fiscella, 2003; Harding 2003) and, the stimulus for this paper, population health in the British countries of Wales and Scotland when compared with England (Boyle 2001; Mitchell, 2005; Rees, 1993/4; Senior, 1998).

Mitchell (2005: 308) asks "whether we can compare self-reported measures of illness between *countries and cultures*". Perhaps there is something about being English, Scottish or Welsh that influences the way in which people answer a question about their health. Alternatively, there may be something about being born in or living in England, Scotland or Wales which affects the population's health. Here we explore the influences of country of birth and country of residence on the self-reporting of health in Britain. We investigate, for example, the health of the population in Wales by comparing those born in Wales with those born elsewhere. Similarly, we consider whether those who are Welsh born report their health differently when they are resident in another country. Mitchell (2005: 308) also asks how the self-reporting of illness can be tracked "*over time* when cultures, expectations, and awareness of health are all in a state of flux", so our analyses are based on Census data for both 1991 and 2001.

Data & methods

Self-reported health data in the UK Census

During the nineteenth and early twentieth centuries, the UK's decennial census was periodically used to collect information on people suffering from particular disabilities. For example, the 1911 Census asked if anybody included on the form was deaf, dumb, blind or lunatic. The collection of this type of data was discontinued, however, as results were found to be unreliable (Charlton, Wallace & White, 1994). Although

it has been possible to derive limited health data from economic activity questions, the 1991 Census was the first since 1911 to include a direct health-related question. The LLTI question, "Does the person have any long-term illness, health problems or handicap which limits his/her daily activities or the work he/she can do?" was asked of all persons in households and communal establishments (OPCS/GROS, 1992: 31). In the 2001 UK Census, the word 'handicap' was replaced by 'disability'.

When the 1991 data were released answers to the LLTI question were found to provide valuable information about levels of morbidity which correlated well with other data on general practitioner (GP) consultations and in- and out-patient visits to hospital (Dale, 1993). UK Census information on LLTI enabled much health-based research at aggregate level using the Small Area Statistics (SAS) and Local Base Statistics (LBS) (see, for example, Boyle, Gatrell & Duke-Williams, 1999; Senior, 1998) and at individual level using the Sample of Anonymised Records (SARs) (see, for example, Boyle, Duke-Williams & Gatrell, 2001; Boyle, Norman & Rees, 2002; Borooah, 1999; Gould & Jones, 1996) and the Office for National Statistics (ONS) Longitudinal Study (LS) (see, for example, Bartley and Plewis, 1997; Boyle, Norman & Rees, 2004; Harding, 2002; Norman, Boyle & Rees, 2005; Sloggett & Joshi, 1998; Wiggins, Joshi, Bartley, Gleave, Lynch & Cullis, 2002). Within the census context, levels of LLTI can be investigated in relation to age, sex, economic position, ethnic group, household composition and housing characteristics (Jordan, Ong & Croft, 2000).

Census Samples of Anonymised Records

A major innovation of the 1991 Census was the decision to release large samples of individual census records (Gould and Jones, 1996). Unlike traditional area based statistics where data are aggregated into pre-defined tables, these 'Samples of Anonymised Records' (SARs) (equivalent to the Public Use Microdata Sample in the US) allow users to carry out flexible, multivariate analysis at the level of the individual (Dale *et al.*, 2000). Further SARs were subsequently extracted from the 2001 Census (CCSR, 2005). The cross-sectional files we used were the 1991 2% Individual SAR and the 2001 3% Licensed Individual SAR. With over a million individual cases, a key advantage of using SAR data is that sample sizes are far in excess of those available in sample surveys (such as the Health Survey for England and equivalents in the rest of the UK). This ensures relatively high precision on sample estimates with a much greater potential to report statistically significant differences between sub-groups.

Study population

For both the 1991 and 2001 SARs we defined a study population of household residents in England, Wales and Scotland, with persons having a valid Social Class (thereby excluding school children) and with students at their term-time address. Since we are interested in the influence of current country of residence, to ensure that the study population was resident in their country for at least a year, we excluded persons who migrated into England, Wales or Scotland during the year before each of the 1991 and 2001 Censuses. Our data extract derived from the 1991 and 2001 SARs comprises 623,717 and 954,744 individuals respectively. We

focus on British countries to be in line with other studies (Senior, 1998; Mitchell, 2005) and because creating a UK-wide SAR for 1991 is problematical as data for Northern Ireland were supplied as a separate file with different variable availability and definitions.

Variables

We extracted SARs files for 1991 and 2001 with an aim of ensuring that the variables appropriate to the study were consistently defined for both these Census years. There were differences in questions in the 1991 and 2001 Censuses and categorisations of responses. There were also changes in statistical disclosure control procedures over time and different policies in 2001 between the Office for National Statistics (England and Wales) and the General Register Office (Scotland). Thus, some restrictions in defining consistent variable detail exists. Nevertheless, a wide range of variables commonly used in health studies were developed and included in this study. The variables and categorisations are listed in Table 1. The outcome dependent variable of interest was the binary yes/no answer individuals gave to the LLTI question. Independent variables include age-group, sex, educational qualification, ethnicity, social class, access to car, unemployment and tenure. Of particular relevance to this study are each respondent's country of birth and country of residence and a variable derived from this information which indicates for those born in a country, the country in which they are now resident; 'Country of birth by country of residence'. We acknowledge that when we describe somebody as 'Scottish' based on their country of birth, that the person themselves may not regard themselves as being 'Scottish' due, for example, to their parental country of birth or their adopted nationality.

Method

We developed a parallel series of logistic regression models for 1991 and for 2001 with the reporting of LLTI in each of those years as a binary dependent variable. Initially we focused on LLTI variations by country of residence and then by country of birth and include socio-economic variables expected to influence the reporting of LLTI. We pay particular attention to our derived variable: 'Country of birth by country of residence'. So that we can compare the model outputs for 1991 and 2001 we convert the log odds to probabilities and express these as percentages.

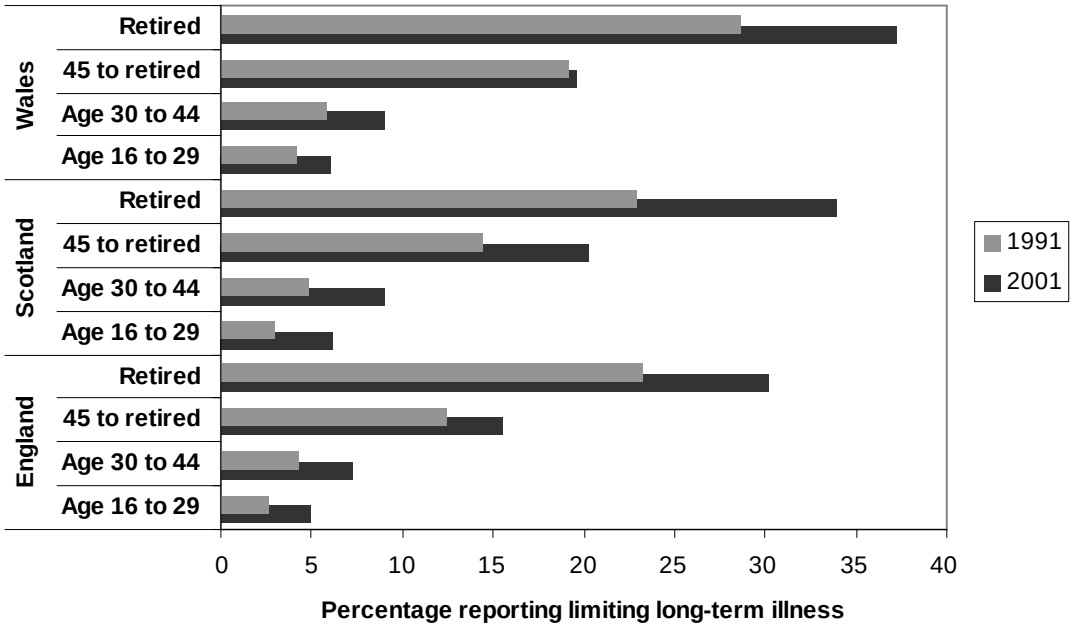
Table 1: Model variables and categories derived from the 1991 and 2001 Individual Sample of Anonymised Records

Variable	Category
Dependent variable	
Limiting long-term illness	Did not report LLTI Reported LLTI
Independent variables	
Age	16-29 30-44 45-Retired Retired
Sex	Male Female
Country of residence	England Scotland Wales
Country of birth	English Scottish Irish (North & South) Welsh Rest of the world (RoW)
Country of birth by country of residence	English in England English in Scotland English in Wales Scottish in England Scottish in Scotland Scottish in Wales Irish in England Irish in Scotland Irish in Wales Welsh in England Welsh in Scotland Welsh in Wales Rest of the World in England Rest of the World in Scotland Rest of the World in Wales
Ethnicity	White Non-white
Tenure	Owner occupiers Public renters Private renters
Educational qualifications	No higher education degree Higher education degree & equivalent
Social Class	I Professional, etc. occupations II Managerial & Technical occupations III N Skilled occupations-non-manual III M Skilled occupations-manual IV Partly skilled occupations V Unskilled occupations
Employment	Other Employed
Access to car	No car Access to car

Results

Using the individual level Samples of Anonymised Records data aggregated by age and country of residence, Figure 1 shows age-specific percentages of people who reported LLTI in the 1991 and 2001 Censuses in the three countries comprising Great Britain. Rates of LLTI rise with age as we would expect with, in 1991 a great similarity between England and Scotland but with higher levels of illness at every age-group in Wales. By 2001 rates of self-reported illness increased significantly between 1991 and 2001 but proportionately more in Scotland than in England or Wales.

Figure 1: Age-specific rates of LLTI by country of residence, 1991 & 2001

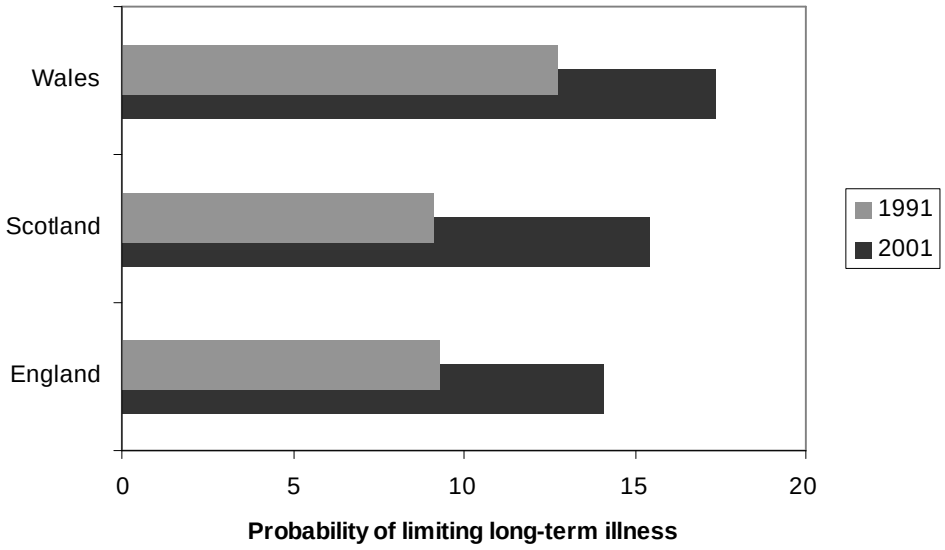


Using logistic regression, in Model 1 we build on the age-specific rates by estimating the probability of reporting LLTI by people's country of residence. In addition to age and sex we control for socio-economic factors shown by previous research to have strong relationships with health outcomes. Thus, included in the logit models for both 1991 and 2001 were variables on tenure, higher qualifications, social class, employment, car ownership and ethnicity (listed in Table 1). Figure 2 shows that in 1991 the probability of reporting LLTI in Scotland was marginally lower than in England (the odds ratio in table 2 is not significantly different). Probabilities in Wales are significantly higher though. By 2001, health in all three countries appears to have worsened as the modelled probabilities of LLTI increased but proportionally more for those people resident in Scotland. The relatively poor health reported by people living in Wales remains evident.

All of the explanatory variables included in Model 1 were significant ($p<0.05$) in both census years. Table 2 shows the odds for females reporting LLTI are lower than males, the reference category. Odds of LLTI increase through ages 30 to retirement age but decrease somewhat for the retired. This unexpected relationship is because only persons with a valid Social Class are included in this analysis and many retired

persons do not have Social Class recorded. The Non-White group have higher odds than the White group, although this is not significant in 2001. In terms of tenure, compared with owner occupiers, private renters and public renters have successively higher odds of LLTI. Those persons with higher educational qualifications have lower LLTI odds than those with lesser or no qualifications. There are progressively higher odds for lower Social Classes (SC), although in 2001 persons in SCIII have marginally higher odds than SCIV. The employed have lower LLTI odds than the other categories as do those persons with access to a car compared with those who do not. The socio-economic factors utilised here in Model 1 are included in all the models reported below and the models for 1991 and 2001 are operationalised consistently. For each of these explanatory variables the odds of LLTI compared with each reference category effectively remain the same for all subsequent models and are not reported in further model outputs.

Figure 2: Probability of LLTI by country of residence, 1991 & 2001



Independent variables: Age, Sex, Country of residence, Ethnicity, Tenure, Educational qualifications, Social Class, Employment, Access to car

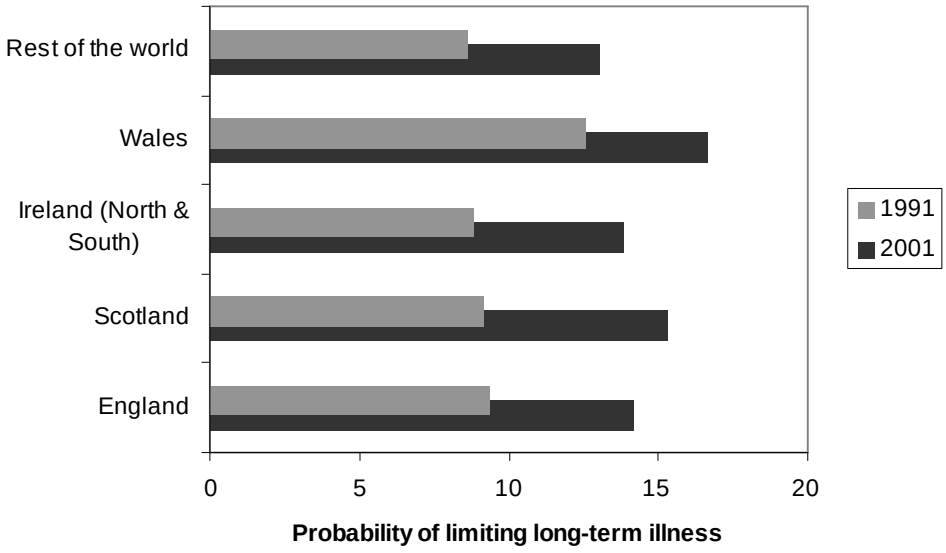
Table 2: Models 1 & 2, odds of LLTI by country of residence, country of residence and various socio-economic variables, 1991 & 2001

Explanatory variables	Model 1 exp(B) (95% CI)	
Country of residence	**1991**	**2001**
England	1	1
Scotland	0.97 (0.94-1.01) (NS)	1.11 (1.09-1.13)
Wales	1.42 (1.36-1.48)	1.28 (1.24-1.31)
Sex		
Male	1	1
Female	0.65 (0.64-0.67)	0.79 (0.77-0.80)
Age-group		
Age 16 to 29	1	1
Age 30 to 44	2.05 (1.98-2.12)	1.88 (1.84-1.93)
45 to retired	5.72 (5.53-5.91)	4.27 (4.17-4.37)
Retired	4.29 (4.14-4.45)	3.74 (3.66-3.83)
Broad ethnic group		
White	1	1
Non-White	1.08 (1.03-1.14)	1.02 (0.99-1.05) (NS)
Tenure		
Owner occupiers	1	1
Public renters	1.35 (1.32-1.38)	1.61 (1.58-1.64)
Private renters	1.06 (1.02-1.11)	1.24 (1.21-1.26)
Educational qualifications		
No higher qualifications	1	1
Higher qualifications	0.72 (0.68-0.75)	0.84 (0.82-0.85)
Social Class		
I Professional, etc. occupations	1	1
II Managerial & Technical occupations	1.10 (1.03-1.18)	1.18 (1.14-1.22)
III N Skilled occupations-non-manual	1.14 (1.06-1.22)	1.23 (1.18-1.27)
III M Skilled occupations-manual	1.27 (1.19-1.36)	1.42 (1.37-1.48)
IV Partly skilled occupations	1.40 (1.31-1.50)	1.40 (1.35-1.46)
V Unskilled occupations	1.47 (1.36-1.58)	1.47 (1.40-1.53)
Employed		
Other	1	1
Employed	0.15 (0.14-0.15)	0.19 (0.18-0.19)
Access to car		
No Car	1	1
Access to car	0.75 (0.73-0.77)	0.74 (0.73-0.76)

Explanatory variables	Model 2 exp(B) (95% CI)	
Country of birth	**1991**	**2001**
England	1	1
Scotland	0.97 (0.94-1.01) (NS)	1.09 (1.06-1.11)
Ireland (North & South)	0.93 (0.87-1.00) (NS)	0.97 (0.92-1.02) (NS)
Wales	1.40 (1.34-1.45)	1.21 (1.17-1.24)
Rest of the world	0.91 (0.86-0.96)	0.91 (0.87-0.93)
Further explanatory variables; odds ratios as in Model 1		

In Model 2 we investigate the effect of country of birth on the reporting of LLTI. In addition to England, Scotland and Wales, we have variables for people born in Ireland (Northern Ireland and the Republic of Ireland combined) and in all other countries combined; the 'Rest of the World' (RoW). Figure 3 illustrates that in 1991, people born in the RoW or Ireland have probabilities of LLTI significantly lower than people born in England but the lower probabilities for those born in Scotland are not significant. The odds ratios are reported in Table 2 and compare the different countries with the reference category England. People born in Wales have significantly worse health than those persons born in England. In 2001, a very similar pattern between the different countries persists but relatively higher probabilities of LLTI are found for the Scottish-born who now have significantly higher odds of LLTI than the English born. Those people born in Wales are still reporting the highest probabilities of long-term illness.

Figure 3: Probability of LLTI by country of birth, 1991 & 2001



Independent variables: Age, Sex, Country of birth, Ethnicity, Tenure, Educational qualifications, Social Class, Employment, Access to car

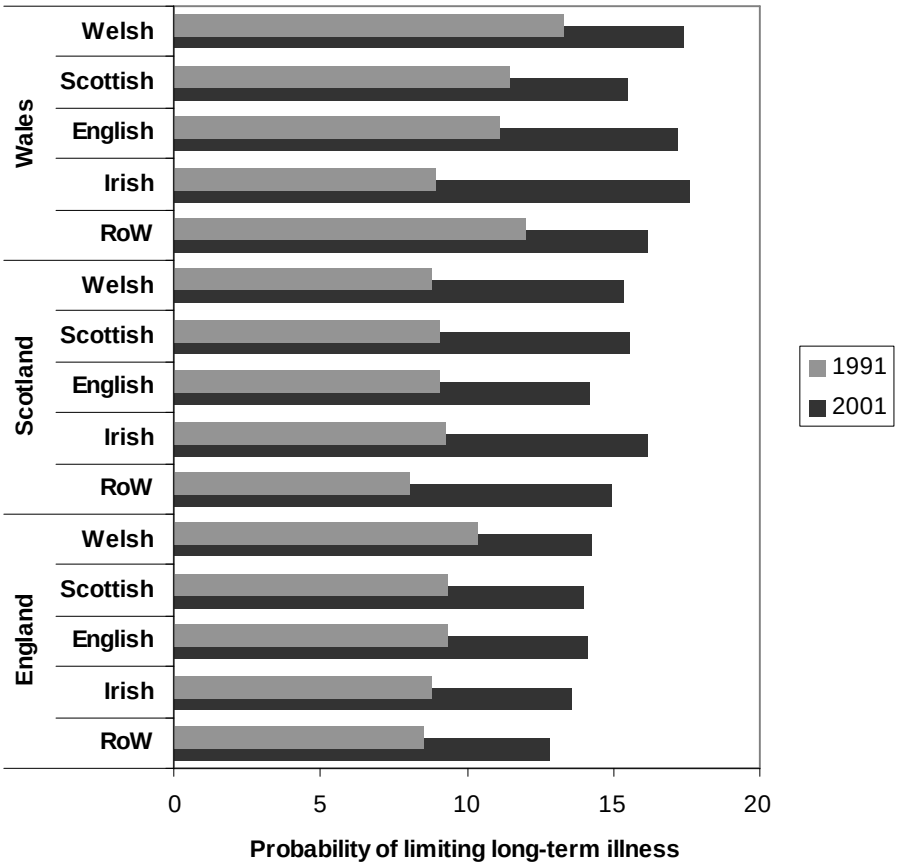
We include the derived variable 'Country of birth by country of residence' in Model 3 as an explanatory variable alongside the age, sex and socio-economic factors listed in Table 1. In Figure 4, the output from Model 3 is arranged by country of residence with subcategories by country of birth. For persons resident in England in 1991 there is a gradient of health whereby the Welsh-born have the highest probabilities of LLTI followed by the Scottish, English and Irish with the RoW born having the lowest probabilities. Table 3 shows that the Welsh-born and RoW born have respectively significantly higher and lower odds compared with the English living in England. By 2001, whilst the probabilities for all persons living in England have increased, only the relative advantage of the RoW born remains significant.

For persons in Scotland in 1991 there is no gradient across the different countries of birth. Although the RoW born appear to have a health advantage, this is not significant in the model, due to small numbers and

none of the categories are significantly different to the reference category, English in England. In 2001, the probabilities of LLTI have all increased, but compared with the reference category only the Scottish-born living in Scotland have significantly higher odds of reporting LLTI.

In 1991 in Wales there is a steep gradient of LLTI probabilities with the Welsh born having the highest probabilities followed by the Scottish, English and Irish. Whilst the RoW born have higher probabilities then when living in England or in Scotland. Compared with the English in England, all countries of birth have significantly higher odds of LLTI except the Scottish and Irish born. Of all combinations, the Welsh living in Wales having the highest probabilities of LLTI in 1991. By 2001 probabilities of LLTI have increased for those living in Wales. The English and Welsh born having significantly worse health than the base category but differences for the Scottish, Irish and RoW born are not significant in the model, due to small numbers.

Figure 4: Probability of LLTI by country of birth by country of residence, 1991 & 2001



Independent variables: Age, Sex, Country of birth by country of residence, Ethnicity, Tenure, Educational qualifications, Social Class, Employment, Access to car

Table 3: Models 3 & 4, odds of LLTI by country of residence, country of residence and various socio-economic variables, 1991 & 2001

Explanatory variables	**Model 3 exp(B) (95% CI)**		**Explanatory variables**	**Model 4 exp(B) (95% CI)**	
Country of birth by country of residence	**1991**	**2001**	*Country of residence*	**1991**	**2001**
English in England	1	1	England	1	1
Welsh in England	1.13 (1.04-1.23)	1.01 (0.95-1.07) (NS)	Scotland	0.97 (0.91-1.03) (NS)	1.09 (1.05-1.14)
Scottish in England	1.00 (0.93-1.08) (NS)	0.99 (0.94-1.04) (NS)	Wales	1.26 (1.19-1.34)	1.26 (1.21-1.32)
Irish in England	0.94 (0.87-1.01) (NS)	0.95 (0.90-1.01) (NS)			
RoW in England	0.91 (0.85-0.95)	0.89 (0.86-0.92)	*Country of birth*		
			England	1	1
English in Scotland	0.97 (0.86-1.09) (NS)	1.00 (0.93-1.07) (NS)	Scotland	1.01 (0.94-1.06) (NS)	1.01 (0.97-1.05) (NS)
Welsh in Scotland	0.94 (0.55-1.61) (NS)	1.09 (0.78-1.54) (NS)	Ireland (North & South)	0.94 (0.87-1.01) (NS)	0.96 (0.91-1.01) (NS)
Scottish in Scotland	0.97 (0.94-1.01) (NS)	1.11 (1.09-1.14)	Wales	1.17 (1.10-1.24)	1.01 (0.97-1.06) (NS)
Irish in Scotland	0.99 (0.74-1.32) (NS)	1.17 (0.95-1.43) (NS)	Rest of the world	0.91 (0.86-0.96)	0.90 (0.87-0.93)
RoW in Scotland	0.85 (0.68-1.06) (NS)	1.06 (0.94-1.20) (NS)			
English in Wales	1.21 (1.11-1.32)	1.26 (1.18-1.34)			
Welsh in Wales	1.49 (1.42-1.56)	1.28 (1.23-1.32)			
Scottish in Wales	1.25 (0.84-1.86) (NS)	1.11 (0.84-1.47) (NS)			
Irish in Wales	0.95 (0.61-1.47) (NS)	1.30 (0.96-1.74) (NS)			
RoW in Wales	1.32 (1.01-1.73)	1.17 (0.97-1.40) (NS)			
Further explanatory variables; odds ratios as in Model 1			*Further explanatory variables; odds ratios as in Model 1*		

Table 3 has the odds from Model 4 so that we can separately compare the effects of country of birth and country of residence. Holding all other variables constant, compared with persons born in England, in 1991 the Welsh born have significantly higher and the RoW born lower odds of LLTI. Odds for the Scottish and Irish born are not significantly different. By 2001, only the lower odds for RoW born remains significant. For country of residence, compared with persons living in England, persons in Wales have significantly higher odds but the slightly lower LLTI odds for those in Scotland is not significant. By 2001 though, the those persons living in Scotland now have significantly higher odds of LLTI. The relatively poor health situation for those in Wales persists.

Discussion

The modelled odds of individual level self-reported limiting long-term illness in 1991 are consistent with previous area level, aggregate studies. We have found 1991 levels of LLTI relatively high in Wales and low in Scotland after controlling for age, sex and socioeconomic factors often found to be highly related to health outcomes. Rees (1993/94: 255) previously suggested that as LLTI is self-reported and as such was subjective, it looked "likely that the Welsh and the Scots react somewhat differently to their health status." Senior (1998) agreed that the Welsh experience of LLTI appeared exceptional because of the extent to which modelled LLTI was under-predicted and that in Scotland it was over-estimated. He suggested (p. 279) there may be "national cultural effects on self-reported LLTI with the residents of Wales in 1991 being more prone to claim limiting illness or disability, and perhaps with those in Scotland being less likely to do so."

Rees and Senior each reported on health for residents of areas (at a variety of geographical scales down to electoral wards) and implying their results are applicable to the nationality (e.g. the Welsh). In this paper, by modelling LLTI probabilities simultaneously by country of birth and country of residence, we are trying to disentangle levels of health determined for a geographical area such as one of Great Britain's constituent countries (England, Scotland and Wales) from those reported by the different nationalities (English, Scottish and Welsh, plus Irish and the Rest of the World). We acknowledge that we are assuming an individual's country of birth is their nationality and that the influence of country of residence could be based on as little as one year's duration.

The probabilities of LLTI modelled using the 1991 and 2001 Individual SARs Census data suggest something of a 'Welsh' and a 'Wales' effect. *A Welsh effect?* In 1991, those born in Wales appear more likely to report LLTI than other nationalities when resident in Wales or England but not in Scotland. By 2001, this effect ameliorated with only those Welsh born and living in Wales having significantly higher odds of LLTI. *A Wales effect?* For those resident in Wales in 1991, excepting the Irish in Scotland, all nationalities have higher odds of reporting LLTI than those nationalities living at this time in either England or Scotland. Although not all differences are significant, this situation in Wales still exists in 2001.

Relative to both England and Wales, probabilities of LLTI in Scotland increased between 1991 and 2001. *A Scotland effect?* As noted above, LLTI in 1991 may have been under-reported so an increase by 2001 could be due to a change in willingness to report poor health for those resident in Scotland; perhaps due to the change in question wording from the use of the word 'handicap' in 1991 to 'disability' in 2001. A change in the age structure might lead to a higher percentage elderly and more illness, but Scotland has no more an ageing population than England or Wales and the models control for age, of course. Since we find that the Welsh born have higher LLTI odds and the Rest of the World have lower odds, a change in Scotland's residential structure by country of birth might influence a change on population health. However, the mix of population in England, Wales and Scotland by country of birth scarcely changes between 1991 and 2001. Further explanations would be to explore whether other aspects which influence health, such as area deprivation, health-related behaviours and the standard of and access to health care, have changed during this period.

Previous findings show international migrants to be relatively healthy (McDonald and Kennedy, 2004; Newbold, 2005; Sundquist, 2001). Any health advantage is thought due to 'self-selection' since only those individuals who are fit enough are likely to undertake a move between countries and because international migrants tend to be young and those entering a country (legally) may to need to pass health checks at customs (Bentham, 1988). Consistent with this, we find a health advantage for those born in the Rest of the World. The Wales effect exists with the Rest of the World-born having relatively poorer health when resident in Wales compared with those living in England or Scotland, particularly in 1991.

When modelled separately, we find both country of birth and country of residence to influence odds of reporting LLTI. When included in the same model, country of residence has the stronger effect. In terms of country of birth, the relative positions of the different countries remain consistent over time for these two cross-sectional datasets, although the effects are weaker in 2001. Compared with the English born, there is no significant difference for the Scottish or Irish in either 1991 or 2001. Whilst the Welsh born have an apparent health disadvantage in 1991, this is no longer significant in 2001. A health advantage for those born in the Rest of the World remains significant. The influence of country of residence changes over time, however. Here we find that odds of LLTI are higher for those who are resident in Scotland in 2001 compared with the situation in 1991 whilst the relative position of the Scottish-born remains the same. These findings are consistent with early life influences persisting and with people experiencing different area effects as their residential circumstances change whether as migrants they move, for example, to more or less deprived areas (Norman *et al.*, 2005) or for non-migrants whose areas change characteristics over time (Boyle *et al.*, 2002). Our country of birth remains fixed but our area of residence can change.

As noted above, Mitchell (2005) is interested in whether over time we can compare self-reported measures of illness between countries and cultures. Here we have held all aspects as consistent as possible between two time points: data source, geography, variables and models. As a result we can see at different times that

country of birth has a consistent but somewhat weak relationship with self-reported health, the most telling effect being for those born in the Rest of the World who exhibit long-distance migrant health advantages. Residents in Wales, particularly the Welsh born, consistently have the poorest health in Great Britain. This implies that length of residence in an area associated with poor health will have an adverse impact on self-assessed health. The biggest change between 1991 and 2001 is that health appears to worsen in Scotland, relative to the rest of Britain.

To build on our cross-sectional approach we could use linked individual data from sources such as the Office for National Statistics Longitudinal Study (England and Wales), the Scottish Longitudinal Study or the British Household Panel Survey to investigate changes in the self-reporting of health over time. We would not be able to determine peoples' expectations and awareness of health, for which qualitative data would be needed, but we would be able to tell whether fixed and changing aspects of peoples' characteristics and locational circumstances impact on their self-reported health.

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Note that discussions with Paul Boyle underpin the motivation behind carrying out this work which was planned to be submitted to Social Science & Medicine or to Health & Place. However, the work overlaps with and was subsequently superseded by work led by Frank Popham. Interested readers would therefore be advised to read the following:

Popham, F. (2006). Is there a ''Scottish effect'' for self reports of health? Individual level analysis of the 2001 UK census. *BMC Public Health* 6 (1), 191.

Popham, F., Boyle, P. & Norman, P. (2010). The Scottish excess in mortality compared to the English and Welsh: Is it a country of residence or country of birth excess? *Health & Place* 16: 759-762.

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