ESRC FINAL REPORT
Developing integrated analyses of the England and Wales, Scottish and Northern Ireland Census Longitudinal Studies: health and mortality as a case study

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- **Background**

In the UK there are currently three separate record linkage studies which include census and vital registration data covering England and Wales (the ONS LS), Scotland (Scottish LS) and Northern Ireland (NILS). They are managed in three separate statistical offices and the data are subject to confidentiality restrictions which means that they are not released to researchers' desktops for analysis. To date there has been little thought about how integrated projects might be undertaken using these three studies. This is an important issue as there are significant demographic and health differences between these constituent parts of the UK which are under-explored. The overall aim of this project was to encourage and facilitate use of the ONS LS, SLS and NILS together by considering relevant practical, procedural and methodological issues that could undermine cross-study analysis and addressing and documenting difficulties and ways around them. To do this, an original research project was undertaken which drew on information from all three. This is an exemplar of how to undertake UK analyses of the three sources in combination and deal with the various statistical (different sampling fractions etc) procedural/technical (different variable names etc) and other challenges posed.

The substantive focus of the project was on analysis of the association between indicators of health collected in the 2001 Census and subsequent mortality and how this association related to socio-economic status and location. This is an important topic because of academic and policy interest in health inequalities in the UK and indications from previous ecological research that patterns of reporting health may differ between constituent countries of the UK (O'Reilly, Rosato et al. 2005). We analysed socio-economic and socio-demographic variation in reporting long limiting long-term illness and self rated health in 2001 in and between England & Wales, Scotland and Northern Ireland, and analysed associations between reporting of health status in 2001 and subsequent mortality.

Previous studies have shown that self reported health indicators are predictive of subsequent mortality, implying a degree of robustness, (Idler and Benyamini 1997; DeSalvo, Bloser et al. 2005), but that this association varies between populations and population sub-groups. For example, research has demonstrated that self-reported health is less predictive of mortality at older ages (Singh-Manoux, Dugravot et al. 2007); has a stronger association with mortality for men than for women (Idler and Benyamini 1997); and is more predictive of mortality for those of lower than those of higher socio-economic status, particularly among middle aged working adults (Singh-Manoux, Dugravot et al. 2007). Variations in reporting of self-rated health over time (Mitchell 2005), and by geographic region (Boyle, Gatrell et al. 1999 ; Bardage, Pluijm et al. 2005), including by constituent countries of the UK, have also been reported. Analysis of area level data has shown that for a given level of health, mortality rates are higher in Scotland than in Northern Ireland or Wales, an association that persists after control for socio-

economic status (O'Reilly, Rosato et al. 2005). Thus on the evidence of mortality, the Scottish population is the least healthy, England is the most healthy with Northern Ireland and Wales in between. However, on the evidence of self-reported health data, the population of Northern Ireland is less healthy than that of Scotland (O'Reilly, Rosato et al. 2005; Breakwell and Bajekal 2006). In this study, we cannot disentangle whether these differences are due to actual differences in health status between areas or to differences in the propensity to report self-rated health in the Census. However, we are able to establish whether this association is present at the individual level and not just the population level. Previous research on this topic has generally been carried out using ecological area level data.

- **Objectives**

Developmental:

1) To demonstrate how parallel and, if possible, combined, analyses of the England and Wales, Scottish and Northern Ireland Longitudinal Studies may be undertaken to provide UK results.

This has been achieved (see main text).

2) To negotiate with Census offices and support units a set of procedures facilitating UK level analyses.

There are no formal procedures in place as a result of this project, however, the process we went though in developing and combining the datasets meant that the statistical offices had to set up new procedures between themselves, for example, working out protocols for the exchange of data between the Office for National Statistics (ONS) and the General Register Office for Scotland (GROS) despite different policies on data handling and requirements for encryption. It will therefore be easier for others wishing to do the same in the future. In addition, as a result of this project, ONS, GROS and the Northern Ireland Statistics and Research Agency (NISRA) are now considering the possibility of establishing a combined ONS LS, SLS and NILS analysis sample for those wishing to carry out work on two or three of these studies together. A paper on this topic has been prepared by member of ONS staff (Jim Newman) and discussed at a meeting of the UK Population Committee.

3) To produce a guide for users undertaking parallel analyses of more than one of the three studies (to be published via web).

Described in outputs section below.

4) To set up and publish (on web) a Core Variables Data Thesaurus which gives equivalent variable names in the 3 databases.

Described in outputs section below.

Substantive:

1)To analyse socio-economic and socio-demographic variations in reporting long limiting long-term illness and self rated health in 2001 within England & Wales; Scotland and Northern Ireland;

2)To analyse associations between reporting of health status in 2001 and subsequent mortality (taking account of socio-economic and socio-demographic factors).

We met these research objectives and outline the methods and results in the relevant sections below.

- **Methods**

Datasets

We used three datasets for our analysis, the Office for National Statistics Longitudinal Study (ONS LS), the Scottish Longitudinal Study (SLS) and the Northern Ireland Longitudinal Study (NILS).

Analysis phases

As outlined in the proposal, we planned three analysis phases as follows:
1. parallel analysis using individual level data
2. parallel analysis using source specific aggregated datasets
3. creation of a combined aggregated datasets

Development of separate individual level datasets for the first phase of analysis and separate aggregated datasets for the second phase of analysis was straightforward and involved the standard application to each statistical office via the relevant user support service. As explained in the proposal, we were unsure as to whether it would be possible to carry out the third analysis phase mentioned above, due to restrictions on release of aggregated data from the NISRA and GROS safe settings, and the larger minimum cell count restriction for release of NILS data from the NISRA safe setting (a minimum cell count of 10 compared with 3 for the ONS LS and SLS). After applying to GROS and NISRA, we were granted permission for release of aggregated datasets for both the NILS and SLS and also permission for a minimum cell count of 3 for the NILS dataset, all on the proviso that datasets would only be released to ONS for the NILS and any other statistical office safe setting for the SLS. Once aggregated datasets were produced, they were transferred to the ONS safe setting for analysis.

We also made enquiries to the statistical offices into the possibility of carrying out a fourth analysis phase, to combine subsets of individual level data from the three datasets. This was not approved due to the confidentiality restrictions for these datasets. However, the three statistical offices are now, as a result of this project, in discussion about the possibility of creating a combined analysis sample of the NILS, SLS and ONS LS in the future.

Sample and variables

The study population consisted of those aged 35 and over and present at the 2001 Census for each LS, and we focused our analysis on those aged 35-74. We developed, as far as possible, identical variables for the three studies. The individual level datasets contained more variables and variable detail than aggregated datasets, because of cell count restrictions on the latter datasets. (Assessing how much difference this made to the substantive results gives an indication of the effect of these count restrictions). In all analysis, we used a binary indicator of the presence of a limiting long term illness and a binary self-rated health variable (good versus fair or poor health). Survival time for the mortality outcome was measured from the 2001 Census to 30th June 2006 (five years and two months of follow up). Other variables used include age (age group for aggregated data), gender, marital status and four socio-economic status indicators, education, NS-SEC, housing tenure and car ownership. For the aggregated datasets, we had to create a

combined socio-economic score (0-5) based on these four variables instead of using them separately. Finally, for combined country analysis, we used a country indicator.

Analysis method

After carrying out descriptive analysis, we used logistic regression to examine the association of socio-economic and socio-demographic indicators with the outcome of self-rated health and limiting long term illness. To examine country differences in health and mortality outcomes we produced age and sex standardised health prevalences and mortality rates. Then, using Poisson regression, we examined the association between self-reported health and other co-variates with mortality. For both the individual level analysis and the aggregated analysis, we carried out separate country analysis (phases 1 and 2 above), and were able to compare the level of detail in the results for the two methods. Additionally using the aggregated dataset, we carried out combined country analysis with country as a co-variate (phase 3 above).

- **Results**

We first report results from the data analysis, and then compare the strengths and weaknesses of each analysis method.

Results of data analysis

Country differences in socio-economic and socio-demographic characteristics

Socio-demographic sample characteristics were broadly similar for England and Wales, Scotland and Northern Ireland, as shown in Table 1. The samples had a similar age and sex structure, however the NILS sample had a marginally younger average age of 51.7 years than the ONS LS and the SLS with an average age of just over 52. The NILS sample had a slightly larger proportion married and a smaller proportion divorced than in England and Wales or Scotland.

The education variable differed the most between the samples due to education system differences between Scotland and the other countries and the fact that nearly 9% of the England and Wales sample were in the 'other' qualifications category, which the other LSs did not include. Scotland had the highest proportion in the highest education category at 39% compared with 25% in England and Wales and only 21% in Northern Ireland. In the Northern Ireland sample, 51% had none of the educational qualifications asked about, compared with 40% of the Scottish sample and 35% of those in England and Wales. There were some differences between countries for the other socio-economic status indicators, NSSEC, housing tenure and car access. In Northern Ireland, the proportion in the managerial and professional category for NSSEC was 3-5 percentage points lower than in the other countries, and the proportion in the category of never worked, unemployed, students and other was approximately 2 percentage points larger. Approximately 78% of the sample were home owners in England and Wales and Northern Ireland compared with only 72% in Scotland, where comparatively larger proportions lived in social housing. Car ownership was also approximately 7 percentage points less common in Scotland than in England and Wales or Northern Ireland. For the socio-economic score, used in aggregated dataset analysis, the NILS sample had the highest proportion with missing values at 20% compared with 17% in England and Wales and 13% in Scotland. (This illustrates one of the main disadvantages of using summary scores such as this – the high proportion with missing values on at least one of the variables used to construct it). The mean socio-economic score was lowest (representing a lower mean level of deprivation) in England and Wales at 2.4, followed by Scotland with a score of 2.5 and Northern Ireland with a score of 2.7. Note that

Scotland had the highest proportion of the sample in both the least and most deprived categories.

[Table 1 here]

Self-rated health

The NILS sample had the highest proportion with fair or not good self-rated health at 43% compared with 41% in the ONS LS and the SLS.**.** Age and sex standardisation showed that the Scottish sample were 1% more likely to report poor health than the England and Wales sample, and that the Northern Ireland sample were 6% more likely to do so.

[Tables 2 and 3 here]

Next, we analysed the association between socio-economic and demographic characteristics and the outcome of self-rated health using logistic regression. In both individual level (Table 2) and aggregated analysis (Table 3), the likelihood of poorer self-rated health increased with age, and was significantly higher for women than men, although the gender difference was smaller once marital status and socio-economic status were controlled for. Inclusion of single year of age in individual level analysis models meant that we were able to more completely control for age than in aggregated models which only included three age groups, as confirmed by a comparison of r-squared values for Model 1 individual level versus aggregated dataset analysis (r=0.042 for individual analysis and r=0.037 for aggregated analysis, for Scotland).

In line with the standardisation above, multivariate analysis using the combined aggregated dataset (see table 3) demonstrated that after adjusting for age and gender, those in Northern Ireland were 10 percent more likely to report poorer health (CI 1.09-1.11) than those in England and Wales, and that there was no difference in this regard between Scotland and England and Wales. However, after additionally adjusting for marital status and socio-economic score, those in Scotland were less likely to report poorer health (OR 0.96, CI 0.95-0.97) and there was no significant difference between England and Wales and Northern Ireland.

Using both analysis methods we found that that the unmarried were more likely to report poor-self rated health than the married, and individual level analysis showed that the separated and divorced, and the never married were more likely to report poor health than the married. However the widowed were not more likely to report poor health than the married and in England and Wales and Scotland the widowed were marginally less likely to do so (OR for England and Wales 0.96, CI 0.92-0.99)..

In all countries, those living in social rental accommodation, with no car, with no educational qualification and those who were in lower status occupations or not employed were the most likely to report poor health. However, there were some country differences. Reported health differentials by tenure were weaker for England and Wales than Scotland and Northern Ireland, however health differentials for NSSEC were stronger in England and Wales than the other countries. For example, in England and Wales those who had never worked were 89% more likely to report poor health than managers or professionals (CI 1.80-1.99) whereas the equivalent figure for Scotland was 55% (CI 1.44-1.67). Those with missing values for all socio-economic status indicators tended to have poorer self-rated health than the least deprived category, except for car

access. In Scotland and to some extent in England and Wales, those with missing data for car access were more likely to report poor health while in Northern Ireland they were 17% less likely to do so (CI 0.78-0.89). Finally, for the education variable, there were smaller health differentials in Scotland between those with no educational qualifications and those with upper secondary or degree level education than in England and Wales or Northern Ireland, a finding that may relate to the larger proportion of the population in the highest education category in Scotland. Analysis of aggregated datasets for individual countries demonstrated a dose response relationship between increasing socio-economic score (indicating a higher level of deprivation) and poorer reported health. This association appeared to be the strongest in Northern Ireland where those in the most deprived category were 5.4 times more likely to have poor or fair self-rated health than the least deprived (CI 5.19-5.66). In England and Wales the equivalent ratio was 4.4 (CI 4.20-4.52) and in Scotland, 4.7 (4.47-4.89).

Mortality

Country differences

Age and sex standardisation showed that in the 35-74 year old age group, mortality rates were 24% higher in Scotland than in England and Wales, and that Northern Ireland's mortality rate was 3% higher.

[Tables 4 and 5 here]

Next, we analysed the association between health and socio-economic and socio-demographic characteristics and mortality using individual level and aggregated datasets (Tables 4 and 5). The aim of mortality analysis was to examine the association between health status and subsequent mortality in the three countries, however, first we briefly describe associations between other co-variates and mortality.

In all countries, hazard ratios of mortality increased with age and were higher for men than for women, a difference that increased once marital status and socio-economic status were controlled for. For marital status, despite widows and widowers being no more likely to report poor health than the married, they were significantly more likely to die in the follow up period in all countries. Indeed in England and Wales, hazard ratios for the widowed were as high as for the separated, divorced and never married. Reflecting the analysis of the health outcome above, mortality was the highest for those living in social rental accommodation, those with no educational qualifications and for those who had never worked, were unemployed, students or 'other'. Analysis of individual country aggregated datasets showed that there was a stronger association between socio-economic score and mortality in Northern Ireland than in the other countries. After control for self-rated health status, the association between socio-economic status and mortality weakened in all models and for all countries, but was still significant. In other words, health status differentials only partly explained the association between socio-economic status and mortality.

Combined country aggregated dataset analysis demonstrated that after control for age group and gender (Table 5), the Scottish sample were significantly more likely to experience mortality in the 5 years and two months following the 2001 Census than those in England and Wales (HR 1.23, CI 1.19-1.27). In Northern Ireland, mortality rates were not significantly different from England and Wales (HR 1.01 CI 0.98-1.05). After control for socio-economic and marital status, the ratio for Scotland decreased marginally

to 1.19 (CI 1.15-1.23). However, the hazard ratio for Northern Ireland fell to 0.95 (CI 0.92-0.98) indicating that the Northern Ireland sample were less likely to die in the follow up period after control for marital status and socio-economic status. Additional control for self-rated health status (model 3, all countries) did not alter the differences between countries in terms of mortality risks.

Those reporting poor health were over twice as likely to die in the follow up period than those reporting good health after control for socio-demographic and socio-economic factors (All Model 3s, Tables 4 and 5). However, there was some variation in this association by analysis method. For all countries, hazard ratios for self-rated health were 7-9% higher using the individual than aggregated datasets. This reflects variation that was not captured in the aggregated datasets because they contained less detailed socio-demographic and socio-economic variables (age group rather than single year of age, two category marital status instead of four categories, and socio-economic score instead of separate socio-economic indicators). The association also varied by country. Using both analysis methods, the association between health status and mortality was stronger in Scotland after control for all other factors (aggregated analysis HR 3.01, CI 2.81-3.22) than in England and Wales (HR 2.57 CI 2.45-2.70) or Northern Ireland (HR 2.69 CI 2.54-2.86) which reflects the lower propensity to report poor health combined with relatively high levels of mortality in Scotland.

Summary of results

In all countries, women were more likely than men to report poor health but were less likely to die in the follow up period. The never-married, divorced and separated were also more likely to report poor health. All unmarried groups, including the widowed, were more likely to die in the follow up period than the married. Worse socio-economic score was associated with poorer self rated health and with mortality in all countries. Of the individual socio-economic indicators, living in social rental accommodation, not having a car, having no educational qualifications and having never worked or being unemployed were all associated with higher levels of reported poor health and mortality. There was some variation in the strength of these associations by country, more so for socio-economic status indicators than socio-demographic factors. From the socio-economic status score it appeared that socio-economic differentials in health and mortality were larger in the Northern Ireland sample than in Scotland and England and Wales. Associations for the separate socio-economic indicators also showed differing associations by country.

We found a strong association between reporting of poor health and mortality in all countries after control for socio-economic status. This association was stronger for Scotland than Northern Ireland or England and Wales. This reflects our finding that the Scottish sample were no more likely to report poor health than those in England and Wales, but that they were much more likely to die in the follow up period. The Northern Ireland sample were somewhat more likely to report poor health (although after control for marital status and socio-economic status, this association disappeared) and no more likely to die in the follow up period than in England and Wales. This result supports the findings of previous research using area level data.

Strengths and weaknesses of each analysis methods

Development of the individual level datasets involved standard procedures for application to use the datasets and in dataset preparation, and so they were quicker and easier to prepare and use than the combined aggregated analysis datasets. There were no

limits on the variables and categories used in the individual level datasets because all analysis was carried out in the safe setting for each longitudinal study. Preparation of combined aggregated datasets, however, was much more time consuming and logistically complex. It took time to obtain approval for release of aggregated NILS and SLS datasets from the safe settings, and for approval from all three statistical offices to combine these aggregated datasets. Data set preparation took much longer than for the individual level datasets, because of the iterative process necessary to ensure that all datasets met disclosure control protocols of each longitudinal study and ensure that they were also identical in terms of the variables and categories included. Finally, the statistical offices had to put into place systems to transfer the data between them which also took longer than expected.

Statistically, the individual level datasets provided more detailed, richer information than the aggregated datasets, including individual year of age instead of three age groups; four marital status groups instead of only two; and separate socio-economic variables instead of a combined socio-economic score. We therefore obtained more detailed country comparison of the associations between different socio-economic and demographic indicators associations using the individual level datasets, and variables (particularly age) were more completely controlled for than in the aggregated dataset analyses, as confirmed by the r-squared values presented above. Additionally, it was only possible to carry out an exploration of the characteristics of those with missing data using individual level and not aggregated datasets because of small numbers that would have precluded clearance of such an aggregated dataset. There are therefore a number of advantages to using the individual level datasets. However, the major drawback was the difficulty in ascertaining country differences in the outcome of interest besides using basic age and sex standardisation. Using the combined aggregated datasets, we were easily able to ascertain country differences in health and mortality controlling for all co-variates, and to calculate (although not presented here) interaction effects of, for example, country on the association between health status and mortality, or country on the association between deprivation and mortality.

In summary, the individual level datasets provided much richer data with more variables and less time taken for dataset development, however there was no easy way to make statistical comparisons between the countries. The combined aggregated datasets were logistically much more challenging and time consuming to prepare, and had less variable detail, but enabled direct analysis of country comparisons. Both methods therefore have benefits, and the choice is likely to depend on the focus of research. For future researchers, if country differences are a focus, then it would be advisable to create and use a combined aggregated dataset. However, for some analyses with rarer outcomes, keeping to a minimum cell count of three for an aggregated dataset would preclude having enough variables in a dataset to allow meaningful analysis. For example, we were limited to using a socio-economic index for aggregated analysis because in mortality datasets there were relatively few deaths, especially at younger ages. For any analysis needing more detail on mortality, for example cause specific mortality, or mortality at very young ages, or more detailed regional analysis it would only be possible to use aggregated datasets that include very few variables in a dataset and/or very broad groupings of values. Although it is not possible at present, the ability to combine subsets of individual level data from the three studies would, in the opinion of the researchers involved in this project**,** combine the benefits of both of the methods currently possible. We, as researchers, suggest that this would provide more scope for detailed analysis of

country comparisons, and so recommend that the possibilities for this be investigated further.

- **Activities**

Results from this project have been presented at the following events:

1. Census Microdata Conference at Manchester University on 1st September 2008
2. Census workshop on health and ethnicity at City University on 16th April 2009. The aim of this workshop was to promote use of the ONS LS and other data sources to academics and others.
3. Joint Conference of the ESRC Census programme and Census Study Group on 13th May 2009.

4. We also organized a British Society for Population Studies day conference on 14th May 2009 on health and mortality using record linkage data, at which we presented results from this project.

- **Outputs**

3. 'Technical working paper: guide to parallel and combined analysis of the ONS LS, SLS and NILS' : Document for web publication, documenting the steps involved in combined analysis of these three datasets as guidance for others wishing to do the same, to be placed on the CeLSIUS, LSCS and the NILS RSU websites.

4. Core variable thesaurus including equivalent names of commonly used variables in the ONS LS, SLS and NILs and their equivalent coding, available on the websites of CeLSIUS, LSCS and NILS RSU.

Planned publications:

3. Paper for submission to International Journal of Epidemiology or Journal of Epidemiology and Community Health: 'Does the relationship between self-reported health and mortality vary according to constituent countries of the UK ? An analysis based on three census-based longitudinal studies.'

4. Paper for submission to Population Trends: 'Comparative analysis of the England and Wales, Scotland and Northern Ireland Longitudinal Studies: a tale of two methods'.

- **Impacts**

The main potential impact of this project is that it has made the prospect of a mechanism for combined analyses of the UK census based longitudinal studies much more likely and this is being actively taken forward by ONS and the other statistical offices.

The project should also have an impact on the three support services for the three studies, and those who use them, as feedback on ease of use and usefulness of resources such as the relevant data dictionary was fed back to each.

Additionally the project has the potential for impact on debates about health inequalities within and between the constituent countries of the UK and debates about the most appropriate indicators of health to use for policy, as well as research, purposes.

- **Future Research Priorities**

Further work on the statistical approaches to disclosure control would be useful in enabling maximum use of all three resources.

ANNEX A: REFERENCES

Bardage, C., S. Pluijm, et al. (2005). "Self-rated health among older adults: a cross national comparison." Eur J Ageing **2**: 149-158.

Boyle, P. J., A. C. Gatrell, et al. (1999). "Self-reported limiting long term illness, relative deprivation, and population stability in England and Wales " Social Science and Medicine **49** 791-9.

Breakwell, C. and M. Bajekal (2006). "Health expectancies in the UK and its constituent countries, 2001." Health Statistics Quarterly **29**: 18-25.

DeSalvo, K. B., N. Bloser, et al. (2005). "Mortality Prediction with a Single General Self-Rated Health Question: A Meta-Analysis." Journal of General Internal Medicine **21** (3): 267–275.

Idler, E. and Y. Benyamini (1997). "Self-rated health and mortality: a review of twenty-seven community studies." Journal of Health and Social Behaviour **38**: 21-37.

Mitchell, R. (2005). "Commentary: The decline of death - how do we measure and interpret changes in self-reported health across cultures and time ?" Int J Epidemiol **34**: 306-308.

O'Reilly, D., M. Rosato, et al. (2005). "Self reported health and mortality: ecological analysis based on electoral wards across the United Kingdom." British Medical Journal **331**: 938-9.

Singh-Manoux, A., A. Dugravot, et al. (2007). "The association between self-rated health and mortality in different socioeconomic groups in the GAZEL cohort study." Int J Epidemiol **36**: 1222-1228.

ANNEX B: ACKNOWLEDGEMENTS

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Table 1: Socio-demographic and socio-economic characteristics of the population aged 35-74 in				
England and Wales, Scotland and Northern Ireland, ONS LS, SLS, NILS 2001				
Variable	Categories	LS Sample		
		ONS LS	SLS	NILS
Age	Mean	52.2	52.1	51.7
	Standard error	0.022	0.032	0.025
Age group				
	35-49	44.5	45.3	47.0
	50-64	37.4	36.8	36.2
	65-74	18.0	17.9	16.8
Gender				
	Men	48.8	47.9	48.3
	Women	51.2	52.1	51.7
Marital status				
	Married	69.3	68.1	71.5
	Separated or divorced	14.1	13.9	10.4
	Widowed	5.9	6.9	6.6
	Never married	10.7	11.0	11.5
Highest educational qualification				
	Upper secondary or degree	22.5	35.2	18.1
	Lower secondary	28.5	19.6	23.7
	None	34.9	40.1	51.0
	Other	8.7	-	-
	Missing	5.5	5.2	7.3
NS-SEC				
	Manager or professional	30.0	28.9	25.2
	Intermediate occupations, small employers and own account	19.8	18.9	19.8
	Lower supervisory, technical, semi-routine and routine	33.5	39.7	35.1
	Never worked, unemployed, student, other	3.8	3.4	5.4
	Missing	12.9	9.2	14.6
Housing tenure				
	Owner	78.4	72.3	78.2
	Private rental and other	5.9	5.1	4.0
	Social rental	13.3	20.7	14.2
	Missing	2.4	1.9	3.6
Car access				
	Car	83.9	77.5	82.7
	No car	14.5	21.2	14.8
	Missing	1.6	1.2	2.5
Socio-economic score				
	Mean (excluding those with missing values)	2.4	2.5	2.7
	Standard error	0.004	0.006	0.004
Socio-economic score				
	0 - Least deprived	13.6	18.5	11.5
	1	13.4	10.7	9.7
	2	14.7	12.8	12.3
	3	16.5	13.6	14.9
	4	15.4	16.0	19.2
	5 - Most deprived	9.3	15.6	12.0
	Missing	17.2	12.8	20.5
Total		100.0	100.0	100.0
N		254,918	122,753	192,251
Source: ONS, GROS, NISRA				

parallel analysis

Table 2: Odds ratios of the proportion of the population aged 35-74 with poor or fair self-rated health by socio-demographic and socio-economic characteristics in England and Wales, Scotland and Northern Ireland, ONS LS, SLS, NILS 2001. using parallel datasets

		England & Wales						Scotland						Northern Ireland					
		Model 1			Model 2			Model 1			Model 2			Model 1			Model 2		
		OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI
Age		1.05	***	1.04,1.05	1.04	***	1.04,1.04	1.04	***	1.04,1.05	1.04	***	1.04,1.04	1.05	***	1.05,1.05	1.04	***	1.04,1.04
Gender (Reference: men)																			
	Women	1.17	***	1.15,1.19	1.09	***	1.07,1.11	1.20	***	1.17,1.23	1.13	***	1.10,1.16	1.19	***	1.16,1.21	1.13	***	1.11,1.15
Marital status (Reference: married)																			
	Separated or divorced				1.20	***	1.17,1.23				1.31	***	1.26,1.36				1.35	***	1.30,1.39
	Widowed				0.96	*	0.92,0.99				0.97		0.92,1.02				1.01		0.97,1.06
	Never married				1.08	***	1.05,1.11				1.10	***	1.06,1.15				1.11	***	1.08,1.15
Housing tenure (Reference: owner occupier)																			
	Private rental and other				1.25	***	1.21,1.30				1.40	***	1.32,1.48				1.41	***	1.34,1.48
	Social rental				1.84	***	1.79,1.89				1.99	***	1.92,2.06				2.10	***	2.03,2.17
	Missing				1.21	***	1.14,1.28				1.38	***	1.26,1.51				1.29	***	1.22,1.37
Car access (Reference: yes)																			
	No				1.49	***	1.45,1.53				1.54	***	1.48,1.59				1.45	***	1.40,1.49
	Missing				1.07		0.99,1.15				1.20	**	1.07,1.34				0.83	***	0.78,0.89
Education (Reference: upper secondary or degree)																			
	Lower secondary				1.16	***	1.13,1.19				1.23	***	1.18,1.27				1.30	***	1.26,1.35
	None				1.72	***	1.68,1.77				1.60	***	1.54,1.65				1.88	***	1.82,1.95
	Other				1.46	***	1.41,1.51												
	Missing				1.48	***	1.42,1.55				1.42	***	1.33,1.52				1.49	***	1.42,1.56
NSSEC (Reference: manager or professional)																			
	Intermediate occupations, small employers and own account				1.11	***	1.08,1.14				1.11	***	1.07,1.15				1.12	***	1.08,1.15
	Lower supervisory, technical, semi-routine and routine				1.34	***	1.31,1.38				1.34	***	1.29,1.38				1.39	***	1.35,1.44
	Never worked, unemployed, student, other				1.89	***	1.80,1.99				1.55	***	1.44,1.67				1.62	***	1.54,1.70
	Missing				1.63	***	1.58,1.69				1.53	***	1.45,1.61				1.50	***	1.45,1.56
	N=	254918						122753						192,251					

* p<0.05 ** p<0.01 *** p<0.001

Model 1: Age

Model 2: Additionally includes marital status and socio-economic score

Source: ONS, GROS, NISRA

combined analysis

Table 3: Odds ratios of the proportion of the population aged 35-74 with poor or fair self-rated health by socio-demographic and socio-economic characteristics in England and Wales, Scotland and Northern Ireland and for all countries combined, ONS LS, SLS, NILS 2001. using combined aggregated datasets

illness by country other co-variates, ONS LS, SLS, NILS 2001.

		England and Wales						Scotland						Northern Ireland						All countries					
		Model 1			Model 2			Model 1			Model 2			Model 1			Model 2			Model 1			Model 2		
		OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI	OR	p	CI
Age group (Reference: 35-49)																									
	50-64	1.88	***	1.85,1.92	1.77	***	1.73,1.80	1.91	***	1.86,1.96	1.75	***	1.71,1.80	2.18	***	2.13,2.22	2.01	***	1.96,2.05	1.99	***	1.96,2.01	1.84	***	1.82,1.87
	65-74	3.38	***	3.30,3.46	2.72	***	2.66,2.79	3.25	***	3.15,3.36	2.53	***	2.44,2.62	3.75	***	3.65,3.85	2.96	***	2.88,3.04	3.47	***	3.42,3.52	2.76	***	2.72,2.81
Gender (Reference: men)																									
	Women	1.17	***	1.15,1.19	1.08	***	1.06,1.09	1.2	***	1.17,1.23	1.12	***	1.10,1.15	1.19	***	1.17,1.21	1.11	***	1.09,1.13	1.18	***	1.17,1.19	1.1	***	1.08,1.11
Marital status (Reference: married)																									
	Not married				1.21	***	1.19,1.23				1.33	***	1.30,1.37				1.34	***	1.31,1.37				1.28	***	1.26,1.30
Socio-economic score (Reference: least deprived)																									
	1				1.23	***	1.19,1.28				1.34	***	1.28,1.41				1.28	***	1.22,1.34				1.27	***	1.24,1.30
	2				1.51	***	1.46,1.56				1.6	***	1.52,1.67				1.69	***	1.62,1.77				1.58	***	1.55,1.62
	3				1.86	***	1.80,1.92				1.96	***	1.87,2.05				2.08	***	2.00,2.17				1.95	***	1.90,1.99
	4				2.7	***	2.62,2.79				2.67	***	2.56,2.79				2.93	***	2.82,3.04				2.76	***	2.70,2.82
	5 (most deprived)				4.36	***	4.20,4.52				4.67	***	4.47,4.89				5.42	***	5.19,5.66				4.77	***	4.66,4.88
	Missing				3.02	***	2.92,3.12				3.3	***	3.15,3.45				3.13	***	3.01,3.25				3.09	***	3.02,3.16
Country (Reference: England & Wales)																									
	Scotland																			0.99		0.98,1.01	0.96	***	0.95,0.97
	Northern Ireland																			1.1	***	1.09,1.11	1.01		0.99,1.02
	N=	254918						122,753						192,251						569922					

* p<0.05 ** p<0.01 *** p<0.001

Model 1: Age (and country for all areas combined)

Model 2: Additionally includes marital status and socio-economic score

Source: ONS, GROS, NISRA

parallel analysis

Table 4: Hazard ratios of mortality for the population aged 35-74 by socio-demographic and socio-economic characteristics and health status in England and Wales, Scotland and Northern Ireland, ONS LS, SLS, NILS 2001. using parallel datasets

		England & Wales									Scotland									Northern Ireland								
		Model 1			Model 2			Model 3			Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
		HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI
Age		1.10	***	1.10,1.11	1.09	***	1.09,1.10	1.09	***	1.08,1.09	1.11	***	1.10,1.11	1.10	***	1.09,1.10	1.09	***	1.09,1.09	1.11	***	1.10,1.11	1.10	***	1.09,1.10	1.09	***	1.09,1.09
Gender (Reference: men)																												
	Women	0.65	***	0.62,0.68	0.58	***	0.55,0.60	0.58	***	0.55,0.60	0.67	***	0.63,0.71	0.61	***	0.57,0.64	0.60	***	0.57,0.64	0.64	***	0.61,0.67	0.58	***	0.55,0.61	0.57	***	0.54,0.60
Marital status (Reference: married)																												
	Separated or divorced				1.26	***	1.18,1.34	1.23	***	1.16,1.31				1.36	***	1.25,1.48	1.30	***	1.20,1.42				1.28	***	1.18,1.40	1.21	***	1.11,1.32
	Widowed				1.23	***	1.14,1.32	1.24	***	1.16,1.33				1.14	**	1.05,1.25	1.15	**	1.05,1.25				1.13	**	1.05,1.23	1.13	**	1.04,1.22
	Never married				1.24	***	1.15,1.34	1.26	***	1.16,1.36				1.28	***	1.16,1.41	1.29	***	1.17,1.42				1.26	***	1.16,1.36	1.25	***	1.16,1.35
Housing tenure (Reference: owner occupier)																												
	Private rental and other				1.25	***	1.14,1.37	1.19	***	1.09,1.30				1.36	***	1.21,1.54	1.26	***	1.12,1.43				1.23	***	1.09,1.39	1.16	*	1.02,1.31
	Social rental				1.51	***	1.43,1.60	1.38	***	1.30,1.46				1.52	***	1.42,1.63	1.34	***	1.25,1.44				1.53	***	1.43,1.63	1.36	***	1.27,1.46
	Missing				1.39	***	1.23,1.56	1.34	***	1.19,1.51				1.44	***	1.22,1.69	1.34	***	1.14,1.58				1.27	***	1.13,1.44	1.21	**	1.07,1.37
Car access (Reference: yes)																												
	No				1.49	***	1.41,1.58	1.40	***	1.32,1.48				1.40	***	1.30,1.50	1.28	***	1.19,1.37				1.47	***	1.38,1.57	1.39	***	1.30,1.48
	Missing				1.17	*	1.01,1.36	1.17	*	1.00,1.35				1.25	*	1.02,1.53	1.19		0.97,1.46				1.12		0.96,1.30	1.16		0.99,1.34
Education (Reference: upper secondary or degree)																												
	Lower secondary				1.09		1.00,1.19	1.06		0.98,1.16				1.06		0.95,1.18	0.99		0.89,1.11				1.16	*	1.03,1.31	1.10		0.98,1.24
	None				1.41	***	1.30,1.52	1.26	***	1.17,1.36				1.32	***	1.21,1.45	1.18	***	1.07,1.29				1.39	***	1.25,1.54	1.20	***	1.08,1.33
	Other				1.27	***	1.16,1.40	1.17	**	1.07,1.29																		
	Missing				1.50	***	1.36,1.65	1.37	***	1.24,1.51				1.38	***	1.21,1.58	1.26	***	1.11,1.43				1.49	***	1.31,1.69	1.32	***	1.16,1.50
NSSEC (Reference: manager or professional)																												
	Intermediate occupations, small employers and own ac				1.05		0.97,1.13	1.02		0.95,1.10				1.03		0.92,1.14	1.02		0.92,1.14				1.07		0.97,1.18	1.04		0.95,1.15
	Lower supervisory, technical, semi-routine and routine				1.11	**	1.04,1.19	1.05		0.98,1.12				1.20	***	1.09,1.32	1.13	*	1.03,1.24				1.18	***	1.08,1.29	1.09	*	1.00,1.19
	Never worked, unemployed, student, other				1.34	***	1.21,1.50	1.21	***	1.09,1.35				1.36	***	1.16,1.61	1.27	**	1.08,1.49				1.43	***	1.27,1.62	1.31	***	1.16,1.48
	Missing				1.21	***	1.12,1.31	1.11	**	1.03,1.20				1.26	***	1.13,1.41	1.17	**	1.05,1.31				1.27	***	1.15,1.39	1.16	**	1.05,1.27
Self-rated health (Reference: good health)																												
	Fair or poor health							2.38	***	2.26,2.50							2.82	***	2.63,3.01							2.50	***	2.35,2.66
	Pyrs=	1251009									597711									928237.5								

* p<0.05 ** p<0.01 *** p<0.001

Model 1: Age

Model 2: Additionally includes marital status and socio-economic score

Model 3: Additionally includes health status indicator

combined analysis

Table 5: Hazard ratios of mortality for the population aged 35-74 by socio-demographic and socio-economic characteristics and health status in England and Wales, Scotland and Northern Ireland, and for all countries combined, ONS LS, SLS, NILS 2001. using combined aggregated datasets

		England & Wales									Scotland									Northern Ireland									All								
		Model 1			Model 2			Model 3			Model 1			Model 2			Model 3			Model 1			Model 2			Model 3			Model 1			Model 2			Model 3		
		HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI	HR	p	CI
Age group (Reference: 35-49)																																					
	50-64	3.78	***	3.50,4.09	3.69	***	3.41,3.99	3.28	***	3.04,3.55	4.25	***	3.83,4.72	3.98	***	3.58,4.42	3.52	***	3.17,3.91	3.9	***	3.57,4.26	3.69	***	3.38,4.04	3.2	***	2.92,3.50	3.93	***	3.74,4.14	3.76	***	3.57,3.96	3.31	***	3.14,3.49
	65-74	13.02	***	12.08,14.0	11.19	***	10.37,12.0	9.17	***	8.50,9.90	13.97	***	12.63,15.4	11.23	***	10.14,12.4	9.18	***	8.29,10.18	13.54	***	12.43,14.7	11.27	***	10.34,12.2	8.99	***	8.24,9.81	13.41	***	12.77,14.0	11.24	***	10.70,11.8	9.12	***	8.67,9.59
Gender (Reference: men)																																					
	Women	0.65	***	0.62,0.68	0.58	***	0.56,0.61	0.58	***	0.56,0.61	0.67	***	0.64,0.71	0.61	***	0.58,0.65	0.61	***	0.57,0.64	0.64	***	0.61,0.68	0.58	***	0.55,0.61	0.57	***	0.54,0.60	0.65	***	0.64,0.67	0.59	***	0.57,0.60	0.58	***	0.57,0.60
Marital status (Reference: married)																																					
	Not married				1.42	***	1.36,1.48	1.38	***	1.32,1.45				1.46	***	1.38,1.55	1.38	***	1.30,1.46				1.41	***	1.34,1.49	1.35	***	1.28,1.42				1.43	***	1.39,1.47	1.37	***	1.33,1.41
Socio-economic score (Reference: least deprived)																																					
	1				1.26	***	1.12,1.41	1.2	**	1.07,1.35				1.17	*	1.00,1.38	1.1		0.94,1.29				1.26	**	1.06,1.50	1.18		0.99,1.41				1.25	***	1.15,1.35	1.18	***	1.09,1.28
	2				1.39	***	1.25,1.55	1.26	***	1.13,1.41				1.41	***	1.23,1.63	1.24	**	1.08,1.43				1.6	***	1.37,1.87	1.4	***	1.20,1.64				1.45	***	1.34,1.56	1.29	***	1.20,1.39
	3				1.57	***	1.41,1.74	1.35	***	1.22,1.50				1.61	***	1.41,1.84	1.36	***	1.19,1.56				1.8	***	1.56,2.08	1.49	***	1.29,1.72				1.64	***	1.52,1.76	1.39	***	1.29,1.49
	4				1.94	***	1.76,2.15	1.56	***	1.41,1.73				1.94	***	1.72,2.19	1.51	***	1.34,1.71				2.12	***	1.84,2.43	1.62	***	1.41,1.86				1.98	***	1.85,2.12	1.56	***	1.46,1.67
	5 (most deprived)				2.93	***	2.65,3.25	2.16	***	1.95,2.40				2.97	***	2.65,3.33	2.06	***	1.83,2.31				3.44	***	2.99,3.95	2.37	***	2.06,2.72				3.06	***	2.87,3.28	2.18	***	2.04,2.33
	Missing				2.48	***	2.25,2.73	1.94	***	1.76,2.14				2.7	***	2.41,3.04	2.01	***	1.79,2.26				2.71	***	2.37,3.10	2.03	***	1.77,2.33				2.57	***	2.41,2.75	1.97	***	1.85,2.10
Self-rated health (Reference: good health)																																					
	Fair or poor health							2.57	***	2.45,2.70							3.01	***	2.81,3.22							2.69	***	2.54,2.86							2.71	***	2.62,2.80
Country (Reference: England & Wales)																																					
	Scotland																											1.23	***	1.19,1.27	1.19	***	1.15,1.23	1.2	***	1.16,1.24
	Northern Ireland																											1.01		0.98,1.05	0.95	**	0.92,0.98	0.94	***	0.91,0.97
	Pyrs=	1251008.5									597710.6									942434								2791153								

* p<0.05 ** p<0.01 *** p<0.001

Model 1: Age (and country for all areas combined)

Model 2: Additionally includes marital status and socio-economic score

Model 3: Additionally includes health status indicator

Source: ONS, GROS, NISRA