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Variation in mortality by country of birth in Northern Ireland: A record linkage study

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ABSTRACT

The study of health differences between those residing in the same country but originating in different countries is a potential source of insight into the causes of ill-health. Within Northern Ireland, those born in England, Wales, the Republic of Ireland and outside of the British Isles have a lower mortality risk than the Northern Ireland born; however, these differentials are largely explained by the demographic and socio-economic characteristics of these migrants. Conversely, the Scottish born residing in Northern Ireland have higher mortality than the Northern Ireland born, especially from ischemic heart disease, suggesting that the Scottish immigrants maintain the health disadvantage of their country of birth.

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1. Background

The study of health differences between migrant groups and their host country is a source of insight into the causes of ill-health and can contribute to debates on the relative contribution of genetic or environmental factors in the aetiology of particular diseases (Marmot et al., 1975; Hammar et al., 2002). Often the most significant migrant groups to a country are those from neighbouring countries, yet these groups are often infrequently studied, perhaps because of an assumption that close proximity is equivalent to similarity, thereby rendering them somewhat invisible to the research agenda (Pearson et al., 1991). One localised migration receiving some attention is that of the Irish in the UK, with research showing that the Irish-born resident in England and Wales having higher mortality than either non-migrating Irish or the host population (Adelstein et al., 1986; Wild and Mckeigue, 1997). In addition, Scottish-born migrants to England and Wales experience excess mortality similar to the Irish (Wild and Mckeigue, 1997), while Irish-born living in Scotland have mortality rates that are 20–30% higher than the native Scots (Abbotts et al., 2001).

The reasons for the higher mortality of these migrant groups are not clear. In relation to the Irish, it has been argued that selection effects cannot be the major explanation for the excess mortality and would not explain its persistence in later generations (Raftery et al.,

1990). While both Scottish and Irish migrants tend to be more disadvantaged than the general population of England and Wales (Chance, 1996), socio-economic status does not fully explain the excess mortality. The importance of lifestyle factors are frequently cited (Cruickshank, 1996) though there is little evidence supporting this (Harrison et al., 1993). Another explanation looks to competing ideas of context and content, since migrants tend to gravitate towards certain geographical areas (Macintyre and Ellaway, 2000). Alternatively immigrant mortality differences could simply reflect the established health patterns of the areas they live in.

There has been practically no research looking at the health of migrants to Northern Ireland – probably because high unemployment rates and local civil unrest acted as a deterrent to inward population flows. However, there has been a recent increase in immigration, with the 2001 Census recording that just under 9% of the resident population were born outside Northern Ireland, with the majority born in the British Isles. In addition, anecdotal evidence suggests that there has been a significant increase in the number of migrants from Eastern European countries over the past number of years. Examining the health status of migrants provides useful insights about the influence of country of origin, country of destination and possibly the process of migration on health status. This is particularly interesting for those coming to Northern Ireland from other parts of the UK where, despite shared health and welfare systems, significant differences in health status exist. The aims of this analysis are to determine firstly, if migrants to Northern Ireland are more or less healthy than the Northern Ireland born, and secondly to determine if the health status of migrants most closely resembles that of their country of origin or destination.

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2. Methods

The Northern Ireland Mortality Study (NIMS) is a prospective record linkage study, based on the 2001 Census returns for the whole enumerated population, to which subsequent registered deaths have been linked. This forms a longitudinal study, with 94% of all deaths occurring in the six year post-census period linked to a census return. Details of the linkage process are described elsewhere (O'Reilly et al., 2008). These data were anonymised, held in a safe setting by NISRA and made available to the research team for this study.

All attributes of the cohort members were as described on the census record. The census included a question on country of birth, allowing the following responses: Northern Ireland, England, Wales, Scotland, Republic of Ireland and elsewhere – with those born 'elsewhere' asked to include their country of birth. Demographic characteristics included age-group, sex and marital status. Socio-economic status was assessed using housing tenure, car availability, educational attainment and national statistics socio-economic classification (NSSEC). In addition, the income domain of the Northern Ireland Index of Multiple Deprivation (Northern Ireland Statistics and Research Agency, 2005) indicated relative area affluence, with census super output areas (average population = 1894) ranked from low to high and divided into quintiles, each containing approximately 20% of the population. Health status was assessed using the two self-reported health questions in the census: limiting long-term illness (LLTI), which elicited a yes or no response and general health in the year prior to census, which included the responses good, fairly good or poor. Both health measures have been included in the analysis as earlier analysis has shown that both independently contribute to mortality risk.

The cohort was restricted to those aged 25–74 to ensure that socio-economic factors could be applied to the whole of the analysis population: many of those aged less than 25 will not yet have finished their full time education, while neither education nor social class were coded for those aged 75 and over in the 2001 Census. Members of the Armed Forces stationed in Northern Ireland because of the civil unrest were excluded. These groups were predominantly from Great Britain, and formed an exceptional group of young disproportionately healthy adults.

Cox Proportional Hazards modelling was used to detect differences in the mortality (all cause and cause specific) experience of the country of birth groups over the six year period. No adjustment for was made for multiple hypothesis testing. Cause specific mortality included ischemic heart disease (IHD) (International Classification of Disease (ICD) 10 I20–I25); stroke (ICD 10 I60–I69); respiratory disease (ICD 10 J00–J99); cancer (ICD 10 C00–C97) and external causes (ICD 10 V01–Y98).

3. Results

Just over 90% of the cohort was born in Northern Ireland. Of the remainder, 4.2% were born in England, 1.2% in Scotland, 0.2% in Wales, 2.7% in the Republic of Ireland and 1.7% were born outside of the British Isles. The English born and those born outside of the British Isles tended to be younger than those born in Northern Ireland, Scotland, Wales and the Republic of Ireland (Table 1). Those born in the Republic of Ireland tended to be older (42% were aged 55–74 compared to only 30% of those born in Northern Ireland), and had a correspondingly higher proportion of females. The indicators of socio-economic status showed a mixed picture of the relative affluence of those born in different countries: for example, almost 78% of those born in Northern Ireland lived in an owner-occupier property, compared to 66% of those born in Scotland and 67% born outside of the British Isles; conversely, 39% of the English born and 42% of the Welsh-born were classed as

professionals, compared to 28% of those born in Northern Ireland. Just over 16% of those born in Northern Ireland had a degree, compared to 23% of those born in England, Wales and the Republic of Ireland, and 39% of those born outside of the British Isles. The almost equal distribution of the Northern Ireland born across the quintiles of area deprivation is to be expected, given the method used to create the indicator; with the exception of those born in the Republic of Ireland, those born outside of Northern Ireland tended to live in more affluent areas.

During the six years of follow-up, the cohort recorded a total of 39,511 deaths. Table 2 shows the demographic, socio-economic and health factors associated with mortality: the expected relationships were observed. In the fully adjusted model (Model 3) females were approximately 40% less likely to die than males (Hazard ratio (HR)=0.58; 95% confidence interval (CI) 0.57, 0.59), while married people had a lower risk than the never or previously married. Marked social gradients are evident with car availability, housing tenure and educational attainment each making an independent contribution to mortality risk. The relationship between NSSEC and mortality was more tenuous, with only those not currently working having an excess mortality risk, once adjustment was made for all other demographic and socio-economic characteristics. A graded relationship between mortality risk and relative deprivation of area of residence was observed even after adjustment for demographic and socio-economic factors; however, it was attenuated with further adjustment for health status.

There were relatively few deaths (57) among those born in Wales, making it more difficult to detect statistically and clinically significant associations. Adjusting for age and sex (Table 2), the Scottish born had higher mortality rates than those born in Northern Ireland, while other migrant groups had lower mortality than the Northern Ireland born. For example, those born in Scotland were 8% more likely (HR=1.08; 95% CI=0.98–1.18) to have died in the follow-up period than the Northern Ireland born. Conversely, those born in England were 14% less likely to have died in the follow-up period than the Northern Ireland born (HR=0.86; 95% CI=0.81–0.91); those from the Republic of Ireland were 17% less likely to have died (HR=0.83; 95% CI=0.78–0.88), while those born outside the British Isles were 22% less likely to have died (HR=0.78; 95% CI=0.71–0.87).

With the exception of the Scottish born, adjusting for the demographic and socio-economic characteristics (Model 2) and health status (Model 3) of the cohort attenuated the differences between the groupings, though in the fully adjusted model, those born in the Republic of Ireland continued to be significantly less likely to die in the follow-up period than the Northern Ireland born. After adjusting for the demographic, socio-economic and baseline health status of the cohort, the excess mortality among the Scottish born increased (HR=1.15; 95% CI=1.05–1.27).

The five major causes of death included in the analysis – IHD, stroke, respiratory, cancer and external causes, accounted for 75% of all deaths to the cohort in the follow-up period. Cancer accounted for 49.1% of these deaths, while IHD accounted for almost 25%. Mortality risk by country of birth differed depending on the cause of death examined (Table 3). Compared to the Northern Ireland-born residents, risk of IHD was lower for the Republic of Ireland (HR=0.74; 95% CI=0.64–0.86) and English (HR=0.85; 95% CI=0.73–0.99) born, even after adjusting for a wide range of demographic and socio-economic characteristics. Migrants from outside the British Isles recorded lower levels of both IHD (HR=0.74; 95% CI=0.57–0.97) and stroke (HR=0.58; 95% CI=0.35–0.96). Conversely, the Scottish born had significantly higher rates of IHD (HR=1.42; 95% CI=1.17–1.72), and an elevated risk of a respiratory death, though that did not reach conventional levels of significance. The small numbers of deaths among the Welsh-born migrants renders the estimates for cause-specific mortality unreliable.

Table 1
Demographic and socio-economic characteristics of the study population at the time of the census.

	<i>Northern Ireland</i>	<i>England</i>	<i>Scotland</i>	<i>Wales</i>	<i>Republic of Ireland</i>	<i>Outside the British Isles</i>
Total population	837,646	38,725	10,797	1846	25,413	15,792
Age						
25–34	23.8	30.7	25.4	28.8	17.4	36.0
35–44	25.1	30.0	27.5	24.5	19.0	30.4
45–54	20.9	19.1	19.6	21.8	21.4	16.0
55–64	17.3	13.0	15.6	15.0	22.3	8.2
65–74	13.0	7.5	11.9	9.9	20.0	9.5
Sex						
Male	48.4	52.2	50.6	57.2	37.0	47.6
Female	51.6	47.8	49.5	42.9	63.0	52.4
Marital status						
Single	20.9	19.1	16.3	15.2	16.2	21.4
Married	64.2	64.7	65.7	69.0	67.5	65.3
Separated	4.7	5.6	5.7	4.7	4.7	4.4
Widowed	5.1	7.4	7.1	7.2	3.8	5.3
Divorced	5.2	3.3	5.2	3.9	7.9	3.6
Tenure						
Owner-occupier	78.7	68.5	65.6	66.6	78.7	67.1
Private rent	5.2	15.1	15.4	17.0	8.5	20.0
Social renter	16.2	16.5	19	16.4	12.8	12.9
Car availability						
Two or more	41.1	37.8	34.6	37.7	42.6	38.0
One	43.4	48.5	48.5	50.4	44.4	46.4
None	15.5	13.7	16.9	11.9	13.0	15.6
Education						
Degree	16.1	23.3	20.1	23.4	23.3	38.8
To A Level	5.8	8.5	8.3	9.6	7.1	8.0
To GCSE+	13.5	16.3	14.4	17.5	13.8	12.8
To GCSE	16.3	21.6	16.9	18.6	8.6	13.7
No qualifications	48.3	30.3	40.3	30.9	47.2	26.8
NSSEC						
Professional	27.8	38.9	36.9	41.9	36.1	40.0
Intermediate	11.6	13.0	11.9	13.8	9.5	10.6
Own account	10.5	7.4	5.8	5.3	9.7	11.1
Lower supervisory	9.3	8.9	9.5	9.6	6.7	6.9
Routine	33.7	26.7	30.0	24.2	28.2	21.3
Not working	6.6	4.5	5.3	4.6	9.0	6.5
Full time students	0.4	0.6	0.6	0.6	0.8	3.7
Relative affluence						
Least affluent quintile	20.9	13.8	13.0	10.7	24.6	9.9
2nd	20.7	21.0	19.8	21.0	21.5	18.4
3rd	20.2	22.6	24.2	24.6	21.5	24.3
4th	20.1	22.2	21.5	21.4	18.1	23.0
Most affluent quintile	19.0	20.4	21.6	22.4	14.3	24.4
LTI						
No	75.2	80.0	77.0	81.0	74.1	85.5
Yes	24.8	20.0	23.0	19.0	25.9	14.5
General health						
Good	61.8	66.6	63.4	69.2	62.2	72.6
Fair	24.0	21.9	23.9	20.9	24.0	19.5
Not good	14.2	11.5	12.7	9.9	13.8	8.0

4. Discussion

Northern Ireland is a relatively isolated part of the UK and traditionally high unemployment levels and years of civil unrest may have acted as a deterrent to inward migration. Perhaps for these reasons Northern Ireland is the least diverse part of the British Isles with 8% of its resident population born outside its boundaries. Equivalent 2001 Census figures for England, Wales, Scotland and the Republic of Ireland were 13%, 25%, 13% and 11%, respectively. 80% of migrants to Northern Ireland are from either Great Britain or the Republic of Ireland and some, like the Scots or Irish, have settled in geographical locations patterned probably by history and kinship.

While migrants generally tend to have a younger age profile (Champion et al., 1998), in this study migrants from the Republic of Ireland were generally older than the Northern Ireland-born population. It is not known if this reflects patterns of earlier migratory flows that have settled and aged, or a more recent migration of older people. While it is postulated that migration poses significant hurdles that tend to select younger more healthy individuals these descriptions are based on studies of long distance international migrants rather than the more local migrations described here. With the exception of Scottish migrants, mortality was generally lower for migrant groups though much of this is associated with higher socio-economic status: adjustment for a range of socio-economic indicators increased mortality levels of all other groups,

Table 2

All cause mortality by country of birth: hazard ratios (HR) and 95% confidence intervals from Cox proportional hazards analysis.

	Deaths (number)	Adjusted for age and sex	Model 2	Model 3
Country of birth				
Northern Ireland	36,350	1.00	1.00	1.00
England	1064	0.86 (0.81, 0.91)***	0.97 (0.91, 1.03)	0.96 (0.90, 1.02)
Scotland	465	1.08 (0.98, 1.18)	1.13 (1.03, 1.24)**	1.15 (1.05, 1.27)**
Wales	57	0.81 (0.62, 1.05)	0.90 (0.69, 1.18)	0.96 (0.74, 1.26)
Republic of Ireland	1188	0.83 (0.78, 0.88)***	0.90 (0.85, 0.96)***	0.92 (0.87, 0.98)**
Outside UK	387	0.78 (0.71, 0.87)***	0.91 (0.82, 1.01)	0.93 (0.84, 1.03)
Sex				
Male	22,495	1.00	1.00	1.00
Female	17,016	0.65 (0.64, 0.66)***	0.58 (0.57, 0.59)***	0.58 (0.57, 0.59)***
Marital status				
Single	6667	–	1.00	1.00
Married	22,341	–	0.80 (0.78, 0.83)***	0.77 (0.75, 0.80)***
Separated	1818	–	0.96 (0.91, 1.01)	0.87 (0.82, 0.92)***
Widowed	2303	–	0.96 (0.91, 1.01)	0.88 (0.84, 0.92)***
Divorced	6382	–	0.96 (0.93, 1.00)*	0.92 (0.88, 0.95)***
Tenure				
Owner-occupier	24,895	–	1.00	1.00
Private rent	2,078	–	1.13 (1.08, 1.18)***	1.05 (1.00, 1.10)*
Social renter	11,020	–	1.41 (1.37, 1.44)***	1.23 (1.19, 1.26)***
Car availability				
Two or more	8077	–	1.00	1.00
One	17,692	–	1.28 (1.25, 1.32)***	1.17 (1.14, 1.20)***
None	12,224	–	1.69 (1.63, 1.75)***	1.47 (1.41, 1.52)***
Education				
Degree	2781	–	1.00	1.00
To A Level	827	–	1.12 (1.04, 1.21)**	1.07 (0.99, 1.16)
To GCSE+	2760	–	1.15 (1.09, 1.21)***	1.11 (1.05, 1.17)***
To GCSE	2275	–	1.17 (1.10, 1.24)***	1.10 (1.03, 1.16)**
No qualifications	30,868	–	1.33 (1.27, 1.40)***	1.15 (1.10, 1.20)***
NSSEC				
Professional	7472	–	1.00	1.00
Intermediate	3335	–	1.04 (1.00, 1.09)*	1.03 (0.99, 1.08)
Own account	3857	–	0.98 (0.94, 1.02)	0.98 (0.94, 1.02)
Lower supervisory	4310	–	1.10 (1.05, 1.14)***	1.03 (0.99, 1.07)
Routine	15,835	–	1.09 (1.05, 1.12)***	1.03 (1.00, 1.07)
Not working	4680	–	1.26 (1.21, 1.31)***	1.19 (1.14, 1.24)***
Full time students	22	–	0.67 (0.44, 1.02)	0.69 (0.46, 1.05)
Relative affluence				
Most deprived	9803	–	1.00	1.00
2nd	8912	–	1.06 (1.02, 1.10)***	1.03 (0.99, 1.06)
3rd	7806	–	1.10 (1.07, 1.14)***	1.04 (1.01, 1.08)*
4th	6894	–	1.16 (1.12, 1.20)***	1.06 (1.03, 1.10)***
Least deprived	6096	–	1.22 (1.17, 1.260)***	1.05 (1.01, 1.08)*
LLTI				
No	14,752	–	–	1.00
Yes	24,759	–	–	1.49 (1.44, 1.53)***
General health				
Good	10,456	–	–	1.00
Fair	12,828	–	–	1.40 (1.36, 1.44)***
Poor	16,227	–	–	2.32 (2.24, 2.40)***
Log likelihood	–	–514,463.3	–491,219.7	–487,237.9

Model 2: Adjusted for age, sex, marital status, tenure, car availability, education, NSSEC and relative affluence of area of residence. **Model 3:** Model 2 with further adjustment for LLTI and General Health.

Statistical significance:

* < 0.05.

** < 0.01.

*** < 0.001.

although the Republic of Ireland born maintained significantly lower mortality rates.

The lower mortality observed in some migrant groups could be due to a number of factors: a healthy migrant effect; better levels of general health in the home country than the host country; or becoming 'lost to follow-up' – where ill migrants return to their home country without informing the host authorities, and

thereby do not appear in the morbidity or mortality statistics (Weitofel et al., 1999). As previous work has shown death rates to be broadly comparable in the Republic of Ireland and Northern Ireland (NISRA and ONS, 2008), it is likely that the health advantage of those born in the Republic of Ireland but living in Northern Ireland is explained by a healthy migrant effect or the loss to follow-up. Conversely, the health disadvantage of the

Table 3

Cause specific mortality by country of birth: hazard ratios (HR) and 95% confidence intervals from Cox proportional hazards analysis with adjustment for age, sex, marital status, tenure, car availability, education, NSSEC, LLTI, general health and relative affluence of area of residence.

	<i>Cause of death</i>				
	IHD (7401)	Stroke (2386)	Respiratory (3724)	Cancer (14,633)	External (1655)
Northern Ireland	1.00	1.00	1.00	1.00	1.00
England	0.85* (0.73–0.99)	1.17 (0.93–1.48)	0.89 (0.71–1.11)	1.02 (0.92–1.12)	0.84 (0.64–1.11)
Scotland	1.42*** (1.17–1.72)	0.74 (0.46–1.17)	1.29 (0.97–1.72)	0.98 (0.83–1.15)	1.09 (0.70–1.69)
Wales	0.83 (0.43–1.60)	2.71** (1.41–5.21)	1.26 (0.57–2.81)	0.86 (0.57–1.34)	1.04 (0.33–3.22)
Republic of Ireland	0.74*** (0.64–0.86)	0.79 (0.62–1.01)	0.88 (0.73–1.06)	1.04 (0.95–1.13)	1.13 (0.84–1.53)
Other	0.74* (0.57–0.97)	0.58* (0.35–0.96)	1.07 (0.77–1.47)	0.99 (0.85–1.16)	1.24 (0.84–1.82)

Statistical significance:

* < 0.05.

** < 0.01.

*** < 0.001.

Scottish born likely relates to poorer levels of health in the home country. For the countries within the United Kingdom, data from the Office for National Statistics has shown standardised mortality ratios to be lowest in England, followed by Wales and Northern Ireland (whose rates are similar) and highest in Scotland (Collins et al., 2008). In particular, rates of IHD have been shown to be significantly higher in Scotland than England, a trend mirrored here for the Scottish born residing in Northern Ireland. Information on variations in lifestyle are not available in the current dataset but Mitchell et al. (2005) have demonstrated that levels of conventional risk factors do not explain the higher rates of ischaemic heart disease in Scotland than in England. Given the diversity of countries included in the born outside the British Isles category it is not possible to explain their health advantage from this analysis, though it may be that selection effects for longer distance migrants plays a part in explaining health differences.

At the 2001 Census there were relatively few immigrants from countries other than Great Britain or the Republic of Ireland, and cause specific analysis for this group produced estimates with correspondingly wide confidence intervals. While this is a current difficulty, longer periods of follow-up will allow more robust cause-specific analyses to identify differentials between migrant groups – an important consideration in explaining differences and in establishing appropriate distributions of healthcare resources. While there is no official record of the numbers of immigrants to Northern Ireland, there has been an influx in recent years, especially since the ascension of various Eastern European countries to the European Union. It is likely that this large increase from countries other than near neighbours will have important implications for the health and demographic profile of Northern Ireland and the operation of its health system.

This study has a number of potential weaknesses. Information relating to migration patterns is limited; in particular there is no information on when the migration occurred and this might be important in assessing if the increased risk for IHD amongst those born in Scotland was largely attributable to early life factors accrued in Scotland or lifestyle factors whilst resident in Northern Ireland. Similarly without knowledge of when migration occurred it is not possible to determine if the lower mortality amongst the migrants from Republic of Ireland represents recent selective migration or a healthy surviving subset from an early cohort of migrants. The inclusion of more detailed questions in previous censuses has enabled researchers to explore the health of both immigrants and the subsequent experience of their descendants and to track the persistence of health disparities over time (Raftery et al., 1990; Harding and Balarajan, 1996, 2001). A further limitation is a lack of knowledge of the extent to which assimilation, including inter-marriage has occurred. The method of data

collection may also present a problem: data was collected at Census, a relatively burdensome survey especially for those for whom English is not the first language. This may result in a bias if some groups systematically do not fully complete the census form (or do not return one at all). Finally, no adjustment was made for multiple hypotheses testing in the analysis, although this is unlikely to impact on the results of the cause specific mortality analyses.

In summary, immigration to Northern Ireland has increased in recent years. At the 2001 Census the majority of such migrants were from either the rest of the UK or the Republic of Ireland. While English-born residents in Northern Ireland recorded lower mortality levels and the Scottish born higher mortality levels than those Northern Ireland-born, other migrant groups showed little difference. Contrary to expectations the shorter distance migrants from the Republic of Ireland had lower mortality risk. The forthcoming 2011 Census in Northern Ireland will include a question about the date of entry to the country, which will allow better classification of migratory patterns and provide better clues as the origins for the observed patterns of illness. Previous studies have demonstrated a marked geographical segregation along religious and cultural lines (O' Reilly and Rosato, 2008) and it might be useful in future studies to see if migrants, and especially the Scottish born, gravitate to certain areas, as this would help identify areas with higher need and therefore potentially better targeting of public health interventions.

Competing interests

None

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