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The contribution of migration to changes in the distribution of health over time: Five-year follow-up study in Northern Ireland

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Abstract

A number of recent studies have highlighted the potential contribution of migration to increasing inequalities in health between areas with different levels of deprivation. Some of these studies have reported that increasing inequalities between areas can, at least partly, be explained by selective migration. Both mortality and morbidity have been used as indicators of health status, but many of the studies focusing on morbidity have suffered from specific methodological problems, including the use of self-reported health measured after migration had occurred, thereby ignoring the possible effect that migration itself may have on health and the reporting of health. This study used general practice records assessed prior to movement, an arguably more objective measure of health status, from 40 general practices, to determine whether selective migration influenced the distribution of health in Northern Ireland between the years 2000 and 2005. Evidence of selective migration was found in the study, with migrants often having significantly different levels of health to non-migrants. However, overall migration within this cohort did not substantially alter the distribution of health through time, partly because the migrants out of the deprived and affluent areas were replaced by in-migrants with similar levels of health. The absence of an effect of migration in this instance should not be used, however, to conclude that migration effects are unimportant in assessing changes in inequalities through time. Rather, migration should be viewed in the context of the underlying population dynamics, which at the time of this study were characterised by a process of urban regeneration. Varying population movements, operating at different times and locations, require that the effects of migration be considered in all studies which examine changes in the spatial distribution of health.

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Keywords: Northern Ireland; Selective migration; Health inequalities; Morbidity; UK

Introduction

A number of studies in recent years have showed an increased polarisation of health between areas; examples within the UK include Dorling (1997), Dorling, Davey Smith, and Shaw (2001), McLoone and Boddy (1994), Phillimore, Beattie, and Town-

send (1994) and Shaw, Davey Smith, and Dorling (2005), and outside the UK, include Geronimus, Bound, and Waidmann (1999), Michelozzi et al. (1999), and Singh (2003). Many of these studies have used mortality as the health outcome measure but the presumption is that an increase in the differentials in morbidity levels have also occurred. A common methodology for measuring changes in inequalities is to use ecological studies repeated at two separate time periods. This methodology is currently used by both the Department of Health in

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England and Wales (Department of Health, 2003) and the Department of Health, Social Services and Public Safety (DHSSPS) in Northern Ireland (Department of Health, Social Services and Public Safety, 2002) and involves the use of the same assessment tools to produce a snapshot of health or inequalities in health at the two points and comparing for any changes. The justification for this approach has been that it is a fair comparison as the areas (or groups of areas) are unchanged and the same instruments have been used to assess the population. However, such comparisons may not be reasonable if the populations being compared have changed. One important way that populations change over time is through migration and if the health of the migrants (in and out of an area) differs systematically from that of the non-migrants, then the average level of health of an area can change while the health status of the individuals remain constant. For example, if it is the more wealthy (and healthier) who leave deprived areas, then an ecological study of inequalities will show a decline in the average health status of that deprived area and a likely increase in inequality across areas. This increase in inequality would not be due to an improvement or deterioration in the health status of any individual or group of individuals but rather to the selective movement of individuals between areas with different levels of deprivation.

The premise that population movement may significantly influence the spatial distribution of health is not new. Farr (1864) indicated the possible impact that health selective migration may have on cross-sectional comparisons of mortality rates between areas, and Hill (1925) commenting on selective migration between urban and rural areas, noted that *"not only is it the stronger element that tends to migrate, the weaker element that tends to remain at home, but that this stronger element secures a higher economic position in the towns, while the weaker element in the country is subjected to worse housing conditions and to a lower diet"*. The effects were explored by Fox and Goldblatt (1982) in their first report on socio-demographic differentials from the Office for National Statistics Longitudinal Study, though by 1998, Davey Smith, Shaw, and Dorling were still commenting that population change was an important factor that had not been sufficiently investigated in relation to spatial patterns of mortality.

A number of studies over the last two decades have attempted to quantify the impact of migration

on spatial gradients in health, but these have produced conflicting results. For example, a study by Brimblecombe, Dorling, and Shaw (1999) concluded that migration explained all of the observed inequalities in mortality between districts in Britain; while a later study by Boyle, Exeter, and Flowerdew (2004) found that the widening mortality gap in Scotland between 1981 and 2001 could not be explained as an artefact of population change. While both of these studies focused on mortality as the outcome measure, a similar study by Norman, Boyle, and Rees (2005) examined both mortality and morbidity, with the later being assessed by responses to the limiting long-term illness question in the census. That study compared the mortality and morbidity gradients across the deprivation spectrum for people in 1991 with the gradients for the same group of people in 1971. They found that, particularly for limiting long term illness, the gradient was steeper in 1991 than it would have been had people remained in the same deprivation circumstances they were experiencing at the time of the 1971 census, suggesting that migration had explained some of the increase.

Many of the studies, investigating the effects of migration on patterns of morbidity, have suffered from two related methodological problems; one concerning the use of self-reported measures of health and the other with the potential effect of change of residence on health status. There is therefore a potential for both confounding, if the tendency to migrate and reporting of health are in some way related, and reverse causation, if migration influences reported health. The measures of morbidity used were usually based on self-report, which is known to reflect both the expectations of health and the experience of it (Calman, 1984) and an increasing number of studies (such as Bentham, Eimermann, Haynes, Lovett, & Brainard, 1995; Boyle & Duke-Williams, 2004; Norman et al., 2005; O'Reilly, Rosato, & Patterson, 2005) have indicated that the perception and reporting of health may be influenced by demographic, socio-economic and cultural factors. This subjectivity of the morbidity measures could potentially lead to confounding if migratory propensity was related to factors that also influenced the perception and reporting of health status. For example, those who migrate may have a more optimistic outlook on life, a personality characteristic that is perhaps related to the perception and propensity to report poor self-reported health.

Secondly, moving home is a significant life event and stressor (Holmes & Rahe, 1967) that may negatively impact on an individual's health status (and maybe even the reporting of health status); even more so if the move is to an area with different social and socio-economic characteristics than the migrant is accustomed. Most of the studies investigating the impact of migration on the distribution of health (Boyle & Duke-Williams, 2004; Norman et al., 2005) used measures of morbidity which were assessed after the migration had occurred, thereby ignoring the possibility that migration per se may have influenced the perception of health status. Although there does not appear to be research evidence to prove it, it would seem reasonable to assume that self-reported health measured shortly after change of residence may not best reflect underlying health status.

The aim of this paper was to use an arguably, more objective measure of health status, assessed prior to movement, to determine whether selective migration influences the distribution of health across affluent and deprived areas through time. The specific objectives were (i) to compare the health status of migrants and non-migrants in their areas of origin and the areas to which they move; (ii) to examine inequalities in morbidity across quintiles of deprivation before and after migration; (iii) to quantify the contribution of migration, if any, to spatial inequalities in morbidity.

Methods

Data sources

The Data Retrieval in General Practice (DRGP) project

Information on morbidity was extracted from General Practices contributing to the DRGP project in Northern Ireland. The DRGP project was a sentinel network of general practices distributed across Northern Ireland, trained to record the incidence and prevalence of selected conditions on their practice computer systems. Forty of 41 practices agreed to participate. Information was extracted on all individuals registered with one of the 40 practices as of the 1 April 2000, producing a combined population of 255,403 patients (15% of Northern Ireland's population). Although these practices were self selected, previous analyses have shown a close correspondence between their demographic profiles and that for Northern Ireland as a

whole (Boydell, Grandidier, Rafferty, McAteer, & Reilly 1995).

The Central Services Agency (CSA)

Information on area of residence and migration was obtained from the CSA. The CSA is the Northern Ireland equivalent to the National Health Service Central Register in England and Wales, and maintains a computerised record of all people in Northern Ireland registered with a GP.

The GP and CSA records were linked using the patient's full name, address, sex and date of birth. This was a two-stage process, to ensure the anonymity of the clinically sensitive patient information. The final dataset made available to the researchers did not contain any identifiable demographic information. A match rate of 91% was achieved, leaving 232,200 individuals for analysis. The age and sex composition of the final cohort was very similar to that of the Northern Ireland population enumerated at the 2001 Census. Fifty percent of the cohort were female; 23% were aged less than 15% and 13% were older than 65. There were no details of patient ethnicity on the GP's computer system, but less than 1% of Northern Ireland's population were recorded as non-white at the time of the 2001 census.

The electoral ward provided by the CSA was used to assign each matched individual in the General Practitioner dataset to a quintile of deprivation. Deprivation was measured using the income deprivation domain of the Northern Ireland Multiple Deprivation measure (NIMDM) (Northern Ireland Statistics and Research Agency, 2005). This is the measure that the DHSSPS use to identify deprived wards of Northern Ireland when determining whether they have achieved their target of reductions in health inequalities (Department of Health, Social Services and Public Safety, 2002).

Measures of migration

In this paper, migration was defined as a change of quintile of deprivation of residence between 2000 and 2005. People who changed electoral ward of residence but remained in the same quintile of deprivation were regarded as non-migrants, as their movements would not influence the socio-economic distribution of health through time. Information on change of address can be transmitted to the CSA in two ways. When a patient changes address and lets the GP know of the change, the GP passes details of

the new address to the CSA. Alternatively, if a patient registers with a new GP, the new GP will get in contact with the CSA and the CSA can then update its records. The CSA was therefore, able to provide details of the electoral ward of residence for each patient in the years 2000 and 2005. The ward was then used to assign each patient to a quintile of deprivation and a comparison of the quintile in 2000 with that in 2005 tells whether a particular patient was a socio-economic migrant.

Summary measure of health

The practice-based morbidity records were used to indicate the patient's recent health status. This measure involved a count of the number of significant medical conditions (Box 1) the patient had been diagnosed with between 1 April 1995 and 31 March 2000. These were aggregated into two groups "no medical condition" or "at least one

medical condition". An attempt to use an alternative cut-off of two or more conditions had to be abandoned due to the smaller number of affected patients, especially at younger ages. Diagnoses between 1995 and 2000 were chosen as diagnoses received prior to 1995 may not have been relevant to health status in 2000. Diagnoses after 2000 were excluded as they could have occurred after migration.

Statistical methods

The main measure of health status in this analysis was the indirectly standardised-illness ratio (SIR), where ill-health was defined as a diagnosis of at least one of the pre-identified medical conditions. The SIR was calculated by the method outlined by Boyle and Parkin (1991) where an SIR is defined as the ratio of the observed number of people in poor health to the number of people expected, multiplied by 100. The expected number was obtained by applying the age-specific rates for the total study population to each of the migrant and non-migrant groups.

A logistic regression analysis was used to determine the likelihood of having at least one medical condition by age, sex, practice and quintile of deprivation. These regression models assume independence of observations, an assumption that may not hold if patients' characteristics within a practice were correlated; the clustering of patients within practices could lead to an exaggeration of the precision with which associations are estimated. The initial models therefore included an adjustment for this clustering, using robust estimation in STATA (Rogers, 1993), but as the standard errors and confidence intervals increased by only relatively small amounts, indicating that the clustering within practices had affected our results little, the results from the simpler model are presented.

Results

Between 2000 and 2005, 48,103 members of the cohort (21%) changed electoral ward of residence while 28,922 (13%) changed quintile of deprivation; much of the movement was between adjacent quintiles, with for example 70% of patients leaving the most deprived quintile (quintile one) moving to quintiles two and three and only 11% moving to the most affluent quintile. Of the 28,922 people who changed quintile, 12,915 (45%) went to a more

Box 1

List of medical conditions and there associated read code used in the construction of the summary measures of health

Read code	Condition
B* (excluding B7 & B8)	Neoplasms (excluding benign neoplasms and carcinoma in situ)
C0*	Disease of the thyroid gland
C10*	Diabetes
D*	Anaemia
E*	Mental disorders
F12	Parkinsons disease
F25*	Epilepsy
F110	Alzheimer's disease
F49*	Blindness and low vision
G2*	Hypertensive disease
G3*	Ischaemic heart disease
G58*	Heart failure
G6*	Cerebrovascular disease
H3*	COPD (including asthma)
K0*	Renal failure

*Implies that all codes beginning with the code before the * are also included in this category.

deprived quintile and 16,007 (55%) went to a less deprived quintile, confirming a little net movement from deprived to more affluent areas. The next section details how the morbidity rates of migrants compared to those of non-migrants in both the quintile of origin and destination; the following section then quantifies the contribution of migration to changes in inequalities over time.

Health differences between the non-migrants and migrants

Table 1 shows how the SIRs of migrants compared to that of the non-migrants in both the quintiles of deprivation that they leave and the non-migrants in the quintiles of deprivation that they join. The SIRs were calculated for each quintile of origin and destination separately; so the comparisons are for the migrants and non-migrants in each row separately. For both the most deprived and most affluent quintiles, migrants in and out, were less healthy than the non-migrants. Within the intermediate quintiles, those that moved up to the most affluent quintile were marginally more healthy than the non-migrants, and both are significantly more healthy than those who moved to the most deprived quintile. By 2005, those that had entered the intermediate quintiles in the preceding five years, whether they had come from the most or least deprived quintiles, had higher levels of morbidity than the non-migrants.

The result of this movement on the distribution of health is not immediately apparent. For example, the loss of the less healthy from the most affluent

quintile would increase the average level of health of that quintile; but the addition of a slightly larger group with poorer levels of health would result in deterioration in the average level of health of that quintile. The overall impact of this population change would depend on how the health of the in-migrants compares to the out-migrants and the non-migrating groups, and on the numbers of people in each group. The effect of this migration on the socio-economic inequalities in health is examined next.

The contribution of migration to changes in the distribution of health over time

Table 2 shows the odds ratio of having at least one medical condition for those aged less than 74 by quintile of deprivation, in a logistic regression model adjusting for age, sex and GP practice. In the “2000 Quintile” column the distribution of health by people’s quintile of residence in 2000 is shown, while the “2005 Quintile” column shows the

Table 2

Odds ratio of having at least one medical condition (1995–2000) for those aged 0–74 by quintile of deprivation in 2000 and 2005 controlling for age, sex and practice

Quintile	2000 Quintile	2005 Quintile
Most deprived	1.453	1.453
2	1.257	1.287
3	1.246	1.257
4	1.129	1.134
Most affluent	1.000	1.000
Highest to lowest	1.45	1.45

Table 1

Standardised illness ratios for 0–74s by migrant status for the area of origin and destination (with 95% confidence intervals) and numbers of patients in each group

Quintile	Migrants up (to less deprived quintile)	Non-migrants	Migrants down (to more deprived quintile)
<i>Quintile of origin 2000</i>			
Quintile 1 (most deprived)	104 (99–110) 5900	99 (97–101) 36,878	N/A
Quintiles 2, 3, 4	98 (92–104) 5032	99 (98–101) 105,897	127 (118–137) 2974
Quintile 5 (most affluent)	N/A	98 (96–100) 53,504	120 (113–127) 5431
<i>Quintile of destination 2005</i>			
Quintile 1 (most deprived)	N/A	100 (97–102) 36,878	106 (99–114) 3340
Quintiles 2, 3, 4	124 (117–131) 5021	99 (98–100) 105,897	102 (95–108) 5065
Quintile 5 (most affluent)	117 (111–124) 5911	98 (97–100) 53,504	N/A

SIRs were calculated for each quintile of origin and destination separately; so the comparisons are for the migrants and non-migrants in each row separately.

distribution of health for the same time period (1995–2000) by quintile of residence in 2005. The expected socio-economic gradient is observed, with those in the most deprived quintile having a 45% excess in ill-health relative to those in the most affluent quintile; the gradient is also observed across the intermediate quintiles. However, the distribution of health across the quintiles was largely unchanged, whether the 2000 or 2005 quintile of residence is used, indicating that migration has had little part to play in changing the distribution of health over this time period. Previous research has shown that the relationship between health status and migration varies according to age, so the analysis was also conducted for those aged over 75. As expected, the magnitude of health inequalities across deprivation quintiles was smaller at older ages, but the contribution of migration to changes in inequalities over the time period was, as with the younger age group, found to be minimal.

While the previous section shows that the health of migrants differ significantly from that of non-migrants, the overall conclusion was that the net migratory changes had not substantially altered the distribution of health across the deprivation quintiles in Northern Ireland over time. There are a number of reasons why this may be the case, with [Table 1](#) providing evidence of one possible explanation: that those who move to more affluent areas may be healthier than those they leave behind, but they are less healthy than those they join. Depending on the number of migrants, such movements could be responsible for a narrowing of mortality differential through time. This is known as gradient constraint ([Blane, Harding, & Rosato, 1999](#)).

An alternative explanation of why selective migration has not contributed significantly to increase inequalities over time relates to the net migration flows. [Table 3](#) shows the SIRs calculated for the most deprived; the most affluent quintile and

the intermediate quintiles separately. The SIRs are calculated for those that remained in the same quintile for the 5-year period (2000–2005), those that moved out of that quintile and those that moved in, in the follow-up period. Generally those that entered and left tend to have similar levels of health, which was generally poorer than the non-migrants, the result of which would be to maintain the average levels of health in these areas.

Discussion

This study found evidence of socio-economic and health selective migration in Northern Ireland between 2000 and 2005. This selective migration did not however, significantly contribute to a widening of health inequalities between areas. There are a number of possible reasons for this, including the replacement of out-migrants with another group of in-migrants with similar levels of health.

The principle conclusion is in keeping with previous work ([Boyle & Duke-Williams, 2004](#); [Boyle et al., 2004](#); [van Lenthe, Martikainen, & Mackenbach, 2007](#)), which found that selective migration did not exaggerate the relationship between deprivation and health. [Boyle and Duke-Williams \(2004\)](#) found that individuals in poor health were more likely to migrate to affluent rather than to more deprived areas, and in a later paper ([Boyle, 2004](#)) suggested that the selective migration might even result in an underestimation of the relationship between deprivation and health. However, other studies, many using a longitudinal design similar to the current study, such as [Brimblecombe et al. \(1999\)](#), [Brimblecombe, Dorling, and Shaw \(2000\)](#) and [Norman et al. \(2005\)](#), concluded that migration makes a very significant contribution to the spatial gradients in health.

How might these differences be reconciled? Although some of the differences in the conclusions

Table 3
SIRs for 0–74s by quintile of deprivation and migration status (with 95% confidence intervals) and numbers of patients in each group

	People who remain in quintile over the five-year period	People who move out of the quintile between 2000 and 2005	People who move into the quintile between 2000 and 2005
Most deprived quintile	99 (97–101) 36,878	104 (98–109) 5900	106 (99–113) 3340
Intermediate quintiles	99 (97–100) 105,897	108 (102–113) 8006	112 (107–117) 10,086
Most affluent quintile	97 (95–99) 53,504	118 (111–125) 5431	115 (109–122) 5911

SIRS were calculated for each set of quintiles separately so the comparisons are for the non-migrants, in-migrants and out-migrants in each row separately.

of these studies could be explained by variations in methodology and design, we believe that the timing of the studies themselves may also be an important consideration. Previous research has demonstrated that migratory patterns in Northern Ireland, at the start of the 1990s, were very similar to those in the rest of the UK (O'Reilly & Stevenson, 2003) so it is unlikely that the effects of selective migration vary by location. It is possible that migration *did* contribute to spatial inequalities in health in previous decades but has not done so in recent years because of changes in the composition and direction of population movement. This change in population dynamics may have been especially evident around cities and large towns.

In the 1980s and 1990s the main cities of Northern Ireland shared the fate of many cities across the developed world (McGivern, 2006); they were seen as repositories of crime, social deprivation, stress, alienation and so forth and suffered huge population loss, as those who could afford to move from the centres did so (O'Reilly, Browne, Johnson, & Kelly, 2001). More recently, the development of urban regeneration initiatives has seen resurgence in the fortunes of these cities, with a reversal of the earlier population loss, rejuvenation of desolate urban areas and a gentrification of previously deprived areas. The effects of selective migration may therefore depend on the stage of the urban decline–regeneration cycle that is studied. During the earlier period of urban decline and population exodus, it is likely that selective migration played a significant role in the widening socioeconomic and health inequalities between areas. More recent years have represented a turning point for cities and the effects of migration have been neutral. If current trends continue, it is possible that in future years selective migration, in the form of gentrification, may be responsible for a narrowing of these spatial inequalities.

In this study health was ascertained prior to migration, avoiding the influence of migration on health; we also used general practitioner data, which is arguably a better, more objective measure of health status than those depending on self-report. The limitations of the study should however, also be noted. The follow-up period of 5 years was relatively short and it could be argued that the impact of migration might have become apparent had a longer follow-up period been used. However, this was a large study of over 200,000 patients, 21% of whom changed electoral ward and 13% changed

quintile of deprivation over a 5-year period, and it is more likely that the absence of a migration effect was due to the timing of the study in terms of the number and direction of population flows rather than to the duration of the study. A second problem, and one that is common to all longitudinal studies including those based on the census, relates to possible biases arising from the 9% of records that could not be linked to the CSA central dataset. However, there were no significant differences in the matched and unmatched records by age or sex, though by definition it is not possible to say how they may have differed on other parameters, including migratory tendency. It is likely that perhaps half of these records represented list inflation (Ashworth et al., 2005) where patients should have been removed from the GP's computer some time before the start of the study. Finally, there are some limitations associated with using GP data to measure population health. The data came from voluntary practices, which may differ from non-volunteering practices, though this population is known to be representative of the Northern Irish population in terms of basic demographic characteristics and urban–rural mix. It is recognized that practice-based morbidity measures are a function not only of ill-health but also of people's propensity to visit the doctor and of the doctor's diagnostic and recording habits (McAlister et al., 2004), all of which may vary between doctors and practices, though the use in the analysis of wide diagnostic categories and the statistical adjustment for clustering within practices would make such variations unlikely to bias the main study findings.

This study has shown that selective migration has not significantly altered the spatial distribution of health in Northern Ireland between 2000 and 2005. This is not to say that migration effects are unimportant; on the contrary we suggest that the magnitude and direction of these effects will depend on the underlying population dynamics, which will undoubtedly change over time. The effects of migration should be therefore considered as a possible explanation in all studies examining the changes in the spatial distribution of health inequalities.

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