Modelling Mortality from Self-Reported Health and Disability Data: A Multi-Scale Report from Ireland, 2011-2016

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1. SUBJECT

The main subject of this paper is to model relationships between mortality and morbidity within Ireland between 2011 and 2016. Such relationships are well-established and there has always been a strong associational relationship between the two measures; this has been less tested at an aggregate areal scale than one might expect (McIntyre, Ellaway and Cummins, 2002). Typically, places that have high levels of morbidity tend to produce high levels of mortality, with the most common causal factors associated with low socio-economic status (SES), high levels of poverty and deprivation (Boyle et. al., 2004; Brown et. al, 2017). Debates within social and health geographies focus on the relative importance of context (the place) or composition (the people in a place) in explaining spatial variations (Pickett and Wilkinson, 2015). Arguments for the importance of context require good data at a fine enough scale of analysis to get as close to neighbourhood level as possible. An ongoing constraint is that access to data at meaningful spatial scales can be difficult (Foley and Kavanagh, 2016).

2. OBJECTIVES

This paper presents data from Ireland on mortality, collected for the first time at an intermediate level geography and, models this against morbidity data based on self-reported health and limiting long-term conditions (illness and disability, or LLTC). Data is also available for two different time-periods from administrative records and from five-yearly censuses. Three scales of geography are used, intermediate area (IA), electoral division (ED) and small area (SA). The novelty of the paper is that this is the first time testing out associations of mortality and morbidity data in Ireland over two time-periods, as the relevant data has not been available before now. The aim of the piece is to identify whether any strong associations emerge to prove the relative importance of context. A further objective was to provide some additional nuanced

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results by cause of death to see if there were stronger relationships for these specific indicators. While a number of additional constraints were identified, at the heart of the work was the identification of the value of aggregated mortality data and its capacity to be modelled at an area-level spatial scale, notwithstanding some known modifiable areal unit problems (Schuurman et. al., 2007; Rigby et. al., 2017)

3. DATA AND METHODOLOGY

Core data was downloaded from the national Census (2011 and 2016) for all the lower two scales, ED and IA. Questions on self-reported health were asked for the first time in 2011 and again in 2016, based on a five part Likert scale (Very good – good – fair – bad – very bad). The final LLTC variable, based on specific census questions, was an amalgamated count/rate of all people who recorded a range of disabilities and illness conditions including hearing and visual impairments, mental and physical health problems and chronic illness, as well as the extent to which these conditions impaired them in carrying out basic daily tasks. Individual level mortality records were collected from the Central Statistics and General Registrar's Office. These were cleaned and geo-referenced to a newly-created intermediate level geography (IA, n=410, average population=10,900). The value of the aggregation provided data protection and security as well as better matching of uncertain addresses. Mortality data was available for all deaths (SMR) and premature death (ASR), as well as for four different causes of death (essentially the main 'killers' in Ireland), namely; stroke, cancer, heart and respiratory conditions. Self-reported health was mapped in three ways: firstly, as a combined rate for poor health status (an amalgamation of the three lower categories, fair to very bad); secondly, as a weighted health score (the KFIW Index: values for very good health were given the lowest weighting and values for very bad health the highest) and, finally, as a single combined indicator for LLTC. Given there was a nested relationship between the scales, redistricting techniques using union/dissolve commands, were used in GIS to scale from the bottom up, to enable direct comparisons at IA scale for all the variables.

4. RESULTS

The initial mapped patterns at IA level showed different patterns across the country. The SMR Under 75 (a measure of premature mortality) rates ranged nationally from 33 to 229, with the higher values, in some cases, twice the national average, occurring in a mix of rural and urban settings, though with a strong urban association with areas associated with high levels of deprivation (Rigby et. al., 2017). The morbidity data showed a similar pattern and again showed the highest values in the more remote rural areas and in poorer parts of cities. Rates for people with overall poor health averaged around 10% with higher rates in urban areas, while the KFIW scores had a mean of 145.5 with a fairly narrow range (128 to 171) and was effectively an inverse health score, i.e. those EDs with the highest score were the areas with the highest levels of poor health. The LLTC data for 2016 averaged around 13% and was a significant increase from 9% recorded in 2011. It is reasonable to surmise that this increase was down to a shift in the percentage of the population living to older ages, but within which identifiable health needs were visibly increasing.

The main aim of the paper was to measure associations and these were derived from correlation/regression modelling at the smaller IA scale, for the dependent variables, poor self-reported health, KFIW index score and high levels of LLTC. Overall the scores for the ASRs and MSRs produce the best results, with the strongest relationships evident for premature mortality against poor self-reported health (0.417, 0.437) but even for all age mortality the associations are significant and reasonably large (0.342, 0.336). The relationships with the KFIW Score are weaker and in the cases of all age ASR and MSR, not significant, while the measures are lower for premature mortality (0.204, 0.215). The results for LLTC, somewhat surprisingly, are weaker again and we feel this may also be due to an artefact in the aggregation of that data, where the combination of a range of conditions and severity levels have the effect, in data terms of cancelling each other out. In the case of the individual cause of death data, the associations are relatively low, though with some variations. Pearson's Correlation values (statistically significant) between the dependent variables and heart disease were the highest (0.353, 0.335, 0.211) with the next highest associations recorded against cancers (0.294, 0.261) and respiratory disease (0.288, 0.257). In the case of these latter two causes of death, the LLTC data was not significant. Statistics for the associations with stroke were not statistically significant and were the lowest of the set for health and KFIW measures (0.134, 0.126). The results identified that associations were statistically significant and of mixed magnitude, but had relatively low r-squared values. The associations were strongest for premature (under 75) mortality, while additional correlations for cause of death were lower again. From this, we concluded that the self-reported health/LLTC statistics, while of some potential explanatory value, were not especially useful as predictive variable.

4. CONCLUSIONS AND SUMMARY

In terms of showing the relative importance of context in explaining associations between mortality and morbidity, we would have to say the results suggest that, for spatially aggregated Irish data, this is, at best, a limited association. The importance of wider structural factors, associated with poor SES, high unemployment and the compositional effects of poverty and deprivation would seem to be equally and potentially more important. The work is still of value for comparative analyses in the the British Isles other parts of Europe including Andalucía. A second conclusion from the analysis concluded that the self-reported health statistic, modelled for the first time, was limited in its value as a predictive variable when aggregated up at national level. Suggestions for improvement would be to take into account deprivation as a second explanatory factor operating within cross-sectional work (Cairns, Curtis and Bambra, 2012). One surprise was our expectation of the LLTC category as being a good predictor of mortality, or at least a variable with relatively high levels of association, as noted elsewhere in the literature (Boyle, et. al., 1999, 2004). The data used was an amalgamation of individual questions and that has introduced an effective data artefact. Better results might emerge from individual discrete variables on physical and emotional health and chronic illness and model these, though this would involve a lengthy data request and secure environment work and this would be work for future research. A final important policy finding of the work was the potential for the IA level geographies, a scale never used before for the collection of health data, to be a potentially valuable in-between scale for future health data research. Finally, modelling at different spatial scales might act as a useful guide for comparative analysis in Andalucía and other regions of Spain, where spatial scales may be similar in terms of size and scale.

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