A Multilevel Model of the Prevalence of Depression in Ireland

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Summary

The conventional wisdom is that mental illnesses are more prevalent in urban settings. Traditionally this variation has been attributed to differences in the demographic and socioeconomic characteristics of individuals within urban areas. However, the past two decades has seen a growing interest in the effects places of residence have on mental health. This paper uses multilevel models to examine the relative importance of the compositional and contextual differences across differing urban and rural spaces on depression in Ireland.

Key words: Depression, Urban-rural differentials, compositional and compositional effects, multilevel modelling, Ireland

1. Introduction

The conventional wisdom is that mental illnesses are more prevalent in urban settings. Traditionally this variation has been attributed to differences in the demographic and socio-economic characteristics of individuals and levels of deprivation within urban areas (Rejneveld and Scheme, 1998). However, it is also recognised that cases of mental health disorder may be under enumerated in rural areas (Philo et al., 2003). However, recent studies in the UK on rural/urban rates of psychiatric morbidity have indicated that there is little evidence of geographical variation between urban and rural areas in the prevalence of the most common mental disorders of anxiety and depression, even when socio-economic differences are accounted for (Paykel et al., 2000; Wainwright & Surtees, 2003; Weich et al., 2003, 2005). In Ireland, recent research using a spatial microsimulation model to produce a small area level profile of depression by Morrissey et al., (2010) found a higher prevalence of depression in the rural areas of the North-West, South West and West of the country. Following on from this work, this paper aims to examine if this differentiated spatial pattern in rates of depression in Ireland and if so, whether this is at the individual (compositional) or area (contextual) level. Multilevel models (MLM), unlike single-level linear models, are able to explore the relative size of variance at differing spatial scales level, the amount of residual variance explained by introducing explanatory individual and area variables, and interactions between exposures at different levels. Using data from the Quarterly National Household Survey (QNHS) 2007 and the Census of Population 2006 within a MLM this paper provides the first empirical analysis of both individual and area effects on rates of depression in Ireland.

2. Data

The QNHS is a representative dataset for the whole of Ireland focusing on labour force participation. However, while the main purpose of the QNHS is the production of quarterly labour force estimates, there is also a provision for the collection of data on social topics through the inclusion of special survey modules. In Quarter 3, 2007, a special module on health and health service utilisation was included; the data included in that module provides the basis of this paper. The QNHS Health survey contained 20,255 and included a variety of medical health status, health conditions and health utilisation data, as well as demographic and socio-economic data. Of interest to this paper is that the survey contained a specific question on depression (self-reported), whether the individual lived in an urban or rural area, along with the demographic and socio-economic variables, including age, gender,

principle economic status and education level. Examining the depression variable, it was found that in 2007, 4% (809 individuals) of the Irish population reported having being diagnosed with depression. The QNHS also contains a spatial identifier; an urban/rural variable. The urban/rural variable is broken down into an eight category variable. The spatial categories included are depicted in Table 1.

Table 1. Urban/Rural Identifier in the QNHS

Urban/Rural Location	
Cities	Suburbs of cities
Mixed urban/rural bordering on the suburbs of cities	Towns and their environs with populations of 5,000 or over
Mixed urban/rural bordering on the environs of larger towns	Towns and their environs with populations of 1,000 to 5,000
Mixed Urban/Rural	Rural

With regard to contextual effects, data will be taken from the 2006 Census of Population (CoP). The CoP 2006 is delineated across a number of spatial scales; region, county, small area, electoral division level and specific to this paper urban/rural districts. Data may be extracted from the CoP and delinated according to the urban/rural category within the QNHS. The contextual variables included in this analysis are therefore taken from the Census. These variables include the aggregate urban/rural eight category rates of employment, unemployment, retirement, carer duties, university education, disability, male married, female married, male plus 75 years of age and female plus 75 years of age. Thus, using data from the QNHS and the CoP provides sufficient data to examine both the compositional and contextual variation in depression between differing urban and rural areas.

3. Methodology

Using multilevel logistic models, depression may be analysed as a binary outcome, whereby the first stage involves fitting a simple variance component model (null model) to identify the two components of variation: that between urban and rural residences and that between individuals within urban and rural residences. In the second and third stages, individual- and area-level exposures, respectively, were added as fixed effects to the model and changes in variances noted. However, as the outcome variable within this paper is binary; its properties differ from those of continuous, normally distributed outcomes. In particular, the variance associated with the intercept term is neither constant across groups nor independent of the mean value within groups. Therefore, it is not possible to ascertain the true variance of the intercept term at higher levels or (hence) to directly quantify total variance associated with models of this nature (Weich et al., 2005).

These difficulties are overcome by means of a logistic model based on the notion of a continuous latent variable, in which a threshold defines the binary outcome (Weich et al., 2005). An underlying standard logistic distribution of $\pi^2/3 = 3.29$ for the binary outcome at the individual level (level 1) is assumed and the proportion of the total unexplained variance occurring at level 2, ε_o^2, is estimated as $\varepsilon_o^2/(\varepsilon_o^2 + 3.29)$. Numerically, this proportion is equal to the intra-class correlation coefficient (ρ) or the correlation between values for two randomly selected persons (at level 1) within randomly selected urban/rural districts (level 2). In each of the logistic models, the constant term is the logistic (log of the odds) of a person in the base (reference) category having depression. The prevalence of depression (p) in this group is estimated from the constant term in the null model, which is equal to $\ln(p/1 + p)$.

To quantify the proportion of variance explained by known risk factors for depression, the predicted value of the (assumed) underlying continuous latent variable is modelled using an equation with both fixed (intercept plus regression coefficients for explanatory variables) and random parts. The proportion of variance explained at level 1 is estimated as the proportion of total variance attributable to the fixed part of a model that included individual-level explanatory variables, divided by the total variance in the underlying latent variable. The total variance (in models 2 and 3) is equal to the sum of

the variances of the fixed part of the model and the (unexplained) variances at each of the higher levels (Weich et al., 2005).

4. Discussion

This study will be the first to estimate variance in the prevalence of depression at the individual and urban-rural level in Ireland. Using an eight category urban/rural variable, rather than the traditional two category urban/rural dichotomy will ensure that heterogeneous variability within, as well as across, urban/rural areas is more aptly captured. The contextual heterogeneity between the differing urban and rural categories will be further encompassed through the addition of interaction variables. This will allow the analysis to examine the compositional, contextual and the interacting relationship between contextual and compositional determinants on levels of depression in Ireland.

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5. Biography

Karyn is a Lecturer in human geography in the University of Liverpool. She completed her Ph.D. entitled 'Access to Health Care Services in Rural Ireland' in 2008 with the School of Geography, University of Leeds. Much of her work to date has been interdisciplinary primarily in the fields of computational methodologies, health and environmental economics.