A needs index for mental health care in England based on updatable data

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Abstract Background Mathematical models relating rates of mental health care use to population characteristics such as social deprivation are widely used in both planning and researching mental health services. The models currently in wide use in England are based on data mostly derived from the 10-yearly population censuses. These are perceived to be out of date many years before new census data are available for their replacement. A new set of government deprivation monitoring statistics based mainly on annually updatable data has recently been developed. This study set out to produce a mental illness needs index based on these new data. Methods A series of regression models were tested using individual domain scores from the DETR Index of Multiple Deprivation and the Office of National Statistics area-type classification as independent variables to predict 1998/9 psychiatric admission rates for broad diagnostic groups for 8251 of the 8414 electoral wards in England as dependent variables. Results The distribution of admission numbers in wards showed a pattern of over-dispersion with an excessive number of zero values for conventional regression approaches. A two-stage ‘hurdle’ model was, thus, adopted, predicting first the likelihood that wards would produce any admissions and second the probable number. This produced satisfactory predictive power, with residual variance showing strong geographical patterns associated with administrative areas, probably arising from differential resourcing or idiosyncratic clinical practice. Conclusions A website providing data on the various indicators has been provided and its uses are indicated.

Key words health service needs and demand – mental health services – epidemiology – regression analysis – England

Introduction

The prevalence of mental illness in English populations varies with a range of population characteristics that can broadly be described as social deprivation. This has planning, evaluation and resource allocation implications for both health service and social care agencies. Allowance must be made for the effect of deprivation, but to do this quantitatively requires a numerical estimate of the likely extent of its effect in any area.

There are several published accounts of indices to calculate the likely level of mental illness in specific areas either in absolute or relative terms. All start from some widely published numerical population data, mainly census variables. Using a range of mathematical regression techniques, they develop models to predict some variable characterising the prevalence of illness, usually the hospital admission rate. Indices based on census data are easily calculated for any geographical area in the country, but have the disadvantage that they can only be updated every 10 years. Other variables which have been proposed, such as standardised mortality ratios, or drug misuse notification rates (Carr-Hill et al. 1994; Jarman et al. 1992) may be difficult or impossible to obtain for relevant geographic areas.

In 1997, the then Department of the Environment, Transport and the Regions (DETR) commissioned the Department of Social Policy and Social Work at Oxford University to develop a set of deprivation indicators based on sources which could be updated annually (DETR 2000). Six domains of deprivation were identified for which nationally collected data could produce scores at electoral ward level. A composite Index of Multiple Deprivation was produced as a weighted aggregate of the domain scores. The combined index seeks to encapsulate a general concept of deprivation. However,
some components in its calculation, for example child poverty, would be expected to have at most an indirect connection with mental illness. There is also no obvious a priori way to identify the numerical relationship between increases in the combined score and increases in the prevalence of mental illness; a 2% increase in deprivation could be associated with a 1%, 2% or 10% increase in mental illness.

The key benefit of this programme for mental illness need indicator work was that it brought into the public domain a range of new types of data about the characteristics of the population of England at electoral ward level. This study set out to explore whether these new data could be used to develop a mathematical model which would predict patterns of mental health care need and use effectively.

The present work in the context of previous studies

Previous work in this area has discussed many aspects of both the choice of predictor variables and the strategies for deriving the indices. The following is not intended as a comprehensive review of this topic; rather it seeks to locate the present work within the major themes of the debate.

Choice of independent variables

Thornicroft (1991) and Carr-Hill et al. (1994) argued that modelling work should entail defining specially tailored combinations of individual census items, rather than taking the simpler approach of using an existing composite deprivation index, such as Jarman’s Under Privileged Area Score. Thornicroft demonstrated that while the latter included the former, the relative weighting of the variables in composite indices is not necessarily optimal for the purpose. The present study did not use the DETR’s new combined Index of Multiple Deprivation, rather it used the new, regularly updatable sources of ward-level population data made available as a result of this programme. At first sight, the Index of Multiple Deprivation domain scores are themselves composites, but they are of a different kind. Each seeks to provide a comprehensive count of all the individuals in each area affected by one aspect of deprivation. For example, the income deprivation score is the sum of the numbers of people in any of nine, mutually exclusive, income support categories (DETR 2000).

Geographic scope and scale

Studies have varied in the geographic area encompassed by their data sets, from single districts, to health service regions, or the whole of England. The smaller the area, the greater the doubt about their generalisability. They have also varied in their granularity, undertaking analysis by enumeration district (200–500 population), electoral ward (600–30k population), ‘synthetic ward’ (see below), health district (200k–300k population) and region (3–6 million population). Finer grained analysis should be able to reflect more detailed variations, although predictor variables and accurate population data for calculating service-use rates are harder to obtain for smaller areas. Smaller units will also more frequently have low or zero numbers of cases in dependent variable data. This is not necessarily a problem, but it may require different modelling strategies. The development of synthetic wards is an appealing compromise, using real wards where these are satisfactorily large, and producing amalgamations of adjacent wards where they are not. However, with this approach, inevitably some arbitrary choices about which to merge must be made; this could potentially influence the final model, though probably not greatly.


Dependent variables

Different dependent variables have been selected for modelling. The commonest choice is psychiatric admissions rates or prevalences. There is consensus that this is a far from ideal indicator of the distribution of mental illness. Many types of illness seldom require hospital admission. For those where hospitalisation is common, recent and increasingly widespread use of alternative, home-based treatment strategies may have reduced the fidelity with which hospitalisation rates reflect population prevalence; if so, this should give rise to poorer prediction in indices based on more recent data.

However, in modelling patterns of need for general secondary care services, admission rates are the commonest choice of dependent variable, simply because other measures are almost impossible to obtain. (In the foreseeable future, the new mental health minimum data set should change this.) Buckingham et al. (1996) developed a community resource allocation indicator using community psychiatric nurse contact rates. However, these authors could only find six districts able to supply data. Heady and Ruddock (1996) and Lewis and Booth (1992) used data from large national population-based surveys. This approach, however, inevitably yields indices which predominantly indicate the distribution of the common mental illnesses mainly treated in primary care. While important, there is evidence that the more severe problems which dominate the work of secondary care services are differently (less uniformly) distributed (Glover et al. 1999). The present study used psychiatric admission rates.