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Ethnic density, physical illness, social deprivation and antidepressant prescribing in primary care: ecological study

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Background
Antidepressant prescribing should reflect need. The Quality and Outcomes Framework has provided an opportunity to explore factors affecting antidepressant prescribing in UK general practice.

Aims
To explore the relationship between physical illness, social deprivation, ethnicity, practice characteristics and the volume of antidepressants prescribed in primary care.

Method
This was an ecological study using data derived from the Quality and Outcomes Framework, the Informatics Collaboratory of the Social Sciences, and Prescribing Analyses and CosT data for 2004–2005. Associations were examined using linear regression modelling.

Results
Socio-economic status, ethnic density, asthma, chronic obstructive pulmonary disease and epilepsy explained 44% of the variance in the volume of antidepressants prescribed.

Conclusions
Lower volumes of antidepressants are prescribed in areas with high densities of Black or Asian people. This may suggest disparities in provision of care. Chronic respiratory disease and epilepsy may have a more important association with depression in primary care than previously thought.

Declaration of interest
A.T. and P.W. have received speaker fees and symposia fees from several companies including Lilly, Servier and Lundbeck. A.T. has received research funds from several companies.

Antidepressant prescribing should reflect need. An increase in antidepressant prescribing by general practitioners (GPs) would therefore be expected in areas of social deprivation and in patients with chronic physical illness, both of which are associated with increased psychiatric morbidity.[1–3] There is a dearth of evidence on the effects of ethnic density on antidepressant prescribing, although ethnic density does appear to affect mental health outcomes[4–6]and would also be expected to correlate with volumes of antidepressant prescribing. There is some evidence that practice characteristics (such as length of consultations) may affect GP recognition of depression[7] and so volumes of antidepressants prescribed. The aim of this research was to explore the relationship between physical illnesses (coronary heart disease, hypertension, diabetes mellitus, asthma, chronic obstructive pulmonary disease (COPD), epilepsy, stroke and transient ischaemic attacks, hypothyroidism, cancer and severe mental illness), social deprivation, ethnic density, practice characteristics (length of consultation, training status of practice, and number of patients per GP) and the volume of antidepressant medications prescribed in primary care. We hypothesised that there would be a positive association between physical illness, social deprivation and the volume of antidepressants prescribed, and a negative association between ethnic minority density and volumes of antidepressants prescribed. A secondary hypothesis was to explore whether certain practice characteristics measured as part of the Quality and Outcomes Framework (www.ic.nhs.uk/services/qof) were associated with the volumes of antidepressants prescribed.

Methods

The Quality and Outcomes Framework

The Quality and Outcomes Framework in England has provided an opportunity to explore these relationships. Established in 2004, it gives financial incentive to GPs for achieving certain performance targets.[8] General practitioners are remunerated for achieving targets in four domains: clinical, organisational, additional services (such as cervical smears or maternity services) and patient experience. In 2004/5 the clinical domain included 11 chronic illnesses: coronary heart disease, left ventricular dysfunction, hypertension, diabetes mellitus, asthma, COPD, epilepsy, stroke and transient ischaemic attacks, hypothyroidism, cancer and severe mental illness. Severe mental illness was loosely defined as any patient with serious impairment as a result of a mental illness. In practice this was largely restricted to individuals with psychotic illnesses. Among other targets, practices were asked to keep registers of all people with these illnesses attending their practices. Although participation in the Quality and Outcomes Framework is voluntary, 8515 practices participated in the 2004–2005 period amounting to 99.5% of all registered patients in the England.[9] Data derived from it are held on the Quality Management Analysis System, a national system developed to support the Quality and Outcomes Framework. These data primarily provide GP practices and primary care trusts with objective feedback on performance, though were not designed necessarily to be used as a research tool.

Study data

Quality Management Analysis System data for all general practices in England (n=8576) for 2004–2005 were obtained from the Information Centre for Health and Social Care, Leeds. The unadjusted prevalence data for the 11 chronic illnesses were calculated by dividing the total number of cases on the Quality and Outcomes Framework disease registers by the sum of the practice list sizes.

Practice list size per full-time equivalent GP and training practice status were obtained from the Primary Care Research and Development Centre, University of Manchester.

Data from the 2001 UK national census were obtained and linked to practice data using the super output area for each practice.[10] Super output areas are geographical, 'socially homogeneous' areas containing an average population of about 1500

people. They form the basis for calculating the Index of Multiple Deprivation (IMD), 2004.[10] Within the IMD scores, deprivation is described by seven domains: income, employment, health and disability, education skills and training, barriers to housing and services, crime and living environment. The IMD–2004 data based on the super output area of each participating practice was used because place of residence data were not available for national data-sets of registered patients. Deprivation data were therefore at practice level rather than patient level. Census-derived figures based on super output areas linked to general practice postcodes were used to estimate the proportion of the local population from each ethnic group. Self-report ethnicity data were derived from the 2001 UK national census. These data were provided by the Informatics Collaboratory of the Social Sciences (ICOSS), University of Sheffield, and derived from variables using the Neighbourhood Statistics website (www.neighbourhood.gov.uk).

Prescribing data for antidepressant medicines were collected from April 2004 to March 2005 from national Prescribing Analyses and CosT (PACT) data.[11] Data on the volume of prescriptions were obtained and standardised according to the age/gender breakdown of the registered population in each practice, using specific therapeutic group age–gender weightings-related prescribing units (STAR-PUs) for antidepressants.[12] STAR-PUs are a convenient denominator when comparing prescribing between practices. They are age and gender standardised and so take into account age and gender differences of practice populations for whom drugs in specific therapeutic groups are prescribed.[13] The average daily quantity (ADQ) was used to measure the volume of prescriptions.[14] The ADQ is an English version of the World Health Organization's Defined Daily Dose. It is a standardised measure of volume based on the average daily dose of each antidepressant. Such a measure overcomes the problems of having to base prescribing volume calculations on the number of prescriptions issued which may mask wide variations in the quantity of medication issued per prescription.[13]

Statistical analyses

A data-set was constructed from the Quality Management Analysis System data, practice and census-based variables, and prescribing data. Of the 8576 practices eligible for inclusion, 61 (0.7%) practices were excluded because they were no longer independent at the end of the study year, had a list size of fewer than 750 individuals or fewer than 500 per full-time GP. These were excluded as it was likely they were either new practices or practices about to close. The final Quality and Outcomes Framework data-set contained 8515 practices. Due to postcode and super-output-area code anomalies, IMD data could be matched to 8480 (98.8%) practices, and of these, disease prevalence data were available for 8430 (98.3%) practices.

Data were analysed using STATA Version 8.2 for Windows. Linear regression was used to explore the univariate associations between the volume of antidepressants (as a dependent variable) and the Quality and Outcomes Framework, practice and census-derived independent variables. These variables were then included in a stepwise multiple linear regression analysis. Adjusted regression coefficients (B) and standardised adjusted regression coefficients (β) were calculated. A parsimonious regression model was than constructed using the dependent variables that contributed most to the variance in the volume of antidepressants prescribed.

Results

The distribution of variables is described in Table 1. There was a wide variation between practices in the volume of antidepressants prescribed. The mean volume of antidepressants prescribed was 2471 ADQs per 1000 STAR-PUs (s.d.=985, range 10–15 066, median 2404). A quarter of practices prescribed fewer than 1833 ADQs per 1000 STAR-PUs and a quarter over 3039 ADQs per 1000 STAR-PUs. The univariate associations between the standardised volumes of antidepressant prescribing, and independent variables are described in Table 2. In the univariate analysis the main variables associated with antidepressant prescribing were the chronic diseases (COPD, epilepsy, coronary heart disease and asthma). Social deprivation, as measured by IMD scores, was responsible for 4% of the variation in the standardised volume of antidepressant prescribing.

A regression model constructed using all variables in Table 2 accounted for 49% of the variation in the volume of antidepressant prescribing. A parsimonious regression model of the volume of antidepressants prescribed and six variables (the unadjusted prevalence of COPD, epilepsy and asthma, the proportion of people of Black and Asian ethnicity, and the IMD score) was then constructed and accounted for 44% of the variation in the volume of antidepressant prescribing. Table 3 summarises the regression coefficients and standardised beta-values for the volume of antidepressants prescribed adjusted for confounding by the other variables. The most powerful predictors were social deprivation, ethnicity and the chronic diseases, COPD, asthma and epilepsy. The standardised beta-values for the association between the volume of antidepressants prescribed and the proportion of patients of Black or Asian ethnicity were negative (−0.24 and −0.19 respectively) indicating that volumes of antidepressant prescriptions are lower in practices serving populations with high densities of people of Black and South Asian ethnicity.

Table 1 Summary of study variables

Practice characteristic	Distribution
Antidepressant volume (ADQs per 1000 STAR-PU), mean (s.d.)	2471 (985)
List size per full-time equivalent GP, mean (s.d.)	2199 (755)
Group practice, *n* (%)	6209 (74)
Training practice, *n* (%)	2252 (27)
Practices with 10-min appointments, *n* (%)	8041 (94.4)
IMD–2004 score, mean (s.d.)	25.8 (17.0)
Severe mental illness,[a] % (s.d.)	0.6 (0.5)
Coronary heart disease,[a] % (s.d.)	3.5 (1.4)
Left ventricular dysfunction,[a] % (s.d.)	0.4 (0.3)
Stroke and transient ischaemic attack,[a] % (s.d.)	1.4 (0.7)
Hypertension,[a] % (s.d.)	11.2 (3.6)
Diabetes,[a] % (s.d.)	3.5 (1.0)
Chronic obstructive pulmonary disease,[a] % (s.d.)	1.4 (0.8)
Epilepsy,[a] % (s.d.)	0.6 (0.2)
Hypothyroidism,[a] % (s.d.)	2 (0.8)
Cancer,[a] % (s.d.)	0.5 (0.2)
Asthma,[a] % (s.d.)	5.7 (1.6)
Patients from a White ethnic group, % (s.d.)	87.3 (18.8)
Patients from an Asian ethnic group,[b] % (s.d.)	6.9 (14.3)
Patients from a Black ethnic group,[c] % (s.d.)	3.2 (6.7)
Patients from Chinese or 'other' ethnic group, % (s.d.)	1.1 (1.6)

ADQs, average daily quantities; GP, general practitioner; IMD, Index of Multiple Deprivation; STAR-PU, specific therapeutic group age–gender weightings-related prescribing unit.
a. Unadjusted prevalence.
b. Includes Asian or Asian British, Indian, Pakistani, Bangladeshi and 'other Asian' but excludes Chinese.
c. Includes Black, Black British, Caribbean, African or 'Black other'.

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Table 2 Univariate associations between antidepressant-prescribing volume and predictor variables

Variable	R^2 (variation explained by each variable) %	Unadjusted regression coefficient B	*P*	95% CI
Chronic obstructive pulmonary disease[a]	25.0	574.3	<0.001	553.1 to 595.6
Epilepsy[a]	24.2	2130.6	<0.001	2050.1 to 2211.2
Coronary heart disease[a]	21.5	329.3	<0.001	315.9 to 342.8
Asthma[a]	18.2	258.1	<0.001	246.4 to 269.8
Stroke and transient ischaemic attack[a]	16.5	556.2	<0.001	529.5 to 583.0
Left ventricular dysfunction[a]	12.8	1297.4	<0.001	1224.9 to 1369.9
Proportion of patients from a Black ethnic group	12.4	−51.5	<0.001	−54.5 to −48.6
Hypothyroidism[a]	9.8	354.7	<0.001	331.7 to 377.7
Proportion of patients from Chinese ethnic group	8.5	−178.8	<0.001	−54.5 to −48.6
Proportion of patients from a White ethnic group	14.6	20.0	<0.001	18.9 to 21.0
Proportion of patients from an Asian ethnic group	7.4	−18.7	<0.001	−20.2 to −17.3
Hypertension[a]	5.4	63.1	<0.001	57.5 to 68.8
Group practice	4.4	465.1	<0.001	418.7 to 511.6
Index of Multiple Deprivation score	4.0	11.5	<0.001	10.3 to 2.7
Cancer[a]	4.0	787.9	<0.001	705.6 to 870.2
List size per full-time equivalent GP	2.9	−0.2	<0.001	−0.24 to −0.19
Mental health[a]	1.8	269.3	<0.001	226.8 to 311.9
Training practice	1.9	297.1	<0.001	250.8 to 343.3
10-min consultation	0.0	−95.7	<0.001	−187.0 to −4.4
Diabetes[a]	0.0	6.4	0.54	−13.9 to 26.7

GP, general practitioner.
a. Unadjusted prevalence.

Discussion

The greatest predictors of the volume of antidepressants prescribed by practices were social deprivation, the prevalence of chronic illness (asthma, COPD and epilepsy) and ethnic density. Organisational factors in general practice appeared to have little influence on the volumes of antidepressants prescribed and did not greatly improve the regression models. This is somewhat surprising as practices with training status, consultations of at least 10 min, and lower number of patients per GP would have been expected to prescribe increased volumes because of the association between these variables and increased recognition rates of depression.[7] This may indicate that organisational factors are less important than previously thought.

Higher volumes of antidepressants prescribed by general practices serving more socio-economically deprived areas is to be expected and is likely to be due to a higher prevalence of depression in these areas.[15] Chronic illness is also associated with increased rates of depression.[1] This may account for the increased volumes of prescriptions in practices with a high prevalence of these illnesses. It should be noted that this study may underestimate the strength of this association as depression in people with chronic illness is under-recognised.[16,17]

The chronic illnesses that had the strongest effect on the regression models were pulmonary disease and epilepsy. Although coronary heart disease, stroke and diabetes have a well-documented association with depression, they had a small effect on the regression models.[18–22] The prevalence of asthma had a strong association with volumes of prescribed antidepressants in all models. There are a number of reasons that could account for this. The association may be confounded by variables such as age and smoking status. However, it is unlikely that age of the practice populations would explain the whole association as depression is more common in the middle-aged and a closer association with the prevalence of coronary heart disease or diabetes would be expected if this were the case. This would also be true of the association between smoking and the prevalence of coronary heart disease. Patients with asthma may consult more frequently and

Table 3 Multivariate associations between antidepressant-prescribing volume and six predictor variables[a]

Predictor variable	Adjusted regression coefficient B	(95% CI)	Standardised adjusted regression coefficient, β
Index of Multiple Deprivation score	13.92	12.75 to 15.10	0.24*
Proportion of patients from a Black ethnic group	−34.44	−37.15 to −31.73	−0.24*
Asthma[b]	118.49	107.11 to 129.67	0.20*
Proportion of patients from an Asian ethnic background	−12.66	−13.90 to −11.42	−0.19*
Epilepsy[b]	755.45	668.52 to 842.36	0.17*
Chronic obstructive pulmonary disease[b]	183.94	159.65 to 208.22	0.16*

a. This model explains 43.5% of the variation. Model containing all the predictors from the univariate analysis explains 49.0% of the variation in the volume of antidepressants prescribed.
b. Unadjusted prevalence.
*$P<0.001$.

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therefore be more likely to have a depressive illness diagnosed and hence be prescribed an antidepressant. It is unlikely that this association is confounded by socio-economic status as IMD scores should have adjusted for this. Finally, there may be a true association between the prevalence of depression and the prevalence of asthma.

The association between respiratory disorders and depression has not received the same attention as coronary heart disease or diabetes. Up to 50% of people with asthma may have clinically significant depressive symptoms, and over a third of asthmatic out-patients have been found to have a major depressive episode.[1,23,24] Ettinger *et al* compared the frequency of depression in individuals with epilepsy and asthma with 'healthy' controls.[25] They found 37% of people with epilepsy and 28% of people with asthma were depressed compared with only 12% of healthy controls.

There is also evidence to suggest that poor lung function in general is associated with depression. Godwin *et al* found individuals with restrictive or obstructive airway disease were more likely to have lower overall well-being, general health and more likely to be depressed than those with normal lung function.[26] Ng *et al* recently found that individuals with comorbid COPD and depressive symptoms were associated with poorer survival, longer hospitalisations, were persistent smokers, had increased symptom burden and poorer physical and social functioning.[27] They also found that interventions reducing depressive symptoms improved COPD outcomes. They hypothesise that this may be because depressed people have less motivation to attend health services when unwell and so present with more severe stages of disease. It is interesting that the prevalence of severe mental illness, as defined by the Quality and Outcomes Framework, was not strongly associated with the volumes of antidepressants prescribed. This is probably explained by the fact that the severe mental illness register was confined to people with severe long-term mental health problems, and so most practices were recording individuals with psychotic illnesses rather than those with depression.

Weich *et al* conducted a large cross-sectional survey of adults in England to explore the prevalence of anxiety and depression across ethnic groups.[28] They found the prevalence was higher among some populations of Asians (in particular middle-aged Pakistani men, and older Indian and Pakistani women), and as common in Black populations as in White populations.[28] However, they did not explore the effects of ethnic density on the prevalence of common mental disorders. In our study, practices based in areas with higher densities of patients of Black or Asian ethnicity had lower volumes of antidepressant prescribing. This association was independent of other variables including social deprivation. This may imply that populations with a high density of ethnic minorities are relatively disadvantaged in terms of antidepressant prescribing, though this needs to be interpreted with some caution as the density of ethnic minorities is highly negatively skewed and the relatively few areas with a high density of ethnic minorities would have a disproportionate effect on the regression model. Hull *et al*, in a cross-sectional survey, examined prescribing rates of antidepressants and anxiolytics in East London general practices.[29] They found that antidepressant (and anxiolytic) prescribing was lower in practices with high proportions of Asian patients. An explanation for this finding may be the 'ethnic density effect'. This suggests that there is an inverse correlation between the prevalence of mental illness in an ethnic group and the size of that population relative to the overall population.[6,30] Thus, being in a population with a high density of ethnic minorities may confer a protective effect on that ethnic minority population lowering the population's overall prevalence of depression, reflected in the lower volumes of antidepressants prescribed at the population level. This may not necessarily be a linear relationship. Neeleman *et al* for instance found an inverted U-shaped curve better described the relationship between ethnic density and relative self-harm rates.[4] Further research is necessary to explore this association further and determine whether it is because of differences in service provision and utilisation (factors such as cultural and language differences, doctor factors and health service organisation factors), or whether it reflects a decrease in the prevalence of depression in ethnic minority populations living in areas with a relatively high density of ethnic minorities.

Study strengths and limitations

The major strength of this study was the size and completeness of the data-sets used. As with any retrospective study of ecological data this paper has certain limitations. Although GP motivation to participate in the Quality and Outcome Framework was high, the prevalence data obtained were from the first year of its introduction. The prevalence data are unadjusted and do not take into account exception reporting and therefore could be an underestimate of the true prevalence. Therefore, some practices may not have been sufficiently organised to include all known patients with the 11 chronic illnesses remunerated as part of the Quality and Outcomes Framework on its respective registers. This may have led to an underestimation of the prevalence of these illnesses. Moreover, the data from the Quality and Outcome Framework are not standardised by age or gender and therefore these possibly important confounding variables could not be included in the analyses. It should also be born in mind that the Quality Management Analysis System database is not primarily a research database. Since these are population-level data it is not possible to make inferences at the individual level – the ecological fallacy. Neither is it possible to determine the direction of the association between variables. However, a recent study has concluded that practice postcode-linked IMD scores do provide a valid proxy for patient-level deprivation and tend to underestimate the strength of association between deprivation and all-cause mortality.[31]

Although we set out to determine factors affecting the volume of antidepressants prescribed, we have no data on the prevalence of depression across practices as this was not recorded as part of the Quality and Outcome Framework during 2004–2005. We have therefore been unable to examine the association between volume of antidepressants and the prevalence of depression. As we hypothesised, there was a strong association between volume of antidepressants prescribed and chronic illnesses. This is probably because depression is more common in individuals with chronic illness and this is likely to be reflected at the population level.

We have documented the volume of antidepressants prescribed by general practices in the UK and explored factors associated with the variation in prescribing volumes. Socio-economic status, ethnicity, asthma, COPD and epilepsy were the strongest predictors. Further research is necessary to define these associations and determine their clinical impact.

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