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Association of primary care factors with hospital admissions for epilepsy in England, 2004–2010: National observational study

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ABSTRACT

Purpose: There has been little research on the accessibility and quality of primary care services for epilepsy and emergency hospital admissions for epilepsy.
Methods: We examined time trends in admissions for epilepsy in England between 2004–2005 and 2010, and the association of admission rates with population and primary care factors. The units of analysis were the registered populations of 8622 general practices. We used negative binomial regression to model indicators from the Quality and Outcomes Framework, the UK's primary care pay for performance scheme, to measure the accessibility and quality of care for epilepsy, and supply of general practitioners, after adjustment for population factors.
Results: The mean indirectly standardised admission rate decreased from 122.9 to 102.6 (−16.5%; $P < 0.001$) over the study period, while the mean percentage of patients seizure free increased from 65.3% to 74.9% ($P < 0.001$). In the multivariable analysis, a one unit increase in the percentage of seizure free adult patients on epilepsy drugs predicted a 0.20% decrease (IRR = 0.9980; 95% CI: 0.9974–0.9986) in admission rate. The percentage of patients who were able to book a GP appointment over two days ahead predicted a 0.12% decrease (IRR = 0.9988; 95% CI: 0.9982–0.9994). The deprivation score of practice populations (IRR = 1.0179; $P < 0.001$) and general practitioner supply (IRR = 1.0022; $P < 0.001$) were both positively associated with admission rates.
Conclusion: Patient access to primary care appointments and percentage of patients who have been recorded as seizure free for 12 months were associated with lower admission rates. However the effect sizes are small relative to that of population deprivation.

1. Introduction

Epilepsy is one of the commonest neurological conditions and is associated with adverse health outcomes and significant impact on a person's life.[1,2] The mainstay of treatment in epilepsy is antiepileptic drugs. In England, around 340,000 adults (0.8% of the adult population) receive drug treatment for epilepsy.[3] The disease burden of epilepsy is high for patients and the National Health Service (NHS): patients with epilepsy consult their general practitioners twice as often, require three to four times more home visits, and were referred to secondary care three times more often than people without epilepsy, irrespective of age, sex and social class.[4] Epileptic seizures are the commonest neurological complaint among people presenting acutely to hospital, accounting for 3% of all emergency presentations.[5] A 2004 report found that in England & Wales there were about 800 deaths per year where epilepsy was the underlying cause and about 37,000 admissions where epilepsy was the main diagnosis.[6] Both mortality and hospital admission rates for epilepsy remained relatively stable during the periods examined. In North-East England, epilepsy accounted for the highest proportion of patients with two or more emergency admissions for the same condition in the year 2006/07.[7]

Unscheduled or emergency hospital admissions for epilepsy are used as an indicator of health system performance in the NHS

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Outcomes Framework,[8] in which epilepsy is classed as an ambulatory or primary care sensitive condition (PCSC). PCSCs are conditions for all of which it is hypothesised the risk of admission to hospital may be reduced by improvements in primary care. Epilepsy also features in lists of PCSCs used in the United States,[9] Canada,[10] and Australia.[11] Seizures and epilepsy account for 10% of all emergency admissions for PCSCs in England (in 2009–2010) and contribute to 8% of the cost.[12] We examined the time trend in admissions for epilepsy in England between 2004–2005 and 2009–2010, and the association of admission rates with population and primary care factors.

2. Methods

2.1. Study design and setting

We conducted a population-based study by merging data for the English population from a number of sources from the period 1st April 2004 to 31st March 2010. The units of analysis were the registered populations of each general practice in England. The number of practices ranged from 8365 in 2004–2005 to 8140 in 2009–2010, and the registered population from 52,416,417 in 2004–2005 to 54,741,278 in 2009–2010. Practices with a population less than 500 patients (109 of 8405; 1.3%) were excluded as they were more likely to serve unusual patient groups or deliver non-standard primary care services.

2.2. Outcome variables

The outcome variable was the annual number of emergency or unplanned hospital admissions for epilepsy in each practice population. Data were obtained from Hospital Episode Statistics, a national administrative database containing patient-level records of all admissions to NHS-funded hospitals in England. In this database, diagnoses are coded according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10).[13] We included all admissions for which the primary diagnosis was recorded as epilepsy (G40) and G41 (status epilepticus), in accordance with the 2012–2013 NHS Outcomes Framework.[8]

Age–sex breakdowns of each primary care practice's registered population, obtained from the NHS Information Centre, were then indirectly standardised to produce the expected number of admissions for each population, using national age/sex specific rates for the year concerned. The observed number of admissions per practice was the outcome variable used in the regression analyses, and the standardised expected number was the offset.

2.3. Measures of primary care access, quality and supply

We used indicators from the Quality and Outcomes Framework (QOF),[14] the UK's primary care pay for performance scheme, to measure the accessibility and quality of care for epilepsy provided by primary care practices. QOF assesses performance across a wide range of indicators that are categorised into four domains: clinical, organisational, patient experience, and additional services. Annual data were obtained from the NHS Information Centre.

The two indicators of access used were the percentage of the registered population that, on their last attempt, were able to obtain a consultation with a primary care physician (general practitioner; GP) within two working days (indicator Patient Experience PE 7), and the percentage able to book a GP appointment more than two days ahead (indicator PE 8). As PE indicators were first used in 2007, we substituted that year's data for the 2004–2007 period.

We used three further QOF indicators to measure the quality of primary care for epilepsy provided by each practice. These were the percentage of registered patients aged 18 years or over on drug treatment for epilepsy that had a record of seizure frequency in the previous 15 months (indicator Epilepsy EPI 6); had a record of medication review involving the patient and/or carer in the previous 15 months (indicator EPI 7); and had been seizure free for the last 12 months, recorded in the previous 15 months (indicator EPI 8). The first two indicators may be seen as process measures of care quality, while the third indicator is an outcome measure.

We also obtained the prevalence of epilepsy in each practice in each year from QOF data.

To measure the supply of GPs in each general practice, we obtained data on the number of full-time equivalent GPs and the total number of patients registered to each practice from the NHS Information Centre. From these variables, we then calculated the number of full-time equivalent GPs per 100,000 registered patients.

2.4. Population factors

We used the index of multiple deprivation (IMD) to control for the socioeconomic status of each primary care practice's registered population. The IMD is a composite measure of deprivation calculated from seven distinct domains that include income deprivation, employment deprivation, and crime.[15] IMD deprivation scores for Lower Layer Super Output Areas (small geographic areas of minimum population 1000 and mean 1500) for England were obtained from the Department for Communities and Local Government for 2004, 2007, and 2010. As scores change slowly over time, we used each set of scores for the year before and after. We then calculated the average IMD value for a practice's registered population, weighted according to the proportion of registered patients that resided in each lower layer super output area.

2.5. Statistical analysis

We used the Mann–Whitney test to assess the difference in mean values of variables between 2004–2005 and 2010. The associations between the indirectly age–sex standardised number of admissions for epilepsy and the explanatory variables were estimated using negative binomial regression; this was preferred to Poisson regression to account for over-dispersion in the outcome variable. We first conducted a univariable analysis and then performed a multivariable analysis to determine the independent effect of explanatory variables. The explanatory variables retained in the multivariable model were chosen via a backward selection process that removed variables from the full model, with all variables entered, based on the Wald test. We included an indicator variable for each year in the model to allow for national time trends in admissions affecting all practices. Therefore, the coefficients estimated measure the association between explanatory variables and admissions in any given year of the study period. We accounted for the lack of independence of variables for the same practice in different years by estimating associations using robust standard errors. The model goodness-of-fit was assessed using the standard Wald test. The statistical analysis was conducted in Stata Version 11 (StataCorp, College Station, TX, USA).

3. Results

The number of hospital admissions for epilepsy for patients registered in the 8622 primary care practices included in the analysis totalled 62,299 in the year 2004–2005 and 53,828 in