Variance in practice emergency medical admission rates: can it be explained?

Rebecca Duffy, Ron Neville and Harry Staines

SUMMARY

Background: *Emergency admission rates have been rising steadily in recent years, with the majority of the increase owing to emergency medical admissions. Possible causative factors include changing demography, incidence of disease, admission thresholds, multiple admissions, and appropriateness of admission.*

Aim: *To investigate the impact of patient and practice factors on variance in general practices' emergency medical admissions rates.*

Design of study: *Multiple regression analysis relating emergency medical admission rates of general practices to patient and practice characteristics.*

Setting: *The study was conducted between 1996 and 1997 in the acute hospital trust serving the study area, Dundee, Scotland.*

Method: *Scottish Morbidity Record 1 (SMR1) data, which contains details of all hospital consultant episodes, was used to calculate individual practices emergency medical admission rates. These rates were then standardised to an expected value of 100. Forward selection was used to find a suitable multiple regression model to predict each practice's emergency medical admission rate from practice and patient variables.*

Results: *Crude emergency medical admission rates for general practices showed a 1.8-fold variation between the top and bottom deciles. The deprivation status and age of patients explained 42% of the variance in admission rates (64% with the exclusion of one practice that had a poor fit to the model). After correcting for age and deprivation there was a 1.2-fold variation in general practices' emergency medical admission rates.*

Conclusion: *The most important factors in explaining variance in general practices' emergency medical admission rates are socio-demographic, with age and deprivation explaining a large proportion of the variation. We found no evidence to support the contention that general practice factors were linked with admission rates.*

Keywords: *hospital referral; patient admission; emergency admission rate.*

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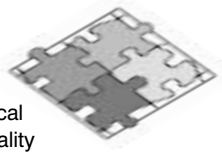
Introduction

VARIANCE in medical practice has been observed in virtually all areas studied and provokes concern as to its implications for quality of care and efficient use of resources. Wide variations in general practitioner (GP) non-emergency referral rates to hospital have been reported, up to twentyfold at the extremes, with at least a three- to fourfold variation generally accepted as real.[1] Although this variation has been extensively investigated it remains largely unexplained. Differences in patient characteristics, practice structure, and doctor characteristics have failed to explain more than a small fraction of the variation.[1,2] There has been much less work reported on GPs' emergency referral or admission rates,[3] although emergency referrals account for 19% of GP referrals,[4] and emergency admissions account for nearly 60% of all admissions.[5]

Emergency admission rates have been rising steadily in recent years, with the majority of the increase owing to medical admissions.[6] Possible causative factors include changing demography, incidence of disease, admission thresholds, and multiple admissions, or so-called 'revolving door patients,' and appropriateness of admission.[6,7] One factor could be the quality of primary care that patients receive in preventing disease; effectively managing chronic diseases and appropriateness of referral for admission. If large variations in the quality of such care exist, large variations in emergency medical admission rates among practices could be expected to reflect this. Indeed, admission rates have been suggested as a performance indicator for primary care.[8] A recent study of emergency medical admission rates for Glasgow general medical practices[9] found a 1.9-fold variation between the top and bottom deciles after correcting for age, sex, and deprivation. The authors of that study suggested that this variation needed further explanation. One factor that was not accounted for was the influence of the secondary care supply side on admissions, which has been shown to be an important factor.[10,11] Dundee provides a good location to examine practice emergency admission rates, as the city is served by a single acute hospital trust with more than 80% of acute medical admissions going to a single acute medical receiving unit. The remaining patients, with infectious diseases or respiratory problems, are admitted to another unit in the city. Although two outlying practices may very occasionally admit to Tayside's other acute hospitals, these admissions were included in the calculations. The population of Dundee is stable and virtually the entire population is registered with a GP. Few emergency admissions occur outwith the city.

The aim of this study was to quantify the size of any variation in medical emergency admission rates among practices and to investigate patient and doctor factors that could be associated with this variation. We hoped to test the hypoth-

HOW THIS FITS IN



What do we know?

Variation occurs in most areas of medical practice and raises concerns about quality of care. Hospital admission rates have been suggested as a performance indicator for primary care.

What does this paper add?

Variation in practices' emergency medical admission rates was smaller than that reported for non-emergency referrals. The variation was largely explained by socio-demographic factors.

esis that variation in the emergency medical admission rate is determined by the quality of primary care offered by GPs.

Method

The rate of emergency medical admissions for general medical practices was chosen as the unit of analysis rather than individual GP emergency referral rates, for several reasons. Roland[12,13] has argued convincingly that referral rates for individual practitioners should only be calculated if they can be related to the number of consultations carried out by the individual practitioner. Otherwise, referral rates should be calculated for whole practices using list size as the denominator. In the context of this study it was not possible to determine individual GPs' consultation rates, whereas practice list sizes were readily determined. Also, GPs are not responsible for referring all emergency medical admissions, as at least 40% arrive via a '999' emergency call, or self-referral, to accident and emergency.[14] Finally, out-of-hours general practice care is provided by two co-operatives that cover all but two of the practices in the study, so patients are unlikely to see their own general practitioner out of hours, and 45% of emergency medical admissions occur out of hours in Dundee.[15] There are 33 practices in and around Dundee that refer emergency medical admissions to one acute hospital trust, serving a registered population of 193 893 at the time of this study.

Details of all hospital admissions are recorded in the Scottish Morbidity Record 1 (SMR1), which contains details of all hospital consultant episodes. The practice with which a patient is registered is reliably recorded, whereas the name of the referring doctor (a GP, or member of the accident and emergency staff) is not recorded. The following data were obtained from Tayside Health Board: anonymised SMR1 data for all emergency admissions to medical specialties within Dundee Teaching Hospitals Trust for the period between 1 October 1996 and 31 September 1997; the total number of patients; the number of patients aged under 65 years, 65 to 74 years, and over 75 years; attracting high; medium; and low-rate deprivation payments registered for each practice for the quarter between 1 October 1996 and 31 December 1996; and the practices' fundholding status. To reflect the increased workload associated with deprivation, patients who live in areas designated as deprived, based on the Jarman index,[16] attract deprivation payments at one of three rates: low, medium, or high. Information regarding practices' training status was obtained from the Tayside Centre for General Practice and on individual practitioner's possession of membership of the Royal College of General Practitioners (MRCGP) from the East Scotland Faculty of the College. These data were used to calculate individual practice's emergency medical admission rates for each group of 1000 registered patients. For each practice the number of patients for each group of 1000 was calculated for the following: aged under 65 years, aged 65 to 74 years, over 75 years, and attracting deprivation payments at low, medium, and high rates. These ratios were then standardised to an expected value of 100. Other practice variables examined are summarised in Box 1. Forward selection was used to find a suitable multiple regression model to predict each practice's standardised emergency medical admission rate from the variables identified above. Using this method, each independent variable is added to the model one at a time. If it contributes significantly to the existing model then it is kept. If its contribution does not reach the 5% significance level then it is discarded. The final model was subjected to the standard diagnostic checks. Access to the data used was approved by the relevant authorities.

Results

During the study period, there were a total of 12 630 emergency medical admissions to Dundee hospitals; 9751 from patients registered with the 33 practices in the study, 1273 from other practices in Tayside (Dundee is a tertiary referral centre), 1380 from practices in Fife (Dundee being the nearest location of an acute hospital for several Fife practices), and 226 from patients registered with GPs outwith Tayside or Fife. There were 36 emergency medical admissions to Tayside's other acute hospitals by patients registered with Dundee practices, giving a total of 9787 emergency medical admissions for the 33 practices. The mean practice emergency medical admission rate for each group of 1000 patients each year was 50.2 (standard deprivation [SD] = 10.7). The ratio of the 90th centile (66.0) to the 10th centile (36.3) showed a 1.8-fold difference for crude practice emergency admission rates for each group of 1000 patients each year. Table 1 shows the mean, SD, and range for each of the variables examined.

Entering these variables into a forward stepwise regression model resulted in three variables being included in the model: high and low-rate deprivation payments, and age

- Number of patients aged under 65 years, standardised.
- Number of patients aged 65 to 74 years, standardised.
- Number of patients aged over 75 years, standardised.
- Number of patients eligible for low rate deprivation payments, standardised.
- Number of patients eligible for medium rate deprivation payments, standardised.
- Number of patients eligible for high rate deprivation payments, standardised.
- List size.
- Average list per partner.
- Number of partners (whole time equivalents).
- Proportion of partners with MRCGP.
- Fundholding status.
- Training status.

Box 1. Summary of variables examined.

Table 1. Mean, standard deviation, and range for each of the variables examined.

		Centiles	
Factor	Mean (SD); 95%CI	10th	90th
List size	5876 (2553); 4970–6781	2104	9204
Number of partners (WTE)	3.6 (1.5); 3.0–4.1	1.3	5.9
Mean list/partner	1640 (196); 1571–1709	1372	1916
Number of patients aged under 65/1000	839.3 (39); 825.5–853.2	780	898
Number of patients aged 65–74/1000	90.6 (19); 84.0–97.	69	117
Number of patients aged over 75/1000	70.0 (22); 62.2–77.8	38	107
Number of patients attracting high rate deprivation payments/1000	71 (58); 46.6–82.5*	2.6	145
Number of patients attracting medium rate deprivation payments/1000	57 (36); 42.9–66.3*	3.4	111
Number of patients attracting low rate deprivation payments/1000	89 (40); 76.4–107.8*	6.1	131
Number of partners with MRCGP (%)	35.7(32); 24.4–47.0	0	86
Number of fundholding practices = 12			
Number of training practices = 9			

*95% confidence intervals for the median as not normally distributed. All other variables were approximately normally distributed, using the Anderson–Darling test (each $P>0.05$)

65 to 74 years. These three variables explained 42% of the variation among practices. The *t* ratios for the three explanatory variables were 2.00, 2.90 and 2.29 respectively. The model had an R^2 of 42.1% and the test statistic for the overall model was highly significant (F [3,29] = 7.04; P = 0.001). The model performed well except for two practices; one practice had a standardised emergency medical admission rate of 76, predicted 111 (standardised residual = -2.15) and another practice, whose observed and predicted standardised admission rate values were 88 and 121 respectively (standardised residual = -3.34). Otherwise, the usual multiple regression assumptions were not violated. If the latter practice is excluded, the R^2 value increases to 64% and the standardised low-rate deprivation payments become non-significant. This practice had particularly high levels of deprivation among its patients, with standardised high-rate deprivation payments more than double those of the practice with next highest rate: this practice also had a substantially younger population than average, and these factors may explain why it did not fit the model. Excluding the first practice increased the R^2 value to 72%. Figure 1 shows the correlation between standardised emergency medical admission rates and standardised high-rate deprivation payments; the outlier is the latter practice that did not fit the model.

After correcting for age and deprivation there was a 1.22-fold variation between the top and bottom deciles for practice emergency medical admission rates.

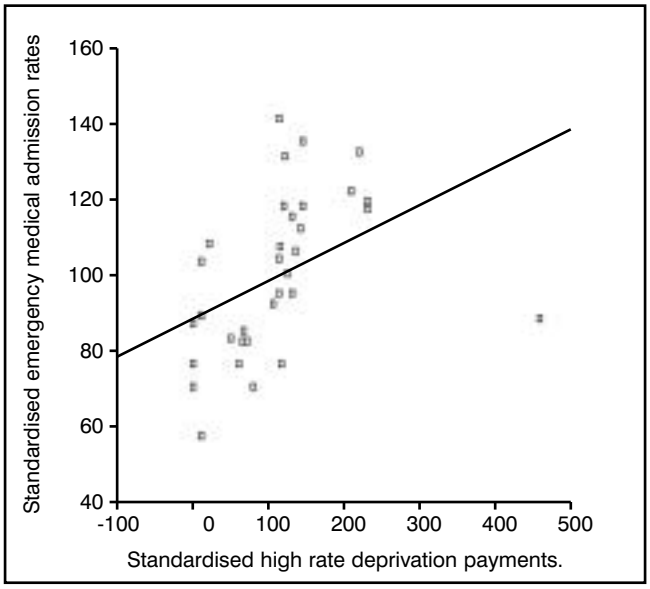


Figure 1. Correlation between standardised emergency medical admission rates and standardised high rate deprivation payments. Spearman's rank correlation = 0.674; P*<0.001. (Spearman's rank correlation, excluding outlying practice = 0.737;* P*<0.001).*

Discussion

The 1.8-fold variation in crude emergency medical admission rates between practices was a smaller variation than had been described for non-emergency referrals.[1] The variation was largely explained by socio-demographic factors; the regression model explained 42% of the variance across the 33 practices (64%, excluding one practice). We found no evidence to support or refute the hypothesis we set out to test, that variations in the quality of primary care are reflected in variations in emergency medical admission rates between practices. Although there was no association between practice admission rate and training status or possession of MRCGP, we have failed to demonstrate that practice factors have no influence. It could be that the quality of practices within Dundee is uniformly high, and that explains why we were unable to demonstrate any influence for doctor factors. However, the size of the variance explained by age and deprivation suggests a lack of causal relationship between doctor factors and admission rates.

The quality of primary care would be expected to influence the outcome of many chronic diseases and studies have demonstrated a link between the quality of care for individual chronic diseases, such as asthma and diabetes, and reduced hospital admission,[17,18] but others have not.[19] However good the quality of primary care a practice offers it cannot be expected to mitigate against the powerful effects of deprivation on health. This study again demonstrates the influence of age and deprivation on health, as these were the most powerful associations with a practice's emergency admission rate, consistent with previous research.[6,20,21]

This raises the question of why the elderly and socially deprived are more likely to have an emergency hospital admission. It is not possible to answer this question from the data in this study. We do not know whether older and more deprived patients were sicker or had less social support and therefore could not be managed outside hospital.

Our findings are consistent with other reported work. Reid *et al*[11] in their study of general practice hospital admission rates in one London health authority found a 1.9-fold difference between top and bottom deciles in practices' crude emergency admission rates with socio-demographic factors accounting for 45% of the variation. A study of admission rates for asthma, diabetes, and epilepsy across 90 family health service authorities in England[10] found that at health authority level socioeconomic characteristics, health status, and secondary care supply factors explained 45% of the variation in admission rates for asthma, 33% for diabetes, and 55% for epilepsy.

Another study in Glasgow[9] found a 1.9-fold variation in emergency medical admission ratios between the top and bottom practice deciles after correcting for age, sex, and deprivation, which is larger than the 1.22-fold variation found in our study. There were differences in methodology in that the Glasgow study used postcodes to assign Carstairs' deprivation categories[22] to individual registered patients, whereas our study defined deprivation using deprivation payments to practices based on the Jarman index. Both deprivation indices use 1991 census data linked to postcodes but they are not directly comparable. Also, in Glasgow there are several large acute hospitals and it is possible that differences in admission policies or cultures between hospitals could have influenced the result. The influence of the admitting hospital on general practice admission rates was demonstrated by Reid's study, where the percentage of each practice's admissions to the different hospitals added significantly to the explanation of variation. This raises the question of how well hospitals deal with the chronic care of patients. If hospitals respond poorly to requests for help with the chronic care of patients, then emergency admissions may result, not because GPs manipulate the system, but simply because lack of high quality routine care leads to genuine medical emergencies.

A strength of our study is that admissions were directed to one acute trust, and the vast majority to one hospital, therefore differences in hospital admission policies, or culture, or quality of care, are unlikely to have biased the results.

There are limitations to the generalisability of the results of this study as the specific characteristics of Dundee may influence the findings. In particular, out-of-hours care is largely provided by two co-operatives, and it is possible that variations in out-of-hours care may have a larger influence on admissions than in-hours care.

This study suggests that patient factors, particularly age and deprivation, are the biggest determinants in variations between general practices' emergency admission rates. However, chronic care management by both primary and secondary care may account for the variance not explained. If admission rates are to be used as performance indicators then they must be adjusted for factors outside the control of general practice, such as the age and deprivation of patients and secondary supply factors.

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