

Emergency medical admissions in Glasgow: general practices vary despite adjustment for age, sex, and deprivation

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SUMMARY

Background. Emergency admission rates have been rising rapidly in Britain. Studies defining the underlying factors are needed.

Aim. To determine the principal diagnoses, demographic, and socioeconomic factors associated with emergency medical admissions.

Method. Cohort study based on the Greater Glasgow Health Board population of 810 423 adults. A fully anonymized dataset linkage of 43 247 adult emergency admissions to Glasgow medical beds in 1997 was obtained. Emergency admission rates were analysed by diagnosis, age, sex, Carstairs' deprivation category, and by individual general practices (after adjustment for other factors).

Results. The commonest principal diagnoses were chest pain (9.6%), chronic obstructive airways disease (5.6%), angina (5.4%), heart failure (4.1%), and acute myocardial infarction (3.9%). Twenty-one per cent of patients were coded as having 'ill-defined signs or symptoms'. Emergency medical admission rates rose with the age of the patient, doubling with every two decades' age increase. Admission rates for patients from deprived areas were twice those from affluent areas. Males were more frequently admitted than females (adjusted odds ratio = 1.19). After adjustment for age, sex, and deprivation, the general practices' emergency medical admission rates showed an almost twofold difference between the top and bottom deciles.

Conclusion. Emergency medical admission rates are higher among the elderly, males, and deprived populations. This has implications for equitable resource distribution in the National Health Service. Admissions for exclusion of myocardial disease were common; however, myocardial infarction was not the final diagnosis in two-thirds of these patients. The large variation between the general practices' admission rates requires further investigation.

Keywords: emergency medical admissions; admission rates; socioeconomic factors; age and sex factors.

Introduction

THE large rise in hospital emergency admissions has recently received increased attention.^{1,2} The effects of this rise on the

National Health Service have been profound, with winter bed crises, growing waiting lists, and adverse media reports.³ Several possible approaches to managing this problem have been proposed,⁴⁻⁶ and considerable extra finance was recently allocated by the United Kingdom government. However, until there is a better understanding of underlying factors, such changes may not help.

In Scotland, emergency admissions have increased by 50% in the past decade.¹ The greatest rise in emergency admissions was for patients admitted to medical rather than surgical beds.¹ The admission rate of patients aged over 65 years was more than twice that of younger patients.¹ However, between 1981 and 1994, population ageing explained less than 6% of the total increase in emergency admissions.¹ Other potentially important contributory factors, such as sex and deprivation, are poorly understood.⁷

As many as 50% of all emergency admission patients may have referred themselves to hospital.⁸ The 'gatekeeper' function (deciding whether patients require emergency admission) must therefore operate for emergency admissions in both hospital accident and emergency departments and general practices.⁹ We analysed data for 43 247 consecutive emergency medical admissions in Glasgow in terms of patients' commonest diagnoses, demographic and socio-economic factors, and their general practices.

Method

The Scottish Morbidity Record dataset number 1 (SMR01) contains details of all hospital consultant episodes in Scotland.¹ A fully anonymized extract of records from this dataset was obtained for all Greater Glasgow Health Board residents admitted as emergencies to all medical specialties during 1997. The medical specialties were general medicine, cardiology, metabolic disease, gastroenterology, geriatric assessment, nephrology, rheumatology, respiratory medicine, homoeopathy, pain control, haematology, medical intensive care, and coronary care. This extract provided details of patient's age and sex, residential postcode, registered general practitioner (GP), and discharge diagnosis coded according to the 10th revision of the International Classification of Diseases (ICD-10).¹⁰ To calculate emergency admission rates, similar population denominator data for patients registered with GPs in Glasgow were obtained from an anonymized extract of the Greater Glasgow Health Board's Community Health Index.

Patients' postcode sectors were matched to deprivation categories derived from the Carstairs' Score¹¹ using 1991 census data.¹² This validated score is based on four census variables: male unemployment, domestic overcrowding, car ownership, and low social class.¹¹

Statistical analyses

Emergency medical admission ratios for individual general practices, indirectly standardized for the age, sex, and deprivation categories of their practice populations, were calculated using a customized Microsoft Access database. These ratios were standardized to an expected value of 100. Confidence intervals were

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derived using the Poisson distribution.¹³ Spearman's rank correlation and logistic regression with forward stepwise selection of variables were both performed using SPSS.¹⁴

Results

In 1997, the Glasgow Community Health Index held details for 810 423 Glasgow residents aged 15 years and over who were registered with Glasgow GPs. The Community Health Index database had an excess of 9.5% above the corresponding 1996 mid-year census estimate of 739 862. Most of this excess (68%) comprised males in the 25- to 54-year-old age range.

In 1997, there were 43 247 emergency medical admissions of Glasgow residents aged 15 years and over who had Glasgow GPs. This excludes the 4524 admissions to Glasgow hospitals of patients not resident locally, 839 emergency admissions of Glasgow residents to hospitals elsewhere in Scotland, and 740 admissions to Glasgow hospitals of local residents whose GPs were not on the Glasgow medical list. Both of these datasets had complete information on age and sex. Postcode data were almost complete (Table 2).

After categorizing admissions by diagnostic groups using the Chapters of the International Classification of Diseases, the commonest diagnoses were cardiovascular disease (27.2%), followed by symptoms, signs, and abnormal findings (Chapter XVIII, 21.0%), respiratory disease (15.1%), and poisoning (8.2%). The five commonest specific diagnoses were chest pain (9.6%), followed by chronic obstructive airways disease (5.6%), angina (5.4%), heart failure (4.1%), and acute myocardial infarction (3.9%). Chest pain, angina pectoris, and myocardial infarction together accounted for 18.9% of all emergency medical admissions (Table 1).

The crude annual admission rate was 53.4 admissions per 1000 Glasgow residents per year (Table 2). Admission rates increased steeply with age, doubling with every two decades' age increase from 15.4 per 1000 among those aged 15 to 24 years-old to 224 per 1000 in those aged over 85 years (Table 2 and Figure 1). Patients from the most disadvantaged deprivation category had more than double the admission rate of patients from the most affluent deprivation category (32.1 per 1000 versus 73.1

per 1000; Table 2).

The age-specific admission rates of males were higher than those of females at all ages (Figure 1). After adjustment for age and deprivation, males had an admissions odds ratio of 1.19 compared with women (95% confidence interval = 1.17 to 1.22; Table 3).

There were 216 general practices in Glasgow, comprising 624 practitioners with a median of 1496 patients. After standardizing for age, sex, and deprivation category, there was a 1.9-fold variation in admission ratios between the top and bottom practice deciles (70.7 versus 132.4; Figure 2). In 1996, there were 40 792 emergency medical admissions aged over 15 years. There was a highly significant correlation between the general practices' standardized emergency admissions ratios for 1996 and 1997 (Spearman's rank $r = 0.78$; $P < 0.00001$).

Discussion

This study reports an analysis of some 43 000 recent emergency medical admissions in Britain's largest and most deprived health authority (51% of the population living in deprivation categories 6 and 7 compared with 20% in the rest of Scotland).^{11,12} Our results highlight the steep rise in emergency admissions with increasing age, with rates doubling for every two decades' age increment.^{1,15} The greater age-specific emergency admission rates for males are consistent with a higher male mortality at all ages; this has only recently been recognized.¹⁵

Socioeconomic deprivation was strongly associated with increasing emergency medical admission rates. This is consistent with a recent study showing increased emergency admissions among the deprived elderly in Nottinghamshire.¹⁵ Furthermore, epidemiological studies have shown deprivation to be associated with increased incidence and mortality in many conditions leading to emergency medical admission, including myocardial infarction,¹⁶ stroke,¹⁷ chronic bronchitis,¹⁸ asthma,¹⁹ lung cancer,²⁰ upper gastrointestinal haemorrhage,²¹ and self-poisoning.²² The biological mechanisms linking such conditions with deprivation are complex and poorly understood, but probably include smoking, high blood pressure, low dietary antioxidants, increased thrombogenesis and *Helicobacter pylori* infection.^{3,23}

Table 1. ICD-10 chapters and principal discharge diagnoses for emergency medical admissions in Glasgow (1997).

Chapter	Main code	Description	ICD10 codes		Chapter		Main code	
			n	%	n	%	n	%
IX		Diseases of the circulatory system	11 764	27.2				
	I20	Angina pectoris					2328	5.4
	I50	Heart failure					1758	4.1
	I21	Acute myocardial infarction					1694	3.9
	-	Other diseases of the circulatory system					5984	13.9
XVIII		Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	9079	21.0				
	R07	Pain in throat and chest					4171	9.6
	R55	Syncope and collapse					1043	2.4
	-	Other symptoms, signs, and abnormal clinical and laboratory findings					3865	8.9
X		Diseases of the respiratory system	6527	15.1				
	J44	Other chronic obstructive pulmonary disease					2432	5.6
	J18	Pneumonia, organism unspecified					1105	2.6
	J22	Unspecified acute lower respiratory infection					1063	2.5
	-	Other diseases of the respiratory system					1927	4.5
XIX		Injury, poisoning, and other consequences of external cause	3567	8.2				
	T39	Poison by nonopioid analgesics antipyretics and antirheumatics					1162	2.7
	-	Other injury, poisoning, and other consequences of external cause					2405	5.2
-	-	Other ICD-10 chapters	12 310	28.4	12 310	28.5	12 310	28.5
		Total (all diagnoses)	43 247	100	43 247	100	43 247	100

Table 2. Age, sex, and deprivation characteristics for emergency medical admissions in Glasgow (1997).

Characteristic	Emergency medical admissions	Population (from Community Health Index)	Emergency medical admission rate (95% CI)
	n	n	Admissions per year x1000
Sex			
Male	20 740	394 575	52.6 (51.8–53.3)
Female	22 507	415 848	54.1 (53.4–54.8)
Age ^a			
15–24	1940	126 193	15.4 (14.7–16.1)
25–34	3024	170 400	17.7 (17.1–18.4)
35–44	3776	150 338	25.1 (24.3–25.9)
45–54	4925	114 152	43.1 (41.9–44.4)
55–64	7141	96 558	74.0 (72.3–75.7)
65–74	9811	84 695	115.8 (113.6–118.2)
75–84	8623	50 197	171.8 (168.2–175.4)
85+	4007	17 890	224.0 (217.1–231.0)
Carstairs' deprivation category ^b			
1 (most affluent)	2438	75 992	32.1 (30.8–33.4)
2	2365	66 538	35.5 (34.1–37.0)
3	2512	63 303	39.7 (38.1–41.3)
4	5048	112 820	44.7 (43.5–46.0)
5	4145	72 284	57.3 (55.6–59.1)
6	9845	183 378	53.7 (52.6–54.8)
7 (most deprived)	16 883	231 062	73.1 (72.0–74.2)
Deprivation category missing	11	5046	
Total	43 247	810 423	53.4 (52.9–53.9)

^aAge (in years); ^bsee Carstairs and Morris.

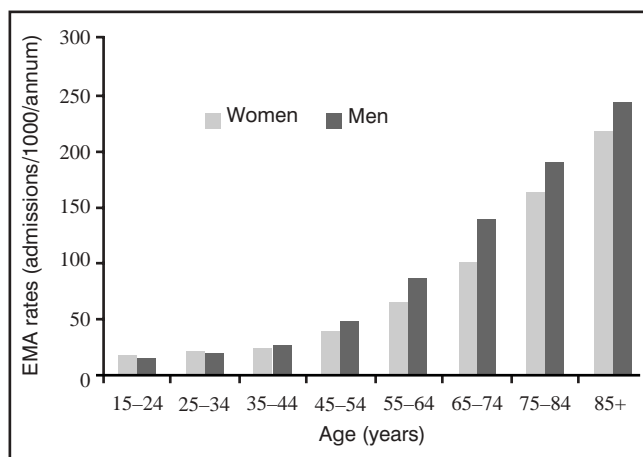


Figure 1. Emergency medical admission (EMA) rates by age and sex.

Deprivation may also affect GPs' elective referral rates.²⁴ However, as a substantial number of emergency admissions present as self-referrals,⁸ this important association merits further study.

Studies such as this have a number of limitations. The routine datasets used in the current study were not created for research purposes and may therefore lack precision. However, since both the Scottish Morbidity Record is used for contracting and the Community Health Index is used for GP payments, the likelihood of bias is low. The Community Health Index inflation of 9.5% was not sufficient to explain the large practice variations that we found. Furthermore, there were relatively few admissions among the younger men comprising most of this excess. The exclusion of the relatively few patients admitted across health board boundaries was far too small to explain these variations. Carstairs' deprivation categories measure average deprivation

across geographical areas containing about 6200 individuals. Because not all these individuals will be equally deprived, this analysis may underestimate the effects of individual socioeconomic effects on admission likelihood. Carstairs' deprivation categories have been shown to be effective measures of individual social status.²⁵ Such ecological analyses can usefully identify and describe associations, highlighting areas for more detailed analytical research.

Even after adjustment for age, sex, and socioeconomic deprivation, an almost twofold variation in emergency medical admission rates between GP practices remained. The high correlation between the practices' emergency medical admission ratios for 1996 and 1997 suggests that these gradients are consistent and real. We suspect this variation to have a complex multifactorial aetiology. It may reflect differences in need, in supply-side factors such as bed availability, and in the behaviour of both GPs and hospital doctors.³ We are not aware of evidence that practices with higher or lower admission rates are achieving different clinical outcomes. This merits further investigation.

One-sixth of emergency medical admissions in Glasgow had suspected heart disease. However, two-thirds of these patients were subsequently shown not to have sustained a myocardial infarction. Exclusion of myocardial pathology consumes significant hospital resources. Rapid assessment chest pain clinics may represent a major advance in clinical management and resource use.²⁶

This study demonstrates the urgent need for further investigation into the reasons for the wide variations between the emergency medical admission rates of different general practices. It also highlights the need for a review of resource allocation for both primary and secondary care in deprived areas.³

References

1. Kendrick S. The pattern of increase in emergency hospital admissions in Scotland. *Health Bull (Edinb)* 1996; **54(2)**: 169-183.

Table 3. Effects of age, sex, and deprivation on emergency admissions in Glasgow: adjusted odds ratios (1997).

Factor	Odds ratio (95% CI)
Age: per decade age increment	1.54 (1.53-1.55)
Sex: men compared with women	1.19 (1.17-1.22)
Deprivation: per unit deprivation category increment	1.16 (1.15-1.17)

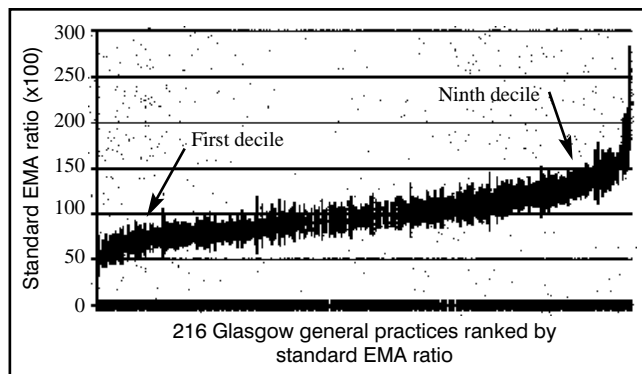


Figure 2. Emergency medical admission (EMA) ratios for Glasgow general practices standardized for age, sex, and deprivation (bars show 95% confidence intervals).

- Harrison A, Hamblin R, Boyle S, *et al.* *Analysing changes in emergency medical admissions: a report by the NHS Trust Federation in collaboration with the King's Fund.* London: NHS Trust Federation/King's Fund, 1995.
- Blatchford O, Capewell S. Emergency medical admissions: taking stock and planning for winter. *BMJ* 1997; **315**: 1322-1323.
- Council of International Hospitals. *Confronting the challenge: seven tactics for managing the rise in emergency admissions.* London: Council of International Hospitals, The Advisory Board Company, 1996.
- Hanlon P, Beck S, Robertson G, *et al.* Coping with the inexorable rise in medical admissions: evaluating a radical reorganisation of acute care in a Scottish district general hospital. *Health Bull (Edinb)* 1997; **55(3)**: 176-184.
- Coast J, Inglis A, Morgan K, *et al.* The hospital admissions study in England: are there alternatives to emergency hospital admission? *J Epidemiol Commun Health* 1995; **49(2)**: 194-199.
- Edwards N. The growth in emergency admissions - a challenge for health services research. *J Health Serv Res Policy* 1996; **1(3)**: 125-127.
- Conway H. Emergency medical care. *BMJ* 1976; **2**: 511-513.
- Hobbs R. Rising emergency admissions. *BMJ* 1995; **310**: 207-208.
- World Health Organization. *International statistical classification of diseases and related health problems. (10th revision.)* Geneva: WHO, 1992.
- Morris R, Carstairs V. *Deprivation and health in Scotland.* Aberdeen: Aberdeen University Press, 1991.
- McLoone P, Boddy FA. *Categorising small geographical areas.* Glasgow: Public Health Research Unit, University of Glasgow, 1994.
- Gardner MJ, Altman DG. *Statistics with confidence - confidence intervals and statistical guidelines.* London: BMJ Press, 1989.
- SPSS Inc. *SPSS for Windows.* Chicago: SPSS, 1993.
- Bernard S, Smith LK. Emergency admissions of older people to hospital: a link with material deprivation. *J Public Health Med* 1998; **20(1)**: 97-101.
- Morrison C, Woodward M, Leslie W, Tunstall-Pedoe H. Effect of socio-economic group on the incidence of, management of, and survival after myocardial infarction and coronary death: analysis of community coronary event register. *BMJ* 1997; **312**: 541-546.
- Maheswaran R, Elliott P, Strachan DP. Socioeconomic deprivation, ethnicity, and stroke mortality in Greater London and south east England. *J Epidemiol Commun Health* 1997; **51(2)**: 127-131.
- Poole PJ, Bagg B, Brodie SM, Black PN. Characteristics of patients admitted to hospital with chronic obstructive pulmonary disease. *N Z Med J* 1997; **110(1048)**: 272-275.

- Watson JP, Cowen P, Lewis RA. The relationship between asthma admission rates, routes of admission, and socioeconomic deprivation. *Eur Respir J* 1996; **9**: 2087-2093.
- van Loon AJ, Goldbohm RA, Kant IJ, *et al.* Socioeconomic status and lung cancer incidence in men in The Netherlands: is there a role for occupational exposure? *J Epidemiol Commun Health* 1997; **51(1)**: 24-29.
- Blatchford O, Davidson LA, Murray WR, *et al.* Acute upper gastrointestinal haemorrhage in west of Scotland: case ascertainment study. *BMJ* 1997; **315**: 510-514.
- Smith T. Differences between general practices in hospital admission rates for self-inflicted injury and self-poisoning: influence of socioeconomic factors. *Br J Gen Pract* 1995; **45**: 458-462.
- Davey Smith G, Hart C, Watt G, *et al.* Individual social class, area based deprivation, cardiovascular disease risk-factors and mortality: the Renfrew and Paisley study. *J Epidemiol Commun Health* 1998; **52**: 399-405.
- Hippisley-Cox J, Hardy C, Pringle M, *et al.* The effect of deprivation on variations in general practitioners' referral rates: a cross sectional study of computerised data on new medical and surgical outpatient referrals in Nottinghamshire. *BMJ* 1997; **314**: 1458-1461.
- Woodward M. Small area statistics as markers for personal social status in the Scottish heart health study. *J Epidemiol Commun Health* 1996; **50**: 570-576.
- Davie AP, Caesar D, Caruana L, *et al.* Outcome from a rapid assessment chest pain clinic. *Q J Med* 1998; **91**: 339-343.

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