Do practice-based preventive child health services affect the use of hospitals? A cross-sectional study of hospital use by children in east London

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SUMMARY

Background. *Acute paediatric admissions have risen steadily over the past 20 years. During the same period, practice-based child health clinics have increased, although provision is less common in areas of deprivation where hospital use is greatest.*

Aim. *To investigate the contribution of practice-based, preventive child health services to rates of hospital utilisation in children under five years of age.*

Method. *A cross-sectional retrospective study examining practice variations in paediatric acute admissions, outpatient referrals, and accident and emergency (A&E) department attendances in the East London and the City Health authority, including all 164 practices in the inner-city boroughs of Hackney, Newham, Tower Hamlets, and the City of London. The main outcome measures were practice-based paediatric hospital attendance rates, for discrete age and sex bands, for the year to 31 March 1996.*

Results. *Hospital use varied with age and sex, with the rates being highest for the youngest children and for boys. The median A&E attendance rate (including reattendances) for boys up to one year of age was 897 per thousand children per practice. In east London, 62% of practices are registered for child health surveillance and 71% provide a child health clinic. Practice approval for child health surveillance, and the provision of child health clinics, did not account for differences between practices in hospital use, but proportionally greater health visiting hours were significantly related to lower rates of emergency hospital admission by young children. Multivariate analyses revealed that up to 23% of the variation between practice admission rates could be explained by health visiting hours.*

Conclusions. *We found significant associations between the amount of health visiting time available to the practice population and rates of acute admission and outpatient referral among children up to five years of age. These findings suggest that increasing health visitor provision could contribute to lower paediatric emergency admission and outpatient referral rates. A small change would have a significant effect, particularly among the youngest children, given that during the study year 10 000 children under two years of age in east London were either admitted or referred to hospital.*

Keywords: *child health surveillance; hospital; accident and emergency; visiting hours; inner-city.*

Introduction

PREVENTIVE child health clinics providing programmes of child health surveillance, immunisation, and advice have been in place in the United Kingdom for many years, although a national survey in 1984 revealed variation in provision with little relationship to local need.[1] Since the introduction of the 1990 Contract for General Practice[2] there has been an expansion in practice-based clinics, but with marked geographic variation. In areas of social deprivation, provision appears to follow the inverse care law.[3] A Liverpool survey in 1992 recorded only 30% of practices offering clinics; reasons for non-provision included inadequate premises, workload, and lack of health visitor support.[4] Where practice-based child health clinics do exist there is evidence of efficacy. Comparison of immunisation uptake for children based in general practice or in child health clinics in the North East Thames Region showed higher rates of completion of primary immunisation in the general practice setting.[5]

Successful child health promotion programmes in general practice rely on good working relationships between community health and practice staff. The third report of *Health for all Children* proposed an increased emphasis on health promotion with a smaller core programme of evidence-based screening tests.[6,7] It stresses that 'The role of the health visitor as the key point of professional contact is perhaps more important than ever before'.[6] Successful programmes will also respond to parents' concerns.[8] This is of particular importance in multi-ethnic districts, where there is some evidence that non-English speakers are less satisfied with services but choose increased input from health visitors.[9]

The relationships between social deprivation and mortality, morbidity, and high use of primary care services are well established.[10-12] The consequences of socioeconomic deprivation for children are seen in a broad range of measures of health and use of health services, as well as in lost chances of benefiting from education and economic opportunities.[13-16] Previous studies have

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shown that children living in deprived areas have higher rates of accident and emergency (A&E) department attendance and hospital admission than those living in non-deprived districts.[18,19] Multiple admissions, which account for 30% of total admissions in those under two years of age, are also associated with social deprivation.[20]

This study examines the relationship between the provision of practice-based child health clinics and the use of hospital services by children, including acute admissions, referral to outpatient clinics, and use of A&E departments. It is set within East London and the City Health Authority, a deprived, multi-ethnic, inner-London district, coterminous with the boroughs of Hackney, Newham, Tower Hamlets, and the City of London, where 22% of the population is under 16 years of age, and mortality rates for children are 20-40% above the national average.[21] Rates of hospital admission (acute and elective), at 92.6/1000 children under 16 years of age for 1995-1996, are high, even allowing for the rising rates of paediatric admissions (Table 1).

Methods

Outcome variables

Routinely collected information on acute hospital admission, elective admission, and outpatient referrals to hospitals, both within and outside the district, were obtained from the integrated district and regional information system for east London residents aged under five years registered at all of the 164 general practices within the health authority boundaries. The acute and elective admission data included readmissions and the outpatient referral data included cancellations and non-attendances for first appointments. Rates, by practice, were calculated per 1000 children per year by age and sex. The denominators were the total number of east London children in each age-sex group on practice lists.

Accident and emergency department attendance data came from the computerised returns of the four major hospitals within the east London area. The analysis was restricted to practices where we believed the attendance data to be comprehensive. Hence, we excluded practices if more than 20% of emergency paediatric admissions were to non-local hospitals, and border practices where 20% or more of the list lived outside the district. Thus, 138 of the 164 practices were retained for the attendance analysis.

Accuracy and completeness of coding were monitored through the health authority data quality specification. Coding of patient to general practices was 96% complete for outpatient referrals and elective admissions and 97% complete for emergency admissions. For the A&E departments, coding of patients to general practices ranged from 82% to 94%; the hospital with the lowest level of practice coding had the smallest numbers of paediatric attendances.

Practice and population characteristics

The East London General Practice Database provided information on practice resources, including the staffing profile, quality of premises, training status, and approval for child health surveillance. (The source of this information was the health authority.) Additional information on the provision and staffing of child health clinics was obtained from a questionnaire survey of 160 practices (98%). Information on health visitor practice attachment came from the three local community trusts. Prescribing data came from the prescription pricing authority. Socioeconomic population variables derived from the 1991 Census at ward level were apportioned to practice populations using the postcodes of patient addresses.[23] The distance in metres between each practice and the nearest A&E department was calculated from grid references.

Statistical analysis

Statistical analyses were carried out in SPSS-PC and STATA. The practice was the unit of analysis. As many of the outcome variables had positively skewed distributions the analysis was undertaken on the logarithm of the adjusted rates per 1000. The adjusted rates per 1000 were calculated by adding 1 to the rate per 1000. This avoids the problem that the log of zero is not definable for the practices that had no cases. Preliminary univariate analyses showed little differences in associations with the explanatory variables when rates were based on individuals rather than admissions or attendances, so the main analysis used attendance rates, admission rates (including readmissions), and referral rates.

For each outcome variable two linear multiple regression models were constructed, one including all of the explanatory variables and the second by a stepwise method with backward elimination of variables using a significance level of 0.05. The categorical variables were analysed using the first category as the baseline against which the other categories were compared.

Results

Practice characteristics and provision of child health services

Almost half of east London practices are single-handed, and a further 23% are partnerships of two. Partnership size is an important determinant of practice resources and organisation (Table 2). Larger practices were more likely than smaller ones to be approved for child health surveillance and to run child health clinics staffed by a combination of health visitors, practice nurses, and general practitioners. A significantly higher proportion of larger practices achieved 90% immunisation targets for children less than two years of age compared with single-handed practices (Table 2). Health visiting hours per practice, allocated by the community trust, did not follow this trend. Larger practices had less health visiting support per 1000 registered children than smaller practices.

Hospital use by east London children

Hospital use varied with age and sex (Table 3). Mean rates decreased for older children. Male children had consistently higher rates than females. Attendance rates at A&E departments were particularly high in male infants under one year of age, at

Table 1. Changes in paediatric admission rates based on current and previous studies.

Emergency and elective admissions to hospital (admission rate per 1000 per year)	1975	1985	1990	1996
England (0–14 years of age)[a]	21.0	34.0		
England and Wales (0–15 years of age)[b]			46.9	
East London and the City Health Authority (0–15 years of age)[c]				92.6

[a]Hill A, 1989; [b]health services indicators, Department of Health, 1990; [c]using the GP registered population as denominator rather than Office of National Statistics figures.

Table 2. Practice characteristics by partnership size in all 164 east London general practices.

Variables	One-partner practices	Two-partner practices	Three or more partners
Number of practices	78 (48%)	37 (23%)	49 (30%)
Mean list size per doctor	2696	2042	1878
% Practices with female principal	15.4	54.1	79.6
% Practices with fundholding status	35.9	24.3	28.6
% Practices employing a practice manager	51.4	52.8	87.8
% Practices employing a practice nurse	59.5	86.1	89.8
% Practices in premise category 1[a]	5.2	5.4	8.2
% Practices in premise category 5	64.9	45.9	24.5
% Practices approved for child health surveillance	38.5	67.6	95.9
% Practices with child health clinic	52.7	75.0	95.9
% Practices with child health clinic staffed by combination of 3 HCPs[b]	17.6	38.8	69.4
Mean no. health visitor hours per week per 1000 ELCHA[c] children	124	133	115
Mean asthma prophylaxis to bronchodilator items ratio	0.4	0.4	0.5
% Practices reaching 90% immunisation target (for under 2 year olds)	35.9 (CI = 25.3–46.7)	40.5 (CI = 25.2–57.0)	63.3 (CI = 49.5–76.5)
% Practices reaching 90% immunisation target (for under 5 year olds)	34.6 (CI = 24.3–45.6)	43.2 (CI = 27.0–59.0)	3.7 (CI = 19.8–46.0)

[a]Premise categories: 1 = good; 5 = poor; [b]HCP = health care professional; [c]ELCHA = East London and the City Health Authority.

Table 3. Hospital use by children: rates per 1000 children per practice by age and sex. Rates include readmissions, reattendances, and rereferrals.

Age	Sex	Mean outpatient referral rates[a] (median and interquartile range)	Mean AEDe attendance rates[b] (median and interquartile range)	Mean emergency admission rates[c] (median and interquartile range)	Mean elective admission rates[d] (median and interquartile range)
0<1 year	Male	372 (347, 239–476)	950 (897, 667–1250)	251 (213, 132–333)	49 (29, 0–71)
	Female	283 (250, 151–358)	763 (684, 452–1000)	170 (143, 77–235)	30 (0, 0–44)
1<2 years	Male	209 (190, 122–273)	752 (696, 540–944)	127 (111, 53–162)	45 (34, 0–63)
	Female	155 (131, 82–176)	621 (561, 401–735)	92 (75, 43–122)	25 (0, 0–33)
2<5 years	Male	172 (161, 109–217)	434 (391, 330–517)	59 (53, 32–79)	67 (57, 32–83)
	Female	122 (111, 77–157)	327 (293, 220–388)	45 (35, 17–61)	57 (34, 16–60)

[a]Base number of outpatient referrals = 23 467; [b]base number of AED attendances = 44 371; [c]base number of emergency admissions = 7892; [d]base number of elective admissions = 6939. [e]AED = accident and emergency department.

950 per thousand children. More than a third of male infants and more than a quarter of female infants were referred to hospital outpatient departments. Annual emergency admission rates (including readmissions) in male infants reached 251 per thousand children per practice.

Explanatory variables

The population and practice factors selected as explanatory variables for inclusion in the analyses, and their distributions, are shown in Table 4. The population and practice resource variables were chosen for their possible association with child health and service provision. We included two measures of practice performance relevant to child health: achievement of either of the immunisation targets for children less than two years of age, and asthma prescribing (prophylaxis to bronchodilator items ratio). This was chosen as a relevant indicator of quality prescribing, respiratory conditions being the most common reason for paediatric admission.[22]

Multivariate analysis

After controlling for practice and population factors we found no association between approval for child health surveillance or the provision of preventive child health clinics and emergency paediatric admissions. The summary results of the final models are shown in Table 5. Health visiting hours was the explanatory variable that occurred most frequently in the models for emergency paediatric admissions, with greater provision of health visiting input associated with lower emergency admission rates. These associations were seen consistently for infants and for boys aged up to five years.

Table 6 illustrates the final models for associations between outpatient referral rates and practice and population factors. Although the amount of variance in referral rates that could be explained was relatively small, greater provision of health visiting was related to lower referral rates in male children under two years of age. Once again, no associations were found with approval for, or provision of, preventive child health clinics.

Analysis of the A&E attendance data showed no associations between rates of attendance and the provision of child health clinics, or with the number of health visiting hours. Among children aged over one year, the most consistent finding was an association between higher rates of attendance and the proximity of the practice to the nearest hospital.

Discussion

Practice characteristics and hospital attendance rates

The past 20 years have seen a steady rise in acute paediatric admission rates, with a shorter length of stay for each episode.[21,25,26] The most common reasons for admission are respiratory symptoms and fever,[21] but the rise in admissions has been distributed across all diagnostic groups.[19] In east London, rates of acute admission among children under one year of age

Table 4. Distribution of population and practice based explanatory variables.

Variables by practice	Number of practices	Median	Min.	Max.	Interquartile range
% Residents unemployed	158	21.1	10.4	27.7	19.2–22.6
% Reporting Asian ethnicity	155	15.6	4.5	50.0	8.0–29.4
% Reporting black ethnicity	155	14.2	3.2	27.8	10.1–19.8
% Residents in households with an economically active household head in socioeconomic group IV & V	159	25.5	15.6	33.9	22.5–28.1
% Children living in overcrowded conditions	161	33.8	18.9	70.1	29.7–38.5
% Living in lone parent households	155	8.3	3.8	14.7	6.4–9.6
Distance of practice from nearest of four hospitals (metres)	155	1703	0	4528	1000–2550
List size per principal	164	2113	594	6010	1711–2606
Health visitor hours per week per 1000 children under five years of age	158	112	0	589	88–138
Asthma prophylaxis/bronchodilator items prescribing ratio	162	0.47	0.12	0.79	0.40–0.55
Annual night visiting rate per 1000 patient population	164	24.6	0	1293	14–35
Percentage of practices					
Approval for child health surveillance	164 (62%)				
Presence of a female doctor	164 (43%)				
Employment of a practice nurse	159 (75%)				
Premises category (1 = good, 5 = poor)	163 (6% [1], 14% [2], 18% [3], 14% [4], 49% [5])				
Practices with a child health clinic	159 (71%)				
Staffing of child health clinic (2 or 3 health professionals [GP, practice nurse, health visitor])	159 (33% [2], 38% [3])				
Practices reaching any under two-year-old immunisation target	164 (62%)				
Practices reaching lower (70%) or higher (90%) under two-year-old immunisation targets	164 (17% [lower], 45% [higher])				
Partnership size (1, 2, 3 or more principals)	164 (47.6% [1], 22.6% [2], 29.9% [3 or more])				

Table 5. Multivariate models describing associations between population and practice characteristics, including preventive child health services, and the outcome variable of emergency admission rates for children aged 0–5 years.

Model	Regression coefficient (95% confidence intervals)		P -value
Males aged under 1 year (149 practices)			
Health visitor hours/1000 children aged under 5 years	-0.006	(-0.008 to -0.003)	<0.001
% Reporting Asian ethnicity	-0.02	(-0.04 to -0.003)	0.02
% Residents in social classes IV &V	0.09	(0.025 to 0.139)	0.005
Adjusted R^2 = 16%, constant = 4.18, F = 10.43, P <0.001			
Females aged under 1 year (156 practices)			
Health visitor hours/1000 children aged under 5 years	-0.008	(-0.012 to -0.005)	<0.001
List size/WTE[a] principal	0.0004	(0.0001 to 0.0007)	0.02
Asthma P/B items prescribing ratio	-2.72	(-4.93 to -0.52)	0.02
Practices with more than 2 partners	0.94	(0.292 to 1.59)	0.005
Adjusted R^2 = 21%, constant = 5.56, F = 9.45, P <0.001			
Males aged 1 year to <2 years (149 practices)			
Health visitor hours/1000 children aged under 5 years	-0.006	(-0.009 to -0.003)	<0.001
% Residents in social classes IV &V	0.09	(0.02 to 0.16)	0.01
Adjusted R^2 = 12%, constant = 2.66, F = 11.13, P <0.001			
Females aged 1 year to <2 years (160 practices)			
List size/WTE principal	0.0004	(0.0001 to 0.0008)	0.01
Practices with 2 partners	0.74	(0.02 to 1.46)	0.045
Practices with more than 2 partners	1.16	(0.47 to 1.84)	0.001
Adjusted R^2 = 6%, constant = 2.26, F = 4.35, P = 0.006			
Males aged 2 years to <5 years (156 practices)			
Health visitor hours/1000 children under 5	-0.007	(-0.009 to -0.005)	<0.001
Asthma P/B items prescribing ratio[b]	1.51	(0.07 to 2.96)	0.04
Adjusted R^2 = 23%, constant = 3.85, F = 24.8, P <0.001			
Females aged 2 years to <5 years (161 practices)			
Practices with more than 2 partners	0.58	(0.12 to 1.03)	0.02
Adjusted R^2 = 3%, constant = 3.09, F = 6.10, P = 0.015			

[a]WTE = whole time equivalent; [b]ratio of prophylaxis to bronchodilator prescriptions.

are particularly high (Table 3). This study shows a consistent association between increased health visiting hours for the practice population and lower rates of emergency admissions. This association was also found for outpatient referrals. Although the

Table 6. Multivariate models describing associations between practice and population characteristics including preventive child health services, and the outcome variable of outpatient referral rates for children aged 0–5 years.

Model	Regression coefficient	(95% confidence intervals)	P value
Males aged under 1 year (152 practices)			
Health visitor hours/1000 children aged under 5 years	-0.006	(-0.008 to -0.003)	<0.001
% Children living in overcrowded conditions	0.01	(0.001 to 0.03)	0.035
Adjusted R^2 = 21%, constant = 5.88, F = 21.0, P <0.001			
Females aged under 1 year (154 practices)			
% Children living in overcrowded conditions	0.02	(0.003 to 0.034)	0.022
Adjusted R^2 = 3%, constant = 4.66, F = 5.36, P <0.022			
Males aged 1 year to <2 years (155 practices)			
Health visitor hours/1000 children aged under 5 years	-0.003	(-0.006 to -0.0006)	0.017
Adjusted R^2 = 9%, constant = 5.6, F = 3.16, P = 0.004			
Females aged 1 year to <2 years (150 practices)			
List size/WTE[a] principal	0.0003	(0.00003 to 0.0006)	0.03
Practices with 2 partners	0.90	(0.27 to 1.54)	0.01
Practices with more than 2 partners	0.89	(0.24 to 1.53)	0.01
% Reporting black ethnicity	-0.052	(-0.10 to -0.006)	0.03
% Households with lone parents	0.018	(0.05 to 0.31)	0.01
Employment of practice nurse	-0.68	(-1.26 to -0.096)	0.02
Adjusted R^2 = 8%, constant = 3.20, F = 3.03, P = 0.008			
Males aged 2 years to <5 years (153 practices)			
Health visitor hours/1000 children aged under 5 years	0.18	(0.02 to 0.34)	0.03
Presence of a female principal	40.8	(15.0 to 66.5)	0.002
Child health clinic staffed by 2 HCPs[b]	-38.6	(-71.5 to -5.7)	0.02
Child health clinic staffed by 3 HCPs	-46.4	(-80.1 to -12.7)	0.007
Premises category 4	-69.4	(-126 to -12.7)	0.02
Premises category 5	-60.05	(-111 to -9.12)	0.02
Adjusted R^2 = 12%, constant = 208, F = 3.71, P = 0.0006			
Females aged 2 years to <5 years (153 practices)			
Asthma P/B items prescribing ratio	124	(22.3 to 225)	0.02
% Residents unemployed	6.28	(1.26 to 11.3)	0.01
Adjusted R^2 = 6%, constant = -64.3, F = 3.46, P = 0.01			

[a]WTE = whole time equivalent; [b]HCP = health care professional.

amount of variance explained by the models was not high, the frequency of health visiting hours as an explanatory variable was notable. This finding is of importance, as interventions that achieve even modest changes in areas where rates of admission are high will be of interest both to clinicians and to purchasers of paediatric services.

This study is original in finding significant associations between the rates of hospital use by children and practice factors. Previous studies[23] have been unable to explain the variation between practices in overall paediatric admission rates, although associations between markers of social deprivation and the use of A&E as a route of admission have been noted. Our study suggests that different explanatory variables are associated with specific age and gender groups, emphasising the importance of analysing groups separately.[24] Factors affecting hospital use, and the potential for change in patterns of use, may show considerable variation between children of different ages.

Interpreting the results

Cross-sectional studies, using multiple regression analysis of general practice and census-based data, are useful in the attempt to explain variation and examine complex associations, but have important limitations. Statistical associations must be distinguished from causal relationships. The choice of explanatory variables should be considered with care, some that appear to have explanatory power may simply be markers for unidentified factors at practice or population level. It may be that key variables were missing from our study; for example, measures of case-mix between practices, or the availability of practices to their patients. Good measures of these, and other potentially important practice factors, are not routinely available.

The use of routinely collected data may introduce bias. Recording of hospital attendances will vary in completeness between hospital sites, and admission policies may vary between hospital sites. Information routinely collected from practices needs to be treated with caution. General practice lists in east London have varying levels of inflation, which may run at 20% to 30%.[27] Inflated denominators will cause deflated attendance rates. This may produce an underestimate of the differences in hospital usage between practices.

Census-derived variables have been used to examine the relationship between social deprivation at area level and the use of general practice and hospital services.[22,28-30,33] While socioeconomic data linked to individuals are more powerful predictors of consulting behaviour than census data linked to practice populations,[12] these are not routinely collected, so practice-attributed census variables will continue to be used for exploratory studies. In the multivariate analysis of this study few associations were found between practice socioeconomic characteristics and hospital use, although such relationships have been demonstrated in other paediatric studies,[17] and in practice-based studies on adult referral rates and A&E department attendance rates.[28,31] There are several possible reasons for this. East London is uniformly deprived, and the data may lack sufficient contrast between the practice populations to show important differences; further analyses using practices from more affluent districts may be necessary to highlight these differences. The use of census variables attributed to practice populations is also likely to weaken associ-

ations, as they are calculated on the assumption that ward populations are homogenous and that patients registered at a practice are representative of the ward in which they live. In the inner-city population groups may selectively register at different practices, introducing a further source of bias.

Implications for paediatric services

The pattern of hospital use by children continues to change. Increasing numbers of children attend A&E departments, many bypassing primary care services, but those requiring admission stay only one or two nights. These changes in use may be linked to a greater public awareness of rare but serious childhood illness. Both parents and doctors may be more inclined to seek early hospital admission if repeated observation or early diagnosis of non-specific symptoms is needed.[26] This argues for changes in the type of hospital facilities, such as the development of ambulatory care programmes, with a greater emphasis on an observation and immediate investigation area staffed by experienced clinicians.[32]

The most important practice-based influence identified by this study is the health visitor, who appears to be associated with a moderating influence on the rate of emergency admissions among children aged under one year. The important role of the health visitor in helping families to manage minor symptoms, develop networks of support, and use health services appropriately is often undervalued. These attributes may be increasingly under threat as efficiency gains are sought by community trusts located in hard pressed inner-city areas.[34,35] Evidence already exists that home visiting programmes have the potential to reduce the rates of childhood injury.[36] Our findings suggest that further research, including studies using a qualitative approach, should be undertaken to explore the relationships between health visitor input to practices and hospital use by young children.

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