Cost effectiveness of treating primary care patients in accident and emergency: a comparison between general practitioners, senior house officers, and registrars

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Abstract

Objectives—To compare outcome and costs of general practitioners, senior house officers, and registrars treating patients who attended accident and emergency department with problems assessed at triage as being of primary care type.

Design—Prospective intervention study which was later costed.

Setting—Inner city accident and emergency department in south east London.

Subjects—4641 patients presenting with primary care problems: 1702 were seen by general practitioners, 2382 by senior house officers, and 557 by registrars.

Main outcome measures—Satisfaction and outcome assessed in subsample of 565 patients 7-10 days after hospital attendance and aggregate costs of hospital care provided.

Results—Most patients expressed high levels of satisfaction with clinical assessment (430/562 (77%)), treatment (418/557 (75%)), and consulting doctor's manner (434/492 (88%)). Patients' reported outcome and use of general practice in 7-10 days after attendance were similar: 206/241 (85%), 224/263 (85%), and 52/59 (88%) of those seen by general practitioners, senior house officers, and registrars respectively were fully recovered or improving ($\chi^2=0.35$, $P=0.840$), while 48/240 (20%), 48/268 (18%), and 12/57 (21%) respectively consulted a general practitioner or practice nurse ($\chi^2=0.51$, $P=0.774$). Excluding costs of admissions, the average costs per case were £19.30, £17.97, and £11.70 for senior house officers, registrars, and general practitioners respectively. With cost of admissions included, these costs were £58.25, £44.68, and £32.30 respectively.

Conclusion—Management of patients with primary care needs in accident and emergency department by general practitioners reduced costs with no apparent detrimental effect on outcome. These results support new role for general practitioners.

Introduction

A new accident and emergency triage system at King's College Hospital resulted in 41% of new patients being prospectively classified as presenting with "primary care" problems suitable for management by a general practitioner.¹ This enabled us to undertake a controlled intervention study comparing "primary care" consultations made by junior and middle grade medical staff with those made by general practitioners (employed on a sessional basis).² We found significant differences, with the general practitioners seeming to be more discriminating in their selection of patients for investigation, treatment, and referral. Employing general practitioners seemed to offer a means of reducing rates of referrals,

investigations, and treatments. However, questions about outcome and costs remained: in particular, whether the general practitioners were undertreating patients or merely transferring activity and use of resources to community based services, together with the overall cost implications of the differences observed.

Studies asking such questions are scarce. In the United States studies have compared use of resources by physicians at hospitals and non-hospital sites,³ use of resources by general practitioners in clinics and doctors in hospitals,⁴ and the costs of non-urgent care in emergency departments,⁵ but their findings are not directly applicable to Britain. The subject of our current study is the relation between patient outcome and the average cost of each patient to the hospital. It was beyond the resources and scope of our study to consider the costs of ensuing care in general practice or the community.

Subjects and methods

We sampled a random selection of 419 three hour sessions stratified by time of day, day of week, and month between 10 am and 9 pm throughout a 12 month period, and we included all patients presenting with primary care problems who were treated during these sessions. We have already fully described the study setting, the triage system, the sampling of patients, and methods of collecting data on the consultation process.^{1,2}

PATIENT SATISFACTION

We interviewed patients who attended the accident and emergency department during a randomly selected subset of 90 sessions stratified by time of day, day of week, and month while they were waiting to be seen by the consulting doctor, and we asked them about their reasons for attending. We have already reported the sampling method and results of these interviews.⁶ We interviewed the patients again 7-10 days later by telephone (or sent them a postal questionnaire if they lacked a telephone) about their satisfaction with their assessment and treatment in the department, the extent of their recovery, and the health care they required after attending the department. Responses to questions of satisfaction were recorded on five point Likert scales, ranging from very satisfied to very dissatisfied.

THREE MONTH FOLLOW UP OF CLINICAL OUTCOME

We assessed the care received by patients in the three months after attending the accident and emergency department for all the 1458 patients in the study sample who were registered with practices near the hospital and who had been discharged for community or general practice follow up. We sent a brief questionnaire, with two reminders if necessary, to the general practitioners asking about the care that patients had required during this period. This questionnaire was completed by the

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patients' general practitioner, and, if requested, a member of the project team visited the practice to help with data collection.

ASSESSING HOSPITAL COSTS

We did this retrospectively by re-analysing the data from our previous study² in terms of the costs involved for each intervention that patients experienced as a result of attending the hospital (see box). Full descriptions of the methods used and costs derived are available from the authors. We estimated the costs of investigations, treatments, and referrals from hospital costing data and by consulting hospital finance staff and the managers of the units concerned. We calculated all costs at 1990-1 levels. There was insufficient information available from the original study to allow calculation of costs of referral to rehabilitation or community services.

Costing categories for treating patients in accident and emergency department

- Staff time
  - Consultations
  - Transactions
- Diagnostic tests
  - Radiology
  - Haemopathology
  - Chemical pathology
  - Microbiology
  - Electrocardiography
- Treatments and referrals
  - Pharmacy
  - Dressings and minor treatments
  - Outpatients
  - On call teams
  - Hospital admissions

Costs of diagnostic tests

We allocated diagnostic tests to cost categories which reflected the staff time and consumables used in the investigation: we used the Korner system for *x* ray investigations (this weighted investigations according to the amount of radiographer's time and materials used during the procedure) and the Welcan system for pathology tests (this is derived from the Welsh Workload Measurement System Manual and is a comprehensive costing system of staff time involved in recording patients' identity, assigning tests, performing tests, and interpreting and reporting results). We added overheads to the cost of staff time and consumables in proportions that reflected the greater and varying capital concentration in these departments.

The calculation of radiology costs illustrates the complexity of deriving costs for each procedure. In consultation with the consultant radiologist we allocated each *x* ray picture (blind to the requesting doctor) to Korner category A, B, C, or D. The cost per Korner unit was £5.90. Hospital managers estimated overheads—administration, clerical staff, capital depreciation, maintenance costs, and general hospital overheads (including heating and lighting)—to be 50-100% of the staff costs and consumables used.

Treatment costs

Prescription costs were estimated from the hospital pharmacist's price list (which included overheads and staff costs) according to the drug prescribed, the quantity provided, and whether it was dispensed during pharmacy opening hours or from the department's out of hours store. We also calculated the cost of antitetanus toxin, including the time taken by nurses to administer it.

Dressings—We estimated the time taken to dress and clean wounds and apply bandages by observing accident and emergency nurses and from discussions with nurse managers and staff. Costs for consumables were taken from the hospital price list for these items.

Referral costs

Outpatient referrals—Although data were available on outpatient referrals, it was difficult to obtain a complete data set relating to the outcome of each visit. In calculating the costs of outpatient referral, we therefore assumed, on the basis of data from the outpatient department on non-attendance for first appointment, that only 75% of patients attended. We costed each outpatient referral by specialty from hospital financial returns.

Referral to on call teams—Information on interventions that took place once a patient was referred to an on call team was limited. From our observations and discussions with departmental staff and managers we estimated that, on average, a referral resulted in an extra 30 minutes of the on call house officer or senior house officer time and 15 minutes of registrar time (excluding the time taken to contact the on call team). We added the costs of investigations and treatments ordered by the on call team.

Admissions—In all, 128 (2.8%) of the "primary care" patients were admitted to hospital. We calculated costs on the basis of the health authority's financial returns, weighted by specialty and length of stay.

Costs of doctors' time and transactions

We calculated the average length of consultations by analysing a subsample of 163 consultations that had been videotaped in June 1990 for studying doctors' consulting styles.⁷ We estimated the costs of doctors' time from their employment costs, converting these to costs per minute after adjusting for working hours and leave. To these costs we added transaction costs, which reflected the time involved in administration and communicating about tests and referrals with patients and with doctors, nurses, and clerical staff in other departments. Time taken to make arrangements by telephone and collate records are examples of transaction costs. We interviewed hospital managers and staff to establish the time taken in writing notes and setting up investigations, treatments, and referrals.

Derivation of average cost per case

We aggregated the costs identified for each intervention category for each type of doctor and divided this by the total number of patients seen by each type of doctor to give an average cost per patient treated.

Sensitivity analysis

We explored possible reasons for bias in the observed cost differentials by testing the data at various levels to find the percentage error at which the differences in costs between groups would disappear.

Modelling annual costs

To estimate the annual costs of treating all "primary care" patients attending King's College Hospital accident and emergency department between 10 am and 9 pm, we constructed workload models based on two assumptions: firstly, that about 75% (56 000) of the total 75 000 patients attending the department do so between these hours (as we found to be the case in our research study) and, secondly, that the 41% of patients who were triaged as "primary care" during the sampled sessions reflect the overall proportion of primary care patients attending the department. This gives a total annual attendance of some 22 500 patients. We

Table 1—Numbers (percentage) of patients expressing satisfaction with consultation with different types of doctor after attending accident and emergency department with problems of primary care type

Aspect of consultation	Type of doctor seen			χ^2 (P value)
	General practitioner	Senior house officer	Registrar	
Assessment	182/239 (76)	205/264 (78)	43/59 (73)	0.64 (0.73)
Treatment	176/238 (74)	196/261 (75)	46/58 (79)	0.72 (0.70)
Doctor's manner	192/214 (90)	202/231 (87)	40/47 (85)	1.03 (0.60)

estimated the costs of treating these patients using different configurations of medical staffing.

Results

PATIENT SATISFACTION AND OUTCOME

Of the 855 patients selected for interview, 567 (66%) responded to the telephone and postal survey. Of these patients, 240 (42%) had been seen by a general practitioner, 268 (47%) by a senior house officer, and 59 (10%) by a registrar or senior registrar. As shown in table 1, the patients expressed high levels of satisfaction for all aspects of the consultation, with 430/562 (77%) being "satisfied" or "very satisfied" with the clinical assessment (including examinations and investigations), 418/557 (75%) being happy with the treatment, and 434/492 (88%) being happy with the consulting doctor's manner.

There were slight, non-significant differences between the types of doctor in the reported levels of dissatisfaction ("dissatisfied" or "very dissatisfied"). Dissatisfaction with the consulting doctor's manner was expressed by 9/213 (4%) of the patients seen by a general practitioner, 20/231 (9%) of those seen by a senior house officer, and 5/47 (11%) of those seen by a registrar ($\chi^2=4.49$, $P=0.11$).

In terms of outcome, 206/241 (85%) of those seen by a general practitioner, 224/263 (85%) of those seen by a senior house officer, and 52/59 (88%) of those seen by a registrar reported that they were either fully recovered or improving by the time of the interview ($\chi^2=0.35$, $P=0.840$). Similar proportions of patients in each group reported visiting general practices during the seven to ten days after attending the accident and emergency department: 48/240 (20%) of those seen by a general practitioner, 48/268 (18%) of those seen by a senior house officer, and 12/57 (21%) of those seen by a registrar reported seeing a general practitioner or practice nurse ($\chi^2=0.51$, $P=0.774$).

When asked how they would respond to a similar problem in the future, 138/238 (58%) of the patients seen by a general practitioner, 166/262 (63%) of those seen by a senior house officer, and 39/59 (66%) of those seen by a registrar said that they would attend an accident and emergency department ($\chi^2=2.15$, $P=0.341$). More of the patients seen by a general practitioner said that they would either treat themselves or visit their own general practitioner in future.

Table 2—Associations between type of doctor seen in accident and emergency department and subsequent care required by patients in three months after discharge to community. Values are numbers (percentages) of patients unless stated otherwise

Aspect of consultation	Type of doctor seen			χ^2 (P value)
	General practitioner (n=438)	Senior house officer (n=469)	Registrar (n=107)	
Attended general practice for same problem	114 (26)	103 (22)	20 (19)	3.55 (0.17)
Underwent an investigation	27 (6)	20 (4)	2 (2)	4.06 (0.13)
Referred to outpatient clinic	24 (5)	19 (4)	3 (3)	1.90 (0.39)

THREE MONTH FOLLOW UP

Of the 1458 patients who were followed up three months after being discharged to the community, 1117 (77%) provided details of the general practice care that they had required after attending hospital. Of these patients, 255 (23%) had consulted their general practitioner on at least one occasion for the same reason that they had attended the accident and emergency department and 583 (52%) had consulted for other reasons. Table 2 gives details of the 438 patients who had seen a general practitioner when they attended the accident and emergency department, 469 who had seen a senior house officer, and 107 who had seen a registrar. The patients who had seen a general practitioner in hospital tended to make greater use of general practices and receive more referrals and investigations in the three months after their hospital visit.

COSTS

Table 3 shows the number of episodes recorded, total cost, and average cost per case associated with each cost category and with each type of consulting doctor. Admissions, referrals to outpatients, x ray investigations, and referrals to on call teams were, in that order, the most important contributors to the differences in costs between the types of doctor. Because the rates of admission were not significantly different, costs are given including admissions and excluding them. The hospital doctors were more likely to order x ray investigations and to order more expensive investigations than the general practitioners. However, consultation costs were higher for the general practitioners than for the hospital doctors because they spent, on average, 2 minutes and 58 seconds longer for each consultation and were paid about twice the hourly rate of senior house officers.

Excluding admission costs, we estimated the cost of treating each patient to be £11.70 if they were seen by a general practitioner, £19.30 if seen by a senior house officer, and £17.97 if seen by a registrar. When admission costs were included, the costs were £32.30, £58.25, and £44.68 respectively. The greatest difference in costs was between general practitioners and senior house officers, with patients seen by general practitioners costing about 40% less.

Sensitivity analysis

Many assumptions were made in calculating the costs. We explored the costs of each type of intervention individually and in aggregate to identify the variation necessary to change the ranking between the types of doctor. Some of the categories of investigation comprised only small numbers of events (such as chemical pathology and haematology), but 75% of the cost differences for investigations was due to the highly significant differences between the three groups of doctors in requests for x rays ($P<0.001$).²

For treatment costs, the main difference in aggregate costs was due to differences in outpatient referrals and admissions. Because of the small numbers of admissions, we also calculated aggregate costs without admissions. We made many assumptions in costing outpatient visits, referral to on call teams, and hospital admissions. As we applied conservative estimates of costs throughout, the size of the differences in costs may have been much greater than that calculated above.

Only when we compared maximum estimates of costs for general practitioners (25% above average) with minimum estimates of costs for hospital doctors (25% below average) did the latter seem less costly—by £0.12 per patient for registrars and £0.81 for senior house officers. In practice, however, movement in aggregate costs resulting from different estimates of the values of key interventions would be expected to occur in the

Table 3—Costs of different types of doctor treating patients attending accident and emergency department with primary care problems

Cost category	General practitioners (n=1702)			Senior house officers (n=2382)			Registrars (n=557)		
	No of episodes	Cost (£)		No of episodes	Cost (£)		No of episodes	Cost (£)	
		Total	Per case		Total	Per case		Total	Per case
Doctor consultation time	1 702	3 948	2.32	2 382	1 524	0.64	557	601	1.08
x Ray investigation	207	4 425	2.60	618	14 029	5.89	140	3 119	5.60
Biochemistry	13	153	0.09	86	1 048	0.44	9	105	0.19
Haematology	17	119	0.07	117	833	0.35	7	50	0.09
Microbiology	39	442	0.26	115	1 310	0.55	11	122	0.22
Electrocardiography	21	51	0.03	64	166	0.07	7	16	0.03
Pharmacy	636	1 174	0.69	975	1 834	0.77	247	512	0.92
Tetanus	115	119	0.07	209	214	0.09	48	50	0.09
Dressings	603	612	0.36	1 026	1 048	0.44	274	278	0.50
Outpatient referral	66	5 037	2.96	174	13 696	5.75	48	3 804	6.83
On call referral	85	2 791	1.64	252	8 622	3.62	39	1 024	1.84
Admission	15	35 061	20.60	72	92 778	38.95	6	14 877	26.71
Transactions	1 817	1 038	0.61	3708	1 643	0.69	836	323	0.58
Total:									
Including admissions		54 970	32.30		138 745	58.25		24 881	44.68
Excluding admissions		19 909	11.70		45 967	19.30		10 004	17.97

same direction for all three doctor groups. The difference in aggregate costs therefore seems to be robust.

Modelling annual costs

Our first model of annual costs is based on all 22 500 "primary care" patients who attend in a year between 10 am and 9 pm being treated by senior house officers and registrars in the proportions described in this study. Thus, senior house officers would see about 18 000 (80%) of the patients and registrars would see 4 500 (20%) at an average cost per case of £19.30 and £17.97 respectively (excluding admission costs). This gives a total cost for treating these patients of £428 265 a year.

The second model is based on general practitioners, senior house officers, and registrars seeing the same proportions of "primary care" patients over a year as they did in the study sample. Thus, general practitioners would see 8325 (37%) patients at an average cost per case of £11.70, senior house officers would see 11 475 (51%) patients, and registrars would see 2700 (12%). With this model, the total cost of treating these patients would be £367 389 a year.

If admission costs are included the difference is substantially greater, with the estimated savings from employing general practitioners increasing to about £150 000 a year at 1991 costs. As the differences between the doctor groups in the rates of admission and lengths of stay were not significant, the inclusion of these costs in the model must be viewed with caution.

Discussion

Our study is the first economic analysis in Britain to compare the management by different types of doctor of patients presenting to an accident and emergency department with primary care problems. The results suggested that if general practitioners, senior house officers, and registrars treated the same proportions of the "primary care" patient workload as they did in our study then the annual costs of care would be at least £61 000 less (1991 costs) than if general practitioners were not included.

The strength of this economic evaluation rests on the robustness of the clinical data from which costs were derived.² Although a rigorously controlled trial was precluded by unavoidable constraints operating in a busy hospital department, our study was designed to ensure that collection and analysis of data were unbiased. All the interventions that occurred during patients' attendance at the department were recorded, and the sample

size was sufficiently large to detect significant differences in many of them. During our study eight general practitioners, four registrars, and 27 senior house officers were employed in the accident emergency department. Thus, each doctor category included consultations made by a group of doctors, which should increase the generalisability of our findings. However, we cannot exclude the possibility that there were differences in case mix between the patients seen by the three groups of doctors.

SATISFACTION AND OUTCOME

It is well recognised that episode specific questionnaires may elicit more favourable ratings from patients than general questions about satisfaction,⁸ so the high degree of reported satisfaction with all aspects of care is not surprising. Although the less interventionist approach of the general practitioners did not seem to lead to less satisfied patients, this may have reflected a lack of sensitivity in the questionnaire used. For our study, patients were not informed about the grade or specialty of the doctor who treated them to avoid this influencing their satisfaction. However, as the general practitioners in the study were supernumerary, waiting times were reduced when they were present. This could not be controlled for, and the reduced waiting times may have increased patient satisfaction.

Given the broad range of conditions presented by the patients in our study and that many of the disorders were self limiting, the sample size was insufficient to determine differences in clinical outcome between the patients seen by the three groups of doctors. We therefore searched for any indicators that might imply inadequate care by considering patients' subsequent treatment and their satisfaction. Although the patients who had seen a general practitioner in the department tended to attend their own general practice more often, the differences were not significant and the effect sizes were small.

From inspecting patients' records, it was apparent that many of the patients who had seen a general practitioner in the accident and emergency department had been advised about the importance of continuity of care and had been encouraged to attend their own general practice for review and further care. This was consistent with the underlying philosophy of employing general practitioners in the department, which was to encourage the follow up of patients by primary care services in the community. However, it is also possible that this trend might have reflected inadequate care. It

was beyond the scope of the study to consider the longer term impact on clinical outcome and overall costs to the health service and patients.

LIMITATIONS WITH COSTING

The limitations of hospital costing information, especially at the time when we undertook the study, should be considered. Although financial estimates have been refined in recent years, there are still large disparities between hospitals in their cost estimates for the same procedure. Until costing conventions and hospital accounting practice are universal, the generalisability of such costing data will be limited. This study, though, provides a model that could be used to assess other schemes using locally based costs.

The list of items costed, while comprehensive, was not exhaustive because of the constraints in the original research project. For example, we could not estimate the cost impact of the differences between the groups of doctors in their referral rates to general practice and other primary care services in the community, nor could we estimate the costs of accident and emergency follow up or rehabilitation. Costs to patients and their families in using the accident and emergency department rather than their general practice will be the subject of a future study.

We studied only the additional costs of treating "primary care" patients in the accident and emergency department. Whether a hospital doctor or a general practitioner treated a patient would not have affected capital or overhead costs, and so these were not included in the analysis. We could not calculate management costs involved in administering the scheme because these were absorbed into the research costs of this study. Thus, there may be important hidden costs that should be considered by hospitals planning to institute a similar scheme.

Clearly, estimated savings associated with employing general practitioners may be only partially realisable. We have made some attempts to assess the realisable impact of general practitioners' employment in accident and emergency on the costs and workload of supporting departments. For example, our findings suggest that, on average, each three hour session spent by a general practitioner treating "primary care" patients in the accident and emergency department would result in roughly one less x ray investigation being performed than if the patients had been seen by a hospital doctor. Associated savings in consumables would amount to about £1.50 per patient. Radiology staff reported that the extra time created could be used to do more teaching, provide staff support, and allow staff to take appropriate breaks.

CONCLUSION

The results of our study suggest that employing general practitioners in accident and emergency departments to treat patients with primary care problems may be beneficial. However, the applicability of our results outside the controlled conditions of a research study must be considered. At King's College Hospital, general practitioners now work in the accident and emergency department for 52 hours a week and together see 11% of all new attendances. As well as the benefits shown in our study, several other gains have been observed. For example, the greater integration between general practitioners and hospital staff seems to have led to more effective and efficient referral and communication between community based and hospital based teams. The cost implications that this might have for the health service are difficult to predict.

Key messages

- Improving the cost effectiveness of treating patients attending accident and emergency departments is important to both purchasers and providers of services
- We compared the costs and outcomes of general practitioners and hospital doctors treating patients with primary care problems who attended an accident and emergency department
- There were no significant differences between the types of doctor in terms of patients' satisfaction and clinical outcome
- General practitioners provided care more cheaply than did the hospital doctors, reflecting their less frequent requests for investigations and referrals
- Employing general practitioners in accident and emergency departments offers a potential means of reducing the costs of treating patients with primary care problems

Following commendation by the National Audit Office and the Tomlinson inquiry,^{9 10} several districts have now established services based on this model. Many of these have been purchaser led, and purchasers have a key role in specifying the criteria against which the effectiveness of these developments should be judged. Cost effectiveness is likely to reflect not only the characteristics and experience of the general practitioners employed in these services but also a range of local circumstances, such as demand, and management and operational issues (such as service leadership and team development).¹¹

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