

THE COSTS OF VISITS TO EMERGENCY DEPARTMENTS

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Abstract Background. Many visits to emergency departments are for minor medical problems, and these visits are criticized as being expensive and economically inefficient. This study examines the marginal costs (the extra costs for an additional visit) of emergency department visits.

Methods. Monthly data on the costs of hospital and physicians' services from 1991 through 1993 were obtained from a sample of six community hospitals in Michigan. The data were analyzed with ordinary least-squares regression techniques to determine the ratio of marginal to average costs. Average and marginal costs were then determined for 24,010 visits during 12 randomly selected weeks in 1993. A visit by an individual patient was the unit of analysis, and visits were classified as nonurgent, semiurgent, or urgent according to explicit criteria. Costs and charges were determined for all visits and were classified according to the degree of urgency.

Results. For all emergency department visits, the average charge was \$383, the average cost was \$209, and the marginal cost was \$88 (42 percent of the average cost). Thirty-two percent of the visits were classified as nonurgent, 26 percent as semiurgent, and 42 percent as urgent. For nonurgent visits, the average charge was \$124, the average cost was \$62, and the marginal cost was only \$24. For semiurgent visits, the average charge was \$312, the average cost was \$159, and the marginal cost was \$67. For urgent visits, the average charge was \$621, the average cost was \$351, and the marginal cost was \$148.

Conclusions. The true costs of nonurgent care in the emergency department are relatively low. The potential savings from a diversion of nonurgent visits to private physicians' offices may therefore be much less than is widely believed. (N Engl J Med 1996;334:642-6.)

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THE costs of services provided by hospital emergency departments have become a major concern. Patients complain about the high costs of health care. President Bill Clinton has referred to emergency departments as "the most expensive place of all."¹ It is widely believed that about half of all visits to emergency departments are for minor medical problems and that the cost of a nonurgent visit to an emergency department is triple the cost of a visit to a physician's office.^{2,3} Diverting nonurgent visits from emergency departments to private physicians' offices is viewed as a way to gain substantial savings.⁴

Visits to hospital emergency departments continue to increase. In 1993 the General Accounting Office reported that emergency department use had increased by 19 percent from 1985 to 1990, with 99.6 million visits to emergency departments in 1990.⁵ There was a 34 percent increase in visits by patients with Medicaid, a 29 percent increase in visits by patients with Medicare, and a 15 percent increase in visits by uninsured patients.

Several authors have pointed out the need for a methodologically sound study of emergency department costs.^{6,7} Yet a comparison of the costs of services at private physicians' offices and in hospital emergency departments is complex. A simple comparison of charges provides a very distorted basis for a cost analysis. An accurate comparison can be made only by examining the actual costs of providing services in the two settings. Furthermore, the terminology of costs can be confusing and is inconsistent in the literature. Fixed costs are defined as those that are not dependent on volume, and variable costs as those that are dependent on volume. Fixed and variable costs may be either direct, such as the costs for medical staff, ancillary services, and supplies, or indirect, such as overhead and administrative costs.

The marginal cost can be defined as the extra cost for one additional visit.⁸ For example, there is very little marginal or extra cost involved in squeezing in a visit by a 12-year-old patient with acute asthma at a private physician's office at 4 in the afternoon. At 4 in the morning, however, the marginal cost of a visit to a physician's office by the same patient with asthma would be very high because of the inconvenience and expense of opening the office at a time when it is normally closed. In contrast, the marginal cost of seeing a patient with asthma in the emergency department at 4 a.m. is small, because the early morning is usually a slack period, yet the emergency department remains completely staffed.

There have been few studies of the costs of emergency department services.^{6,9,10} Policy makers are forced to rely on anecdotal information or make financial projections based on charges or average costs that include both urgent and nonurgent visits to emergency departments. The purpose of the study reported here was to determine the average and marginal costs of visits to emergency departments according to the urgency of the visit.

METHODS

Study Sample

The analysis of emergency department charges and costs is based on data from a convenience sample of six community hospitals in Michigan. The hospitals vary in terms of location, size, and volume of visits to the emergency department. None of the hospitals are located in the Detroit metropolitan area. Emergency services are provided on a fee-for-service basis by four independent and unaffiliated physician groups that use a common billing company. None of the hospitals make separate payments to the physician groups for emergency services. The physician groups and hospitals did not participate in the design of the study or the analysis of the data.

Study Design

There were two phases of the study. The objective of the first phase was to determine the ratio of the marginal cost to the average cost for services provided by the physician groups and emergency departments. These ratios were used in the second phase of the study to determine the marginal costs for individual patient visits. The hospitals and physician groups provided monthly data on the volume of visits, charges, and detailed direct and indirect costs for the 36-month period from January 1991 through December 1993. Marginal costs were de-

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terminated by ordinary least-squares regression analysis. The dependent variables were the total monthly direct cost for physicians' services and the total monthly direct cost for hospital services. The independent variables included the monthly volume of visits and the indicator variables for the hospitals. The direct costs of services provided by the hospitals and physician groups were selected for analysis because of inconsistencies in the accounting techniques used by the hospitals and physician groups in reporting indirect costs. Marginal direct costs were divided by average direct costs to determine ratios of marginal to average costs. Monthly volume, charge, and cost data were also used to determine average charges and cost-to-charge ratios.

In the second phase of the study, the costs for individual visits were determined according to the urgency of the visit. The hospitals and physician groups provided data for a total of 32,854 visits during three randomly selected weeks in each quarter of 1993. Data included demographic information, Current Procedural Terminology (CPT) codes, *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnostic codes, hospital charges by category (emergency department facility, laboratory, radiology, pharmacy, supplies, and other), and physicians' charges.^{11,12} The data provided by the hospitals and physician groups were merged on the basis of the unique patient registration number, date of service, and last name of the patient. After the merging, data were available for 24,010 emergency department visits.

The level of urgency was determined by senior coding personnel using explicit criteria.¹³ Urgent visits were defined as those that required immediate services in the emergency department. Patients whose visits were urgent included those who were admitted to the hospital; had conditions assigned urgent or critical care CPT codes; were transferred to another institution for special treatment, such as care of burns; or had lacerations requiring sutures, fractures, or medical conditions requiring extended evaluation in the emergency department. Visits classified as nonurgent were those for minor medical problems, such as acute pharyngitis, otitis media, upper respiratory tract infection, or first-degree burns. Visits by patients with moderately serious injuries or medical conditions were classified as semiurgent.

The cost-to-charge ratios for the hospitals were calculated from 1993 hospital Medicare Cost Reports. These ratios were multiplied by charges to estimate direct and indirect costs for supplies, pharmacy, laboratory, radiology, and miscellaneous items at the level of the individual visit.

Relative-value units for physicians' services, according to the resource-based relative-value scale, were used to estimate the cost of physicians' services for each visit.¹⁴ Approximately 95 percent of all the visits involved one of the CPT codes for emergency medical services (99281, 99282, 99283, 99284, 99285), with a total of about 100 CPT codes assigned. Total costs for physicians' services at each hospital were determined by multiplying the total charges for such services by the cost-to-charge ratios determined in the first phase of the study. Relative-value units for corresponding CPT codes were summed for all visits to each hospital. Hospital-specific conversion factors for relative-value units were determined by dividing the total costs for physicians' services by the sum of the relative-value units at each hospital. The cost of physicians' services for each visit was determined by multiplying the number of relative-value units for the visit by the hospital-specific conversion factor for the relative-value unit.

A major category of emergency department costs that may not be accurately represented by average cost-to-charge ratios is the allocation of nursing and support resources. Time and effort on the part of nursing and support staff are reflected in the emergency department's facility charge but may vary considerably according to the urgency of the visit. At some hospitals, the facility charge is the same for all visits, regardless of the severity of the medical condition. This analysis is based on the assumption that the allocation of nursing and support resources parallels that of physician resources, with a similar method of calculating relative-value units used to estimate personnel costs.¹⁰

Total facility costs for the emergency department at each hospital were determined by multiplying total facility charges by the cost-to-charge ratio, which was obtained from Medicare Cost Reports. A conversion factor was determined for each hospital by dividing the total facility costs for that hospital by the sum of patient-specific relative-value units. The personnel cost for each visit was determined by multiplying the number of relative-value units for the visit by the hospital-specific conversion factor for the relative-value unit.

The total cost for each visit, including direct and indirect costs, can be expressed as follows:

$$\text{Total cost per visit} = \text{Fac} + \text{Sup} + \text{Phar} + \text{Anc} + \text{Phy}$$

where Fac denotes total (direct plus indirect) facility costs (calculated in terms of relative-value units); Sup denotes total (direct plus indirect) supply costs (calculated in terms of the cost-to-charge ratio); Phar denotes total (direct plus indirect) pharmacy costs (calculated in terms of the cost-to-charge ratio); Anc denotes total (direct plus indirect) laboratory, radiology, and other ancillary costs (calculated in terms of the cost-to-charge ratio); and Phy denotes total (direct plus indirect) physicians' costs (calculated in terms of relative-value units). The total cost for each visit, excluding indirect costs, is the above cost minus the indirect costs associated with the facility, physicians' services, supplies, pharmacy, and ancillary services.

The marginal cost for each visit was estimated on the basis of the ratio of marginal to average costs for physicians' services (0.35) and facility services (0.41), as determined in phase 1 of the study. A ratio of 0.50 was assumed for all other costs (supplies, pharmacy, laboratory, radiology, and other ancillary services).¹⁵ The marginal cost for each visit was determined according to the following equation:

$$\begin{aligned} \text{Marginal cost} = & \text{Fac} \times 0.41 + (\text{Sup} + \text{Phar} + \text{Anc}) \\ & \times 0.50 + \text{Phy} \times 0.35. \end{aligned}$$

The analysis was performed with SAS statistical software.¹⁶ An analysis of variance was estimated with the standard techniques. Confidence intervals were determined at the 95 percent level, and P values of less than 0.05 were considered to indicate significance. A more detailed description of the study methods is available elsewhere.*

RESULTS

Selected characteristics of visits to the six emergency departments are shown in Table 1. The use of emergency departments according to the urgency of the medical problem is shown in Table 2. A total of 32 percent of the visits were classified as nonurgent, 26 percent as semiurgent, and 42 percent as urgent.

Emergency department charges, average costs, and marginal costs are shown in Table 3. The average total charge, including hospital and physicians' charges, for the 24,010 visits was \$383.29, the average direct cost was \$166.28, the average total cost (direct plus indirect) was \$209.42, and the marginal cost was \$87.68 (42 percent of the average cost). The average total charge for nonurgent visits was \$124.02, the average total cost was \$62.06, and the marginal cost was \$24.40. For semiurgent visits, the average total charge was \$312.49, the average total cost was \$159.47, and the marginal cost was \$66.94. For urgent visits, the average total charge was \$621.32, the average total cost was \$350.61, and the marginal cost was \$147.88. The frequency distribution for the most common ICD-9 diagnoses among nonurgent visits is shown in Table 4.

DISCUSSION

This study shows that the average cost of a nonurgent visit to an emergency department is much lower than commonly believed, and the marginal cost of a nonurgent visit is about \$25. For all 24,010 visits, the average cost was 55 percent of the average charge. One reason that the charges are twice the costs is that about half of

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all emergency department charges go uncollected.^{6,17} To put it another way, for each nonurgent visit to the emergency department by a patient who actually pays the charge of about \$125, there is one visit by a patient who pays nothing for the services rendered. An obvious implication is that per-visit charges could be substantially reduced if a larger percentage of visits to emergency departments were covered by third-party payers, such as managed-care plans or state Medicaid programs. It is important to note, however, that without an alternative financing mechanism or some type of universal insurance coverage, reimbursement for emergency department services on the basis of cost could severely compromise the financial viability of many emergency departments that currently provide essential services to uninsured patients.

Marginal costs of nonurgent visits to emergency departments are the basis of the potential cost savings from the diversion of such visits to other settings, such as private physicians' offices. Although estimates of the marginal costs of office visits are lacking in the literature, average charges are well established. The median 1993 charge to a new patient for an office visit was \$53, of which about \$45 was collected.^{18,19} In the case of patients with nonurgent conditions who visit emergency departments during the day, when physicians' offices are open, referrals to private physicians may result in cost savings, because the marginal cost of office visits may be less than \$25. At night and on weekends and holidays, however, such referrals would result in savings only if the marginal cost of providing services during these times at physicians' offices were less than the marginal cost of providing the services in emergency departments. Moreover, one cannot assume that all patients have access to sources of care other than the local hospital. Many inner-

Table 2. Characteristics of Emergency Department Visits According to the Urgency of the Medical Problem.

CHARACTERISTIC	NONURGENT	SEMIURGENT	URGENT
No. of visits (%)	7657 (32)	6176 (26)	10,177 (42)
Male patient (% of visits)	49	48	48
Race (% of visits)			
Black	22	16	16
White	75	81	81
Other	3	3	3
Mean age of patient (yr)	23.5	27.6	40.6
Age group (% of visits)			
1-12	35	24	14
13-19	11	17	10
20-34	30	30	25
35-64	20	21	28
≥65	4	8	23
Type of insurance (% of visits)			
None	14	13	12
Blue Cross-Blue Shield	16	24	20
Medicare	6	9	25
Medicaid	33	24	17
Workers' compensation	8	4	3
Managed care	3	3	3
Other	20	23	20
Family doctor of record (% of visits)	61	70	74
Weekend visit (% of visits)	30	30	30
Holiday visit (% of visits)	4	4	4

city and poor patients rely on the emergency department for health care services.^{20,21} According to a recent study, access to timely, episodic ambulatory care outside the emergency department is extremely limited, especially for Medicaid beneficiaries in urban areas.²²

Previous analyses of emergency department costs have not accounted for the severity of illness. Grannemann et al. used a multiple-output cost function and ordinary least-squares regression to estimate inpatient and outpatient hospital services, including the marginal costs of emergency department services.⁹ The dependent variable was the total annual cost as reported in Medicare Cost Reports. The marginal cost for all emergency department services was estimated at \$123 (61 percent of the average cost) and ranged from \$71 (41 percent of the average cost) in high-volume emergency departments to \$225 (89 percent of the average cost) in low-volume departments. Whereas Grannemann and associates used data from the 1982 National Ambulatory Care Survey and included a number of independent variables related to inpatient services and case mix, the current study was based specifically on detailed monthly data on emergency department costs and volume for a three-year period.

There are limitations of the study. The six community hospitals in Michigan were not randomly selected, although certain characteristics of vis-

Table 1. Characteristics of Visits to the Six Emergency Departments Studied.

CHARACTERISTIC	TOTAL	HOSPITAL					
		1	2	3	4	5	6
No. of visits*	24,010	4,806	4,973	4,132	2,873	4,677	2,549
No. of beds	—	165	75	370	70	350	270
Annual volume (no. of visits)	—	19,100	11,500	59,900	11,000	34,800	20,600
Urgency of condition (% of visits)							
Nonurgent	32	20	54	35	25	29	19
Semiurgent	26	26	18	29	32	28	23
Urgent	42	54	28	36	43	43	58
Mean age of patient (yr)	29.1	28.1	25.9	27.5	30.8	31.7	33.3
Male patient (% of visits)	49	51	47	48	50	45	50
Race (% of visits)							
Black	16	1	6	25	2	16	54
White	80	97	89	71	98	82	41
Other	4	2	5	4	0	2	5
Type of insurance (% of visits)							
None	13	7	9	23	7	16	12
Blue Cross-Blue Shield	22	33	26	12	27	15	20
Medicare	12	10	14	8	13	13	13
Medicaid	24	19	22	29	12	22	43
Workers' compensation	4	5	2	8	8	1	3
Managed care	3	4	3	2	6	5	1
Other	22	22	24	18	27	28	8
Family doctor of record (% of visits)	69	79	71	46	70	74	76
Arrived by ambulance (% of visits)	8	11	2	8	6	3	11
Admitted to hospital (% of visits)	13	14	6	7	15	15	25

*The number of visits refers to the total number of visits during three weeks in each quarter of 1993.

Table 3. Charges, Direct and Total Costs, and Marginal Costs, According to the Urgency of the Medical Problem.*

VARIABLE	ALL VISITS	NONURGENT VISITS	SEMIURGENT VISITS	URGENT VISITS
	<i>mean (95% confidence interval)</i>			
Charge (\$)				
Hospital services	271.93 (267.10–276.76)	59.43 (58.43–60.43)	213.13 (208.54–217.72)	467.49 (457.83–477.17)
Physicians' services	111.36 (110.68–112.03)	64.59 (64.24–64.93)	99.36 (99.04–99.68)	153.83 (152.77–154.88)
Total	383.29 (378.11–388.47)	124.02 (122.83–125.20)	312.49 (307.90–317.08)	621.32 (611.36–631.28)
Direct cost (\$)				
Hospital services	107.21 (105.62–108.81)	22.20 (21.90–22.51)	82.68 (81.32–84.03)	186.07 (183.07–189.06)
Physicians' services	59.07 (58.52–59.63)	23.81 (23.65–23.98)	44.53 (44.27–44.81)	94.42 (93.53–95.32)
Total	166.28 (164.28–168.29)	46.01 (45.59–46.43)	127.21 (125.80–128.62)	280.49 (277.02–283.96)
Total cost (\$)				
Hospital services	145.50 (143.63–147.37)	36.49 (36.07–36.90)	111.36 (109.99–112.73)	248.24 (244.92–251.56)
Physicians' services	63.92 (63.23–64.52)	25.57 (25.40–25.75)	48.11 (47.84–48.39)	102.37 (101.41–103.33)
Total	209.42 (207.08–211.76)	62.06 (61.52–62.61)	159.47 (158.04–160.89)	350.61 (346.71–354.52)
Marginal cost (\$)	87.68 (86.64–88.72)	24.40 (24.18–24.63)	66.94 (66.25–67.64)	147.88 (146.11–149.66)

*Hospital charges and costs are for the emergency department facility, supplies, laboratory, radiology, pharmacy, and other ancillary services. Total costs are the sum of direct and indirect costs. $P < 0.001$ for each comparison, by an analysis of variance.

its to the emergency departments of these hospitals, including the mean age of the patients, age distribution, sex distribution, use of ancillary services, admission rate, and distribution of CPT codes, are similar to those reported in other studies of multiple hospitals.^{3,17,23–26} The results, however, may not be applicable to other hospital settings or locations. In addition, the six emergency departments participating in the study contracted with physicians who used a common billing company. It is possible, but unlikely, that hospitals using such arrangements are atypical of community hospitals.

In addition, there is considerable disagreement about the definition of urgency, and other investigators may challenge the validity of the criteria used to classify visits as nonurgent, semiurgent, or urgent. The explicit criteria used in this study were based on the patient's condition and actual use of emergency department services.

The use of charges as a proxy for costs may not provide an accurate picture of the true costs of services, but the cost-to-charge method used in the study is similar to methods used by other investigators to determine costs.^{10,27–33} The assumption of a 0.50 ratio of marginal

to average costs for ancillary services (supplies, pharmacy, laboratory, radiology, and other services) may distort the estimates of marginal costs at the level of the individual visit. Ratios of marginal to average costs are rarely reported in the literature, and an assumed value of 0.50 is conservative, as compared with the calculated ratios for physicians' costs (0.35) and facility costs (0.41).¹⁵ The use of the relative-value unit in estimating physicians' and facility costs is based on empirical estimates of the use of physician resources but has not previously been used to determine emergency department costs.¹⁴ Under the prospective payment system based on diagnosis-related groups, hospital payments include emergency department costs for patients who are admitted, but the hospitals participating in the study could not provide complete data on outpatient charges for patients who were admitted from the emergency department. Hence, my estimate of costs for urgent visits is probably low. However, these deficiencies in the data should not affect the estimates of average and marginal costs for nonurgent and semiurgent patient visits.

Many important questions remain regarding the true costs of emergency department care for urgent and nonurgent conditions. Additional research is needed to determine the optimal use of emergency departments. However, this study provides evidence that the true marginal costs of nonurgent care at hospital emergency departments are far less than generally assumed.

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Table 4. Frequencies of Principal Diagnoses among 7657 Nonurgent Visits to Emergency Departments.

DIAGNOSIS*	NO. OF VISITS	DISTRIBUTION (%)	CUMULATIVE DISTRIBUTION (%)
Suppurative or unspecified otitis media	692	9	9
General symptoms (unspecified diagnosis)	655	9	18
Acute pharyngitis	579	8	26
Head injury	474	6	32
Upper respiratory infection	415	5	37
Sprain	235	3	40
Acute bronchitis	182	2	42
Toothache	167	2	44
Hand or finger injury	153	2	46
Conjunctivitis	148	2	48
Other	3957	52	100

*Based on the diagnostic codes in the *International Classification of Diseases, Ninth Revision, Clinical Modification*.¹²

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