Decreasing Reimbursements for Outpatient Emergency Department Visits Across Payer Groups From 1996 to 2004

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Study objective: There is increasing concern that decreasing reimbursements to emergency departments (EDs) will negatively affect their functioning, but little evidence has been published identifying trends in reimbursement rates. We seek to examine and document the trends in reimbursement for outpatient ED visits throughout the past decade.

Methods: We use Medical Expenditure Panel Survey data covering a 9-year span from 1996 to 2004, using outpatient ED visits as the unit of analysis. Our primary outcome variables were total and per-visit charges and payments across insurance. Using regression analyses with a generalized linear models approach, we also derived the adjusted mean payment and mean charge for each ED visit, as well as the average payment ratio.

Results: Overall, adjusted mean charges for an outpatient ED visit increased from $713 (95% confidence interval [CI] $665 to $771) in 1996 to $1,390 (95% CI $1,317 to $1,462) in 2004. The adjusted mean payment also increased from $410 (95% CI $366 to $453) in 1996 to $592 (95% CI $551 to $634) in 2004. Because payments increased at a slower rate in all payer groups compared with charges, the overall share of charges that were paid decreased over time from 57% in 1996 (n=3,433) to 42% in 2004 (n=5,763; $P<.001$). The proportion of total charges paid in 2004 was highest for privately insured visits (56%; n=2,005) and lowest for Medicaid visits (33%; n=1,618). For visits by uninsured patients (n=996), 35% of charges were paid in 2004.

Conclusion: The proportion of charges paid for outpatient ED visits from Medicaid, Medicare, and privately insured and uninsured patients persistently decreased from 1996 to 2004. These concerning decreases may threaten the survival of EDs and their ability to continue to provide care as safety nets in the US health care system. [Ann Emerg Med. 2007;xx:xxx.]

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INTRODUCTION

Background

Although emergency departments (EDs) are widely regarded as a key part of the nation's health care infrastructure, observers have voiced concern that the health of many EDs is threatened by persistent financial pressures.[1-5] The Emergency Medical Labor and Treatment Act of 1986 (EMTALA) mandates that all patients presenting to an ED be examined and medically stabilized regardless of ability to pay, resulting in increased demands on ED budgets as instability in the insurance environment has increased. Concerns about increasing medical costs have also fueled health plan efforts to contain cost growth, which can disproportionately affect EDs and the providers of other services with relatively high costs. Recent closures of EDs around the country have underscored these concerns.[6,7]

Importance

Although there is increasing concern from those in the emergency community about the financial feasibility of EDs as currently structured with public and private payers, little work has been done to elucidate this issue. Previous studies show that charges for health care services have been increasing for patients in all insurance categories, both private and public.[4] The uninsured are also paying more for each ED visit.[4] However, there is little evidence about the proportion of payments to charges; although payments may be increasing in absolute terms, this may actually be a relative decrease compared to

Editor's Capsule Summary

What is already known on this topic

US emergency departments (EDs) are mandated to provide care yet are not guaranteed payment for the care they provide. The cost of providing uncompensated care has been cited as the reason for closure of some US EDs.

What question this study addressed

This study determined trends in average ED charges, payments, and reimbursement rates from 1996 to 2004.

What the study adds to our knowledge

ED charges increased faster than ED payments throughout the study period, resulting in lower reimbursement rates. The pattern of decreasing reimbursement rates over time was observed across all 4 insurance categories examined: private insurance, Medicare, Medicaid, and no insurance.

How this might change clinical practice

Decreasing reimbursement rates will likely put more financial pressure on our already strained emergency care system.

charges. This belief is held widely by those in the ED community, but there is meager documentation of this phenomenon.

Goals of This Investigation

The ED "reimbursement ratio"—the share of ED charges that are ultimately paid—is a potentially important indicator of the financial pressures facing EDs, but current information about reimbursement rates is limited. We are aware of only a few studies, most of them small and more than a decade old.[8-11] The most recent work available, by Tsai et al,[4] showed decreasing reimbursements for ED visits from 1996 to 1998. Our primary goal is to determine, using visit-level regression analyses of national data from 1996 to 2004, whether the percentage of total charges paid per ED visit has been steadily increasing or decreasing overall. We also investigate whether there are differences among the insurance subgroups of patients who are uninsured or insured by Medicare, Medicaid, or private insurance.

MATERIALS AND METHODS

Study Design and Setting

This is a cross-sectional study using a large-scale, national survey spanning the 8-year period from 1996 to 2004, using the ED visit as the unit of analysis. The Medical Expenditure Panel Survey is publicly available data supported by the US Agency for Healthcare Research and Quality and provides data on health care use and expenditures for a nationally representative probability sample of the noninstitutionalized civilian population of the United States.[12]

Selection of Participants

For this study, the ED visits analyzed were obtained through the Medical Expenditure Panel Survey–Household Component, whose data are supplemented and verified with the Medical Provider Component. The sampling frame for each panel is taken from respondents to the National Health Interview Survey, administered by the National Center for Health Statistics. Person-level response rates from 1996 to 2004 vary by year and range from 64% to 71%.[13]

We focused our analysis on ED visits by individuals covered by Medicare, Medicaid, or private insurance and visits by uninsured individuals. We excluded visits that were covered under flat-fee arrangements or for which a zero charge was reported because it was not possible to clearly identify the appropriate charges and payments in these cases. We excluded visits that resulted in hospital admission because it was frequently not possible to disaggregate charges and payments for the ED visit from those for the subsequent inpatient care.

We accordingly excluded any visits for which insurance coverage could not be identified and any visits for which any coverage was obtained through CHAMPUS, CHAMPVA, TRICARE, worker's compensation. Visits covered under any other public hospital or physician insurance program (eg, Maryland Kidney Disease Program)[14] were also excluded because these insurance programs contribute to medical care costs in a variety of ways that are not representative of the general population. Finally, we excluded visits by patients for whom information required in our risk adjustment regressions was missing.

Data Collection and Processing

The Medical Expenditure Panel Survey–Household Component follows a panel for 2-and-a-half years in 5 rounds of interviews to obtain 2 full years of data. A new panel is chosen each year, but the previous year's panel is still surveyed for another year to create an overlapping panel design. This format allows data from 2 panels to be used to provide data for 1 calendar year. Each round of interviews covers the period in question (the "reference period"), along with the time after the previous interview was done. Medical Expenditure Panel Survey collects detailed information on medical events such as dental visits, hospital inpatient stays, outpatient visits, ED visits, office-based medical provider visits, home health, and prescribed medicines.

For our analysis, we abstracted detailed data on use of EDs and charges and payments for ED care from the Medical Expenditure Panel Survey database. Respondents were asked to use a diary to compile information about their health care use, associated charges, and out-of-pocket and insurance payments. These diaries were reviewed, and respondents were queried about any additional medical care use. The Medical Expenditure Panel Survey researchers obtained permission from

respondents to contact their providers and insurers to verify the information given. The Medical Expenditure Panel Survey also contains detailed information about demographics, insurance coverage, medical conditions, and related characteristics of respondents, which we also incorporated in our model.

We examined charges and payments separately for 4 groups: uninsured patients and patients covered by Medicare, Medicaid, and private insurance. The Medical Expenditure Panel Survey records insurance status for each respondent monthly, so we assigned each ED visit to a payer group according to the insurance indicated for the patient during the month in which the visit took place. Individuals were identified in Medical Expenditure Panel Survey as having private insurance if they indicated private coverage for hospital and physician services and did not indicate having Medicare or Medicaid coverage. The Medical Expenditure Panel Survey identified individuals as Medicare recipients if they indicated having Medicare coverage or, in a small number of cases, if they did not indicate having Medicare coverage but were older than 65 years and met one of the following conditions: indicated receiving Social Security benefits; reported receiving Medicaid, Medigap, or other public insurance; had a spouse aged 65 years or older who reported having Medicare coverage or, for visits after October 1, 2001, had TRICARE (earlier known as CHAMPUS or CHAMPVA) coverage.[14] Individuals reporting both Medicare and Medicaid coverage were classified as having Medicare, as were those reporting both private insurance and Medicare. The Medical Expenditure Panel Survey identifies individuals as having Medicaid coverage if they indicate Medicaid coverage or, in a small number of cases, if they do not indicate Medicaid coverage but do indicate having coverage from Aid for Families with Dependent Children, Supplemental Security Income, or the Women, Infant and Children Nutrition program.[14] Individuals were considered uninsured if they did not indicate having coverage from any source or indicated only coverage that did not provide for at least physician and hospital services (eg, dental coverage only).

The Institutional Review Board reviewed this study and classified it as exempt.

Outcome Measures

Our main outcome variables were total charges and total payments for each visit, as well as the ratio of these 2 variables (eg, the percentage of total charges paid). Total charges were defined as the aggregate of facility and physician charges. The total charge recorded in the Medical Expenditure Panel Survey reflects the sum of all fully established charges for medical care, including diagnostic tests, laboratory work, services, and treatment, before negotiated discounts are applied and before accounting for any adjustments or payments for bad debt or free care.[14-16] Total charges do not include charges for prescriptions for discharge medications. This measure reflects the amount charged by the hospital and need not reflect the actual resource cost of providing the services.

Total payments recorded in the Medical Expenditure Panel Survey are the sum of all payments to the facility and to providers treating the patient. They include out-of-pocket payments and payments made by private insurers, Medicare, Medicaid, and other sources that are directly tied to the specific medical care visit. They would not typically capture bonuses or other retroactive payment adjustments from third-party payers that might be linked to the visit.[17] Data for charges and payments from all years are converted to 2004 dollars with the Consumer Price Index.

The last outcome is the reimbursement ratio, or the proportion of charges that are paid. This can be reported 2 ways: as the average of the ratios (eg, the average of the proportion of each ED bill that is paid) and the ratio of the averages (eg, the ratio of the payments to charges as received by the hospital overall). Because these alternative ratios shed light on 2 different reimbursement aspects important to health providers and hospital administrators, we calculate and report both.

Primary Data Analysis

We focused our analysis on mean charges per visit, mean payments per visit, and the ratio of mean payments to mean charges. We began by examining unadjusted totals and means from the data. To account for variation in patient characteristics across insurers and over time, we concentrated our attention on estimates that adjust for a number of factors. To do the adjustment, we estimated visit-level regression models in which payments or charges were the dependent variable and independent variables captured important self-reported demographic characteristics and risk factors, including age (categorical in 4-year increments up to age 85 years; ages 5 years and up categorized in 1 group), sex, race (white, black, or other race); ethnicity (Hispanic or non-Hispanic), family income relative to the federal poverty line (less than 100%, 100% to 124%, 125% to 199%, 200% to 399%, or 400% or greater), educational attainment (less than high school, high school diploma, bachelor's degree, master's or doctoral degree, other degree, missing information, or not applicable); and marital status (single, married, widowed, divorced, separated, or, for those under age 16, not applicable). The models also adjust for geographic location, including the patient's census region (Northeast, Midwest, South, or West) and whether or not the patient lived within a metropolitan statistical area. We include these variables (all categorically coded) because they could change the use and charges of patient visits. We did not include any interaction terms.

Finally, the models adjust for the clinical characteristics of the visit, using indicator variables for the clinical classification code assigned to the visit, which also could affect the charges of each visit and control for acuity of patients across time. For each visit, the Medical Expenditure Panel Survey reported up to 3 *International Classification of Diseases, Ninth Revision (ICD-9)* condition codes and 1 *ICD-9* procedure code. These *ICD-9* codes were aggregated using Clinical Classification Software

Table 1. Distribution of excluded visits from sample, 1996–2004.

		Excluded Visits						
Year	Initial MEPS Sample	Flat Fee	Corresponding Hospital Stay	Missing ER Date or MEPS Weight	Insurance Category Not Defined	TRICARE, Other A, or Other B	No Urban/Rural Designation	Total Analyzed Obs
1996	3,899	31	163	140	59	38	35	3,433
1997	5,975	28	141	279	86	65	93	5,283
1998	4,154	34	53	186	41	49	68	3,723
1999	3,835	28	117	169	31	52	56	3,382
2000	4,192	43	284	188	40	53	0	3,584
2001	6,444	61	522	216	90	88	0	5,467
2002	7,858	50	575	352	107	148	0	6,626
2003	6,845	38	478	255	81	126	0	5,867
2004	6,827	48	562	285	72	97	0	5,763
Total	50,029	361	2,895	2,070	607	716	252	43,128

MEPS, Medical Expenditure Panel Survey.

(Agency for Healthcare Research and Quality, Washington, DC) to compose 260 mutually exclusive and clinically homogeneous categories, called clinical classification codes. Each visit could have 1 clinical classification code.[15,16]

The distributions of charges and payments were highly skewed. To account for this, we estimated the regressions using a generalized linear models approach, specifying a log transformation of the dependent variable and a Poisson variance structure (see Appendix E1, point 2, for further discussion; available online at http://www.annemergmed.com).[18-20] We calculated adjusted mean charges and adjusted mean payments holding all of the control variables fixed at their sample means and also computed the percentage of total charges paid as the ratio of adjusted mean payments to adjusted mean charges. We tested hypotheses about the equality of charges and payments from 1996 to 2004, and across insurance groups, using results from the regressions. We also tested hypotheses about the equality of reimbursement ratios by using variances derived from regression results incorporated into the Δ method.

All of our analyses used the sampling weights provided by the Medical Expenditure Panel Survey to account for unequal selection probabilities resulting from the complex study design, adjustment for nonresponse, and oversampling of subgroups. We used Stata software (version 8.0; StataCorp, College Station, TX) for the statistical analysis. All the dollar amounts are Consumer Price Index–adjusted for 2004 dollars, as mentioned above, and should be taken as a matter of course; the term "adjusted" in this article refers to results that have controlled for the clinical characteristics of each visit, as described in the Materials and Methods section.

RESULTS

In total, the data contain information about 50,029 visits. Application of our exclusion criteria left a sample of 43,128 visits spanning 1996 to 2004 (Table 1). Using the sampling weights from the Medical Expenditure Panel Survey to extrapolate to the entire population, 401 million total visits met our inclusion criteria. The number of visits tended to grow over time, with about 42 million visits in 1996 and 49 million in 2004 (Table E1, Appendix E1, available online at http://www.annemergmed.com). The characteristics of all the visits were similar over time, except for small changes in the insurance profile of the ED visits, with a slight increase in the number of visits covered by Medicare and Medicaid and a slight decrease in the number of visits covered by private insurance (Table E2, Appendix E1, available online at http://www.annemergmed.com).

Because total payments and charges can be misleading owing to volume of ED visits per subgroup, we examined mean charges and payments. Grouping all 4 insurance categories, in 1996 the unadjusted mean charge for an ED visit in our sample was $756 (95% confidence interval [CI] $699 to $813; Table 2). The unadjusted mean charge in 2004 was $1,528 (95% CI $1,449 to $1,607), and between 1996 and 2004, the unadjusted mean amount paid per visit increased from $458 (95% CI $418 to $498) to $703 (95% CI $659 to $747).

One thing that could drive changes over time is trends in the characteristics of patients. To account for this, we used regression models to adjust for a range of demographic characteristics and risk factors of patients. Table 2 presents data on charges and payments from 1996 through 2004, standardized for age, sex, race and ethnicity, income, education, marital status, geographic region, residence in a rural area, and the clinical classification code of the visit. Adjusted mean charges increased from $713 (95% CI $655 to $771) to $1,390 (95% CI $1,317 to $1,462). The adjusted mean amount paid also increased, from $410 (95% CI $366 to $453) to $592 (95% CI $551 to $634), Although both amounts increased, charges increased at a faster pace than payments, so the ratio of charges to payments decreased significantly between 1996 and 2004.

The changes between 1996 and 2004 shown in Table 2 are the result of trends in charges and payments over time. Figure 1 plots the trends in adjusted mean charge and adjusted mean

Table 2. Unadjusted and adjusted mean charges and payments by insurance category, 1996 and 2004.*

	All, $, n=43,128		Medicaid, $, n=10,058		Medicare, $, n=8,060		Private, $, n=17,446		Uninsured, $, n=7,564	
	Means	(95% CI)	Means	(95% CI)	Means	(95% CI)	Means	(95% CI)	Means	(95% CI)
1996										
Mean charges, unadjusted	756	699–813	580	524–636	1,096	926–1,267	760	659–860	628	560–696
Mean charges, adjusted	713	655–771	642	584–700	758	608–907	759	642–876	649	574–724
Mean payments, unadjusted	458	418–498	241	216–266	549	478–621	575	497–652	262	216–308
Mean payments, adjusted	410	366–453	279	245–312	381	296–467	537	446–629	275	224–326
1997										
Mean charges, unadjusted	780	743–816	642	585–699	1,082	930–1,233	743	701–786	716	644–789
Mean charges, adjusted	732	698–767	706	635–776	727	578–876	745	691–799	739	648–830
Mean payments, unadjusted	475	445–504	293	253–334	653	526–779	499	465–533	391	333–449
Mean payments, adjusted	429	404–454	340	292–389	440	317–564	477	435–518	409	342–477
1998										
Mean charges, unadjusted	847	806–888	674	599–749	1,035	946–1,124	830	761–898	858	769–948
Mean charges, adjusted	790	744–836	763	665–861	709	601–818	802	733–870	869	739–1,000
Mean payments, unadjusted	452	428–475	240	217–263	456	414–497	528	488–569	413	349–476
Mean payments, adjusted	402	375–430	285	251–318	311	249–373	489	445–532	430	323–537
1999										
Mean charges, unadjusted	840	794–886	693	623–764	1,112	991–1,233	827	752–902	719	646–791
Mean charges, adjusted	786	740–833	793	703–882	768	644–892	816	731–901	718	622–815
Mean payments, unadjusted	459	426–492	258	228–289	526	469–584	543	481–604	308	262–355
Mean payments, adjusted	411	377–444	306	264–349	357	286–428	504	438–569	320	255–384
2000										
Mean charges, unadjusted	901	855–947	642	578–706	1,259	1,127–1,390	821	758–884	927	806–1,047
Mean charges, adjusted	808	763–854	697	629–766	842	695–989	802	736–868	907	762–1,052
Mean payments, unadjusted	465	437–492	265	233–296	593	519–667	501	459–543	385	320–449
Mean payments, adjusted	408	381–435	309	272–346	401	317–486	463	416–511	386	307–465
2001										
Mean charges, unadjusted	1,012	967–1,058	878	794–962	1,343	1,196–1,490	948	885–1,011	939	852–1,027
Mean charges, adjusted	925	881–970	978	870–1,087	891	749–1,033	910	835–985	939	834–1,045
Mean payments, unadjusted	528	499–557	361	313–409	609	528–690	598	551–644	386	339–434
Mean payments, adjusted	464	436–493	417	357–476	408	323–493	540	484–596	394	326–462
2002										
Mean charges, unadjusted	1,132	1,066–1,198	924	826–1,023	1,468	1,196–1,739	1,104	1,045–1,164	1,014	932–1,096
Mean charges, adjusted	1,028	967–1,089	1,044	916–1,173	987	751–1,222	1,055	987–1,123	994	898–1,089
Mean payments, unadjusted	553	525–581	398	321–474	558	494–622	661	622–700	416	370–463
Mean payments, adjusted	490	458–521	465	364–566	378	303–454	596	549–643	423	368–478
2003										
Mean charges, unadjusted	1,311	1,263–1,360	1,009	939–1,078	1,618	1,494–1,742	1,298	1,222–1,374	1,329	1,186–1,472
Mean charges, adjusted	1,199	1,149–1,249	1,138	1,047–1,229	1,112	964–1,259	1,227	1,148–1,306	1,338	1,155–1,520
Mean payments, unadjusted	572	548–597	302	280–324	595	541–650	722	675–770	467	405–529
Mean payments, adjusted	485	462–507	353	319–388	408	336–481	639	588–690	487	400–574
2004										
Mean charges, unadjusted	1,528	1,449–1,607	1,167	1,073–1,261	1,664	1,537–1,792	1,579	1,434–1,724	1,635	1,375–1,895
Mean charges, adjusted	1,390	1,317–1,462	1,280	1,160–1,401	1,146	969–1,322	1,491	1,312–1,670	1,646	1,314–1,977
Mean payments, unadjusted	703	659–747	372	332–412	626	556–695	936	841–1,031	558	467–649
Mean payments, adjusted	592	551–634	418	373–464	431	325–536	835	716–955	581	445–716

*All figures shown are reported in Consumer Price Index–adjusted 2004 dollars.

payment over time. Before 2000, charges trended upward slowly, whereas payments remained relatively stable. Thereafter, mean charges began to increase relatively rapidly, whereas mean payments showed a smaller amount of growth. The confluence of these 2 trends leads the reimbursement ratio to decrease over time, most steeply after 2000. These decreases were observed in all subgroups (Figures E1-E4; see Appendix E1, available online at http://www.annemergmed.com) and were verified with regressions to test for a linear trend over time as well as bootstrapping (see Appendix E1, available online at http://www.annemergmed.com; point 4).

We report both the unadjusted and adjusted ratios of payments to charges, which represent the average of the ratios (ie, average portion of bills paid) and the ratio of the averages (ie, what the hospital receives), respectively. As seen in Table 3, the adjusted ratios are consistently lower than the unadjusted ratios (except for the Medicaid and Medicare subgroups in 1997), which indicates that there are a significant number of

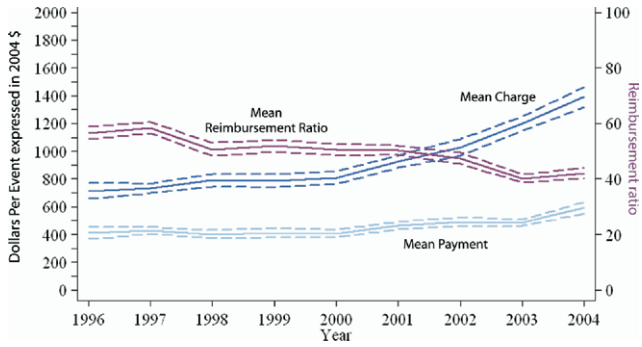

Figure 1. Adjusted mean charges and payments for all, 1996 to 2004 (dollar figures are Consumer Price Index–adjusted 2004 dollars; error bars represent 95% CIs).

large hospital bills that are reimbursed poorly. (For further discussion, see Appendix E1 [available online at http://www.annemergmed.com], point 3, as well as Goldman and Smith).[21]

There are notable differences across the 4 payer groups we studied. Before adjustment, charges of Medicaid-covered visits were consistently lowest across all groups, and those of Medicare-covered visits were uniformly highest in every year from 1996 to 2004. After adjustment, however, mean charges again were lowest in the beginning in visits by Medicaid patients ($642; 95% CI $584 to $700), but after 1997, Medicare visits had the lowest charges across all insurance groups in all years except 2000. Generally speaking, adjusted charges were higher for visits covered by private insurance, as well as uninsured visits.

Unadjusted payments were lowest in the Medicaid-covered visits every year, but adjusted payments were in several years lowest for uninsured visits. Both Medicare and privately covered visits had higher unadjusted payments, but after adjustments, visits covered by private insurance were always the highest ($537 in 1996, 95% CI $446 to $629; and $835 in 2004, 95% CI $716 to $955).

Both ratios—the proportion of bill paid per ED visit, as well as the share of charges hospitals received—were consistently the highest for visits by privately insured patients and lowest for Medicaid and uninsured patients, with the exception of 2002 (Figure 2). Between 1996 and 2004, there were downward trends in the reimbursement ratios in each of the 4 insurance categories. Although privately insured and Medicare visits had higher reimbursement ratios, they also had the largest decreases over time, more than 13 percentage points. On a relative scale, however, the decrease in the share of charges received by hospitals was greatest, 25%, for Medicaid and Medicare. The reimbursement ratio decreased the least for visits by uninsured patients, decreasing by 7 percentage points, or 17%, from its ratio in 1996.

LIMITATIONS

Our findings should also be considered with several limitations in mind. First, the Medical Expenditure Panel Survey data are based on surveys and depend on household reports, which are susceptible to recall bias. We assume this would lead to underreporting of ED visits. Second, the Medical Expenditure Panel Survey database does not consider individual physician or hospital billing. As hospitals and individual physician billing systems vary widely in their accounting practices, this, too, would not be able to be taken into account. In the same vein, there is no manner in which funds such as disproportionate share payments can be incorporated into the analysis. Because we cannot assign certain dollar amounts to the payment received on behalf of individual patient visits, the hospital may be receiving more payments than can be individually accounted for.

Finally, the third limitation for which the Medical Expenditure Panel Survey has been often criticized is its undercounting of ED visits.[22] The National Hospital Ambulatory Medical Care surveys, for example, estimate that there were more than 90 million visits to the ED in 1996 and more than 113 million in 2003, which is double that of what Medical Expenditure Panel Survey estimates.[23,24] Specifically, one large group of patients not included in the Medical Expenditure Panel Survey are nursing home patients, which means that our estimates of total nationwide charges and payments may be too low. However, the focus of our paper is on the *proportion* of payments to charges and should thus not be affected. Nor would our evidence about trends be biased unless there is differential undercounting over time, which we have not seen suggested, because the process for sampling Medical Expenditure Panel Survey data has been similar for the years we include. We are also unaware of any evidence suggesting differential undercounting across payer groups, so comparisons between payer groups should still be useful.

Related concerns of Medical Expenditure Panel Survey data surrounding its discrepancy in admission rates (compared with the National Hospital Ambulatory Medical Care Survey) and expenditure data (compared with the National Health Expenditures) are discussed in greater detail in point 1 of Appendix E1, (available online at http://www.annemergmed.com). In the end, the Medical Expenditure Panel Survey is accepted as the only national source of publicly available data that combines patient-level encounters with use rates, along with expenditure data.[25]

Because we excluded ED visits resulting in hospitalization, our results apply only to patients not admitted to the hospital from the ED. Because admitted patients may have different percentages of total charges paid and also will likely be billed at a higher level of complexity (which could be reimbursed differently), these results cannot be extrapolated to the overall discussion of ED charges and payments. Furthermore, general conclusions about the controversial question of whether EDs are "cost centers" or "revenue centers" cannot be drawn from our results.

Table 3. Unadjusted and adjusted percentage of charges paid by insurance category, 1996 and 2004.

	All, %, n=43,128		Medicare, %, n=8,060		Medicare, %, n=8,060		Private, %, n=17,446		Uninsured, %, n=7,564	
	Total	(95% CI)	Total	(95% CI)	Total	(95% CI)	Total	(95% CI)	Total	(95% CI)
1996										
Charges paid, unadjusted	64	63–65	48	46–50	56	54–58	76	75–78	52	47–57
Charges paid, adjusted	57	54–59	43	39–47	50	44–57	71	67–74	42	36–49
1997										
Charges paid, unadjusted	63	62–64	48	47–50	58	57–60	70	69–71	56	53–60
Charges paid, adjusted	58	56–60	48	44–53	61	53–68	64	62–66	55	49–61
1998										
Charges paid, unadjusted	60	59–61	44	42–46	52	50–55	71	69–72	51	48–54
Charges paid, adjusted	51	48–53	37	34–41	44	39–49	61	57–65	49	42–57
1999										
Charges paid, unadjusted	58	57–59	43	41–45	51	49–53	68	66–70	48	44–51
Charges paid, adjusted	52	50–54	39	35–43	46	42–51	62	58–65	44	37–52
2000										
Charges paid, unadjusted	58	56–59	46	44–49	55	49–61	65	64–67	49	45–52
Charges paid, adjusted	51	49–53	44	40–49	48	42–53	58	55–61	43	36–49
2001										
Charges paid, unadjusted	57	56–58	45	43–47	49	47–51	69	67–70	46	43–48
Charges paid, adjusted	50	49–52	43	39–46	46	41–51	59	57–62	42	37–47
2002										
Charges paid, unadjusted	54	54–55	45	44–47	45	44–47	65	64–66	46	44–48
Charges paid, adjusted	47	45–50	45	39–50	38	33–44	57	54–59	43	38–47
2003										
Charges paid, unadjusted	51	50–52	40	39–42	43	41–44	62	61–63	44	41–46
Charges paid, adjusted	40	39–42	31	28–34	37	33–40	52	49–55	36	31–42
2004										
Charges paid, unadjusted	51	51–52	40	39–41	44	43–46	64	63–65	41	38–43
Charges paid, adjusted	42	40–44	33	30–36	38	33–43	56	53–59	35	26–45

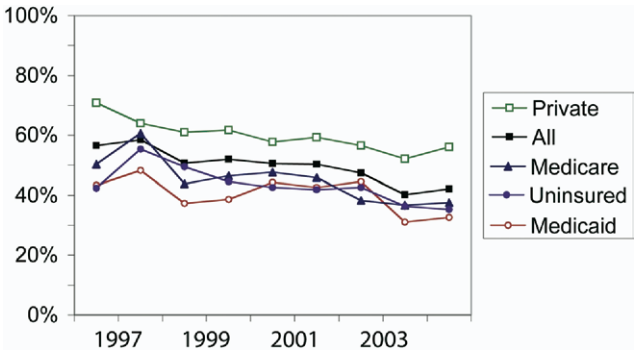

Figure 2. Percent of charges paid by insurance category, 1996-2004.

DISCUSSION

Nationwide between 1996 and 2004, the overall proportion of ED charges paid for outpatient ED visits decreased from 57% to 42%. The share of charges paid was consistently the lowest for visits by Medicaid and uninsured patients and consistently the highest for visits by patients covered by private insurers. Interestingly, the decreases in the proportion of payments to charges over time tended to be sharper among patients with insurance than among the uninsured.

This study is not designed to identify the particular causes of the changes in charges or payments that we observe. There are, in fact, a number of forces that could be at work. We observed that charges for outpatient ED visits, both the average charge per visit and total charges nationwide, increased over time. Charges may have increased over time for a variety of reasons. One possibility is that charges reflect, to at least some degree, the resource cost associated with providing care. It seems reasonable to expect that resource costs have increased over time. For example, tightness in the labor market for nurses has compelled employers to offer greater monetary and nonmonetary retention benefits over time.[26] Costs may also have increased because of higher utilization of services for diagnosis or treatment of any particular disease process. In many areas of medicine, technologies introduced even in the past decade have made new treatments available to patients, leading to increased costs.[27] Recent evidence documenting things such as increases in the number of computed tomography scans for abdominal pain seems consistent with this view. [28,29] Our model adjusted for many factors associated with patient severity but would not have captured variation in the procedures performed for patients with a given set of characteristics. Although we attempted to adjust for patient severity with the clinical classification code, it is possible that we were not able to completely capture all aspects of potentially higher acuity and

thus could contribute to higher charges as well. Finally, larger-scale factors such as increasing gross domestic product and ability to pay, higher patient expectations, defensive medicine, and malpractice litigation may also drive higher utilization of services and diagnostics.[30] These factors, as long as they do not affect payer groups differently, would likely affect all payer groups similarly.

Another possibility is that increases in charges are driven by forces other than changes in the resource costs of providing care. It may be that providers have reasons to increase the amounts charged simply because the market will bear higher prices. Because some payers have reduced reimbursements for ED visits, providers with market power may increase prices to other payers.[31-33] It may also be that the dynamics of negotiations with insurers produce strategic reasons to increase charges, even if providers do not expect to fully recover charged amounts. For whatever reason, these possibilities have led to speculation that "sticker prices" for ED care have been increasing, regardless of the underlying costs.[34]

In absolute terms, total payments and payments per visit increased over time. However, because they increased more slowly than charges, the result is a decrease in the share of charges paid. Pressures from payers to restrain amounts paid for care have been significant and have likely limited payment growth over time. Emergency physicians in 2002, for example, experienced an 8% cut in reimbursement for Medicare services.[35] In the same vein, as the number of Medicaid enrollees has continued to increase, from 42.5 million enrollees in 2000 to 57.3 million enrollees in 2004,[36] there have been both state and federal initiatives to decrease spending.

There has recently been considerable attention focused on the amounts charged to and paid by uninsured patients. We find that although average charges to uninsured patients were in the middle of the 4 insurance groups in 1996, uninsured visits had the highest charges in 2004. Payments for uninsured patient visits also increased noticeably between 1996 and 2004, which is generally consistent with the view that uninsured patients have been disproportionately disadvantaged by trends in ED charges and payments.

We also find that 35% of charges for uninsured visits were paid in 2004. This percentage is lower than that for visits by privately insured or Medicare-covered visits but substantially higher than the payment ratios that are sometimes reported (eg, in California, some emergency physician billing groups have reported recovery rates of approximately 10% for the uninsured/self-pay).[37] Hospital administrators should not regard all uninsured/self-pay patients as universally poor payers. Although the distribution of payments requires further analysis and a stratified analysis by income would likely shed more light, our results do show that the average payment-to-charge ratio is significantly higher than generally believed for this payer group.

The reasons behind a decreasing proportion of payments-to-charges means for EDs could be multifactorial. If "sticker price" adjustments are a substantial contributor to increasing charges, it may be that the increases in payments we observe are in fact sufficient to cover actual changes in resource costs. If decreasing reimbursement ratios cut into the ability of EDs to recover their actual costs of providing care, though, there may be reason for concern.[38] Some data suggest that decreasing relative payments could have negative consequences for EDs. Bamezai et al[39] recently reported that the mean 1998 cost of an ED visit, excluding physician compensation, was $412 in a trauma ED and $295 for a nontrauma ED (in 1998 dollars), which would translate to $536 and $384 in 2004 dollars, using a 4.5% inflation rate. These figures are not unlike the average payments that we observe in 2004, and our payment figures include physician compensation, whereas their cost estimates do not. Although computing the actual costs of ED visits is difficult to do with precision and our data sets are not perfectly comparable, these 2 figures raise the serious possibility that EDs are not recovering their costs in many cases. Some other estimates would concur. According to a 1999 white paper released by the California Medical Association, California EDs treated approximately 9 million patients in 1999, losing an average of $46 per patient treated.[40] Recent years have also seen some ED closures, which may be at least partly related to financial concerns. For example, in California, the number of EDs decreased by 12% during the 1990s (although the total number of ED beds increased by 16%).[7]

Another concern is that providers may respond to decreasing reimbursement rates by raising charges in an attempt to maintain consistent absolute levels of payments. These kinds of changes may help maintain revenue in some cases, such as contracts that specify payments as a percent of charges, at least for a period of time until payers adapt. But this can also have negative impacts on some patients, particularly the uninsured, who would face significantly higher prices for ED care.[41-45]

Increasing numbers of uninsured patients in the United States may also put pressure on EDs in coming years. The Emergency Medical Labor and Treatment Act requires EDs to care for patients regardless of their ability to pay.[1] Existing pressures on EDs could become more acute if more patients move from having insurance, and a relatively high reimbursement ratio, to being uninsured, if that means a lower reimbursement ratio.

EDs provide valuable services to wide variety of patients and act in many cases as core safety net providers.[46-48] We have identified a concerning trend of a decreasing percentage of total charges paid for outpatient ED visits. These findings should serve as an impetus for continued attention to the financial needs of EDs and the hospitals that operate them to ensure that the availability of these services is not inappropriately limited.

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REFERENCES

1. Fields WW, Asplin BR, Larkin GL, et al. The Emergency Medical Treatment and Labor Act as a federal health care safety net program. *Acad Emerg Med*. 2001;8:1064-1069.
2. Burt CW, Arispe IE. Characteristics of emergency departments serving high volumes of safety-net patients: United States, 2000. *Vital Health Stat 13*. 2004;155:1-16.
3. Kane C. *Physician Marketplace Report: The Impact of EMTALA on Physician Practices.* Chicago, IL: Center for Health Policy Research, American Medical Association; 2003.
4. Tsai A, Tamayo-Sarver J, Cydulka R, et al. Declining payments for emergency department care, 1996-1998. *Ann Emerg Med*. 2003; 41:299-308.
5. Schafermeyer RW, Asplin BR. Hospital and emergency department crowding in the United States. *Emerg Med*. 2003;15:22-27.
6. Sun BC, Mohanty SA, Weiss R, et al. Effects of hospital closures and hospital characteristics on emergency department ambulance diversion, Los Angeles County, 1998 to 2004. *Ann Emerg Med*. 2006;47:309-316.
7. Lambe S, Washington DL, Fink A, et al. Trends in the use and capacity of California's emergency departments, 1990-1999. *Ann Emerg Med*. 2002;39:389-396.
8. Saywell R Jr, Woods J, Rodman G Jr, et al. Financial analysis of an inner-city helicopter service: charges versus collections. *Ann Emerg Med*. 1989;18:21-25.
9. Saywell R Jr, Nyhuis A, Cordell W, et al. An analysis of reimbursement for outpatient medical care in an urban hospital emergency department. *Am J Emerg Med*. 1992;10:8-13.
10. Woods J, Saywell R Jr, Rodman G Jr, et al. Financial analysis of an inner-city helicopter service: charges versus collections for patients transferred from another acute care facility. *Ann Emerg Med*. 1989;18:1240-1243.
11. Mitchell T, Remmel R. Level of uncompensated care delivered by emergency physicians in Florida. *Ann Emerg Med*. 1992;21:1208-1214.
12. Cohen J, Monheit A, Beauregard K, et al. The Medical Expenditure Panel Survey: a national health information resource. *Inquiry*. 1997;33:373-389.
13. Agency for Healthcare Research and Quality. Medical Expenditures Panel Survey: frequently asked general questions. August 2005. Available at: http://www.meps.ahrq.gov/faqs/faq_hc.htm. Accessed March 13, 2006.
14. *MEPS HC-079: 2003 Full Year Consolidated Data File*. Rockville, MD: Agency for Healthcare Research and Quality; 2005.
15. *MEPS HC-010E: 1996 Emergency Room Visits*. Rockville, MD: Agency for Healthcare Research and Quality; 2000.
16. *MEPS HC-067E: 2002 Emergency Room Visits*. Rockville, MD: Agency for Healthcare Research and Quality; 2004.
17. *MEPS HC-077E: 2003 Emergency Room Visits*. Rockville, MD: Agency for Healthcare Research and Quality; 2005.
18. Duan N. Smearing estimate: a nonparametric retransformation method. *J Am Stat Assoc*. 1983;78:605-610.
19. Manning WG, Mullahy J. Estimating log models: to transform or not to transform. *J Health Econ*. 2001;20:461-494.
20. Mullahy J. Much ado about two: reconsidering retransformation and the two-part model in health econometrics. *J Health Econ*. 1998;17:247-281.
21. Goldman DP, Smith JP. Methodological biases in estimating the burden of out-of-pocket expenses. *Health Serv Res*. 2001;35: 1357-1365.
22. Wears RL. How many emergency department visits are there? *Ann Emerg Med*. 2003;41:319-321.
23. 1996 National Hospital Ambulatory Medical Care Survey. Hyattsville, MD: National Center for Health Statistics; 1996.
24. 2003 National Hospital Ambulatory Medical Care Survey. Hyattsville, MD: National Center for Health Statistics; 2003.
25. Bigelow JH, Fonkych K, Fung C, et al. *Analysis of Healthcare Interventions That Change Patient Trajectories*. Santa Monica, CA: RAND; 2005.
26. *Cost of Caring: Key Drivers of Growth in Spending on Hospital Care*: Prepared by Pricewaterhouse Coopers for the American Hospital Association and the Federation of American Hospitals; 2003.
27. Cutting Edge Costs: Hospitals and New Technology. *Trendwatch*. 2002;4:1-4.
28. Raptopoulos V, Katsou G, Rosen MP, et al. Acute appendicitis: effect of increased use of CT on selecting patients earlier. *Radiology*. 2003;226:521-526.
29. Rosen MP, Sands DZ, Longmaid HE III, et al. Impact of abdominal CT on the management of patients presenting to the emergency department with acute abdominal pain. *Am J Roentgenol*. 2000;174:1391-1396.
30. Anderson GF, Frogner BK, Johns RA, et al. Health care spending and use of information technology in OECD countries. *Health Aff (Millwood)*. 2006;25:819-831.
31. Ginsburg P. Can hospitals and physicians shift the effects of cuts in Medicare reimbursement to private payers? *Health Aff (Millwood)*. 2003;Web Excl:W3-472-479.
32. Lee J, Berenson R, Mayes R, et al. Medicare payment policy: does cost shifting matter? Health Aff (Millwood). 2003;Web Excl: W3-480-488.
33. Zwanziger J, Melnick G, Bamezai A. Can cost shifting occur in a price competitive environment? *Health Econ*. 2003;9:211-226.
34. Reinhardt U. The pricing of U.S. hospital services: chaos behind a veil of secrecy. *Health Aff (Millwood)*. 2006;25:57-69.
35. American College of Emergency Physicians. Costs of emergency care. June 2003. Available at: http://www.acep.org/webportal/Advocacy/media/tools/talkpts/costsemcare.htm. Accessed May 14, 2006.

36. Implications of Federal Medicaid reform on states, beneficiaries, and providers. *Trendwatch*. 2005;7:1-12.
37. Edwards I. *The Basics of Reimbursement and the Medi-Cal Program. Lifeline*. Sacramento, CA: California Chapter of the American College of Emergency Physicians; 2006:1, 2, 5, 6.
38. Taylor T. Threats to the health care safety net. *Acad Emerg Med*. 2001;8:1080-1087.
39. Bamezai A, Melnick GA, Nawathe AC. The cost of an emergency department visit and its relationship to emergency department volume. *Ann Emerg Med*. 2005;45:483-490.
40. *California's Emergency Services: A System in Crisis.* California Medical Association; 2001.
41. Lagnado L. One critical appendectomy later, young woman has a $19,000 debt. *Wall Street Journal*. March 17, 2003; A1.
42. Lagnado L. Hospitals try extreme measures to collect their overdue debts. *Wall Street Journal*. October 30, 2003; A1.
43. Lagnado L. Hospitals will give price breaks to uninsured, if Medicare agrees. *Wall Street Journal*. December 17, 2003.
44. Tompkins CP, Altman SH, Eilat E. The precarious pricing system for hospital services. *Health Aff (Millwood)*. 2006;25:45-56.
45. Wielawski I. Gouging the medically uninsured: a tale of two bills. *Health Aff (Millwood)*. 2000;19:180-185.
46. 42 U.S.C. s 1395dd (Supp. IV 1987).
47. EMTALA: Survey of Hospital Emergency Departments. In: Office of Inspector General, ed; 2001.
48. Report on the impact of EMTALA on hospital emergency departments, the delivery of emergency care, and CMS/OIG enforcement. In: Report from the General Accounting Office (GAO), ed; 2001.

Editor's Capsule Summary *What is already known on this topic:* US emergency departments (EDs) are mandated to provide care yet are not guaranteed payment for the care they provide. The cost of providing uncompensated care has been cited as the reason for closure of some US EDs. *What question this study addressed:* This study determined trends in average ED charges, payments, and reimbursement rates from 1996 to 2004. *What the study adds to our knowledge:* ED charges increased faster than ED payments throughout the study period, resulting in lower reimbursement rates. The pattern of decreasing reimbursement rates over time was observed across all 4 insurance categories examined: private insurance, Medicare, Medicaid, and no insurance. *How this might change clinical practice:* Decreasing reimbursement rates will likely put more financial pressure on our already strained emergency care system.

APPENDIX E1.

This appendix contains a range of supplementary information about the analysis, as well as supplementary analysis results.

1. Comparison of Medical Expenditure Panel Survey (MEPS) Data and National Hospital Ambulatory Medical Care Survey (NHAMCS) Data

We are very aware of the unease regarding MEPS as a representative sample of ED visits. The underestimation of ED visits is addressed in our article because we are mainly hoping to focus on the *proportion* of payments paid rather than total payments. Also, as we mention, the process for sampling MEPS data has been similar for years included, and because they should not affect the general conclusions of reimbursement rates for payer groups, we hope that these results can be used to lead to some conclusions about the decreasing payer trends.

The issue of lower admission rates in MEPS compared to the NHAMCS is indeed concerning. Our exclusion criteria (for flat-fee, CHAMPUS/CHAMPVA, TRICARE, worker's compensation, other public programs, or visits that resulted in admission) are similar to those in the Tsai et al article in 2003[1], with the same methodology, which excluded even less than 10% of visits using these criteria (396 visits excluded out of 3,899 in 1996 and 196 visits out of 4,154 visits in 1998).

Because MEPS is based on a survey instrument and is thus reported by consumers, its strength and its weakness are in fact this feature. Individuals may misunderstand survey questions, such as not marking an ED visit if it resulted in admission, because they may not recall the ED portion or consider the entire visit 1 hospital admission. In general, provider-based utilization data such as NHAMCS, conducted by the National Center for Health Statistics, is thought to be more accurate.[2] Machlin et al[3] theorize that MEPS and other consumer-based surveys may systematically underreport hospital utilization because they are based on patient's memories of their own hospitalizations or even their family members during the past 6 months, especially for those aged 65 years and older. In addition, because of the way NHAMCS is structured, NHAMCS includes visits from the homeless, nursing home residents, prisoners, and other populations that are not captured by MEPS.[3,4] The exclusion of these categories could contribute to the fact that MEPS data have a lower rate of admission for ED visits.

In terms of expenditure data, too, the usual authoritative source is thought to be the National Health Expenditures (NHE) from Centers for Medicare and Medicaid Services. But in this study, because we want to only examine the goods and services consumed by patients (as opposed to costs of the health care system that are included in NHE, such as administration and net cost of private health insurance), it is appropriate for our purposes.[2]

The alternative to using MEPS, however, is to attempt to adjust these expenditures and visits by attempting to incorporate the NHAMCS and NHE into these data, which introduces an almost infinite number of complexities and may not help clarify the situation at all. In fact, because again we want to examine reimbursement ratios, we believe the absolute numbers are less important than the trends. In addition, because MEPS is the only source of data that combine patient-level encounters with utilization rates, there is no other way to perform this research. As stated by a RAND publication, "There are sources that examine utilization alone, or expenditures alone, or population health status alone; the MEPS is the only publicly available, nationally representative source of data that puts them all together."[2]

2. Model Estimation and Selection

In other work by one of our authors (D.M.), we considered numerous methods for model estimation (D. MacIsaac and K. Bundorf, unpublished data). These models included the least squares with no transformation of the dependent variable, the 2-part model using ordinary least squares to estimate log-transformed expenditures in the second stage and the smearing estimator to generate predicted expenditures, and the generalized linear models specifying a log transformation of the dependent variable and different assumptions for the variance structure of the error term. In examining the generalized linear models models, we used the Park test to identify the most appropriate assumption about the variance of the error term.[5] According to these results, we used only generalized linear models, which assume that the conditional variance follows a γ or Poisson distribution. We then analyzed the overall fit of each of the remaining models by calculating the mean squared error and the mean absolute prediction error. In short, we specify a log transformation of the dependent variable and a Poisson variance structure, which can be interpreted directly and does not require retransformation to the original scale.

3. Unadjusted and Adjusted Ratios

We report both unadjusted and unadjusted ratios of payments to charges because they have different meanings and, thus, various significance to health care providers, hospital administrators, and health policymakers. Our unadjusted numbers cannot be "backed out" from the total payments and total charges from Figure 2, because they are not the ratio of the averages but are, as mentioned, the average of the ratio. The adjusted numbers, which examine the ratio of the averages, can be backed out because they represent what the hospital receives.

As shown in the article, if N is the total number of observations and i is the individual observations, the unadjusted ratio is represented by:

$$\text{Average of the ratio} = \frac{1}{N}\sum_i \frac{\text{payments}_i}{\text{charges}_i}$$

The adjusted ratio is represented by:

$$\text{Ratio of the averages} = \frac{\frac{1}{N}\Sigma_i \text{ payments }_i}{\frac{1}{N}\Sigma_i \text{ charges }_i}$$

To illustrate when these ratios differ, we use 2 simple examples. Using scenario 1 (which illustrates our data because the adjusted ratios are lower than the unadjusted ratios), if there are 3 visits to the ED, with the charge of the first 2 visits as $10 and the third one as $100, but each visit is reimbursed only $10 regardless of the charge, then the total received by the hospital is $30, or 25% (=$30/$120) of its total charges. If, however, one uses the average of the payment rate, in which 2 people paid 100% of their charges and the third person paid only 10% of his charges, then the average payment rate is 70% (=210%/3). The former (what the hospital receives in actual bills) is considered the ratio of the average or, more specifically, the ratio of average payment to average charge.

Scenario 1

Scenario 1	Payment	Charge	Payment Rate
Obs 1	10.00	10.00	100%
Obs 2	10.00	10.00	100%
Obs 3	10.00	100.00	10%
	30.00	120.00	

Calculation 1: (ie, unadjusted)
Average of the ratio (average portion of bill paid)=(210%)/3=70%
Calculation 2: (ie, adjusted)
Ratio of the averages (what hospital receives)=(30/3)/(120/3)=25%

Scenario 2 represents the opposite case, when the largest charges are paid in full but the small charges are reimbursed poorly. This leads to unadjusted ratios (the ratio of the average of bills paid by patients) that are lower than the adjusted ratios (what the hospital receives). This makes intuitive sense because hospitals will not be affected by many relatively small bills that are paid poorly if their largest bills are fully covered.

Unfortunately for hospitals and the health care system, scenario 1 is more often the case for emergency care.

Scenario 2

Scenario 2	Payment	Charge	Payment Rate
Obs 1	10.00	10.00	100%
Obs 2	1,000.00	1,000.00	100%
Obs 3	0.50	6.00	8%
	1,010.50	1,016.00	

Calculation 1: (ie, unadjusted)
Average of the ratio (average portion of bill paid)=(208%)/3=69%
Calculation 2: (ie, adjusted)
Ratio of the averages (what hospital receives)=(1,010.50/3)/(1,016.00/3)=99%

Nota Bene. Both the adjusted and unadjusted ratios in the Tsai et al[1] 2003 article reflect the average of the ratio (the average portion of bills that were paid per ED visit), which explains the variation in our numbers. Our definition of unadjusted and unadjusted is, as explained above, the average of the ratio and the ratio of the averages. In other words, the differences between the ratios in the Tsai et al[1] article and ours are not only semantic; they are alternative ways of calculating what we call unadjusted and adjusted ratios. We thought it more helpful to give both the average of the ratio (unadjusted) and the ratio of the average (adjusted) because their meanings are different, as explained above, and can be interpreted appropriately by interested parties.

4. Hypothesis Testing of Trends Over Time

We used a regression to test for a linear trend over time and found evidence of statistically significant trends in both charges and payments and evidence that charges trended upward more quickly than payments. In addition to this test of trend, we also used a time-intensive process of bootstrapping for all of our adjusted results, which were also significant and We used a regression to test for a linear trend over time and found evidence of statistically significant trends in both showed a *P* value of less than .05. Finally, as mentioned by Schriger and Cooper,[6] visual data analysis is of much more importance than the regression or assessment of statistical significance of any statistical test. We provide graphic representation of these trends in the main article, as well as Appendix E1 (available online at http://www.annemergmed-.com) for the subgroup analysis.

REFERENCES

1. Tsai A, Tamayo-Sarver J, Cydulka R, et al. Declining payments for emergency department care, 1996-1998. *Ann Emerg Med.* 2003; 41:299-308.
2. Bigelow JH, Fonkych K, Fung C, et al. *Analysis of Healthcare Interventions That Change Patient Trajectories*. Santa Monica, CA: RAND; 2005.
3. Machlin SR, Cohen JW, Thorpe JM. Measuring inpatient care use in the United States: a comparison across five federal data sources. *J Econ Soc Measure.* 2000;20:141-151.
4. Machlin SR, Valluzzi JL, Chevarley FM, et al. Measuring ambulatory health care use in the United States: a comparison of 1996 estimates across four federal surveys. *J Econ Soc Measure.* 2001; 27:57-69.
5. Manning WG, Mullahy J. Estimating log models: to transform or not to transform. *J Health Econ.* 2001;20:461-494.
6. Schriger D, Cooper R. Achieving graphical excellence: suggestions and methods for creating high-quality visual displays of experimental data. *Ann Emerg Med.* 2001;37:75-87.

Table E1. Visits (and visits represented) used for analysis by insurance category, 1996 to 2004.

	Medicaid		Medicare		Private		Uninsured		All	
	Visits	Visits Represented	Visits	Visits Represented	Visits	Visits Represented	Visits	Visits Represented	Total Visits	Total Visits Represented
1996	745	7,403,344	517	6,363,710	1,546	21,000,000	625	7,301,590	3,433	42,068,644
1997	1,139	6,205,203	911	6,855,256	2,273	21,200,000	960	7,142,067	5,283	41,402,526
1998	772	6,366,386	685	7,333,633	1,569	20,600,000	697	6,700,052	3,723	41,000,071
1999	600	5,989,375	616	7,047,846	1,581	20,100,000	585	6,348,505	3,382	39,485,726
2000	688	6,437,199	716	8,564,930	1,560	19,800,000	620	6,661,306	3,584	41,463,435
2001	1,115	7,910,427	1,020	9,408,387	2,375	23,200,000	957	7,483,430	5,467	48,002,244
2002	1,662	9,651,844	1,336	10,300,000	2,553	22,500,000	1,075	7,179,420	6,626	49,631,264
2003	1,719	9,728,604	1,115	10,100,000	1,984	21,300,000	1,049	7,599,305	5,867	48,727,909
2004	1,618	9,236,701	1,144	10,000,000	2,005	21,500,000	996	8,056,626	5,763	48,793,327
Total	10,058	68,929,083	8,060	75,973,762	17,446	191,200,000	7,564	64,472,301	43,128	400,575,146

Table E2. Characteristics of ED visits, 1996 to 2004.

Characteristics	1996	1997	1998	1999	2000	2001	2002	2003	2004	All
Insurance										
Medicaid	0.18	0.15	0.16	0.15	0.16	0.16	0.19	0.20	0.19	0.17
Medicare	0.15	0.17	0.18	0.18	0.21	0.20	0.21	0.21	0.21	0.19
Private	0.50	0.51	0.50	0.51	0.48	0.48	0.45	0.44	0.44	0.48
Uninsured	0.17	0.17	0.16	0.16	0.16	0.16	0.14	0.16	0.17	0.16
Race										
White	0.83	0.81	0.81	0.80	0.81	0.81	0.80	0.78	0.79	0.80
Black	0.13	0.15	0.16	0.16	0.16	0.15	0.14	0.16	0.15	0.15
Other race	0.04	0.04	0.03	0.04	0.03	0.03	0.05	0.06	0.06	0.04
Hispanic	0.12	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.12	0.12
Urban	0.76	0.76	0.78	0.77	0.79	0.79	0.78	0.78	0.78	0.78
Income										
Poor	0.21	0.21	0.22	0.18	0.19	0.17	0.20	0.22	0.22	0.20
Near poor	0.06	0.07	0.05	0.06	0.07	0.06	0.06	0.06	0.06	0.06
Low income	0.18	0.15	0.15	0.17	0.18	0.17	0.17	0.18	0.17	0.17
Middle income	0.31	0.32	0.30	0.30	0.31	0.30	0.30	0.28	0.29	0.30
High income	0.24	0.25	0.28	0.30	0.27	0.29	0.27	0.26	0.26	0.27
Region										
Northeast	0.19	0.18	0.18	0.18	0.20	0.19	0.20	0.18	0.18	0.19
Midwest	0.29	0.23	0.25	0.24	0.25	0.26	0.23	0.24	0.25	0.25
South	0.34	0.39	0.37	0.41	0.35	0.36	0.37	0.38	0.37	0.37
West	0.18	0.19	0.19	0.17	0.20	0.19	0.20	0.20	0.20	0.19
Marital status										
Married	0.35	0.38	0.35	0.36	0.35	0.34	0.34	0.35	0.36	0.35
Widowed	0.07	0.06	0.08	0.07	0.08	0.08	0.08	0.08	0.07	0.08
Divorced	0.09	0.10	0.09	0.10	0.09	0.11	0.11	0.09	0.10	0.10
Separated	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
Single	0.22	0.20	0.21	0.22	0.23	0.23	0.21	0.23	0.23	0.22
Too young	0.24	0.23	0.23	0.22	0.22	0.21	0.22	0.22	0.21	0.22
Missing	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Highest education among mother, father, and self										
None	0.43	0.39	0.41	0.40	0.41	0.39	0.41	0.40	0.38	0.40
High school	0.40	0.44	0.42	0.42	0.41	0.41	0.40	0.40	0.44	0.42
Bachelor's	0.07	0.09	0.08	0.09	0.09	0.10	0.08	0.09	0.08	0.09
Master's or doctorate	0.04	0.04	0.03	0.04	0.04	0.03	0.04	0.04	0.05	0.04
Other degree	0.06	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.05
Missing	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Sex and age, y										
Female, 0–4	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.04
Female, 5–9	0.03	0.03	0.03	0.03	0.02	0.03	0.02	0.03	0.03	0.03
Female, 10–14	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.02	0.02	0.02
Female, 15–19	0.05	0.04	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.04
Female, 20–24	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05
Female, 25–29	0.04	0.05	0.05	0.05	0.05	0.03	0.05	0.04	0.04	0.04
Female, 30–34	0.04	0.03	0.04	0.04	0.04	0.05	0.04	0.05	0.04	0.04
Female, 35–39	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.04	0.04
Female, 40–44	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Female, 45–49	0.03	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Female, 50–54	0.02	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03
Female, 55–59	0.02	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.03	0.03
Female, 60–64	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.02
Female, 65–69	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Female, 70–74	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Female, 75–79	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.02	0.02	0.02
Female, 80–84	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
Female, 85	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02
Male, 0–4	0.06	0.05	0.06	0.06	0.05	0.04	0.05	0.05	0.04	0.05
Male, 5–9	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Male, 10–14	0.04	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.04	0.03

Table E2. (continued).

Characteristics	1996	1997	1998	1999	2000	2001	2002	2003	2004	All
Male, 15–19	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.04
Male, 20–24	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Male, 25–29	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.04	0.03	0.03
Male, 30–34	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.03
Male, 35–39	0.04	0.04	0.03	0.03	0.02	0.03	0.03	0.03	0.04	0.03
Male, 40–44	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Male, 45–49	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.03	0.03
Male, 50–54	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.02	0.02
Male, 55–59	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.02	0.02
Male, 60–64	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.02
Male, 65–69	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.01	0.02	0.02
Male, 70–74	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.01	0.01
Male, 75–79	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.01	0.02
Male, 80–84	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Male, 85	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

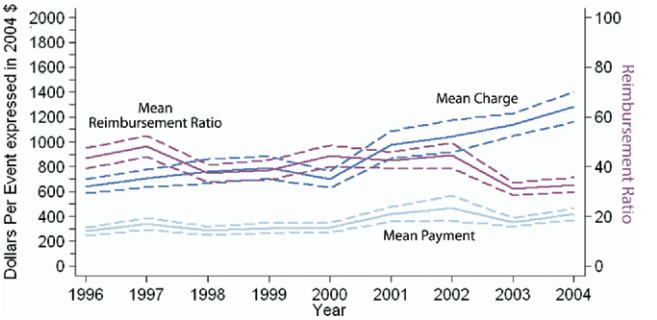

Figure E1. Adjusted mean charges and payments for Medicaid, 1996 to 2004 (dollar figures are Consumer Price Index–adjusted 2004 dollars; error bars represent 95% CIs).

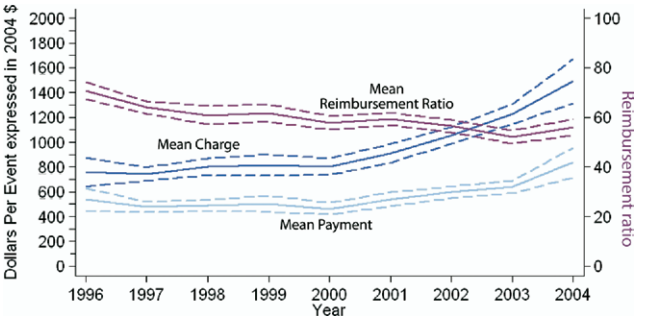

Figure E3. Adjusted mean charges and payments for private, 1996 to 2004 (dollar figures are Consumer Price Index–adjusted 2004 dollars; error bars represent 95% CIs).

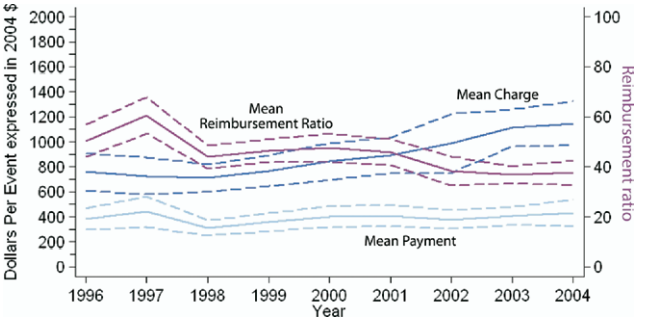

Figure E2. Adjusted mean charges and payments for Medicare, 1996 to 2004 (dollar figures are Consumer Price Index–adjusted 2004 dollars; error bars represent 95% CIs).

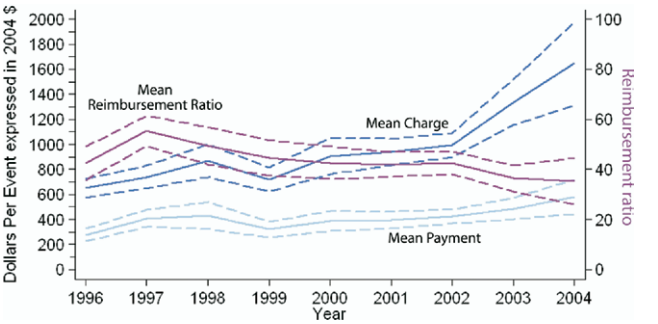

Figure E4. Adjusted mean charges and payments for uninsured, 1996 to 2004 (dollar figures are Consumer Price Index–adjusted 2004 dollars; error bars represent 95% CIs).