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Emergency Department Death Rates Dropped By Nearly Fifty Percent, 1997–2011

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Abstract

Between 1997 and 2011, there was a nearly 50 percent reduction in US emergency department mortality rates for adults. The etiology for this trend is likely multifactorial and may be related to advances in palliative, prehospital, and emergency care.

The core mission of emergency medicine is to provide immediate care to acutely ill and injured patients. The emergency department (ED) also serves as a safety net, allowing patients to access care when other avenues fail.[1] Although not an ideal setting, the ED is often where end-of-life care occurs for patients with either unexpected fatal conditions or acute complications of terminal illness. In fact, over half of older Americans visit the ED in their last month of life.[2,3] Such visits are taxing for patients, caregivers, and providers and contribute to high end-of-life health care costs. The following question thus naturally arises: How often are adult patients dying in the ED?

Despite existing literature on the relationship between ED care and subsequent mortality for selected conditions, little is known about trends in mortality in the ED. Recent efforts in the fields of palliative and prehospital care have sought to shift the locus of death, when feasible, to more appropriate settings. Meanwhile, recent advances in emergency critical care have sought to decrease mortality from immediately life-threatening conditions. Between 1997 and 2011, there was a nearly 50 percent reduction in US adult ED mortality rates (Exhibit 1). Assessing trends in ED mortality rates may help illuminate the impact of these efforts by offering a perspective on where patients are dying. Thus, we sought to describe national trends in US ED mortality and visit rates and to delineate demographic and clinical factors associated with ED death.

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Study Data And Methods

Data

To evaluate adult ED mortality rates in the United States, we analyzed ED visit data from the National Hospital Ambulatory Medical Care Survey (NHAMCS) from 1997 to 2011, the most recent year for which data are available. Detailed information about NHAMCS and our study methods can be found in the online Appendix.[4] Briefly, NHAMCS is an annual survey of a national probability sample of nonfederal, general, and short-stay hospitals conducted by the National Center for Health Statistics (NCHS). A multistage sampling procedure facilitates unbiased national estimates of ED visits, and the survey also includes data on patient demographic characteristics, reasons for the visits, and mortality.[5–9] This study was deemed exempt from review by the Institutional Review Board of [please provide].

Analyses

Our analysis included all ED visits by adults ages eighteen and older throughout the fifteen-year study period. Data were stratified by age, sex, race/ethnicity, insurance status, triage category, urbanicity, geographic region, and whether there had been a recent ED visit or hospitalization.

The primary outcome was annual ED mortality rate per thousand adults, calculated using denominator estimates from the US Census Bureau. NHAMCS data abstractors grouped patients who died in the ED and those who were dead on arrival together for the period 1997–2006 but coded them separately for the period 2007–11. However, there were no definitional changes to either of these terms.[6–9] Thus, consistent with previous literature [1] and NCHS standards, we included in ED deaths both patients who died in the ED and those who were dead on arrival.

We report unweighted visit and mortality data, survey-weighted national estimates, and 95 percent confidence intervals. To evaluate longitudinal changes, we performed survey-weighted trend analysis using weighted least squares regression. For comparison, we also analyzed inpatient hospital mortality rates from 2005 (when these data became available) to 2011. We additionally examined primary “reason for visit” data associated with ED mortality. Finally, we evaluated trends in patient and visit characteristics over the entire study period, specifically assessing changes in ED visit rates and the proportion of ED visits by characteristic.

Limitations

Our study had several limitations. First, while we propose possible explanations for our findings, our study generated only hypotheses. We were unable to test which causative factors were responsible for the observed trends.

Second, as with most research data sets, NHAMCS is imperfect and likely has inherent limitations related to, for example, changes in data abstraction or coding practices over time. Our methodology follows suggested NCHS guidelines to limit potential shortcomings and is

detailed in the Appendix.[4] Moreover, NHAMCS is the largest nationally representative data set that provides epidemiologic data on emergency conditions in the United States, and it remains one of the most widely used resources for research on emergency medicine health services.

Study Results

We examined 367,618 observations, which represented 1.3 billion ED visits across the United States. Compared to patients who survived to ED discharge or hospital admission, those who suffered ED death were on average older, more likely to be male and white, and had more severe triage acuity scores. In addition, among patients who visited a rural ED or an ED in the southern region of the country, the percentage who died was higher than the percentage who survived (Exhibit 2).

ED mortality rates decreased from 1.48 per thousand in 1997 to 0.77 per thousand in 2011, a 48 percent reduction (Exhibit 1). There was no significant change in inpatient hospital mortality from 2005 to 2011, even though the rate peaked in 2009.

For 62.7 percent of the ED visits in which patients died, patients were noted to be in cardiopulmonary arrest, unconscious, or dead on arrival (data not shown). The most common reasons for an ED visit for the remaining patients who suffered ED death were shortness of breath (accounting for 8.3 percent of the visits), injury (5.1 percent), and chest pain (3.9 percent).

Visits by patients younger than sixty-five and by non-Hispanic black patients accounted for the greatest increase in ED visits from 1997 to 2011, after US population growth was controlled for (Exhibit 3). A lower proportion of ED visits were triaged as requiring immediate or emergent care in 2011 (13.2 percent) than in 1997 (22.7 percent) (Exhibit 4). Among adults with Medicare or Medicaid, the ED visit rate per thousand enrollees also increased substantially between 1997 and 2011, from 405.08 to 534.60 and from 646.15 to 863.37, respectively (Exhibit 5). Trends, stratified by ED survivors and nonsurvivors, can be found in the online Appendix.[4]

Discussion

To our knowledge, there has been no previous national study evaluating longitudinal trends in ED mortality. There are several possible explanations for the substantial downward trend —a drop of nearly 50 percent—in ED mortality that warrant further review.

First, it is possible that although fewer patients are dying in the ED, patients may be surviving only until inpatient hospitalization. NHAMCS inpatient mortality data are only available after 2005, but—consistent with previous literature[10]—we found no significant upward trend in inpatient mortality to support this notion. It is more likely that our findings can be explained at least in part by the increasing role of palliative care, which results in more patients dying in hospice settings outside acute care hospitals and EDs than in the past. [11] In fact, patients are increasingly receiving home hospice care, and between 1989 and

2007 there was an increase of more than 50 percent in the [please provide] of home deaths and an accompanying 20 percent decrease in hospital deaths.[12]

Third, withholding or terminating resuscitation efforts in the prehospital setting could also contribute to the reduction in ED mortality. During the study period, several professional societies published guidelines for prehospital termination of resuscitation, and many cities initiated policies that allowed paramedics to forgo resuscitation efforts in certain cases of cardiac arrest.[13] A drop in ED mortality could be the result of patients with cardiac arrest —who previously would have been transported to and declared dead in the ED—no longer being transported to the hospital. However, continued financial, legal, and societal pressures to transport patients have limited the widespread adoption of such termination of resuscitation guidelines and policy changes.[13] Thus, the degree to which changes in resuscitation policies contribute to ED mortality nationally remains unclear.

Fourth, ED visit rates increased substantially for both Medicaid and Medicare beneficiaries. While these populations tend to be sicker and to have poorer access to ambulatory care, compared to the overall national adult population,[14] they did experience improvements in quality and access outcomes during the study period.[15,16] We also found an increase in ED visits by nonelderly adults and an increase in low-acuity ED visits. However, since we present our mortality results per thousand adults (not per total ED visits), our findings cannot be explained by an increase in the proportion of low-acuity visits.

Fifth, improvements in emergency medicine and public health could also help explain the drop in ED mortality. In recent decades, substantial advances have occurred in the acute management of life-threatening conditions such as myocardial infarction, stroke, trauma, and sepsis.[17] Such advances include improved medical therapies, the regionalization of acute medical and trauma care, and enhanced critical care training of prehospital personnel and emergency physicians.

NHAMCS does not provide data on the actual cause of death, and thus many patients in our study were characterized as having suffered from nonspecific cardiac arrest. Managing patients with undifferentiated cardiac arrest is common in the ED, and recent advancements in the care of such patients could also contribute to our results. However, NHAMCS does not allow us to comment on national trends in survival after cardiac arrest. Measuring such survival rates would require a centralized national registry that tracked incidence, interventions, and outcomes, as called for in an Institute of Medicine report on cardiac arrest survival.[18]

Finally, sixth, there have also been continued public health achievements—for example, progressive improvements in smoking cessation and motor vehicle safety—that have contributed to downward trends in mortality across the entire US population during the study period, which could be reflected in our data.[19]

Conclusion

The etiology behind the nearly 50 percent reduction in ED mortality is likely multifactorial. Further research is needed to delineate the underlying causative factors. Describing changes

in ED mortality can help improve understanding of the impact that recent advances in palliative, prehospital, and emergency critical care have had on the locus of death in America.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Biographies

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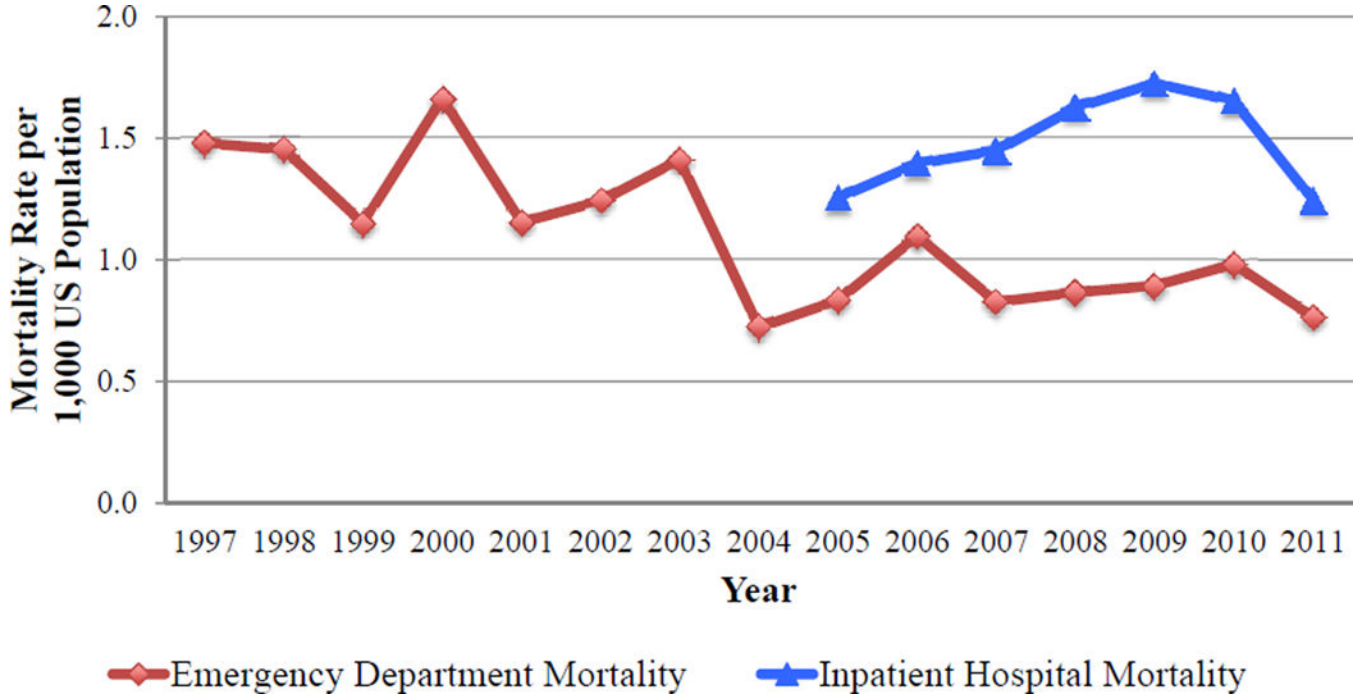

Exhibit 1. Trends in emergency department and inpatient hospital mortality, 1997–2011
Source/Notes: SOURCE Authors' analysis of data for 1997–2011 from the National Hospital Ambulatory Medical Care Survey (NHAMCS). NOTES Mortality rates are per thousand US adults ages eighteen and older. NHAMCS data for inpatient hospital mortality became available only starting in 2005. Appendix Exhibit 1 (see Note 4 in text) is a table with pertinent data points, standard errors, confidence intervals, and other statistical data for this Exhibit.

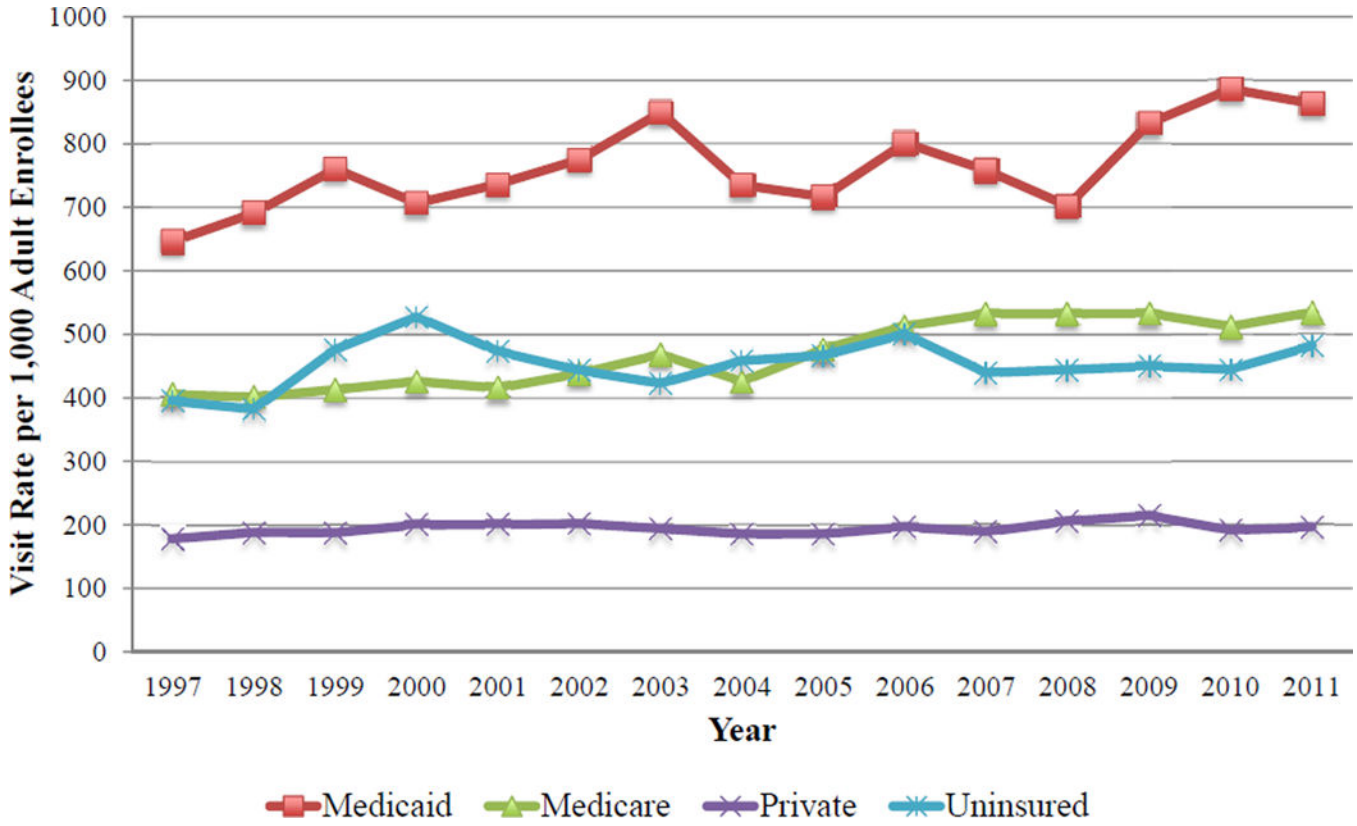

Exhibit 5. Trends in emergency department (ED) visit rate by insurance category

Source/Notes: Authors' analysis of data for 1997–2011 from the National Hospital Ambulatory Medical Care Survey. NOTES Emergency department visit rates are per thousand US adults ages eighteen and older with the respective types of insurance. Appendix Exhibit 2 (see Note 4 in text) is a table with pertinent data points, standard errors, confidence intervals, and other statistical data for this Exhibit

Exhibit 2

Characteristics of US adults ages 18 and older who visited a hospital emergency department (ED), 1977–2011

	Dead on arrival or died in ED			Survived ED visit		
	Unweighted no.	**Weighted %**	**95% CI**	**Unweighted no.**	**Weighted %**	**95% CI**
Total	974	0.3		366,644	99.7	
Age (years) ****						
18–44	154	14.7	11.7, 17.7	201,007	54.7	54.2, 55.2
45–64	271	26.8	23.3, 30.3	94,770	25.6	25.3, 25.9
65–79	278	30.7	27.2, 34.2	43,088	11.9	11.6, 12.2
80 or older	271	27.7	24.0, 31.4	27,779	7.7	7.4, 8.0
Sex ****						
Female	413	44.0	40.1, 47.9	204,028	56.2	55.9, 56.5
Male	561	56.0	52.1, 59.9	162,616	43.8	43.5, 44.1
Race/ethnicity ****						
Non-Hispanic white	671	71.3	67.0, 75.6	231,889	66.2	64.5, 67.9
Non-Hispanic black	193	20.1	16.4, 23.8	78,500	20.7	19.1, 22.3
Hispanic	79	6.4	4.4, 8.4	43,112	10.4	9.4, 11.4
Other	31	2.2	1.0, 3.4	13,143	2.7	2.2, 3.2
Insurance ****						
Private	178	17.3	14.4, 20.2	121,152	33.9	33.1, 34.7
Medicare	462	50.5	46.4, 54.6	75,991	21.2	20.6, 21.7
Medicaid	78	8.0	5.8, 10.2	61,955	15.4	14.7, 16.0
Uninsured	144	13.7	10.9, 16.4	64,928	18.3	17.5, 19.1
Other	__*a*	__*b*	__*b*	21,280	5.0	4.7, 5.4
Missing or unknown	83	7.3	5.3, 9.3	21,338	5.5	4.9, 6.1
Triage category ****						
Immediate or emergent	696	72.1	68.1, 76.1	61,848	16.9	15.9, 17.9
Urgent	89	9.6	6.7, 12.5	136,574	37.4	36.2, 38.6
Semi-urgent or nonurgent	34	3.0	1.5, 4.6	110,708	30.3	28.9, 31.7

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	Dead on arrival or died in ED			Survived ED visit		
	Unweighted no.	Weighted %	95% CI	Unweighted no.	Weighted %	95% CI
Triage not conducted or unknown	155	15.3	12.1, 18.5	57,514	15.3	13.8, 16.8
Region***						
Northeast	212	17.3	14.1, 20.5	92,942	19.6	17.2, 22.0
Midwest	212	23.8	19.9, 27.7	78,312	23.5	20.3, 26.7
South	395	45.0	40.1, 49.9	123,516	38.4	34.5, 42.3
West	155	13.8	11.1, 16.5	71,874	18.5	15.8, 21.2
Metropolitan Statistical Area**						
Urban	807	77.0	69.7, 84.3	315,578	81.7	75.9, 87.5
Rural	167	23.0	15.7, 30.3	51,066	18.3	12.6, 24.0
Seen by [please provide] within 72 hours before visit[c]****						
Yes	__[a]	__[b]	__[b]	11,016	3.8	3.6, 4.0
No	561	76.4	71.5, 81.3	248,474	83.2	81.4, 85.0
Unknown	139	21.8	16.9, 26.7	37,484	13.0	11.2, 14.8
Discharged from hospital within7 days before visit[d]***						
Yes	__[a]	__[b]	__[b]	5,118	2.6	2.4, 2.8
No	206	47.8	40.6, 55.0	112,353	60.3	56.9, 63.7
Unknown	178	49.8	42.6, 57.0	66,699	37.1	33.7, 40.5

SOURCE Authors' analysis of data for 1997–2011 from the National Hospital Ambulatory Medical Care Survey. NOTE CI is confidence interval.

[a]Fewer than thirty visits.

[b]Not reliable because thirty or fewer visits.

[c]Data from 2001–11 only.

[d]Data from 2005–11 only.

** $p < 0.05$

*** $p < 0.01$

**** $p < 0.001$

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Exhibit 3

Estimated emergency department (ED) visits by US adults ages 18 and older by patient characteristics, 1997–2011

	Estimated ED visits									
	Unweighted no.		Weighted no. (millions)		Per 1,000 adults					
	1997	2011	1997	2011	1997	95% CI	2011	95% CI	Difference	95% CI
Age (years)										
18–44	9,453	12,876	40.2	56.6	361.6	306.1, 417.2	499.2	418.8, 579.5	137.6****	40.0, 235.2
45–64	3,654	6,901	15.6	29.8	277.7	236.1, 319.3	360.3	304.5, 416.1	82.6****	13.0, 152.2
65–79	2,134	2,771	9.2	12.0	357.0	299.4, 414.6	400.9	334.0, 467.8	43.9***	−44.3, 132.1
80 or older	1,278	1,918	5.6	8.4	649.9	537.7, 762.1	728.6	602.1, 855.0	78.7**	−90.3, 247.7
Sex										
Female	8,971	13,734	38.7	60.7	370.0	314.4, 425.7	496.5	417.2, 575.8	126.5****	29.6, 223.4
Male	7,548	10,732	31.9	46.2	328.3	279.0, 377.6	399.9	338.2, 461.6	71.6****	−7.3, 150.5
Race/ethnicity										
Non-Hispanic white	11,024	15,225	49.9	66.9	346.0	287.3, 404.7	443.9	366.3, 521.4	97.9****	0.64, 195.2
Non-Hispanic black	3,534	5,071	14.0	24.0	586.6	459.3, 713.8	820.6	622.0, 1,019.2	234.0****	−1.80, 469.8
Hispanic	1,493	3,110	5.1	12.8	238.3	188.6, 288.0	323.5	258.3, 388.6	85.2****	3.4, 167.0
Other	468	1,060	1.5	3.1	181.1	130.7, 231.4	173.9	116.7, 231.2	−7.2	−83.4, 69.0
Insurance[a]										
Private	5,566	6,861	25.0	30.0	177.8	148.9, 206.8	195.7	162.3, 229.2	17.9	−26.3, 62.1
Medicare	3,263	5,626	14.3	24.8	405.1	339.2, 471.0	534.6	442.6, 626.6	129.5****	16.4, 242.6
Medicaid	2,386	5,088	9.2	21.1	646.2	540.2, 752.1	863.4	710.3, 1,016.4	217.2***	31.0, 403.4
Uninsured	3,014	4,311	12.9	20.0	394.5	321.7, 467.3	481.4	394.0, 568.7	86.9	−26.8, 200.6
Other	1,320	985	5.2	0.7	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]
Missing or unknown	970	1,595	4.0	6.4	—[a]	—[a]	—[a]	—[a]	—[a]	—[a]

SOURCE Authors' analysis of data for 1997–2011 from the National Hospital Ambulatory Medical Care Survey. NOTES Adult denominator population estimates for age, sex, race/ethnicity, and insurance come from the US Census Bureau. To assess the significance of changes in ED visit rates over the entire observation period for those variables, we conducted trend tests using weighted least squares regression models; details are available in the Appendix (see Note 4 in text). CI is confidence interval. Significance refers to the entire study period.

[a]Denominator estimates unavailable.

** $p < 0.05$

*** $p < 0.01$

**** $p < 0.001$

Exhibit 4

Characteristics of emergency department (ED) visits by US adults ages 18 and older, 1997–2011

	Unweighted no.		Weighted no.		Percent of estimated ED visits			
	1997	2011	1997	2011	1997	95% CI	2011	95% CI
Triage category****								
Immediate or emergent	3,656	3,149	16.0	14.1	22.7	19.7, 25.7	13.2	11.5, 14.8
Urgent	5,249	11,082	22.3	48.4	31.6	28.8, 34.4	45.3	42.8, 47.7
Semi-urgent or nonurgent	4,025	9,563	16.8	42.0	23.8	20.6, 27.0	39.4	36.6, 42.2
Triage not conducted or unknown	3,589	672	15.4	2.4	21.8	17.8, 25.8	2.2	0.5, 3.9
Region								
Northeast	4,086	5,262	14.7	19.8	20.8	15.5, 28.1	18.5	12.9, 24.1
Midwest	4,035	6,082	18.4	24.2	26.2	19.4, 32.9	22.7	16.0, 29.3
South	5,199	7,545	24.2	42.1	34.3	27.1, 41.6	39.4	31.5, 47.3
West	3,199	5,577	13.2	20.8	18.7	12.6, 24.9	19.4	13.9, 25.0
Metropolitan Statistical Area								
Urban	13,877	21,265	54.3	90.3	76.9	67.6, 86.1	84.5	76.0, 93.0
Rural	2,642	3,201	16.3	16.6	23.1	13.9, 32.4	15.5	7.0, 24.0

SOURCE Authors' analysis of data for 1977–2011 from the National Hospital Ambulatory Medical Care Survey. NOTES To assess the significance of changes in percentage of estimated ED visits over the study period for triage category, geographic region, and Metropolitan Statistical Area, we conducted weighted chi-square tests for trend; details are available in the Appendix (see Note 4 in text.) Significance refers to the entire observation period. CI is confidence interval.

**** $p < 0.001$