

ORIGINAL RESEARCH CONTRIBUTION

Interhospital Transfers from U.S. Emergency Departments: Implications for Resource Utilization, Patient Safety, and Regionalization

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Abstract

Objectives: The authors sought to describe the demographic and clinical characteristics of interhospital transfers from U.S. emergency departments (EDs) along with the primary reasons for transfers.

Methods: This was a retrospective, cross-sectional analysis of the 1997 through 2009 National Hospital Ambulatory Medical Care Survey (NHAMCS). Visit-level characteristics were compared for patients who were transferred, admitted, or discharged. Additionally, data on primary reason for transfer for available years (2005 through 2008) were reviewed. Weighted analyses produced nationally representative estimates.

Results: During this time period, 1.8% (95% confidence interval [CI] = 1.7% to 2.0%) of ED patients were transferred to other hospitals. Compared to visits resulting in admission, those resulting in transfer were more likely to involve patients who were <18 years old (18% vs. 7.9%), male (53% vs. 46%), with Medicaid (22% vs. 16%) or self-payment (15% vs. 8.2%) as a primary expected source of payment, having a visit related to injury (40% vs. 19%), and from a nonurban ED (29% vs. 15%). Among transferred patients, 28% (95% CI = 27% to 30%) received four to six diagnostic tests, and 31% (95% CI = 29% to 34%) received more than six diagnostic tests prior to transfer; 52% (95% CI = 50% to 54%) had diagnostic imaging, and 17% (95% CI = 16% to 19%) had cross-sectional imaging. Of the patients transferred from 2005 through 2008, 47% (95% CI = 43% to 53%) were transferred for a higher level of care, and 29% (95% CI = 26% to 35%) were transferred for psychiatric care.

Conclusions: Transfer of ED patients was relatively rare, but was more common among specific, potentially high-risk populations. Diagnostic testing, including advanced imaging, was common prior to transfer. A majority of transfers were for reasons indicating limited resources or expertise at the referring facility.

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Interhospital transfer from the emergency department (ED) is critical to implementing a safe and efficient regionalized system of acute care. While

transfer provides patients with higher levels of emergency care and access to specialized providers and services, it does pose a potential risk from the process itself and increased distance from social support. Interhospital transfer also can have negative financial implications for the patient, transferring and accepting facilities, and the health care system. Prior studies have demonstrated that transfer to higher levels of care lowers morbidity and mortality in acute myocardial infarction, stroke, and major trauma.^{1–3} However, the practice of transfer has been shown to be inconsistent based on diagnoses and insurance status and can also be difficult to obtain in certain circumstances.^{4,5}

To our knowledge, there is no national descriptive study of interhospital transfer from EDs in the United States. This knowledge is necessary background to study three critical aspects of emergency care systems: 1) regionalization, including prehospital destination protocols and transferring patients for specialized care;

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2) resource utilization and distribution, including protocols for diagnostic tests and interventions, workforce planning, and opportunities for telemedicine; and 3) planning for surge capacity. Specifically, characterizing the reasons patients are transferred will later allow us to identify opportunities for telemedicine and for rationally placed centers of expertise. Understanding the practice of transfer among providers with different training will shape the discussion of the appropriate number and distribution of the workforce to maximize high-quality emergency care and minimize geographic variability, as well as determining efficient distribution and use of resources. Finally, descriptive epidemiology about ED transfer will help to identify opportunities for developing local capacity and planning for surges in disasters and pandemics. The specific objectives of this study were to: 1) compare the characteristics and intensity of ED care for those visits resulting in transfer to those resulting in admission at the index hospital and 2) describe the primary reasons for transfer.

METHODS

Study Design

This study was a secondary analysis of a national cross-sectional survey. We combined data from the ED component of the 1997 to 2009 National Hospital Ambulatory Medical Care Surveys (NHAMCS) to generate national estimates of ED visits resulting in interhospital transfer. Our institutional review board waived review of this analysis as an exempt study.

Data Collection and Processing

Methodologic details for this national survey are described elsewhere.⁶ Briefly, the NHAMCS is a nationally representative, weighted sample of visits to U.S. noninstitutional general and short-stay hospitals, conducted annually by the National Center for Health Statistics. The survey uses a four-stage probability design with samples of primary sampling units, hospitals within primary sampling units, EDs within hospitals, and patient visits within EDs. Trained staff collect data during randomly assigned 4-week periods for each of the sampled hospitals, approximately once every 15 months.

For this study, we used the transfer fields of the visit disposition section to identify the visits resulting in interhospital transfer. In 2009, psychiatric transfers and other transfers were separated; we combined them for the purposes of this analysis to be consistent with other years of analysis. All visits admitted to inpatient or observation status at the index hospital, after the initial ED evaluation, were classified as admissions.

We analyzed demographic data including age, sex, race/ethnicity, and expected source of payment (making Medicaid dominant for dual Medicaid-Medicare-eligible patients). In addition, we analyzed visit characteristics, which include arrival time, emergency medical services (EMS) arrival (available 1997 to 2000 and 2003 to 2009 only), triage urgency, provider type seen, imaging ordered (plain radiography alone or cross-sectional imaging including computed tomography, magnetic resonance imaging, or ultrasound), number of diagnostic

tests, ED length of stay (available 2001 to 2009 only). Hospital characteristics included U.S. Census region, metropolitan statistical area status of the hospital (urban and nonurban), and hospital ownership (nonprofit, government [nonfederal], and private/for profit). The primary reason for transfer variable was available from 2005 to 2008.

We recognize the potential limitations of the NHAMCS data and performed the analysis using suggested methodology and checklist to mitigate these shortcomings.⁷ This checklist included ensuring each estimate was based on at least 30 unweighted records and had relative standard errors of <30%, ensuring item nonresponse rate of <30%, including all records in the data files in the analysis to obtain the correct sample variance estimate, using visit-based analysis, checking variables for consistency across multiple years, and presenting data on average annual estimates when multiple years of data were combined.

Data Analysis

We performed all analyses using Stata 12.1 (StataCorp, College Station, TX). We accounted for NHAMCS variable changes spanning the study period and recoded all such variables appropriately. Using publicly available data files, all analyses used appropriate survey commands in Stata to generate nationally representative estimates. Data files and detailed instructions on analysis of NHAMCS data are available on the National Center for Health Statistics Web site.⁶ The primary analysis was descriptive using difference of proportions with 95% confidence intervals (CIs) to make between-group comparisons. Temporal trends were assessed overall and for subgroups using survey-weighted logistic regression with year as a continuous independent variable. The number of observations in each major subgroup exceeded 30 observations and had less than 30% relative standard errors for all individual years, supporting the reliability of these estimates.

RESULTS

Overall from 1997 to 2009, a total 1.8% (95% CI = 1.7% to 2.0%) of U.S. ED visits resulted in transfer ($n = 8,129$ unweighted observations), while 13% (95% CI = 13% to 14%) resulted in admission at the index hospital ($n = 56,983$ unweighted observations). Demographic characteristics of visits resulting in transfer, compared to those admitted at the index hospital, are presented in Table 1. Compared to admissions, transferred visits were more likely made by younger and male patients, with Medicaid or self-payment as a primary expected source of payment, from nonurban EDs, and by patients living in higher poverty and lower education zip codes. Race/ethnicity was similar between transferred and admitted patients.

Table 2 compares clinical characteristics of transferred versus admitted patients. Compared to admissions, transferred visits were more likely related to injury, but overall had similar time and day of arrival, ambulance arrival, triage urgency, and evaluating provider types. Although transferred visits were more likely to receive fewer diagnostic tests, procedures, or

Table 1
Comparison of Demographic Characteristics of U.S. EDs Visits Resulting in Interhospital Transfer Versus Hospital Admission, 1997–2009

Characteristics	Observations (Weighted %)		
	Transferred, <i>n</i> = 8,129	Admitted, <i>n</i> = 56,983	Difference, Δ% (95%CI)
Patient characteristics			
Age, yr			
<18	1,380 (18)	4,508 (7.9)	9.9 (8.3 to 11)
18–44	3,046 (36)	14,535 (23)	13 (12 to 15)
45–64	1,910 (23)	14,790 (26)	–3.2 (–4.5 to –1.8)
≥65	1,793 (23)	23,150 (43)	–20 (–22 to –19)
Female sex	3,747 (47)	30,511 (54)	–6.7 (–8.4 to –5.0)
Race/ethnicity			
Non-Hispanic white	5,501 (71)	37,889 (71)	0 (–2.7 to 2.7)
Non-Hispanic black	1,503 (18)	10,635 (17)	0.5 (–1.4 to 2.4)
Hispanic	802 (8.7)	6,103 (8.8)	–0.1 (–1.2 to 1.0)
Other	323 (2.7)	2,356 (3.1)	–0.4 (–1.0 to 0.3)
Source of payment			
Private	2,253 (30)	15,622 (28)	1.6 (–0.2 to 3.4)
Medicare	1,845 (23)	20,757 (39)	–16 (–18 to –14)
Medicaid	1,892 (22)	10,784 (16)	6.1 (4.2 to 8.0)
Self-pay	1,189 (15)	4,764 (8.2)	6.6 (5.3 to 7.9)
Other	406 (4.6)	1,596 (2.7)	1.8 (1.1 to 2.6)
Missing	544 (6.1)	3,460 (6.3)	–0.2 (–1.2 to 0.9)
Hospital characteristics			
Region			
Northeast	1,816 (16)	16,660 (23)	–6.8 (–9.5 to –4.1)
Midwest	1,909 (26)	12,972 (27)	–0.8 (–5.5 to 4.0)
South	2,688 (39)	17,072 (34)	5.7 (0.2 to 11)
West	1,716 (19)	10,279 (17)	1.8 (–0.9 to 4.7)
Nonurban	2,040 (29)	6,405 (15)	14 (9.2 to 19)
Ownership			
Voluntary, nonprofit	5,376 (69)	42,824 (79)	–9.8 (–13 to –6.4)
Governmental, nonfederal	1,879 (20)	9,559 (13)	6.6 (3.5 to 9.7)
Proprietary	874 (12)	4,600 (8.6)	3.2 (0.7 to 5.7)
% Poverty in patient home zip code*			
<5.0%	189 (12)	1,530 (16)	–3.9 (–6.9 to –0.9)
5.0–9.9%	343 (23)	2,447 (26)	–3.8 (–8.2 to 0.7)
10.0–19.9%	540 (39)	2,964 (33)	5.9 (1.0 to 11)
≥20.0%	268 (22)	1,932 (20)	1.8 (–3.0 to 6.6)
Missing	79 (5.1)	470 (5.2)	–0.1 (–1.9 to 1.7)
% Bachelors degree in patient home zip code*			
<12.84%	492 (39%)	2,438 (28)	11 (2.9 to 19)
12.84–19.66%	339 (24%)	2,264 (25)	–0.9 (–5.2 to 3.4)
19.67–31.68%	275 (18%)	2,111 (22)	–3.5 (–7.2 to 0.2)
≥31.69%	234 (14%)	2,056 (20)	–6.2 (–9.7 to –2.7)
Missing	79 (5.1%)	474 (5.2)	–0.1 (–1.9 to 1.7)

*Available only 2006–2009.

medications, 59% still received more than three diagnostic tests prior to transfer, and over half had imaging studies (17% having cross-sectional imaging) prior to transfer. The ED length of stay was shorter for transferred visits, but nearly two-thirds still had lengths of stay longer than 3 hours prior to transfer.

For the years the primary reason for transfer variable was available (2005–2008), higher level of care was the most common reason for transfer (47%), followed by need for psychiatric care (29%). Less common reasons for transfer included: pediatric facility needed (8%), other/unspecified reason (7%), continuity of care (6%), and insurance requirement (3%).

The overall rate of ED visits resulting in transfer was steady from 1997–2009 (range = 1.7% to 2.0%; $p_{\text{trend}} = 0.75$). However, during this time, among transferred visits, the proportion of injured and Medicaid as the primary source of payment increased, while the

proportion of uninsured decreased (Figure 1). The proportions of other subgroups among transferred visits were similar during 1997–2009 (all $p_{\text{trend}} > 0.10$).

DISCUSSION

To our knowledge, this is the first national study to characterize interhospital transfers from U.S. EDs. This investigation identified several unique issues inherent to interhospital transfer including a disparity in payer type, demographics, and presenting condition in visits leading to transfer, as well as a high rate of diagnostic tests and imaging prior to transfer. These findings have implications for regionalization of care, resource utilization and distribution, and planning for surge capacity.

Our analysis indicates that injury-related visits were more common among transfers, compared to admitted visits. This finding confirms results of smaller and more

Table 2
Comparison of Clinical Characteristics of U.S. EDs Visits Resulting in Interhospital Transfer Versus Hospital Admission, 1997–2009

Characteristics	Observations (Weighted %)		
	Transferred, <i>n</i> = 8,129	Admitted, <i>n</i> = 56,983	Difference, $\Delta\%$ (95%CI)
Time of arrival			
7:00 a.m.–2:59 p.m.	3,180 (39)	23,146 (41)	–2.1 (–3.6 to –0.6)
3:00 p.m.–10:59 p.m.	3,407 (43)	23,512 (42)	1.1 (–0.4 to 2.6)
11:00 p.m.–6:59 a.m.	1,487 (18)	9,693 (17)	1.0 (–0.2 to 2.2)
Weekend arrival	2,285 (28)	15,408 (28)	0.1 (–1.2 to 1.4)
Ambulance arrival*	2,432 (37)	18,399 (39)	–1.8 (–3.8 to 0.2)
Triage immediacy			
Emergent	2,881 (37)	19,180 (35)	2.0 (–0.2 to 4.3)
Urgent	2,634 (32)	21,637 (37)	–5.1 (–6.9 to –3.4)
Semiurgent/nonurgent	1,129 (14)	7,343 (13)	1.7 (0.1 to 3.4)
Missing	1,485 (17)	8,823 (15)	1.4 (–0.5 to 3.3)
Visit related to injury	3,190 (40)	11,714 (19)	20 (19 to 22)
Providers			
Physician without MLP	7,186 (88)	50,971 (89)	–1.2 (–2.8 to 0.3)
MLP with physician	346 (4.0)	2,867 (4.9)	–0.9 (–1.6 to –0.3)
MLP without physician	130 (1.7)	571 (1.1)	0.6 (–0.1 to 1.3)
Other	467 (6.5)	2,574 (4.9)	1.6 (0.4 to 2.9)
Number diagnostic tests			
0	461 (5.3)	2,033 (2.9)	2.3 (1.5 to 3.2)
1–3	2,905 (35)	11,695 (20)	15 (13 to 17)
4–6	2,127 (28)	15,887 (30)	–1.4 (–3.1 to 0.3)
>6	2,581 (31)	26,783 (47)	–16 (–18 to –13)
Number of procedures			
0	3,244 (39)	14,146 (24)	15 (12 to 17)
1	3,403 (46)	30,775 (58)	–12 (–10 to –14)
>1	1,178 (16)	9,821 (18)	–2.6 (–4.6 to –0.7)
Imaging			
Any imaging	3,923 (52)	38,640 (71)	–19 (–21 to –17)
Any cross-sectional imaging	1,301 (17)	13,702 (24)	–7.1 (–8.7 to –5.5)
Number of medications administered			
0	2,695 (33)	14,178 (24)	8.9 (7.1 to 11)
1	1,664 (22)	10,515 (19)	2.8 (1.4 to 4.3)
2–3	2,266 (28)	18,163 (33)	–4.3 (–5.6 to –2.9)
>3	1,504 (17)	14,127 (24)	–7.4 (–9.1 to –5.8)
ED length of stay, hours [†]			
0–3	2,297 (37)	10,304 (24)	14 (10 to 17)
4–6	1,973 (32)	14,878 (36)	–4.2 (–6.3 to –2.1)
6–12	1,030 (17)	8,287 (18)	–1.6 (–3.4 to 0.1)
>12	484 (6.0)	3,510 (6.4)	–0.4 (–1.7 to 0.9)
Missing	552 (8.3)	7,489 (16)	–7.5 (–9.2 to –5.8)

MLP = midlevel provider.
*Missing 2000–2001.
†Available only 2001–2009.

geographically limited studies and would be expected from the regionalization of trauma care.² Newgard and colleagues⁴ reported that the strongest predictor of transfer for trauma patients was the initial hospital of presentation, perhaps indicating that the capacity and training contributed to the decision to transfer. This may indicate that early prehospital or triage recognition of injury type and potential care needs, in combination with a regionalized system of care, could contribute to delivery of the patient to the most appropriate facility initially and reduce need for subsequent transfer. While it is desirable for EMS to transport each patient to a facility capable of meeting his or her needs, we recognize that it may be most appropriate for EMS to transport certain patients to a closer hospital for stabilization or to limit the effect on the 9-1-1 system.

The most common reasons for transfer were for a higher level of care and need for psychiatric care,

together accounting for a large majority of all transfers from U.S. EDs during the subset of years data were available (2005 to 2008). Prior data identified that lack of on-call specialists contribute substantially to an increase in interhospital transfers,⁵ suggesting that addressing limitations to specialist coverage (including telemedicine) may reduce the need for some transfers. Our study suggests that up to one-third of ED transfers may be affected by increasing local inpatient psychiatric capacity.

For the years that the primary reason for transfer variable was available, 8% listed needing a pediatric facility as the reason. Additionally, 18% of transferred patients were younger than 18 years (vs. 7.9% among admitted patients). While this may represent discomfort with pediatric cases, this also reflects limited inpatient pediatric capacity. Recent recommendations from the American Academy of Pediatrics and Society of Critical

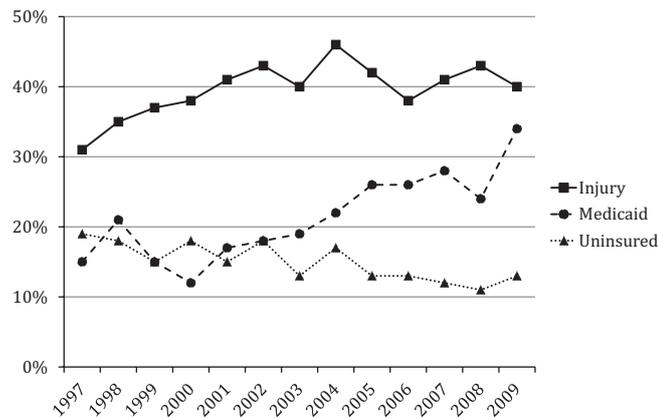


Figure 1. Temporal trends for characteristics among visits to U.S. EDs resulting in interhospital transfer, 1997–2009. Injury (square, solid line)— $\beta = 0.005$ (95% CI = 0.001 to 0.010), $p_{\text{trend}} = 0.02$; Medicaid (circle, dashed line)— $\beta = 0.014$ (95% CI = 0.009 to 0.019), $p_{\text{trend}} < 0.001$; uninsured (triangle, dotted line)— $\beta = -0.006$ (95% CI = -0.009 to -0.002), $p_{\text{trend}} = 0.006$; all other subgroups— $p_{\text{trend}} > 0.10$ (data not shown)

Care Medicine have emphasized the importance of transferring critically ill children to pediatric specialty facilities. However, another study indicated that a majority of transferred children were ultimately discharged from their receiving EDs, indicating that further training and improved specialist consultation (including telemedicine) may reduce some resource use and risk associated with transfer.⁸

The 1986 passing of EMTALA aimed to reduce the transfer of patients with limited or no means of payment. Although the prevalence of uninsured or self-pay patients among ED transfers has declined since 1997, these patients still have nearly double the prevalence among transferred versus admitted visits. Of additional concern, the prevalence of Medicaid insurance among ED transfers was higher than among admissions and increased substantially during the study period. Several other studies have also reported that transferred patients had a disproportionate prevalence of public insurance.^{2,4,5} This trend has important implications for potentially increasing the financial burden on hospitals accepting large volumes of transferred patients, such as teaching and other tertiary care facilities, especially in light of Medicaid expansion through health care reform efforts. As the underlying causes including patient acuity, hospital capacity, and other individual- and institution-level factors are unclear, an important direction for further study will be to identify the underlying reasons for these observed trends.

Time in ED beds is a limited resource. Nearly two-thirds of those visits resulting in transfer had initial ED lengths of stay longer than 3 hours, suggesting opportunities for improved throughput with transferred patients. A prior study of community hospitals identified that when transfers occurred within established interhospital partnerships, there was reduced time spent negotiating and justifying the transfers.⁹ The transfer of a patient between EDs creates a situation where documentation and diagnostic test results, including imaging studies, may not be available for the receiving facility.

Our results indicate that nearly all transferred patients received some form of diagnostic testing and over half had imaging. Although we were unable to determine resource use after transfer, the potential for repetition of testing is an important consideration that may contribute to increased cost, longer length of stay, and higher potential exposure to radiation.^{10,11} Much of the duplication in imaging, especially in rural areas, may result from the lack of formalized relationships and protocols to guide the transfer process.¹² A recent study found that nearly one-third of transferred trauma patients received unnecessary repeat CT imaging, representing a nearly \$1,800 increase in charges and an effective additional radiation dose of 21.5 mSv.¹³ These findings further emphasize the need for efficient information transfer and opportunities to decrease cost by streamlining testing.

Finally, this study provides important descriptive data on the current practice of transfer. In planning for a situation in which resources for a hospital or group of hospitals are overwhelmed, our data allow local planners and the National Disaster Medical System to include a baseline rate of transfer in calculations. In addition, our results help to identify a subset of patients who may benefit from telemedicine consultations or established consultation agreements.

LIMITATIONS

There are several potential limitations to our study inherent to survey data and secondary analysis. These include potential errors in the initial documentation, data abstraction, and coding.^{7,14} For example, one recent study found unexpectedly high incongruence between endotracheal intubation and visit disposition using NHAMCS data.¹⁵ Other limitations associated with NHAMCS include annual changes in variables and survey items, which may reduce the reliability of combining data across years. The clinical outcomes for individual patients could not be assessed, nor could the appropriateness of diagnostic tests or the decision to transfer patients. While it is assumed that most transfers represented ED to ED transfers, there may be some ED to inpatient unit transfers that were included in the data, but that we were unable to identify as such.

There are also several other factors that could influence the decision to transfer patients, not limited to patient-specific considerations. Current ED volume, hospital capacity, and on-call specialist coverage all contribute to the local conditions that may lead to varying rates of transfer. These variables were difficult to assess and account for in this secondary analysis of survey data.

CONCLUSIONS

Transfer of ED patients was relatively rare, but was more common among specific, potentially high-risk populations. As approximately half of transfers were for a higher level of care, coordinating care and developing regionalized health care could reduce redundancy in testing and improve efficiency. Evaluation of interventions, such as defined protocols and telemedicine in the

prehospital and ED setting, may identify opportunities for enhanced delivery of high-quality, appropriate, and cost-effective emergency care across variable capacities of local health care systems.

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