Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

______________________________ _______________

Julia M. Budde Date

The cost of transfer patients at an academic medical center

By Julia M. Budde

Master of Public Health

Epidemiology

____ [Chair's signature]

John E. McGowan, Jr., M.D.

Committee Chair

____ [Member's signature]

Bryce Gartland, MD

Committee Member

____ [Member's signature]

David Tong, MD, MPH, FASN

Committee Member

The cost of transfer patients at an academic medical center

By Julia M. Budde

B.S. in Business Administration, The Ohio State University, 2007

B.S. in Social and Behavioral Science (Economics), The Ohio State University, 2007

Thesis Committee Chair: John E. McGowan, Jr., M.D.

An abstract of
a thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health in Epidemiology
2012

Abstract

The cost of transfer patients at an academic medical center

By Julia Budde

Background

Interhospital transfer patients are known to have higher lengths of stay, costs, and mortality than direct admissions after adjusting for severity of illness and other demographic factors. What is *not* well-studied is the difference in costs between patients transferred from an outside facility's emergency department compared to transferred from an outside facility's inpatient ward or ICU. The purpose of this study is to determine whether the location of a patient before transfer, i.e. ED or inpatient, affects the total cost of hospitalization at the receiving facility.

Methods

The study population included 31,415 hospital admissions to an academic medical center in the southeastern United States from November 1, 2009 through March 20, 2011. The primary exposure was source of admission: directly through the emergency department, transferred from an outside emergency department, or transferred from inpatient status at an outside hospital, including ICU's and regular beds. The outcome measure was the total cost of admission after adjusting for age, gender, race, severity of illness, weekend admission, and insurance type.

Results

There were 27,565 direct admissions, 1841 ED transfers, and 2009 inpatient transfers in the study. The groups were statistically significantly different in age, gender, race, severity of illness, weekend admissions, and insurance type. After adjusting for all these factors, the total cost of an admission was different between the three sources of admission. ED transfers had a higher adjusted total cost than direct admissions (difference=$7,874, 95% CI $6,615, $9,133; p<.0001). Likewise, inpatient transfers cost $10,032 (95% CI $8,832, $11,232; p<.0001) more than direct admissions and $2,158 (95% CI $508, $3,807; p=0.0104) more than ED transfers.

Conclusion

Transfer patients have a higher total cost of admission than do directly-admitted patients, and inpatient transfers are more costly than emergency department transfers, even after accounting for age, gender, race, severity of illness, weekend transfers, and insurance type. Policy makers should consider the financial burden to hospitals with specialized capabilities when considering expanding legislation that requires these hospitals to accept a broader base of transfer patients.

The cost of transfer patients at an academic medical center

By Julia M. Budde

B.S. in Business Administration, The Ohio State University, 2007

B.S. in Social and Behavioral Science (Economics), The Ohio State University, 2007

Thesis Committee Chair: John E. McGowan, Jr., M.D.

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health in Epidemiology
2012

Acknowledgements

Dr. David Tong did extensive work to prepare the dataset and has been a great advisor. Thanks to Kelly McCormick for her help with the statistical analysis.

Thank you, family and friends, for your moral support.

Table of Contents

Manuscript: The cost of transfer patients at an academic medical center

Julia M. Budde

Background

EMTALA

The Emergency Medical Treatment and Labor Act (EMTALA) was enacted by the United States congress as part of the Consolidated Omnibus Budget Reconciliation Act passed in 1986 (1). EMTALA requires participating emergency departments (ED) to provide emergency health care to any patient regardless of citizenship status, legal status, and ability to pay. Hospitals may transfer or discharge a patient who needs emergency healthcare in the following situations: 1) after stabilization, 2) under his/her own informed consent, or 3) if the emergency condition requires services only available at another emergency treatment facility (1).

Any hospital receiving funds from the Department of Health and Human Services Centers for Medicare and Medicaid Services (CMS) for services to Medicare patients is subject to regulation under EMTALA. Most hospitals receive such payments, and henceforth "emergency department (ED)" will refer to those in EMTALA-participating hospitals, acknowledging that some emergency departments such as Veterans Affairs hospitals and Indian Health Service are not subject to regulation by EMTALA.

EMTALA was passed to ensure that no individual is denied lifesaving medical services and to prevent patient dumping, defined as "the denial of or limitation in the provision of medical services to a patient for economic reasons and the referral of that patient elsewhere" (2). Patient dumping leads to decreased access to care and substandard patient care (2).

Under current EMTALA laws, a patient presenting to an ED with an emergency medical condition must be either stabilized or transferred to a facility with specialty services necessary to stabilize the patient (3). Those facilities with specialty services are obligated under EMTALA to accept transfers from the original facility's ED if the original facility does not have the capabilities to stabilize the patient (3). Oftentimes a patient is admitted to the original hospital in an unstable condition with the intention of stabilization. Even though the patient is not yet stable, EMTALA does not apply to inpatients, and therefore obligations of hospitals to stabilize the patient under EMTALA ends at the time of admission (and a separate law governing inpatient rights comes into play) (4). If the admitting hospital later determines that the patient needs specialty care at another hospital, the specialty hospital is not obligated to accept the patient.

Proposed Changes to EMTALA

CMS is now reconsidering the application of EMTALA (3). The proposed interpretation of the law would require hospitals with specialized capabilities to accept *inpatients* from another hospital if that outside hospital cannot stabilize the patient. This differs from the current interpretation by including inpatients, while currently only patients transferring from the emergency department are covered by EMTALA. The rationale behind this interpretation of the act is that the end of one hospital's obligation under EMTALA should not affect another hospital's obligation to an unstable patient with an emergency medical condition, regardless of whether that patient is an inpatient at another hospital (3).

Academic Medical Centers

Academic medical centers (AMCs) are institutions that provide medical care while at the same time providing medical education for health professionals and conducting biomedical research (5). One important role of AMCs in the U.S. health care system is providing specialized services not available at smaller hospitals. Consequently, they care for a disproportionate share of transfer patients compared to non-teaching hospitals (6). This also makes them particularly vulnerable to changes in the interpretation of EMTALA.

Transfer Patients

Cost, length of stay (LOS), and mortality are common markers of resource utilization and outcomes in a hospital, and these markers have been studied in patients transferred from outside facilities. Patients transferred to the intensive care unit (ICU) are sicker, generate more costs per visit and have longer LOS compared to patients directly admitted to the ICU through the emergency department or from the floor (5). One study found that even after adjusting for severity of illness, transfer patients have longer ICU and hospital LOSs and higher mortality rates than directly-admitted patients (7). The mortality difference is confirmed in other studies comparing transfer patients to directly-admitted patients (8,9,10,11). Though there is no agreed-upon explanation for this disparity in outcome measures, it is clear that there is a level of complexity present in transfer patients that differs from that of directly-admitted patients.

What is *not* well-studied is the difference in costs between patients transferred from an outside facility's emergency department compared to transferred from an outside facility's inpatient ward or ICU. That is, what is the resource utilization of patients transferred from different locations within a hospital? One transfer group, those from the ED, is currently governed under EMTALA, whereas inpatient transfers are not currently covered by the law. A prior study found that ED transfers compared to ICU transfers have a lower mortality and hospital LOS after adjusting for acuity (12), indicating lower resource utilization by ED transfers than ICU transfers. However, the study did not include non-ICU inpatients.

The purpose of this study is to determine whether the location of a patient before transfer, i.e. ED or inpatient, affects the total cost of hospitalization at the receiving facility. The hypothesis of this study is that transfer patients are more costly to care for than directly-admitted patients after controlling for severity of illness and other patient-specific factors. Moreover, inpatient transfers, including floor and ICU, have higher total costs of their hospital stay than ED transfers.

Methods

Study Population

The data for this study was obtained from the University HealthSystem Consortium Clinical Data Base (13) and Emory Clinical Data Warehouse (14). 33,069 consecutive patient admissions to a single AMC in the southeastern United States from November 1, 2009 through March 20, 2011 were in the database. After excluding patients that did not have data recorded for total cost, the study population included 31,415 hospital admissions.

Variables

The outcome was total cost of a hospital stay, measured in dollars. Total cost is calculated by applying Medicare's cost-to-charge ratios to direct and indirect hospital charges. This number can be thought of as a marker of resource utilization (15). The primary exposure variable was source of admission. The categories of source of admission included direct admissions, ED transfers, and inpatient transfers. Direct admissions were admitted through the emergency department of the study hospital. ED transfers were patients transferred from an outside hospital's emergency department who were eventually admitted to the study hospital. Inpatient transfers were those patients transferred from inpatient status at an outside hospital and admitted to the study hospital. Both ED and inpatient transfers occurred via the study hospital's "transfer service", a phone operator at the study hospital who receives requests for transfer.

Other variables considered were age (measured in years), gender (male or female), and race (white, black, Hispanic, or other). All Patient Refined Diagnosis Related Group (APR-DRG) is a coding system used by hospitals and CMS for reimbursement and research purposes (16). This coding system assigns each patient admission a severity of illness score, which was used in this study and classified as an ordinal variable with values minor, moderate, major, or extreme. Day of admission was classified as weekend (Saturday or Sunday admission) or weekday (Monday through Friday), and insurance type included commercial/private insurance, Medicare, Medicaid, self-pay, and other, which included military, research, workers compensation, and charity patients. The above patient characteristics were chosen based on prior studies (5,7,9,10,11,12,17,18) that found associations with cost and/or source, as well as expert knowledge.

Statistical Analysis

This was a retrospective cohort study of the total cost of hospitalization for patients who are directly-admitted, transferred from an outside hospital's ED, and transferred from inpatient status at an outside hospital. Descriptive analysis, including evaluation for outliers, was performed on outcome and predictor variables grouped by source. Bivariate analysis was performed using one-way analysis of variance test for continuous variables and Pearson's chi square test for categorical variables to examine the unadjusted relationship between predictor variables and source of admission. Further exploration of secondary predictor variables was performed using simple linear regression and ANOVA to examine the unadjusted relationships between predictors and total cost. Multiple linear regression was used to establish the unadjusted and independent relationships between source and cost. Assumptions of linear regression, including linearity of predictors and the outcome variable, homoscedasticity of the outcome variable, and normal distribution of the outcome variable for a given value of the predictor, were examined using normal probability and residual plots. The independence assumption was met through the sample selection process. Although some patients may have been admitted more than once during the study time period, this would represent a small portion of the total sample size, and in general one patient's cost of hospitalization does not depend on that of another patient in the study. All predictor variables were examined for collinearity using the variance inflation factor. The study results were used to perform a sensitivity analysis of the effect of various possible percentage increases in inpatient transfers on total costs to the study AMC. An alpha of 0.05 was used for hypothesis testing, and data were analyzed using SAS 9.3 (SAS Institute, Cary, NC). The study was approved under expedited review by the Emory University Institutional Review Board. This author was included in that approval as a public health research fellow.

Results

Demographic Data and Exploratory/Bivariate Analysis

A total of 31,415 subjects were included in the study after excluding patients who were missing cost data (Appendix 1). There were no missing data for source of admission. There were several subjects in the dataset aged <18 years old and >100 years old that were suspicious for data entry error. However after chart review it was found that their data was appropriately entered, and they were included in the analysis. Total cost had a positively- (right-) skewed distribution and was log-transformed to evaluate its relationship with the continuous variable age. All other regression assumptions were met, and there was no collinearity between predictor variables.

Table 1 presents the demographic data for the entire study cohort as well as stratified by source. The three source groups were statistically significantly different for all variables. The average age of subjects was 57 years old, with no clinically significant difference between the three groups. 49.9% of subjects were male, with a slight predominance of males in the transfer groups (51.7% ED transfers and 54.0% inpatient transfers, p=0.0001).

The study population was 60.8% white, 30.5% black, 1.5% Hispanic, and 7.1% other races. Black and white patients made up a greater proportion of the direct admission group; 61.8% of direct admissions were white versus 52.6% of ED transfers and 54.7% of inpatient transfers (p<.0001). 31.2% of direct admission were black versus 25.6% of ED transfers and 26.0% of inpatient transfers (p<.0001). There were more subjects of "other" races in the transfer groups than the direct admissions; 20.0% of ED transfers, 17.7% of inpatient transfers, and 5.5% of direct admissions (p<.0001). A greater proportion of transfer patients had an extreme severity of illness compared to direct admissions: 18.6% of ED transfers and 20.6% of inpatient transfers compared to 8.5% of direct admissions (p<.0001). Similarly, only 14.0% and 10.7% of ED and inpatient transfers, respectively, had a minor severity of illness whereas 23% of direct admission had minor severity of illness (p<.0001).

Overall, 14.5% of admissions were on the weekend. This proportion was much higher for transfer patients, with 31.8% of ED transfers on the weekend and 21.8% of inpatient transfers compared to only 12.8% of direct admissions presenting on the weekend (p<.0001). In all three groups Medicare insured the largest percentage of patients: 45.1% of direct admissions, 42.2% of ED transfers and 47.8% of inpatient transfers (p=0.0021). Commercial or private insurance paid for 37.5% of direct admissions and a lesser proportion of transfer patients: 30.6% of ED transfers and 28.9% of inpatient transfers (p<.0001). Only 5.2% of direct admissions were self-pay/uninsured, whereas 14.6% of ED transfers and 10.4% of inpatient transfers were self-pay/uninsured (p<.0001).

The unadjusted analysis of the predictor variables and cost showed that age, gender, race, severity of illness, and insurance type were significantly associated with total cost (Table 2). Age was statistically significantly associated with cost, and the formula in Table 2 can be used to calculate total cost for a given age. Male admissions cost $1,699 more than females (p<.0001). Patients of a race other than white, black or Hispanic had the most costly admissions ($21,806, SD $31,260) and black patients the least costly ($19,629, SD $27,084; p=0.0046). As may be expected, severity of illness was strongly associated with total cost of admission. Minor severity had an average total cost of $14,544 (SD $15,645), compared to $16,288 (SD $18,394) in the moderate group, $21,772 (SD $29,004) for major severity of illness and $38,703 ($49,289) for the highest severity group (p <.0001). Unadjusted total cost varied by payer source: self-pay/uninsured patients cost $22,371 (SD $28,081), Medicaid $21,690 (SD $34,413), Medicare $19,938 (SD $26,500), commercial/private insurance $19,856 (SD $26,065), and other insurance $13,974 (SD $25,363) (p<.0001). Weekend admissions had a higher total cost than weekday admissions ($20,629, SD $30,967 v. $19,784, SD $26,398; p=0.0521), though this difference did not quite reach statistical significance.

Adjusted and Unadjusted Total Cost

The unadjusted average total cost was significantly different between the three source groups (Table 3). Table 4 displays the difference in total cost between each source of admission. ED transfers cost $10,349 (95% CI $9,084, $11,615; p<.0001) more than direct admissions, while inpatient transfers had an even greater unadjusted total cost than ED transfers ($2,724, 95% CI $1,027, $4,420; p=0.0017).

These relationships persisted after adjusting for the influence of age, gender, race, severity of illness, weekend admissions and insurance type on cost. The adjusted total cost of an admission was different between the three sources of admission (Table 3). ED transfers had a higher adjusted total cost than direct admissions (difference=$7,874, 95% CI $6,615, $9,133; p<.0001) (Table 4). Likewise, inpatient transfers cost $10,032 (95% CI $8,832, $11,232; p<.0001) more than direct admissions and $2,158 (95% CI $508, $3,807; p=0.0104) more than ED transfers.

Conclusion

In this study, transfer patients had a higher total cost of admission than did directly-admitted patients, and inpatient transfers were more costly than emergency department transfers, even after accounting for demographic factors (age, gender, race), severity of illness, weekend transfers, and insurance type.

EMTALA did not entirely end the issue of patient dumping, and hospitals still transfer patients for economic reasons (19). Though this study was not designed to draw conclusions about the difference in demographic features between transfer and directly-admitted patients, there were more Medicaid and self-pay patients in the transfer groups and fewer privately-insured patients (see Table 1). From this one can speculate that the transferring facilities in this study preferentially transferred patients who are not profitable.

Judgment should be used when interpreting the applicability of these study results to the real world. A difference in total cost of $2,000 is not dramatic when one considers the total costs of a hospital stay that were found in this study. Though this study demonstrates the statistically significant additional costs of inpatient transfers compared to ED transfers, the impact of this figure may vary depending on the volume of transfer patients a facility sees.

Similarly, other factors may appear significant because the sample size is large and improves precision, but these differences may not be clinically significant. For example, the average age of participants in each source of admission is 57 or 58 (Table 1), biologically nearly identical ages and treated the same by physicians. However, statistically this baseline characteristic is significantly different between groups. Likewise, the unadjusted association between race and total cost is statistically significant (Table 2), but the average costs are relatively similar and have large, overlapping standard deviations. As with all studies, the reader should use judgment when interpreting statistical results.

Limitations and Strengths

There are some limitations to this study. The primary exposure of interest, source of admission, was entered by the telephone-line transfer service. It was assumed that the transfer service correctly ascertained if the patient was being transferred from an outside inpatient bed or the emergency department. If some patients had a misclassified source of admission, meaning some ED transfers were included in the inpatient transfer group, and vice versa, then results will be biased toward the null and measured differences in demographic characteristics and total cost would be less dramatic than if they were properly classified. There was no indication that the transfer service incorrectly classified these patients, but without conducting chart reviews for all subjects, accuracy of classification of the primary exposure cannot be guaranteed.

5% of the original dataset was excluded because of missing data. This risks introducing sampling bias into the study if that part of the population was different from those included in the study. According to statistical analysis (see Appendix 1), the excluded population and study population were grossly similar, and the study population was a good, though not perfect, representation of the underlying population of interest (all admissions to the study hospital).

Strengths of this study are that the study hospital is similar to other AMCs in that it offers tertiary and quaternary services and is a referral center for other hospitals. Adjusting for baseline demographic characteristics makes these results more applicable to hospitals that serve a demographically different population than that of the study hospital. However, in other ways the study hospital is dissimilar from most AMCs because it is one of the few AMCs in the southeastern United States and has a large catchment area. This may mean that the complexity of patients, social factors affecting post-hospitalization placement, and other factors may differ between transfer patients at the study hospital and other AMCs.

Sensitivity analysis

The results of this study can be used to investigate how an increase in transfers of inpatients from outside facilities will affect the total costs faced by referral hospitals similar to the study AMC. Some critics expect that expanding EMTALA to include inpatients at an outside hospital will increase the opportunity for hospitals to transfer away their less-profitable patients (3). If the interpretation of EMTALA is changed, then referral hospitals like AMCs might expect a rise in the number of inpatient transfer requests they receive.

There were a total of 33,069 admissions over the course of 17 months, or 23,343 admissions in a 12-month period. The entire dataset of 33,069 patients can be used in the sensitivity analysis because the distribution amongst transfer sources is the same for the excluded population as the study population (Appendix 1). 87.70% of those patients were direct admissions, 5.86% ED transfers, and 6.44% inpatient transfers.

A 5% increase in inpatient transfers would result in an additional 75 patients per year at the study hospital at a cost of $26,561 per patient. This would result in an additional $2 million per year in total costs to the AMC (Table 5). If the increase in inpatient transfers is more dramatic, the total additional cost per year rises proportionately.

These additional costs will negatively impact the receiving hospital. Medicare reimburses hospitals a lump sum for a given APR-DRG instead of paying for the actual costs that the hospital incurs (20). This system rewards hospitals for spending less than the fixed amount of reimbursement. While the reimbursement does take into account a patient's severity of illness, as this study reveals, transfer patients are costlier to care for than their severity of illness would suggest. Therefore, the receiving hospital will likely spend more on transfer patients than they are reimbursed and ultimately absorb the cost of the care of transfer patients that is not covered by Medicare's lump sum payment. Also, if patient dumping does increase, resulting in additional transfer patients who are uninsured and unable to pay their medical bills, then the receiving facility will bear an increased financial burden.

This study highlights the additional costs of inpatient transfers relative to both ED transfer patients and direct admissions, and found that this difference is not fully explained by demographic data, severity of illness, or payer source. Lawmakers should consider all ramifications of mandating hospitals to accept inpatient transfers from outside facilities, including the additional costs to academic medical centers and other facilities that accept transfer patients.

References

1. United States Code 42 The Public Health and Welfare. Section 1395dd Emergency Medical Treatment and Women in Labor Act (EMTALA), 1986.

2. Ansell DA, Schiff RL. Patient dumping. Status, implications, and policy recommendations. *JAMA.* Mar 20 1987;257(11):1500-1502.

3. Department of Health and Human Services CfMaMS. 42 CFR Part 489 [CMS-1350-ANPRM] RIN 0938-AQ51 Medicare Program; Emergency Medical Treatment and Labor Act: Applicability to Hospital and Critical Access Hospital Inpatients and Hospitals with Specialized Capabilities. 14 Dec 2010.

4. Department of H, Human Services CfMa MS. 42 CFR Parts 482 and 485. 24 2011.

5. Golestanian E, Scruggs JE, Gangnon RE, Mak RP, Wood KE. Effect of interhospital transfer on resource utilization and outcomes at a tertiary care referral center. *Crit Care Med.* Jun 2007;35(6):1470-1476.

6. Wyatt SM, Moy E, Levin RJ, et al. Patients transferred to academic medical centers and other hospitals: characteristics, resource use, and outcomes. *Acad Med.* Oct 1997;72(10):921-930.

7. Rosenberg A, Hofer T, Strachan C, Watts C, Haywards R. Accepting critically ill transfer patients: Adverse effect on referral center's outcome and benchmark measures. *Annals of Internal Medicine.* Jun 2003; 138(1):882-890.

8. Combes A, Luyt CE, Trouillet JL, Chastre J, Gibert C. Adverse effect on a referral intensive care unit's performance of accepting patients transferred from another intensive care unit. *Crit Care Med.* Apr 2005;33(4):705-710.

9. Borlase BC, Baxter JK, Kenney PR, Forse RA, Benotti PN, Blackburn GL. Elective intrahospital admissions versus acute interhospital transfers to a surgical intensive-care unit-cost and outcome predictions. *J Trauma-Injury Infect Crit Care.* 1991;31(7):915-919.

10. Hill AD, Vingilis E, Martin CM, Hartford K, Speechley KN. Interhospital transfer of critically ill patients: Demographic and outcomes comparison with nontransferred intensive care unit patients. *J Crit Care.* 2007;22(4):290-295.

11. Bernard AM, Hayward RA, Rosevear J, Chun H, McMahon LF. Comparing the hospitalizations of transfer and non-transfer patients in an academic medical center. *Acad Med.* Mar 1996;71(3):262-266.

12. Gerber DR, Schorr C, Ahmed I, Dettinger RP, Parrillo J. Location of patients before transfer to a tertiary care intensive care unit: Impact on outcome. *J Crit Care.* 2009;24(1):108-113.

13. University HealthSystem Consortium. About UHC. 2012; (https://www.uhc.edu/12443.htm). Accessed 2 Feb 2012.

14. Emory University. Clinical Data Warehouse - Healthcare. 2012; (http://it.emory.edu/catalog/ehc_clinical_data_warehouse/). Accessed 2 Feb 2012.

15. Department of Health and Human Services CfMMS. 42 CFR Part 412 [CMS–1243–P] RIN 0938–AM41 Medicare Program; Proposed Change in Methodology for Determining Payment for Extraordinarily High-Cost Cases (Cost Outliers) Under the Acute Care Hospital Inpatient Prospective Payment System. 2003.

16. Hughes J. Development of the 3M™ All Patient Refined Diagnosis Related Groups (APR DRGs). 2008; Department of Health and Human Services. Agency for Healthcare Quality Research; (http://www.ahrq.gov/qual/mortality/Hughes.htm). Accessed 17 Dec 2011.

17. Durairaj L, Will JG, Torner JC, Doebbeling BN. Prognostic factors for mortality following interhospital transfers to the medical intensive care unit of a tertiary referral center. *Crit Care Med.* Jul 2003;31(7):1981-1986.

18. Surgenor SD, Corwin HL, Clerico T. Survival of patients transferred to tertiary intensive care from rural community hospitals. *Crit Care.* 2001;5(2):100-104.

19. Gionis TA, Camargo CA, Jr., Zito AS, Jr. The intentional tort of patient dumping: a new state cause of action to address the shortcomings of the federal Emergency Medical Treatment and Active Labor Act (EMTALA). *Am Univ Law Rev.* Oct 2002;52(1):173-308.

20. United States Code 42 The Public Health and Welfare. Section 1395ww Payment to Hospitals for Inpatient Hospital Services, 2011.

Tables

Table 1. Characteristics of total cohort and by source

Variable	**Total**, n=31415	**Direct Admission**, n=27565	**ED Transfer**, n=1841	**Inpatient Transfer**, n=2009	**Test statistic and p-value****
Age, in years, mean (SD)	57 (17.2)	57 (17.3)	57 (16.7)	58 (16.6)	F= 3.59, P=0.0276
Gender, male, n (%)	15670 (49.9)	13633 (49.5)	952 (51.7)	1085 (54.0)	X^2=18.1, p=0.0001
Race, n (%)					
White	19105 (60.8)	17038 (61.8)	969 (52.6)	1098 (54.7)	X^2=95.2, p<.0001
Black	9593 (30.5)	8599 (31.2)	472 (25.6)	522 (26.0)	X^2=46.1, p<.0001
Hispanic	477 (1.5)	412 (1.5)	32 (1.7)	33 (1.6)	X^2=0.906, p=0.635
Other	2240 (7.1)	1516 (5.5)	368 (20.0)	356 (17.7)	X^2=911, p<.0001
Severity of Illness, n (%)					
Minor	6809 (21.7)	6337 (23.0)	257 (14.0)	215 (10.7)	X^2=235, p<.0001
Moderate	11282 (35.9)	10210 (37.0)	480 (26.1)	592 (29.5)	X^2=129, p<.0001
Major	10225 (32.6)	8675 (31.5)	762 (41.4)	788 (39.2)	X^2=121, p<.0001
Extreme	3099 (9.9)	2343 (8.5)	342 (18.6)	414 (20.6)	X^2=475, p<.0001
Weekend Admission, n (%)	4543 (14.5)	3519 (12.8)	586 (31.8)	438 (21.8)	X^2=601, p<.0001
Insurance type, n (%)					
Commercial/Private	11490 (36.6)	10345 (37.5)	564 (30.6)	581 (28.9)	X^2=89.6, p<.0001
Medicare	14169 (45.1)	12431 (45.1)	777 (42.2)	961 (47.8)	X^2=12.3, p=0.0021
Medicaid	2369 (7.5)	2026 (7.4)	154 (8.4)	189 (9.4)	X^2=13.3, p=0.0013
Self-Pay/Uninsured	1904 (6.1)	1427 (5.2)	269 (14.6)	208 (10.4)	X^2=339, p<.0001
Other*	1483 (4.7)	1336 (4.9)	77 (4.2)	70 (3.5)	X^2=8.99, p=0.0112

*Other insurance type includes military, research, workers compensation, and charity

**Chi-square test for all variables except age, one-way ANOVA was used for age variable

Table 2. Unadjusted relationship between predictor variables and total cost

Variable	Total cost, in dollars (SD)	Test statistic and p-value*
Age	=e^(9.22822+0.00352 (age))	F=134.9, p<.0001
Gender		
Male	$20,758 ($28,937)	F=30.9, p <.0001
Female	$19,059 ($25,128)	
Race		
White	$19,797 ($26,476)	F=4.34, p=0.0046
Black	$19,629 ($27,084)	
Hispanic	$20,942 ($31,064)	
Other	$21,806 ($31,260)	
Severity of Illness		
Minor	$14,544 ($15,645)	F=714.2, p<.0001
Moderate	$16,288 ($18,394)	
Major	$21,772 ($29,004)	
Extreme	$38,703 ($49,289)	
Weekend Admission	$20,629 ($30,967)	F=3.77, p=0.0521
Weekday Admission	$19,784 ($26,398)	
Insurance type		
Commercial/Private	$19,856 ($26,065)	F=24.3, p<.0001
Medicare	$19,938 ($26,500)	
Medicaid	$21,690 ($34,413)	
Self-Pay/Uninsured	$22,371 ($28,081)	
Other	$13,974 ($25,363)	

*F-statistic for ANOVA for all variables except age, F-statistic for age is for simple linear regression

Table 3. Unadjusted and adjusted average total cost by source

	Direct Admission	ED Transfer	Inpatient Transfer	Test statistic and p-value**
Total cost, in dollars (95% CI)				
Unadjusted	$18,464 ($18,147, $18,780)	$28,813 ($27,588, $30,039)	$31,537 ($30,364, $32,710)	F=330.1, p<.0001
Adjusted*	$16,529 ($15,223, $17,836)	$24,404 ($22,602, $26,205)	$26,561 ($24,800, $28,322)	F=178.9, p<.0001

*adjusted for age, gender, race, severity of illness, weekend admission, insurance type
**Test-statistic is for overall F-test

Table 4. Difference in unadjusted and adjusted total cost between sources

	Total cost difference, in dollars **(95% CI)**	**Test statistic and p-value****
ED Transfer v. Direct Admission		
Unadjusted	$10,349 ($9,084, $11,615)	t=16.0, p <.0001
Adjusted*	$7,874 ($6,615, $9,133)	t=12.3, p<.0001
Inpatient Transfer v. Direct Admission		
Unadjusted	$13,073 ($11,858, $14,288)	t=21.1, p<.0001
Adjusted	$10,032 ($8,832, $11,232)	t=16.4, p<.0001
Inpatient Transfer v. ED Transfer		
Unadjusted	$2,724 ($1,027, $4,420)	t=3.2, p=0.0017
Adjusted	$2,158 ($508, $3,807)	t=2.6, p=0.0104

*adjusted for age, gender, race, severity of illness, weekend admission, insurance type
**Test-statistic is for partial t-tests

Table 5. Sensitivity analysis for inpatient transfers

Increase in inpatient transfers, %	Additional inpatient transfers per year*	Total cost** per patient, in dollars	Total additional cost per year
5%	75	$26,561	1,992,093
15%	225	$26,561	5,976,279
35%	526	$26,561	13,971,212

*Assuming 23,343 admissions/year, 1,503 inpatient transfers/year at baseline
**Total adjusted cost of inpatient transfers

Appendix 1. Evaluating for Sampling Bias

The original dataset included 33,069 consecutive admissions. 1,654 (5.0%) individuals were missing values for total cost and were excluded from the analysis. Baseline characteristics of this excluded subset were examined and compared to characteristics of the study population using Pearson's chi-square test and Fisher's exact test for categorical variables and Student's t-test for continuous variables.

The purpose of this analysis of the excluded subjects was to evaluate for sampling bias. The analysis examines the source distribution and other baseline characteristics to determine if there was a certain group more likely to be excluded from the study. If there were large differences between the excluded patients and the study population, then one can conclude that the study population did not accurately represent the underlying total population of interest.

There was no difference in distribution amongst source of admission between excluded patients and the study population (Table A1). 86.8% of excluded patients and 87.7% of the study population were direct admissions. 5.9% of each group was transferred from an outside ED, and 7.4% of excluded v. 6.4% of included subjects were an inpatient transfers (p=0.2836). The excluded and study populations were the same with regard to age and gender. The two populations were approximately equally admitted on the weekend amongst all admission sources.

The excluded and study populations were not the same race in the directly-admitted and ED transfer groups. Among direct admissions, 59.7% of the excluded patients were white compared to 61.8% of the study population, and there were slightly more patients of a race other than white, black, and Hispanic in the excluded population than the study group (7.2% v. 5.5%, p =0.0354 for all races). In the ED transfer patients, 42.3% of the excluded patients compared to 52.6% of the study population were white, and 32.0% v. 20.0% were another race (p=0.0373 for all races). Severity of illness in the directly admitted group was statistically significantly different between the excluded population and study population, with small differences in all severity of illness classes (p=0.0080). The two populations were also statistically different with regard to insurance type in the direct admission and ED transfer groups. Of directly-admitted patients, 48.0% of the excluded population compared to 45.1% of the study population were funded by Medicare, 9.3% v. 7.4% by Medicaid, and 34.4% v. 37.5% by commercial/private insurance (p=0.0020 for all insurance types). In the ED transfer group, 40.2% of excluded patients and only 30.6% of study subjects were funded by commercial/private insurance. 26.8% of the excluded group had Medicare compared to 42.2% of the study population, and 10.3% v. 8.4% had Medicaid (p=0.0221 for all insurance types).

There were some statistically significant differences between the patients who were missing data on total cost and those who were included in the study. However, the primary exposure of interest, source of admission, as well as many of the demographic characteristics were the same. Some of the differences arose from slight clinical differences that may only be statistically different due to the large sample size, but not true variation in the underlying population. In summary, the population that was dropped from the study due to missing total cost data differed somewhat, but not glaringly, from the study population, and the study population was a good representation of all admissions to the study hospital.

Table A1. Demographics of study subjects compared to excluded subjects

Variable	Direct Admission		Test-statistic and p-value*	ED Transfer		Test-statistic and p-value	Inpatient Transfer		Test-statistic and p-value
	Included	Excluded		Included	Excluded		Included	Excluded	
Subjects, n (%)	27565 (87.7)	1435 (86.8)	--	1841 (5.9)	97 (5.9)	--	2009 (6.4)	122 (7.4)	X^{2**}=2.52, p=0.2836
Age, in years, mean (SD)	57 (17.3)	58 (17.2)	t=1.65, p= 0.0982	57 (16.7)	55 (16.4)	t=-1.23, p= 0.2202	58 (16.6)	56 (16.6)	t=-1.29, p= 0.1972
Gender, male, n (%)	13633 (49.5)	713 (49.7)	X^2=0.0378, p=0.8458	952 (51.7)	46 (47.4)	X^2=0.678, p= 0.4101	1085 (54.0)	66 (54.1)	X^2=0.0004, p= 0.9843
Race, n (%)									
White	17038 (61.8)	857 (59.7)	p=0.0354	969 (52.6)	41 (42.3)	p= 0.0373	1098 (54.7)	75 (61.5)	p= 0.3521
Black	8599 (31.2)	449 (31.3)		472 (25.6)	23 (23.7)		522 (26.0)	27 (22.1)	
Hispanic	412 (1.5)	26 (1.8)		32 (1.7)	2 (2.1)		33 (1.6)	0 (0.0)	
Other	1516 (5.5)	103 (7.2)		368 (20.0)	31 (32.0)		356 (17.7)	20 (16.4)	
Severity of Illness, n (%)									
Minor	6337 (23.0)	287 (20.0)	X^2=11.8, p=0.0080	257 (14.0)	6 (6.2)	X^2= 4.92, p=0.1775	215 (10.7)	11 (9.0)	X^2= 3.89, p= 0.2736
Moderate	10210 (37.0)	516 (36.0)		480 (26.1)	28 (28.9)		592 (29.5)	29 (23.8)	
Major	8675 (31.5)	491 (34.2)		762 (41.4)	42 (43.3)		788 (39.2)	49 (40.2)	
Extreme	2343 (8.5)	141 (9.8)		342 (18.6)	21 (21.7)		414 (20.6)	33 (27.1)	
Weekend Admission, n (%)	3519 (12.8)	199 (13.9)	X^2=1.48, p=0.2237	586 (31.8)	29 (29.9)	X^2= 0.159, p= 0.6900	438 (21.8)	31 (25.41)	X^2= 0.872, p= 0.3503
Insurance type, n (%)									
Commercial/Private	10345 (37.5)	494 (34.4)	X^2=16.9, p=0.0020	564 (30.6)	39 (40.2)	p=0.0221	581 (28.9)	41 (33.6)	p=0.8436
Medicare	12431 (45.1)	689 (48.0)		777 (42.2)	26 (26.8)		961 (47.8)	54 (44.3)	
Medicaid	2026 (7.4)	133 (9.3)		154 (8.4)	10 (10.3)		189 (9.4)	12 (9.8)	
Self-Pay/Uninsured	1427 (5.2)	62 (4.3)		269 (14.6)	15 (15.5)		208 (10.4)	12 (9.8)	
Other	1336 (4.9)	57 (4.0)		77 (4.2)	7 (7.2)		70 (3.5)	3 (2.5)	

*test-statistic for age, gender, severity of illness, weekend admission is for Pearson's chi-square; Fisher's exact test was used for race and insurance type

**X^2 test for all three sources of admission, all other test statistics are for a single source of admission

IRB Approval Letter

EMORY UNIVERSITY | Institutional Review Board

TO: David Tong, MD
Principal Investigator
MedHospitalMed

DATE: May 16, 2011

RE: **Expedited Approval**
IRB00050193
Cost and outcomes of outside patient transfers to academic medical centers

Thank you for submitting a new application for this protocol. This research is eligible for expedited review under 45 CFR.46.110 because it poses minimal risk and fits the regulatory category F(5), as set forth in the Federal Register. The Emory IRB reviewed it by expedited process on 5/14/2011 and granted approval effective from **5/14/2011** through **5/13/2012**. Thereafter, continuation of human subjects research activities requires the submission of a renewal application, which must be reviewed and approved by the IRB prior to the expiration date noted above. Please note carefully the following items with respect to this approval:

- A complete waiver of informed consent has been granted for this study.
- A complete waiver of HIPAA authorization has been granted for this study, for access of physician records, hospital records, billing records, clinical records, laboratory results, and radiology results.
- The following document was included in this review: Protocol version 3/25/2011

Any reportable events (e.g., unanticipated problems involving risk to subjects or others, noncompliance, breaches of confidentiality, HIPAA violations, protocol deviations) must be reported to the IRB according to our Policies & Procedures at www.irb.emory.edu, immediately, promptly, or periodically. Be sure to check the reporting guidance and contact us if you have questions. Terms and conditions of sponsors, if any, also apply to reporting.

Before implementing any change to this protocol (including but not limited to sample size, informed consent, study design, you must submit an amendment request and secure IRB approval.

In future correspondence about this matter, please refer to the IRB file ID, name of the Principal Investigator, and study title. Thank you.

Sincerely,

Rebecca Rousselle, CIP
Lead Research Protocol Analyst
This letter has been digitally signed

CC: Eig Jennifer MedHospitalMed

There are no items to display

Emory University
1599 Clifton Road, 5th Floor - Atlanta, Georgia 30322
Tel: 404.712.0720 - Fax: 404.727.1358 - Email: irb@emory.edu - Web: http://www.irb.emory.edu/
An equal opportunity, affirmative action university