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Racial and Geographic Disparities in Inter-Hospital Intensive Care Unit Transfers

Patrick D Tyler, MD[1], **David J Stone, MD**[2], **Benjamin P Geisler, MD, MPH**[3], **Stuart McLennan, PhD**[4], **Leo Anthony Celi, MD, MS, MPH**[5,6], and **Barret Rush, MD MPH**[7]

[1]Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Boston, MA, USA

[2]Departments of Anesthesiology and Neurosurgery, University of Virginia School of Medicine, Charlottesville, VA, USA

[3]Department of Medicine, Massachusetts General Hospital/Harvard Medical School, Boston, MA, USA

[4]Institute for History, Ethics and Philosophy of Medicine, Hannover Medical School, Hannover, Germany

[5]Division of Pulmonary, Critical Care, and Sleep Medicine, Beth Israel Deaconess Medical Center, Boston, MA, USA

[6]Institute for Medical Engineering and Science, Massachusetts Institute of Technology, Cambridge, MA, USA

[7]Department of Medicine, University of British Columbia, Vancouver, British Columbia, Canada

Abstract

Objective—Inter-hospital transfer (IHT), a common intervention, may be subject to healthcare disparities. In mechanically ventilated patients with sepsis, we hypothesize that disparities not disease-related would be found between patients who were and were not transferred.

Design—Retrospective cohort study.

Setting—Nationwide Inpatient Sample, 2006–2012.

Patients—Patients over 18 years of age with a primary diagnosis of sepsis who underwent mechanical ventilation.

Interventions—none

Send Correspondence to: Patrick D Tyler MD, Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Rosenberg Building, One Deaconess Road, 2nd Floor, Boston, MA 02215, pdtyler@bidmc.harvard.edu.

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Measurements and Main Results—We obtained age, gender, length of stay, race, insurance coverage, do not resuscitate status, and Elixhauser co-morbidities. The outcome used was inter-hospital transfer from a small- or medium-sized hospital to a larger acute care hospital. Of 55,208,382 hospitalizations, 46,406 patients met inclusion criteria. In the multivariate model, patients were less likely to be transferred if the following were present: older age (OR 0.98, 95% CI 0.978–0.982), black race (OR 0.79, 95% CI 0.70–0.89), Hispanic race (OR 0.79, 95% CI 0.69–0.90), South region hospital (OR 0.79, 0.72–0.88), teaching hospital (OR 0.31, 95% CI 0.28–0.33), and DNR status (OR 0.19, 95% CI 0.15–0.25).

Conclusions—In mechanically ventilated patients with sepsis, we found significant disparities in race and geographic location not explained by medical diagnoses or illness severity.

Keywords

inter-hospital transfer; medical transport; healthcare delivery; sepsis; healthcare disparities

BACKGROUND

Patients, their families, and providers in the intensive care unit (ICU) at smaller regional hospitals commonly face the dilemma of whether the patient should be transferred to a larger, more specialized medical center. This may occur because the patient needs a service or procedure not available at the regional hospital, or because one or more of the key stakeholders (provider, patient, or family members) perceives a mismatch between patient needs and the available resources at the regional hospital (1). Typically, patients undergo inter-hospital transfer (IHT) so they can receive care from providers with greater expertise, and obtain consults or procedures from subspecialists.

The unstated assumption is that patients will experience better outcomes after IHT than if they remain at the referring hospital (2). Transfer thus represents a kind of intervention, and may be subject to the same kind of health disparities that exist in other areas of medicine (3). We compared mechanically ventilated patients with sepsis who underwent IHT and those who did not. We hypothesized that geographic variation and racial disparities exist that are not explained by the patient's diagnosis or medical comorbidities.

METHODS

This study is reported in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement (4). A de-identified dataset was used for this analysis, for which a waiver of consent was obtained from the University of British Columbia Institutional Review Board.

Study Population

We used the National (Nationwide) Inpatient Sample (NIS) for 2006–2012. The NIS is a U.S. Federal all-payer database created by the Agency for Healthcare Research and Quality (AHRQ) using a complex survey design that captures approximately 20% of all US hospitalizations, and allows for the use of weighting to approximate 97% of all inpatient care delivered across the United States.

Cohort definition

All patients ≥ 18 years of age with a primary diagnosis of severe sepsis (International Classification of Disease 9th edition (ICD9) code 995.92) who also underwent mechanical ventilation (treatment codes 96.7x, 96.04) were included. The ICD-9 code for severe sepsis has been prospectively validated to have a sensitivity of 50.4% and a specificity of 96.3% (5). Only patients initially treated at small and medium sized hospitals (as defined by the AHRQ) were included in the analysis.

Covariates

Patient characteristics included: age, gender, length of stay, race (categorized as white, black, Hispanic, or other), insurance coverage (yes vs no), do not resuscitate (DNR) status (ICD-9 V4986), as well as the Elixhauser co-morbidity index. The Elixhauser co-morbidity indices are a set of 29 comorbidities validated to adjust for chronic diseases in multi-variate models. Hospital level characteristics included: size (small, medium, or large, as defined by the AHRQ), teaching status (yes vs no), and region of the United States (Northeast, South, Midwest, West).

Statistical Analysis

All analyses were performed in SAS v9.4 (SAS Institute, Cary, NC, USA) employing complex survey procedures and weights. Independent t-tests were used for continuous variables; chi-squared was used for ordinal and nominal data. Data are presented with 95% confidence intervals where appropriate; a p-value of <0.05 was considered significant. All percentages displayed in Tables are estimates of national projections using proper weights.

Multivariate logistic regression modeling was used to model the likelihood of transferring a patient to a higher level of care. All models were created *a priori*. The first model included: age, gender, insurance coverage, race, hospital region, hospital teaching status, and DNR status. A second model was created which included all the variables in Model 1 as well as the 29 Elixhauser co-morbidity index elements.

RESULTS

A total of 55,208,382 hospitalizations from the 2006–2012 NIS samples were analyzed. There were 46,406 patients who met the inclusion criteria. Of these, 3095 (6.6%) patients were transferred to a large hospital, assumed to be a more specialized center. There were 13,298 (28.7%) patients treated at small hospitals, whereas there were 33,108 (71.3%) patients treated at medium sized hospitals. The results of univariate analysis between those that were transferred and those that were not are displayed in Table 1. Older age, shorter length of stay, insurance coverage, and DNR status were significantly associated with lower probabilities of transfer, but female gender was not. There were significant differences within the categories of race, hospital teaching status, and location that were further explored in the multivariate model

Table 2 displays the results of the multivariate regression model; odds ratios reflect likelihood of transfer. Older patients, black and Hispanic patients, and patients in the South were significantly less likely to be transferred. Patients from teaching hospitals and those with DNR status were significantly less likely to be transferred. Insurance coverage was not associated with transfer likelihood. When the Elixhauser index characteristics were added in model 2, patients with valvular heath disease were more likely to be transferred; those with liver failure, HIV infection, fluid and electrolyte disorder, weight loss, neurological disorders, metastatic cancer, paralysis, and peripheral vascular disease were less likely to be transferred.

DISCUSSION

In this study comparing mechanically ventilated patients with sepsis who underwent IHT to those who did not, we found significant differences in patient characteristics unrelated to diagnosis or illness severity. Factors predictive of non-transfer included older age, minority status (black or Hispanic), and southern regional location (Table 2). As anticipated in both cohorts of patients, DNR status and hospitalization at a teaching facility are the identifiable factors most strongly associated with not being transferred. Our findings satisfied our hypothesis that geographic variation and racial disparities in IHT may exist that are not explained by the diagnosis or medical comorbidities. Black and Hispanic patients were significantly less likely to be transferred compared to white patients, even after adjustment for comorbidities. The category of Other race did not show a significant association with risk of transfer, with a wide confidence interval.

Several explanations are possible. First, there may be implicit or, less likely, explicit bias in medical providers' choices. Second, minority patients and families may be less likely to request or consent to being transferred to large, unfamiliar facilities, and may prefer to receive care from local providers they know and trust. Third, there may be cultural or ethnic differences with respect to preferences that are unrelated to mistrust; studies of end-of-life preferences in chronic obstructive pulmonary disease suggest such differences (6). Fourth, the physicians who treat these patients may be less well-connected with the medical system at large, and therefore less likely to refer patients to external sources of care. Finally, for some patients, language problems and concerns about exposing immigration status might also contribute to this finding.

Healthcare disparities have long been an issue of concern in the US healthcare system. Subsequent reports by the American Medical Association, the Institute of Medicine (since renamed the National Academy of Medicine), and others have confirmed the pervasiveness and persistence of disparities throughout the US healthcare system (3, 7, 8). Our findings are consistent with previous research, including studies conducted by the Dartmouth Atlas and the RWJF demonstrating care variations by race and by region (9, 10).

The study has several limitations. First, the NIS contains no information about severity of illness (SOI). However, even if we assume that transferred patients have greater illness severity than those remaining at the sending hospital, illness severity should be randomly assorted between ethnic groups and geographical locations. That is, even if patients in the transferred cohort were found to be more severely ill, higher SOI scores would not explain racial disparity. If anything, higher SOI scores among transferred patients would make our findings even more concerning, as sepsis appears to be both more common and more severe in patients of black and other non-white ethnicities (11). Second, as with any administrative dataset, there could be unmeasured confounding; in this case, some potential confounders could include patient throughput pressures and bed availability in different transfer regions. However, if such unmeasured confounding results in systematically lower transfer rates for minorities, that would still merit further investigation. Third, because of the sensitivity of the ICD-9 administrative code for sepsis, some patients with sepsis may have been inadvertently excluded; however, the ethnicity of patients not captured by this administrative approach should be random, and thus should not affect our findings on disparity. Finally, because the NIS does not link patient records, we are not able to evaluate the effect of IHT on patient outcomes.

Further research should be directed towards replicating this analysis, and studying IHT using more detailed clinical data to evaluate relative contributions of geography and socioeconomic status as drivers of the findings. We should also study the entire IHT process, including cost-effectiveness and impact on outcomes; this would require high-resolution clinical data, including outcomes, from both the transferring and receiving hospitals. Hospital-level variables such as bed availability, which are not available, would likely also have an impact on IHT.

CONCLUSIONS

In conclusion, we found that, among mechanically ventilated ICU patients with sepsis transferred between hospitals, there were significant disparities in patient ethnicity and location that were unexplained by diagnosis or medical comorbidities.

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ABBREVIATION LIST

AHRQ	Agency for Healthcare Research and Quality
CI	confidence interval
DNR	Do Not Resuscitate
HCUP	Healthcare Quality Utilization Project. Comprehensive source of hospital data produced by AHRQ.
ICU	Intensive Care Unit
IHT	Inter-hospital transfer. Occurs when a patient is moved from one hospital to another.
NIS	National (Nationwide) Inpatient Sample. One of the databases contained in HCUP.
RWJF	Robert Wood Johnson Foundation

US	United States of America

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Table 1

Baseline demographic and patient characteristics for patients transferred to another hospital versus those who were not.

Variables	No Transfer (n=43 311)	Transfer (n=3 095)	p
Age in years, mean (SD)	66.6 (15.5)	61.8 (15.8)	<0.01
Length of Stay in days, median (IQR)	10.9 (4.9–19.6)	7.0 (2.1–16.3)	<0.01
Female sex, n (%)	20729 (47.8)	1436 (46.4)	0.12
Race			
White, n (%)	27103 (65.9)	2013 (69.5)	
Black, n (%)	6993 (17.2)	377 (13.0)	
Hispanic, n (%)	4113 (10.0)	276 (9.4)	
Other, n (%)	2841 (6.9)	236 (8.1)	<0.01
Insurance Coverage, n (%)	40651 (93.9)	2863 (92.5)	<0.01
Hospital Teaching Status & Location			
Rural, n (%)	777 (1.8)	334 (10.7)	
Urban Non-teaching, n (%)	17117 (39.1)	1797 (58.1)	
Urban Teaching, n (%)	25417 (59.1)	964 (31.2)	<0.01
Hospital Region			
Northeast, n (%)	10860 (25.9)	707 (23.2)	
Midwest, n (%)	7855 (18.1)	539 (17.3)	
South, n (%)	15199 (34.8)	981 (32.1)	
West, n (%)	9397 (21.3)	868 (27.4)	<0.01
DNR Status, n (%)	4435 (10.3)	60 (2.0)	<0.01

The p values displayed for race, teaching status, and region apply to the entire category. Note that the significant difference for DNR status indicates a *lower* probability of transfer. (DNR = Do Not Resuscitate)

Table 2

Multivariate models with odds ratios of transfer for patients. Model 2 includes all covariates from model 1, adding the 29 Elixhauser comorbidity indices. For race, White race serves as the reference category. For location of the hospital initiating the transfer, Northeast serves as the reference category.

Covariates	Odds Ratio	Confidence Interval (95%)	p
Model 1			
Age	0.980	0.978–0.982	<0.01
Female Gender	0.97	0.90–1.04	0.36
Insurance Coverage	1.01	0.88–1.17	0.85
White Race	1	1	
Black Race	0.79	0.70–0.89	<0.01
Hispanic Race	0.79	0.69–0.90	<0.01
Other Race	1.08	0.93–1.24	0.31
Northeast Hospital	1	1	
Midwest Hospital	0.98	0.87–1.11	0.78
South Hospital	0.79	0.72–0.88	<0.01
West Hospital	0.97	0.87–1.08	0.54
Teaching Hospital	0.31	0.28–0.33	<0.01
DNR Status	0.19	0.15–0.25	<0.01
Model 2			
Age	0.979	0.977–0.982	<0.01
Female Gender	0.94	0.87–1.01	0.09
Insurance Coverage	1.04	0.90–1.20	0.62
White Race	1	1	
Black Race	0.94	0.75–0.94	<0.01
Hispanic Race	0.80	0.70–0.92	<0.01
Other Race	1.08	0.93–1.25	0.30
Northeast Hospital	1	1	
Midwest Hospital	1.02	0.91–1.15	0.72
South Hospital	0.82	0.74–0.91	<0.01
West Hospital	1.02	0.91–1.14	0.74
Teaching Hospital	0.31	0.28–0.33	<0.01
DNR Status	0.20	0.16–0.26	<0.01
Congestive Heart Failure	0.95	0.87–1.03	0.22
Valvular Heart Disease	1.19	1.03–1.38	0.02
Chronic Pulmonary Disease	0.94	0.86–1.02	0.15
Diabetes-Complicated	0.98	0.84–1.14	0.81
Diabetes-Uncomplicated	1.07	0.97–1.16	0.16
Liver Failure	0.81	0.72–0.90	<0.01
Renal Failure	0.98	0.89–1.08	0.72

Covariates	Odds Ratio	Confidence Interval (95%)	p
HIV Infection	0.36	0.22–0.58	<0.01
Cancer	0.87	0.72–1.04	0.13
Coagulopathy	0.99	0.91–1.09	0.90
Depression	1.07	0.94–1.20	0.30
Alcohol Abuse	0.98	0.85–1.13	0.80
Drug Abuse	0.85	0.71–1.02	0.07
Fluid and Electrolyte Disorder	0.82	0.75–0.89	<0.01
Weight Loss	0.89	0.81–0.96	<0.01
Neurological Disorders	0.76	0.70–0.83	<0.01
Peripheral Vascular Disease	0.81	0.71–0.94	<0.01
Anemia-Iron Deficiency	0.89	0.73–1.10	0.29
Anemia-Blood Loss	0.90	0.67–1.21	0.48
Obesity	1.08	0.97–1.21	0.18
Rheumatoid Arthritis	1.02	0.84–1.25	0.82
Metastatic Cancer	0.43	0.33–0.57	<0.01
Lymphoma	0.87	0.66–1.14	0.31
Peptic Ulcer Disease	0.88	0.59–1.30	0.51
Thyroid Dysfunction	0.90	0.80–1.02	0.11
Paralysis	0.71	0.59–0.86	<0.01
Hypertension	0.96	0.88–1.04	0.30
Arrhythmia	0.93	0.86–1.01	0.09
Pulmonary Circulation Disorder	0.99	0.86–1.15	0.93