CLINICAL

Against the Current: Back-Transfer as a Mechanism for Rural Regionalization

Leah F. Nelson, MD, MS; Karisa K. Harland, PhD, MPH; Dan M. Shane, PhD; Azeemuddin Ahmed, MD, MBA; and Nicholas M. Mohr, MD, MS

ABSTRACT

OBJECTIVES: This paper investigates back-transfer: the transfer of patients near the end of their acute hospitalization to a local community hospital for the completion of their medical care. We seek to describe factors contributing to back-transfer, with the goal of elucidating the current use of back-transfer and barriers to its more widespread adoption for rural healthcare regionalization.

STUDY DESIGN: Observational unmatched case-control.

METHODS: This was a retrospective study of adults hospitalized in Iowa between 2005 and 2013 to identify back-transferred patients. Demographic, geographic, rurality, procedural, and disease information was compared among cases and control groups using univariate analysis and multivariable logistic regression.

RESULTS: Over the 9-year period, 172,544 back-transfer eligible patients were admitted to 1 of 5 large Iowa hospitals, of which 287 (0.2%) were back-transferred. Back-transferred patients were more likely than their non–back-transferred counterparts to be older, male, and white; to live in large rural areas; and to have public insurance. As inpatients, they had longer median lengths of stay (15 vs 5 days; *P* <.001), more medical comorbidities, and were more likely to have a cardiac catheterization procedure than the control group.

CONCLUSIONS: Back-transfer is a very rare event. While demographic and medical differences between back-transferred patients and controls may partially explain the infrequency, other systematic barriers must exist to limit back-transfer. These barriers likely include legal, financial, logistical, and patient care concerns. Despite the rarity with which it is employed, back-transfer is a promising strategy that could better utilize health resources, especially in rural America.

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The concepts of regionalization and centralization are central to managed care. Here, we define regionalization as an "active process by which patients are appropriately matched to appropriate resources."[1] This can be compared with centralization, which is a more unplanned process in which patients are transferred to larger medical centers for a variety of medical, financial, legal, and personal reasons. In rural states, regionalization and centralization processes occur concurrently. Many small hospitals are closing and, thus, care is becoming centralized to fewer hospitals. Simultaneously, small local hospitals are unable to provide comprehensive services, so patients are often transferred for specific types of problems, such as stroke care and cardiac catheterization.

Although transfer to regional care centers is lifesaving for many rural residents, variability exists in patient preferences for transfer. Liu et al reported that 56% of rural patients who lived near a federally designated critical access hospital (CAH) would have preferred to have care locally, but were transferred or referred by their local provider because the care they required was unavailable at their local CAH.[2] Treatment at a regional or tertiary hospital can be a burden for rural patients.[3] Tertiary care hospitals are often far from home, and family members have increased expenses and stressors related to visiting ill loved ones.[4,5]

With tertiary care centers near capacity and smaller community hospitals sitting nearly empty,[6] some have wondered how regionalization can better utilize existing healthcare resources in financially strained health systems at both ends of the hospital-size spectrum. One proposed strategy to better align healthcare resources with utilization is the concept of "back-transfer"—transferring patients near the end of their acute hospitalization to a lower-acuity hospital for the completion of their care.[6] This is part of healthcare regionalization in that patient needs are matched to hospital capabilities, but in this case, those needs can be met at a less-specialized hospital.[6]

Back-transfer has been described previously for select patient populations. In Europe and Canada, the practice is used for cardiac patients after uncomplicated angiography and percutaneous

TAKEAWAY POINTS

Our study found that back-transfer of patients from large hospitals to small hospitals during an acute care episode is a rare event. Demographic and medical differences may partially explain the infrequency, but systematic (legal, financial, logistical, and patient care) barriers must exist to limit back-transfer.

- Back-transport could maximize availability of specialty services, support rural health systems, and move patients closer to home and family.
- Widespread adoption of back-transfer through changes in policy and clinical practice patterns may be a way to better utilize healthcare resources.

coronary intervention (PCI) in specialty centers.[7-10] Matteau et al suggest immediate back-transfer would be safe for up to two-thirds of ST-elevation myocardial infarction patients after PCI.[10] In the United States, back-transfer (or "back-transport") is used for the continued care of neonates after treatment at a tertiary neonatal intensive care unit.[11,12] However, for adult populations in the United States, this concept has not been widely adopted and application of this transfer practice has not been studied.

In this study, we describe a cohort of patients transferred from larger hospitals to smaller hospitals for ongoing acute care over a 9-year period in a largely rural midwestern state. We sought to identify factors contributing to back-transfer, with the goal of elucidating the current use of back-transfer. We also discuss systematic barriers and potential benefits of its more widespread adoption.

METHODS

Study Design and Participants

This was an observational unmatched case-control study of all adults (18 years or older) hospitalized in Iowa between 2005 and 2013. Patients were identified from administrative claims data in the Iowa Hospital Association inpatient data set. Patient records were linked across inter-hospital transfer using a probabilistic linkage algorithm incorporating date of birth, sex, patient zip code, county of residence, visit date, and Social Security number through sequential matching. Records were limited to those eligible for back-transfer. Eligibility was defined as at least a 3-day inpatient hospitalization, residence at least 32 km from a tertiary center and within 32 km of a nontertiary hospital. The University of Iowa institutional review board approved the project under waiver of informed consent. This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[13]

MEASUREMENTS

Rurality was defined based on zip code of residence according to Rural-Urban Commuting Area (RUCA) definitions.[14] Geographic distances were calculated by the Google Maps Application Programming Interface[15] as the driving distance between each hospital and the centroid of the zip code of residence. Diagnosis categories were derived from *International Classification of Diseases, 9th Edition, Clinical Modification* (*ICD-9-CM*) codes categorized using the Clinical Classifications Software (CCS) available from the Agency for Healthcare Research and Quality Health Care Utilization Project (HCUP).[16] Comorbidities were defined using Elixhauser methodology.[17] Surgical procedures were defined as any invasive or noninvasive procedure typically performed in a surgical suite, identified using the Surgery Flag Software available from HCUP.18 Cardiac catheterization was defined by these *ICD-9-CM* procedure codes: 3722, 3723, 8850, 8851, 8852, 8853, 8854, 8855, 8856, 8857, 8858, 3606, 3607, 3609, and 0066. CAHs were defined by federal designation at the time of transfer.

Identification of Back-Transfers

Back-transfer was defined as a transfer to a smaller, less-specialized hospital as part of an acute care hospitalization. An algorithm using both emergency department (ED) volume and state trauma-level designation was used to identify back-transfers. First, hospitals were rank-ordered by annual ED census. Then, hospital trauma level was examined, and higher-level hospitals (eg, state trauma level II hospitals) ranked below lower-level hospitals (eg, state trauma level III hospitals) were moved on the list so the trauma level designation was preserved. Back-transfers were patients who were transferred from a larger hospital to a smaller one, requiring an interval of at least 5 steps down the rank-ordered list. The 5-step threshold was selected after careful examination by 2 independent investigators. Hospitals within 5 steps were felt to be indistinguishable in medical capabilities. For the purposes of this manuscript, the "large" hospital is defined as having a higher annual ED volume and/or trauma designation, and the "small" hospital as having lower annual ED volume and/or trauma designation. Once back-transfers were identified, the investigators observed that all back-transfers originated from 5 large Iowa hospitals. The data set was further limited to only those 5 hospitals. Demographics, diagnoses, procedures, insurance status, rurality of patient residence, and geographic variables were collected.

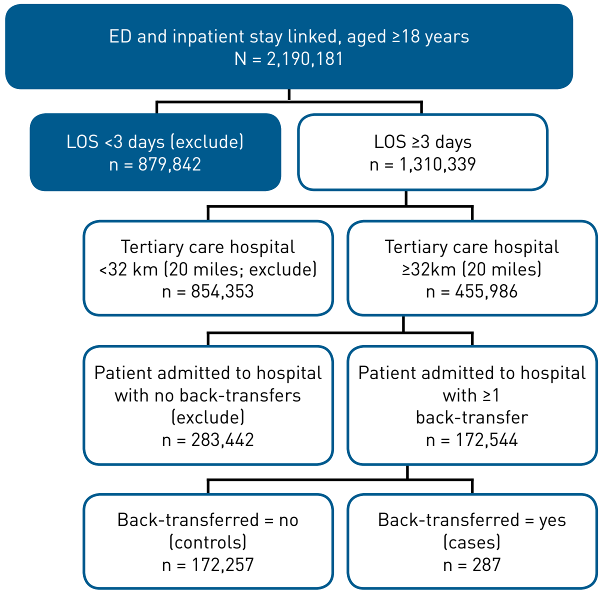
Analysis

Univariate analyses were performed using the t test, c2 test, or Wilcoxon rank-sum test, as appropriate. For the analysis, primary diagnosis is a mutually exclusive category, as an individual can have only 1 primary diagnosis. On the other hand, individuals can have multiple comorbidities. Thus, for the primary diagnosis, group-wise analyses were performed, and for the comorbidities, individual comparisons were made. A multivariable logistic regression explanatory model was developed to identify factors independently associated with back-transfer. Candidate variables for inclusion were selected if univariate analysis suggested a relationship with the dependent variable (back-transfer; $P < .20$). Final model variables were selected based on Bayesian Information Criterion to achieve a parsimonious final model. Interactions and co-linearity were tested in the model, but none were significant. Statistical analysis was conducted using SAS version 9.4 (SAS Institute; Cary, North Carolina) and Stata version 13.1 (StataCorp; College Station, Texas).

RESULTS

Over the 9-year period, 172,544 patients meeting inclusion criteria were admitted, of which 287 (0.2%) patients were back-transferred (**Figure**). All back-transfers were initiated by 5 large hospitals and accepted by 39 smaller Iowa hospitals, of which 16 were CAHs. There was no significant change in hospital admission volume or in back-transfers over the period of this study.

FIGURE. Flow Chart of Identification of Case and Control Populations[a]



ED indicates emergency department; LOS, length of stay.

[a]The flow chart shows how cases and controls were selected from the entire population of admissions in Iowa between 2005 and 2013. Back-transfer was defined as a transfer to a smaller, less specialized hospital as part of an acute care hospitalization. Once back-transfers were identified, the investigators observed that all back-transfers originated from 5 large Iowa hospitals. The data set was further limited to only those 5 hospitals and then the patients who were or were not back-transferred were compared.

Univariate Analysis

Demographic comparison is shown in **Table 1**. Back-transferred patients were more likely than their nontransferred counterparts to be male, older, and white; to live in large rural areas; and to have public insurance.

Length of stay (LOS) differed by back-transfer status. Back-transferred patients were in the hospital longer than the control patients (median of 15 days vs 5 days; $P < .001$), and the median admission LOS prior to back-transfer was 8 days (**Table 2**). Total LOS for back-transferred patients was negatively related to rurality (measured by RUCA). As rurality increased, LOS decreased, with a median LOS of 17 days estimated among urban residents compared with 10 days for residents of small rural areas ($P = .009$). This trend was not found in the control group, which had a median LOS of 5 days regardless of rurality of residence. Those transferred to CAHs had shorter median posttransfer LOS than those transferred to non-CAHs (4.7 days vs 8.7 days; $P = .001$).

In most cases, patients were not hospitalized for acute care at the nearest hospital to their home (Table 2). Patients who were back-transferred were initially admitted to hospitals much farther from home (143 km vs 87 km; $P < .0001$). After back-transfer, patients were much closer to home (median = 10 km) and 53% were sent to the hospital nearest their home. Only 8% (n = 22) of back-transferred patients were transferred to CAHs.

Table 3 shows the disease characteristics of the study population. Controls and back-transferred patients had similar prevalence of CCS level 1 diagnostic codes. The most common primary disease categories in both patient groups were neoplastic, cardiovascular, digestive disease, and injury/poisoning. Significant differences between the 2 groups were present ($P < .0001$), with the greatest differences in obstetric and musculoskeletal diseases. Back-transferred patients were more likely to have each of the comorbidities evaluated. Finally, univariate modeling showed surgical rates were similar between the 2 groups, but back-transferred patients were more likely to have a cardiac catheterization procedure ($P < .0001$).

Multivariable Modeling

Multivariable modeling revealed several strong predictors of back-transfer (**Table 4**). The strongest associations were with cardiac catheterization (odds ratio [OR], 2.90; 95% CI, 1.88-4.49), having Medicaid or other state/federal-issued insurance (OR, 1.61; 95% CI, 1.11-2.33), male gender (OR, 1.57; 95% CI, 1.23-2.00), aged 51 to 65 years (OR, 1.53; 95% CI, 1.08-2.18), or older than 80 years (OR, 1.67; 95% CI 1.00-2.77). A weak association was also observed with hospital volume (OR, 0.995; 95% CI, 0.994-0.997). Several of the primary diagnoses were significant predictors of back-transfer. These were compared using the most common primary diagnosis code (CCS 7, cardiovascular disease) as a referent group. Significant disease associations with back-transfer were identified for CCS 4 (blood and blood-forming organ diseases: OR, 2.48; 95% CI, 1.04-5.91),

TABLE 1. Demographic Comparison of Back-Transferred Patients and Controls

	Controls (n = 172,257)	Cases (n = 287)	*P*
Population			
Male, n (%)	78,894 (45.8)	171 (59.6)	<.0001
Age, years: mean (SD)	58.2 (18.9)	63.1 (15.9)	<.0001
Age range, years	18-106	18-102	
White, n (%)	142,146 (82.5)	266 (92.7)	<.0001
Insurance status			
Medicare	79,347 (46.1%)	157 (54.7%)	.001[a]
Medicaid and other state/federal	27,342 (15.9%)	56 (19.5%)	
Commercial	58,600 (34.0%)	65 (22.7%)	
Uninsured/self-pay	5177 (3.0%)	9 (3.1%)	
Total[b]	170,466 (99.0%)	287 (100%)	
Rurality			
Urban	77,268 (44.9%)	126 (43.9%)	.013[c]
Large rural	39,329 (22.8%)	87 (30.3%)	
Small rural	27,316 (15.9%)	40 (13.9%)	
Isolated rural	27,584 (16.0%)	34 (11.9%)	
Total[d]	171,497 (99.6%)	287 (100%)	

SD indicates standard deviation.
[a]The single *P* values for primary disease categories indicate inter-group comparison between cases and controls, not comparison of individual types of insurance.
[b]Insurance data were incomplete for 1791 (1%) control patients.
[c]The single *P* values for primary disease categories indicate inter-group comparison between cases, not comparison of individual types of residence.
[d]Zip code data for rurality assignment were missing for 760 (0.4%) control patients.

CCS 6 (nervous system and sense organ diseases: OR, 1.95; 95% CI, 1.05-3.65), CCS 9 (digestive system diseases: OR, 1.91; 95% CI, 1.22-2.98), and CCS 13 (musculoskeletal system and connective tissue diseases: OR, 0.41; 95% CI, 0.20-0.85). Rural residence, white race, admission year, Medicare, and age between 66 and 80 years were neither positively or negatively associated with back-transfer in the multivariable model.

DISCUSSION

Back-transfer is a healthcare regionalization technique not previously reported for US adults. This study reports back-transfer using a large statewide claims database. The current study showed differences between back-transferred patients and those who completed their inpatient stay at one of the 5 large hospitals included in the study. Back-transferred patients were more likely than their non–back-transferred counterparts to be male, older, and white; to live in large rural areas; and to have public insurance. Total LOS was also longer for back-transferred patients. Medically, back-transferred patients had chronic diseases with multiple comorbidities and were more likely to have a cardiac catheterization. These differences appear to indicate that back-transferred patients are more medically complex.

It is possible that some of these findings are interconnected in that rural residents tend to be older and on public insurance,[19] but not all of these differences can be attributed to the rural-urban dichotomy. Nationwide analyses from the National Center for Health Statistics has shown no significant difference between patients admitted to rural and urban hospitals for LOS or number of diagnoses.19 Further investigation is warranted to better understand the reason for these demographic and medical differences. We hypothesize that back-transferred patients may request a transfer closer to home because they have a good understanding of their chronic health conditions and anticipate a longer LOS. Furthermore, hospitals in larger rural areas may be more willing to accept back-transfers than hospitals in smaller rural areas because of greater service availability, and providers may select these hospitals for patients who have common chronic conditions.

Obviously, not all patients will be candidates for back-transfer. High-risk obstetric patients, those with rare diseases, or those in whom a fluctuating clinical course can be anticipated, to name a few examples, will require ongoing specialist care throughout an acute hospitalization. However, for many patients suffering from more routine diseases with a more predictable clinical course (eg, following cardiac catheterization), back-transfer may be an appropriate option.

Despite the rarity with which it is employed, back-transfer is a promising strategy that could better utilize health resources, so why is it so rare? We have identified several systematic barriers to widespread adoption of back-transfer in the United States. These barriers can be separated into 4 categories: policy, finance, logistics, and patient care concerns.

Policy barriers. No law directly forbids back-transfer of patients as long as the transfer meets the legal requirements set forth by CMS in the Emergency Medical Treatment and Active Labor Act.[20] Furthermore, the "Stark Laws" apply to transfers in that large hospitals cannot incentivize patients to transfer, encourage back-transfer to specific hospitals, nor enter into contracts with small hospitals to take back-transfers (although this may change with accountable care organizations' [ACOs'] structured hospital networks) (personal communication with Joseph Clamon, JD, January 25, 2016).[21]

Financial barriers. The current payment system for hospitals de-incentivizes back-transfer in both direct and indirect ways. Directly, hospitals that are paid on a diagnosis-related group

(DRG) model stand to lose revenue by the "early" transfer of patients prior to the full DRG payment period (personal communication with A. Showers, BBA, January 8, 2016). Depending on the payment structure of the accepting hospital (Inpatient Prospective Payment System versus cost-based reimbursement at a CAH), the reimbursement from a back-transferred patient for a short acute stay may not cover the cost of caring for the patient.[23] Indirectly, the sending hospital risks financial losses through disruption of referrals and early readmission. Although many tertiary care hospitals have transfer agreements that require sending hospitals to "take back" their transfers after stabilization, these clauses are rarely used. Using this mechanism to force smaller hospitals into taking a back-transfer may result in fewer transfers from that facility in the future, thus reducing revenue for the tertiary hospital in the long term (personal communication with Joseph Clamon, JD, January 25, 2016). Finally, if a patient is back-transferred, but their health deteriorates at the smaller hospital, they may be returned for further care. This would count as a readmission and likely not be reimbursed, whereas if the patient were kept at the large hospital and experienced complications, the entire care episode would be covered under the initial admission.[24] Overall, current payment models do not support back-transfer and risk of financial loss likely plays a significant role in the low frequency of back-transfer.

TABLE 2. Hospitalization Characteristics: Comparison Between Back-Transfers and Control Patients

	Controls (n = 172,257)	Cases (n = 287)	*P*
First admission at hospital closest to home, n (%)	25,549 (14.8)	32 (11.2)	.079
Post back-transfer admission at hospital closest to home (%)	N/A	152 (53.0)	
Distance from home, kilometers: median (IQR)			
Large hospital	87 (51, 140)	143 (125, 183)	<.0001
After back-transfer	N/A	10 (5, 35)	
Total LOS, days: median (IQR)			
Urban	5 (3, 8)	17 (9, 34)	<.0001
Large rural	5 (3, 8)	15 (8, 26)	<.0001
Small rural	5 (3, 8)	13 (7, 21)	<.0001
Isolated rural	5 (3, 8)	10 (6, 16)	<.0001
Total LOS	5 (3, 8)	15 (8, 27)	<.0001
Pre–back-transfer LOS, days: median (IQR)			
Post back-transfer LOS, days: median (IQR)[a]			
Urban	N/A	5 (3, 13)	.013[b]
Large rural	N/A	5 (3, 10)	
Small rural	N/A	4.5 (2, 8)	
Isolated rural	N/A	3 (2, 5)	
CAH	N/A	4 (2, 7)	.198[c]
Non-CAH	N/A	5 (3, 10)	

CAH indicates critical access hospital; IQR, interquartile range; LOS, length of stay; N/A, not applicable
[a]Rurality designations based on Rural-Urban Commuting Area definitions.
[b]The difference in post back-transfer LOS based on rurality of patient residence.
[c]The difference in post back-transfer LOS based on CAH status of accepting hospital.

Logistical barriers. The process of transferring a patient is complex: identification of an accepting hospital and physician, organizing transport, and sharing medical records all require effort. Therefore, an elective back-transfer often comes up against significant inertia within the healthcare system. It can be difficult to find a willing hospital and physician, a patient may only want to go to certain hospitals,[2] differences in electronic health record systems complicate sharing of health records,[25] and most back-transferred patients require ambulance transfer, which is often not covered by insurance (personal communication with Peggy O'Neill, RN, MSN, ACM, January 21, 2016). Each of these obstacles is a potential place where the transfer could derail, and failures result in wasted time for healthcare providers. Thus, the simplest solution is often to keep the patient until they are ready for discharge; consequently, the tertiary hospital's ability to provide specialty care is diluted by provision of routine care for stable inpatients.

Patient care concerns. Both physicians and patients may have concerns about the ability of a small hospital to care for back-transferred patients. Providers at tertiary care hospitals often feel uncomfortable sending their patients back for continued acute management. They do not know if the patient will receive appropriate care (ie, they may not know the capabilities of the small hospital, especially CAHs). Also, the receiving hospital or physician may feel uncomfortable taking a complex patient. Furthermore, loss of continuity and treatment by multiple providers is known to worsen outcomes for patients with multiple chronic conditions or cancer, and those who have received a surgical intervention.[26-28] Finally, patients themselves may have concerns regarding the quality of care at smaller local hospitals. In some cases, patients may have sought care electively at tertiary centers because they perceive higher quality and more comprehensive care.[2] These patients may not want to be back-transferred to their local hospital.

TABLE 3. Patient Disease Characteristics: Comparison Between Back-Transfers and Control Patients

	Controls (n = 172,257)	Cases (n = 287)	*P*
Primary disease			<.001[a]
CCS multilevel 1 codes,[b] n (%)			
1) Infectious & parasitic diseases	5302 (3.1)	15 (5.2)	
2) Neoplasms	23,789 (13.8)	37 (12.9)	
3) Endocrine, nutritional, & metabolic disease and immunity disorders	5063 (2.9)	6 (2.1)	
4) Blood & blood-forming organ diseases	1823 (1.1)	6 (2.09)	
5) Mental illness	2178 (1.3)	1 (0.4)	
6) Nervous system & sense organ diseases	5849 (3.4)	14 (4.9)	
7) Circulatory system diseases	32,070 (18.6)	59 (20.6)	
8) Respiratory system diseases	11,448 (6.7)	24 (8.4)	
9) Digestive system diseases	17,212 (10.0)	43 (15.0)	
10) Genitourinary system diseases	7127 (4.1)	13 (4.5)	
11) Complications of pregnancy, childbirth, & the puerperium	13,718 (8.0)	5 (1.7)	
12) Skin & subcutaneous tissue diseases	2702 (1.6)	7 (2.4)	
13) Musculoskeletal system & connective tissue diseases	17011 (9.9)	9 (3.1)	
14) Congenital anomalies	1052 (0.6)	0 (0)	
15) Certain conditions originating in the perinatal period	2 (0.0)	0 (0)	
16) Injury & poisoning	23,324 (13.5)	32 (11.2)	
17) Symptoms; signs; ill-defined conditions & factors influencing health status	2134 (1.2)	15 (5.2)	
18) Residual codes; unclassified, all e-codes	453 (0.3)	1 (0.4)	

	Controls (n = 172,257)	Cases (n = 287)	*P*
Comorbidities,[c] n (%)			
Congestive heart failure	11,568 (6.7)	61 (21.3)	<.001
Valvular heart disease	7062 (4.1)	29 (10.1)	<.001
Pulmonary circulation disease	5427 (3.2)	27 (9.4)	<.001
Peripheral vascular disease	13,901 (8.1)	48 (16.7)	<.001
Hypertension	80,033 (46.5)	194 (67.6)	<.001
Other neurologic disorder	10,091 (5.9)	32 (11.2)	<.001
Chronic obstructive pulmonary disease	30,352 (17.6)	89 (31.0)	<.001
Diabetes mellitus without complications	29,575 (17.2)	94 (32.8)	<.001
Diabetes mellitus with complications	62,172 (36.1)	79 (27.5)	.003
Hypothyroidism	18,394 (10.7)	42 (14.6)	.030
Renal failure	17,620 (10.23)	76 (26.5)	<.001
Liver disease	5123 (3.0)	27 (9.4)	<.001
Metastatic cancer	6256 (3.6)	19 (6.6)	.007
Solid tumor without metastasis	9012 (5.2)	22 (7.7)	.64
Coagulopathy	9576 (5.6)	55 (19.2)	<.001
Obesity	18,338 (10.7)	65 (22.7)	<.001
Weight loss	9417 (5.47)	60 (20.9)	<.001
Fluids & electrolyte disorder	47,257 (27.8)	172 (59.9)	<.001
Chronic blood loss anemia	3866 (2.2)	16 (5.6)	<.001
Deficiency anemia	29,894 (17.4)	111 (39.7)	<.001
Alcohol use	6277 (3.6)	23 (8.0)	<.001
Drug abuse	3314 (1.9)	15(5.2)	<.001
Psychoses	5899 (3.4)	24 (8.4)	<.001
Depression	22,151 (12.9)	60 (20.9)	<.001
Procedures			
Any surgery	96,493 (56.0)	165 (57.5)	.615
Cardiac catheterization[d]	10,199 (5.9)	35 (12.2)	<.0001

CCS indicates Clinical Classifications Software.

[a]The single *P* values for primary disease categories indicate intergroup comparison, not comparison of individual diagnoses. *P* values for comorbidities and procedures compare the cases and controls for each individual diagnostic code.

[b]CCS numbers represent the multilevel 1 diagnostic group.

[c]Only those with >5% of either case or control population are shown.

[d]Cardiac catheterization was defined by the following *International Classification of Diseases, Ninth Revision, Clinical Modification* procedure codes: 3722, 3723, 8850, 8851, 8852, 8853, 8854, 8855, 8856, 8857, 8858, 3606, 3607, 3609, and 0066.

TABLE 4. Multivariable Model to Explain Back-Transfer

Variable	Odds Ratio	95% CI	*P*
Male	1.57	1.23-2.00	<.001
Race, white	0.88	0.50-1.55	.652
Age, years[a]			
51-65	1.53	1.08-2.18	.018
66-80	1.54	0.97-2.45	.069
>80	1.67	1.00- 2.77	.049
Admission year	0.96	0.91-1.00	.066
Hospital volume	0.995	0.994-0.997	<.001
Cardiac catheterization[b]	2.90	1.88-4.49	<.001
Primary diagnosis			
1) Infectious & parasitic diseases	1.56	0.83-2.95	.168
2) Neoplasms	1.15	0.72-1.84	.565
3) Endocrine, nutritional, & metabolic disease and immunity disorders	0.87	0.37-2.07	.755
4) Blood & blood-forming organ diseases	2.48	1.04-5.91	.040
5) Mental illness	0.32	0.04-2.36	.264
6) Nervous system & sense organ diseases	1.95	1.05-3.65	.036
7) Circulatory system diseases[c]	–	–	–
8) Respiratory system diseases	1.36	0.81-2.29	.24
9) Digestive system diseases	1.91	1.22-2.98	.004
10) Genitourinary system diseases	1.33	0.69-1.67	.398
11) Complications of pregnancy, childbirth, & the puerperium	0.62	0.23-1.67	.344
12) Skin & subcutaneous tissue diseases	1.94	0.86-4.38	.111
13) Musculoskeletal system & connective tissue diseases	0.41	0.20-0.85	.017
14) Congenital anomalies	N/A		
15) Certain conditions originating in the perinatal period	N/A		
16) Injury & poisoning	1.03	0.64-1.66	.889
17) Symptoms; signs; ill-defined conditions & factors influencing health status	5.34	2.94-9.71	<.001
18) Residual codes; unclassified, all e-codes	1.87	0.26-13.7	.538
Insurance[d]			
Medicaid or state papers	1.61	1.11-2.33	.012
Medicare	1.31	0.88-1.93	.195
No insurance	1.27	0.63-2.57	.509
Rural residence	0.84	0.65-1.08	.176

ICD-9-CM, *International Classification of Diseases, Ninth Revision, Clinical Modification*; N/A, not applicable.
[a]The referent group is aged 18 to 50 years.
[b]Cardiac catheterization was defined by the following *ICD-9-CM* procedure codes: 3722, 3723, 8850, 8851, 8852, 8853, 8854, 8855, 8856, 8857, 8858, 3606, 3607, 3609, and 0066.
[c]Codes from Clinical Classification Software 7 is the referent group. This was the most common primary diagnosis; 18.6% of the control population and 20.6% of the cases had a primary diagnosis of cardiovascular disease.
[d]Commercial/private insurance used as the reference group. The family-wise *P* value for insurance status was .0914.

The barriers above create challenges to increased adoption of back-transfer. However, application of this strategy may optimize use of healthcare resources, especially in rural America. Back-transfer could be nurtured as a regionalization tool through creation of a tiered system in which all hospitals are included on a registry of their capabilities,[21] similar to the National Trauma Registry System. This would help providers identify appropriate back-transfer destinations and alleviate concerns about patient care. Furthermore, as healthcare reform occurs in the United States, managed care through ACOs may help network hospitals join functional "hub-and-spoke" systems, with the tertiary care center serving as the "hub" point for specialty care and patient care plan development, and smaller hospitals serving as "spokes," managing routine management and delivering specialist-directed care. ACOs with this organization could create stable transfer agreements among several institutions based on objective criteria for transfer, or for management of specific conditions, thus avoiding problems with patient selection bias.21 Within an ACO or managed care system, shared electronic medical records could further facilitate information transfer. These organizational changes would reduce the workload associated with arranging a transfer. Clearly, these types of systemic changes will be difficult to execute without state and federal support.

Limitations

The results of this study must be considered in light of several limitations. First, back-transfer was a very rare event, and with our strict selection criteria, the final studied population was small. This limits the ability to make comparisons between the relatively large control group and small number of cases, and to measure variability from year to year. Second, the use of ICD-9-CM codes does not allow evaluation of disease severity or other circumstances that may have influenced providers' decision to back-transfer patients. Third, travel distances were computed based on zip code centroids because specific address information was not available in the data. Although this method is imprecise, approximating distance is still important to appreciate a view of healthcare access for rural residents. Fourth, this dataset does not give insight into why patients were admitted or the situation of discharge from the 5 large hospitals included in this study (eg, transfer for higher level of care vs patient preference to bypass local hospitals). Fifth, because we are looking at patient-level predictors, we have not examined business relationships among hospitals or the nonprofit versus for-profit status of the hospitals in this analysis. Finally, this study used claims data from a single Midwestern state and may not be generalizable to the United States as a whole. Future work should make an effort to control for these limitations.

CONCLUSIONS

Despite the rarity with which it is employed, back-transfer is a promising strategy that could better utilize health resources. Appropriate use of back-transfer could simultaneously maximize the availability of specialty services, support rural health systems, and move patients closer to their homes and families. There are several systematic barriers to widespread adoption of back-transfer in the United States, including policy, finance, logistics, and patient care concerns. Further work is needed to better understand the prevalence and outcomes of back-transfer in practice and the barriers impeding its expansion. ■

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Author Affiliations: University of Iowa Carver College of Medicine, (LFN), Iowa City, IA; Department of Emergency Medicine (KKH, AA, NMM), and Division of Critical Care, Department of Anesthesia (NMM), University of Iowa Carver College of Medicine, Iowa City, IA; Department of Health Management and Policy, University of Iowa College of Public Health (DMS), Iowa City, IA.

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Address Correspondence to: Nicholas M. Mohr, MD, MS, University of Iowa Carver College of Medicine, 200 Hawkins Dr, 1008 RCP, Iowa City, IA 52242. E-mail: Nicholas-mohr@uiowa.edu.

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