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CLINICAL RESEARCH

Who Leaves the Hospital Against Medical Advice in the Orthopaedic Setting?

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Abstract

Background Patients who leave the hospital against medical advice are at risk for readmission and for a variety of complications and are likely to consume more healthcare resources. However, little is known about which factors, if any, may be associated with self-discharge (discharge against medical advice) among orthopaedic inpatients.

Questions/purposes We studied the frequency and factors associated with self-discharge in patients hospitalized for orthopaedic trauma and musculoskeletal infection.

Methods Using discharge records from the Nationwide Inpatient Sample (2002–2011), we identified approximately 7,067,432 patient hospitalizations for orthopaedic trauma and 5,488,686 for musculoskeletal infection. We calculated the proportions of admissions that ended in self-discharge for both trauma and infection patients; then, we examined patient demographics, diagnoses, and hospital factors. Multivariable logistic regression models were constructed to determine independent predictors of self-discharge.

Results Approximately one in 333 (0.3%) patients hospitalized for an isolated fracture and one in 47 (2.1%) patients with musculoskeletal infection left against medical advice. Patient characteristics associated with self-discharge included age < 75 years (trauma: odds ratio [OR] 2.7, 95% confidence interval [CI] 2.5–2.8, $p < 0.001$; infection: OR 3.9, 95% CI 3.8–4.1, $p < 0.001$), male sex (trauma: OR 1.7, 95% CI 1.7–1.8, $p < 0.001$; infection: OR 1.4, 95% CI 1.3–1.4, $p < 0.001$), black race/ethnicity (trauma: OR 1.5, 95% CI 1.4–1.6, $p < 0.001$; infection: OR 1.1, 95% CI 1.1–1.1, $p < 0.001$), low household income (trauma: OR 1.5, 95% CI 1.4–1.5, $p < 0.001$; infection: OR 1.4, 95% CI 1.4–1.4, $p < 0.001$), nonprivate insurance (Medicare [trauma: OR 1.7, 95% CI 1.6–1.8, $p < 0.001$; infection: OR 2.5, 95% CI 2.4–2.5, $p < 0.001$] and Medicaid [trauma: OR 2.6, 95% CI 2.5–2.7, $p < 0.001$; infection: OR 3.2, 95% CI 3.2–3.3, $p < 0.001$]), and no insurance coverage (trauma: OR 3.0, 95% CI 2.9–3.1, $p < 0.001$; infection: OR 3.5, 95% CI 3.4–3.5, $p < 0.001$), less medical comorbidity (trauma: OR 0.94 per one-unit increase in the number of comorbidities, 95% CI 0.93–0.95, $p < 0.001$; infection: OR 0.88, 95% CI 0.87–0.88, $p < 0.001$), alcohol (trauma: OR, 2.3, 95% 2.2–2.4, $p < 0.001$; infection: OR 1.5, 95% CI 1.5–1.5, $p < 0.001$), opioid (trauma: OR 2.9, 95% CI 2.7–3.1, $p < 0.001$; infection: OR 4.4, 95% CI 4.3–4.4, $p < 0.001$) and nonopioid drug abuse (trauma: OR, 2.0, 95% CI 1.9–2.1, $p < 0.001$; infection: OR 2.8, 95% CI 2.8–2.9, $p < 0.001$), psychosis (trauma:

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This study has been performed in accordance with the ethical standards in the 1964 Declaration of Helsinki and has been carried out in accordance with relevant regulations of the US Health Insurance Portability and Accountability Act.

This work was performed at the Orthopaedic Hand and Upper Extremity Service, Massachusetts General Hospital, Boston, MA, USA.

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OR 1.3, 95%CI 1.2–1.3, $p < 0.001$; infection: OR 1.3, 95% CI 1.3, 1.4, $p < 0.001$), and AIDS/HIV infection (trauma: OR 1.5, 95% CI 1.2–1.8, $p < 0.001$; infection: OR 1.3, 95% CI 1.3–1.4, $p < 0.001$). Patients with upper extremity fractures (OR 1.9, 95% CI 1.8–1.9, $p < 0.001$) or fractures of the neck and trunk (OR 2.1, 95% CI 2.0–2.2, $p < 0.001$) were more likely to leave against medical advice than patients with lower extremity fractures. Among infection hospitalizations, patients with cellulitis had the highest odds of self-discharge compared with carbuncle/furuncle (OR 1.3, 95% CI 1.2–1.5, $p < 0.001$). Self-discharges were more likely to occur at hospitals of larger size (trauma: OR 1.2, 95% CI 1.1–1.2, $p < 0.001$; infection: nonsignificant), located in urban settings (trauma: OR 1.3, 95% CI 1.2–1.4, $p < 0.001$; infection: OR 1.6, 95% CI 1.5–1.6, $p < 0.001$), and in the Northeast (trauma: OR 1.7, 95% CI 1.6–1.8, $p < 0.001$; infection: OR 1.6, 95% CI 1.6–1.6, $p < 0.001$) than at small, rural hospitals in the South.

Conclusions Our data can be used to promptly identify orthopaedic inpatients at higher risk of self-discharge on admission and target interventions to optimize treatment adherence. Strategies to enhance physician communication skills among patients with low health literacy, improve cultural sensitivity, and proactively address substance abuse issues early during hospital admission may aid in preventing discharge dilemmas and merit additional study.

Level of Evidence Level III, prognostic study. See the Instructions for Authors for complete description of levels of evidence.

Introduction

Approximately 1.4% of all hospital discharges occur before the treating physician recommends discharge [19]. Patients who leave against medical advice represent a public health and financial concern. They are at increased risk of mortality, morbidity, and readmission and are likely to consume a disproportionate share of increasingly scarce healthcare resources [4, 11, 13, 18, 40, 44].

Factors associated with self-discharge have been documented in numerous settings of healthcare delivery [4, 10, 20, 22, 32, 36]. Most studies suggest that patients leaving against medical advice are either socioeconomically disadvantaged or have psychiatric illness [22, 24, 32, 33, 38]. However, we do not know whether patients who leave the hospital before their caregivers recommend discharge after common emergency orthopaedic conditions such as fractures and infections share similar demographic characteristics. Patients who leave the hospital before treatment is completed place themselves at risk for adverse outcomes. Given the clinical and economic consequences of undertreatment of fractures and infections, an understanding of factors contributing to self-discharge might aid in developing quality improvement initiatives to reduce occurrences of self-discharge and ultimately lead to improved quality of care and contained costs.

Using a large administrative database, we undertook this study to report rates and associated factors of self-discharge in patients admitted to US hospitals for orthopaedic trauma and musculoskeletal infection. First, we aimed to determine the frequency of discharge against medical advice in patients with isolated fractures and patients with musculoskeletal infection. Second, we sought to identify demographic, pathology, and hospital factors associated with increased odds of self-discharge.

Materials and Methods

We conducted this retrospective population-based study using the Nationwide Inpatient Sample (NIS) discharge data for the 10 most recent years available (2002–2011). The NIS is managed by the Agency for Healthcare Research and Quality and currently constitutes the largest all-payer database in the United States [5]. Each data-set year represents a 20% stratified sample of inpatient admissions to more than 1000 acute care nonfederal hospitals across the nation [37]. Discharge weight files are provided to produce nationally representative estimates. The NIS database uses International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes to standardize reporting of diagnoses, procedures, and adverse events [27]. Additional data recorded include patient- and provider-related characteristics and hospitalization outcomes such as discharge disposition and length of stay. The NIS database has been regularly used for comparative health services research since its inception in 1988 [23, 34]. Institutional review board approval was not required for this study, because the data contained no personal identifiers.

Relying on discharge records, all adult (aged 18 years or older) individuals with an ICD-9-CM primary diagnosis code for orthopaedic trauma (805.0–809.1 for fractures of neck and trunk; 810.0–819.1 for fractures of upper limb; 820.1–829.1 for fractures of lower limb) or musculoskeletal infection (680.0–680.9 for carbuncle/furuncle; 681.0–682.9 for cellulitis; 730.00–730.29 for osteomyelitis; 728.86 for necrotizing fasciitis; 728.0 for infective myositis) were considered for the study. Only the primary discharge diagnosis was used to define the cause for patient hospitalization [8, 42]. Patients sustaining polytrauma and those who died during hospitalization were excluded from analysis [19, 30]. The final study cohort consisted of 7,067,432 patients with an isolated

fracture and 5,488,686 patients with a musculoskeletal infection. Data were analyzed separately for fracture and infection hospitalizations.

Demographic variables were age, sex, race/ethnicity (white, black, Hispanic, other, and unknown), insurance status (Medicare, Medicaid, private, uninsured, and other), and median household income of the patient's zip code of residence (USD 1–38,999, 39,000–47,999, 48,000–62,999, and ≥ 63,000). Baseline comorbidity status was assessed using the Elixhauser comorbidity algorithm, which contains 30 comorbidities [12, 31, 35]. Four conditions included in the Elixhauser algorithm (alcohol abuse, drug abuse, psychosis, and AIDS/HIV infection) were analyzed separately, because they have been previously associated with self-discharge [22, 32], thus leaving 26 comorbidities for summation (Table 1).

Hospitals were classified on the basis of their location (urban, rural), geographic region (Northeast, Midwest, South, West), teaching status (teaching or nonteaching), and bed size (small, medium, large). The highest percentages of patients with fracture and infection admissions were those discharged from hospitals in the South, in large, urban, and nonteaching hospitals (Table 2).

The primary outcome of interest was discharge disposition; specifically, whether a patient left the hospital against medical advice or was formally discharged. Rates of discharge against medical advice (per 1000 discharges) were calculated for all study variables. We performed bivariate analyses using Pearson chi-square tests for categorical data and independent samples t-tests for continuous data to evaluate the association between each explanatory variable to discharge against medical advice. This exploratory analysis identified the following factors as potentially associated with self-discharge: younger age, male sex, nonwhite race/ethnicity, low household income, nonprivate insurance and no insurance coverage, less medical comorbidity, alcohol and drug abuse, psychosis, AIDS/HIV, fracture of the neck and trunk or of the upper extremity, cellulitis, facilities in the Northeast, and urban, teaching, and larger hospitals. To minimize confounding, multivariable logistic regression models were constructed to determine which factors are independently associated with leaving the hospital against medical advice among patients with (1) orthopaedic trauma; and (2) musculoskeletal infection. All predictor variables were included simultaneously in the multivariable regression models [7]. Results were reported as odds ratios (ORs) with 95% confidence intervals (CIs). The area under the receiver-operating characteristic (ROC) curve was used to evaluate the discriminatory ability of the two models [29]. In our study, the area under the curve (AUC) measured the ability of our regression models to assign a high probability of self-discharge to those patients who actually left against medical advice. AUC values range from 0.50 to 1.0 with higher values meaning better discrimination. In general, values less than 0.70 are considered to show poor discrimination, between 0.70 and 0.80 acceptable discrimination, between 0.80 and 0.90 excellent discrimination, and above 0.90 outstanding discrimination [16]. The areas under the ROC curve predicting self-discharge were 0.81 for both multivariable models, indicating excellent discriminatory ability. We also examined global model performance using the Nagelkerke pseudo R^2, a measure of the proportion of the variation of self-discharge risk explained by our models. To correct for multiple comparisons and the large weighted sample size, the statistical threshold for α error was set at 0.001.

Results

During the 10-year study period, 0.3% (21,035 of 7,067,432) of hospitalized patients with an isolated fracture left the hospital against medical advice. Among hospitalizations for musculoskeletal infection, the rate of self-discharge was 2.1% (116,399 of 5,488,686) (Table 1).

After controlling for potential confounding variables using multivariable modeling (Table 3), patient-related factors associated with leaving against medical advice (AMA) common to patients both with fracture and infection hospitalizations included age < 75 years (trauma: OR 2.7, 95% CI 2.5–2.8, $p < 0.001$; infection: OR 3.9, 95% CI 3.8–4.1, $p < 0.001$), male sex (trauma: OR 1.7, 95% CI 1.7–1.8, $p < 0.001$; infection: OR 1.4, 95% CI 1.3–1.4, $p < 0.001$), black race (trauma: OR, 1.5, 95% CI 1.4–1.6, $p < 0.001$; infection: OR 1.1, 95% CI 1.1–1.1, $p < 0.001$), low household income (trauma: OR 1.5, 95% CI 1.4–1.5, $p < 0.001$; infection: OR 1.4, 95% CI 1.4–1.4, $p < 0.001$), public insurance (Medicare [trauma: OR 1.7, 95% CI 1.6–1.8, $p < 0.001$; infection: OR 2.5, 95% CI 2.4–2.5, $p < 0.001$] and Medicaid [trauma: OR 2.6, 95% CI 2.5–2.7, $p < 0.001$; infection: OR 3.2, 95% CI 3.2–3.3, $p < 0.001$]) and no insurance (trauma: OR 3.0, 95% CI 2.9–3.1, $p < 0.001$; infection: OR 3.5, 95% CI 3.4–3.5, $p < 0.001$), less medical comorbidity (trauma: OR 0.94 per one-unit increase in the number of comorbidities, 95% CI 0.93–0.95, $p < 0.001$; infection: OR 0.88, 95% CI 0.87–0.88, $p < 0.001$), alcohol (trauma: OR, 2.3, 95% 2.2–2.4, $p < 0.001$; infection: OR 1.5, 95% CI 1.5–1.5, $p < 0.001$), opioid (trauma: OR 2.9, 95% CI 2.7–3.1, $p < 0.001$; infection: OR 4.4, 95% CI 4.3–4.4, $p < 0.001$) and nonopioid drug abuse (trauma: OR, 2.0, 95% CI 1.9–2.1, $p < 0.001$; infection: OR 2.8, 95% CI 2.8–2.9, $p < 0.001$), psychosis (trauma: OR 1.3,

Table 1. Patient demographics and clinical characteristics stratified by discharge disposition

Parameter	Orthopaedic trauma					Musculoskeletal infections				
	N = 7,067,432	Disposition		p value	AMA discharge rate per 1000	N = 5,488,686	Disposition		p value	AMA discharge rate per 1,000
		AMA	Formal discharge				AMA	Formal discharge		
Weighted, number (%)	7,067,432 (100)	21,035 (0.30)	7,046,397 (99.70)	–	3.0	5,488,686 (100)	116,399 (2.1)	5,372,287 (97.9)	–	21
Age (years), mean ± SD	68 ± 20	51 ± 19	68 ± 20	< 0.001	–	56 ± 19	43 ± 14	56 ± 19	< 0.001	–
Age group (years) (%)										
≤ 44	16	39	16	< 0.001	7.3	30	56	30	< 0.001	40
45–64	20	36	20		5.4	37	36	37		21
65–74	14	10	14		2.2	13	4.5	13		7.2
≥ 75	51	16	51		0.91	20	3.1	21		3.2
Sex (%)										
Women	64	35	64	< 0.001	1.6	47	33	47	< 0.001	15
Men	36	65	36		5.4	53	67	53		26
Race/ethnicity (%)										
White	64	52	64	< 0.001	2.4	58	53	58	< 0.001	19
Black	5.1	14	5.0		8.3	10	15	10		31
Hispanic	5.6	11	5.6		6.0	8.6	13	8.5		31
Other	3.5	5.9	3.5		5.0	3.6	4.4	3.6		26
Unknown	22	17	22		2.3	20	15	20		16
Primary health insurance (%)										
Private	22	20	22	< 0.001	2.7	28	13	28	< 0.001	10
Medicare	62	30	62		1.5	42	20	42		10
Medicaid	4.8	17	4.8		11	14	31	13		48
Uninsured	5.2	23	5.2		13	11	28	10		56
Other	5.7	9.2	5.7		4.8	5.9	8.1	5.8		29
Median household income (USD) (%)										
1–38,999	24	35	24	< 0.001	4.2	30	39	30	< 0.001	26
39,000–47,999	26	25	26		2.8	26	25	26		20
48,000–62,999	25	22	25		2.5	23	21	23		18
≥ 63,000	25	18	25		2.1	21	15	21		15
Number of comorbidities (%)										
0	23	43	23	< 0.001	5.6	21	38	21	< 0.001	38
1	21	22	21		3.3	20	25	20		26
≥ 2	56	34	57		1.8	59	37	59		13

Table 1. continued

Parameter	Orthopaedic trauma					Musculoskeletal infections				
	N = 7,067,432	Disposition		p value	AMA discharge rate per 1000	N = 5,488,686	Disposition		p value	AMA discharge rate per 1,000
		AMA	Formal discharge				AMA	Formal discharge		
Specific conditions (%)										
Alcohol abuse/dependence	4.4	22	4.4	< 0.001	15	3.8	12	3.7	< 0.001	64
Opioid abuse/dependence	0.40	3.4	0.40	< 0.001	27	3.3	21	2.9	< 0.001	131
Nonopioid drug abuse/dependence	1.1	8.3	1.1	< 0.001	22	3.3	14	3.0	< 0.001	88
Psychosis	3.1	5.4	3.1	< 0.001	5.3	4.6	9.3	4.5	< 0.001	43
AIDS/HIV	0.10	0.60	0.10	< 0.001	19	0.80	2.7	0.70	< 0.001	76
Principal admission diagnosis (%)										
Fracture										
Neck and trunk	21	31	21	< 0.001	4.4	–	–	–	–	–
Upper extremity	13	23	14		5.1	–	–	–	–	–
Lower extremity	66	46	66		2.1	–	–	–	–	–
Infection										
Carbuncle and furuncle	–	–	–	–	–	0.40	0.30	0.40	< 0.001	20
Cellulitis and abscess	–	–	–	–	–	89	92	89		22
Osteomyelitis	–	–	–	–	–	9.3	7.6	9.4		17
Necrotizing fasciitis	–	–	–	–	–	0.80	0.30	0.80		8.9
Infective myositis	–	–	–	–	–	0.10	0.10	0.10		16
Days of care, mean ± SD	4.8 ± 14	3.3 ± 7.7	4.8 ± 14	< 0.001	–	5.3 ± 11	3.1 ± 4.6	5.3 ± 11	< 0.001	–

AMA = against medical advice.

Table 2. Provider characteristics stratified by discharge disposition

Parameter	Orthopaedic trauma					Musculoskeletal infections				
	N = 7,067,432	Disposition		p value	AMA discharge rate per 1000	N = 5,488,686	Disposition		p value	AMA discharge rate per 1000
		AMA	Formal discharge				AMA	Formal discharge		
Hospital location (%)										
Rural	15	10	15	< 0.001	2.0	15	8.8	15	< 0.001	12
Urban	85	90	85		3.2	85	91	85		23
Hospital geographic region (%)										
Northeast	19	27	19	< 0.001	4.2	21	29	21	< 0.001	29
Midwest	24	16	16		1.9	22	15	23		14
South	38	36	38		2.8	39	34	39		18
West	19	22	19		3.3	17	22	17		27
Hospital teaching status (%)										
Nonteaching	58	48	55	< 0.001	2.5	59	53	59	< 0.001	19
Teaching	42	52	45		3.7	41	48	41		24
Hospital bed size (%)										
Small	12	8.0	11	< 0.001	2.0	15	12	15	< 0.001	17
Medium	25	27	25		3.1	26	29	26		24
Large	63	66	64		3.1	59	59	59		21

AMA = against medical advice.

95%CI 1.2–1.3, $p < 0.001$; infection: OR 1.3, 95% CI 1.3, 1.4, $p < 0.001$), and AIDS/HIV infection (trauma: OR 1.5, 95% CI 1.2–1.8, $p < 0.001$; infection: OR 1.3, 95% CI 1.3–1.4, $p < 0.001$). Patients of Hispanic origin had a higher risk for self-discharge AMA after fractures (OR 1.2, 95% CI 1.1–1.3, $p < 0.001$) but a lower risk after musculoskeletal infections (OR 0.92, 95% CI 0.90–0.94, $p < 0.001$).

For diagnosis-related factors, compared with fractures of the lower extremity, upper extremity fractures (OR 1.9; 95% CI, 1.8–1.9; $p < 0.001$) and fractures of the neck and trunk (OR 2.1; 95% CI, 2.0–2.2; $p < 0.001$) were associated with increased risk for self-discharge. Compared with carbuncle/furuncle, cellulitis was the infection associated with the highest odds of patients leaving AMA (OR, 1.3; 95% CI, 1.2–1.5; $p < 0.001$), but osteomyelitis (OR, 1.2; 95% CI, 1.0–1.4; $p = 0.001$) was also associated with self-discharge. In contrast, patients with necrotizing fasciitis were associated with a lower risk of self-discharge (OR, 0.50; 95% CI, 0.43–0.58; $p < 0.001$).

Self-discharges were more likely to occur at urban hospitals (trauma: OR 1.3, 95% CI 1.2–1.4, $p < 0.001$; infection: OR 1.6, 95% CI 1.5–1.6, $p < 0.001$) than rural hospitals, in the Northeast (trauma: OR 1.7, 95% CI 1.6–1.8, $p < 0.001$; infection: OR 1.6, 95% CI 1.6–1.6, $p < 0.001$) than in the South, and at hospitals of medium (trauma: OR 1.3, 95% CI 1.2–1.3, $p < 0.001$; infection: OR 1.1, 95% CI 1.1–1.2, $p < 0.001$) or large size (trauma: OR 1.2, 95% CI 1.1–1.2, $p < 0.001$) than at small-sized institutions.

Discussion

Discharges AMA might lead to adverse outcomes, readmissions to the hospital, and disproportionate use of healthcare resources for patients because of inadequate initial treatment of a medical condition [1, 6, 17, 21, 44]. Although rates and risk factors for self-discharge have been documented in other settings, including pneumonia [36], asthma [4], and gastrohepatic disorders [22, 32], there has been little published regarding orthopaedic patients. In an era of increasing healthcare cost containment, early identification of patients at risk for self-discharge—and, consequently, at risk for high resource use—might help reduce costs while improving hospital efficiency and quality of care. We therefore sought to determine the frequency of premature self-discharge in patients with orthopaedic trauma and musculoskeletal infection and to identify predictors of its occurrence, specifically considering demographic factors, pathology type, and hospital factors.

Despite the large sample size and associated power, our analysis should be interpreted cautiously in light of its limitations. First, like in all studies using administrative claims data, coding misclassification may occur [15, 28].

Table 3. Multivariate regression modeling of predictors of leaving hospital AMA

Predictor	Orthopaedic trauma				Musculoskeletal infections			
	OR	95% CI		p value	OR	95% CI		p value
		Lower	Upper			Lower	Upper	
Age < 75 years (reference: ≥ 75 years)	2.7	2.5	2.8	< 0.001	3.9	3.8	4.1	< 0.001
Men (reference: women)	1.7	1.7	1.8	< 0.001	1.4	1.3	1.4	< 0.001
Race (reference: white)								
Black	1.5	1.4	1.6	< 0.001	1.1	1.1	1.1	< 0.001
Hispanic	1.2	1.1	1.3	< 0.001	0.92	0.90	0.94	< 0.001
Other	1.4	1.3	1.5	< 0.001	1.0	1.0	1.1	0.046
Unknown	1.0	0.96	1.0	0.97	0.86	0.84	0.87	< 0.001
Primary health insurance (reference: private)								
Medicare	1.7	1.6	1.8	< 0.001	2.5	2.4	2.5	< 0.001
Medicaid	2.6	2.5	2.7	< 0.001	3.2	3.2	3.3	< 0.001
Uninsured	3.0	2.9	3.1	< 0.001	3.5	3.4	3.5	< 0.001
Other	1.4	1.3	1.5	< 0.001	2.0	1.9	2.0	< 0.001
Household income, USD (reference: ≥ 63,000)								
1–38,999	1.5	1.4	1.5	< 0.001	1.4	1.4	1.4	< 0.001
39,000–47,999	1.2	1.2	1.3	< 0.001	1.2	1.2	1.2	< 0.001
48,000–62,999	1.2	1.1	1.2	< 0.001	1.1	1.1	1.1	< 0.001
Number of comorbidities per one increase	0.94	0.93	0.95	< 0.001	0.88	0.87	0.88	< 0.001
Specific conditions (reference: absence of condition)								
Alcohol abuse/dependence	2.3	2.2	2.4	< 0.001	1.5	1.5	1.5	< 0.001
Opioid abuse/dependence	2.9	2.7	3.1	< 0.001	4.4	4.3	4.4	< 0.001
Nonopioid drug abuse/dependence	2.0	1.9	2.1	< 0.001	2.8	2.8	2.9	< 0.001
Psychosis	1.3	1.2	1.3	< 0.001	1.3	1.3	1.4	< 0.001
AIDS/HIV	1.5	1.2	1.8	< 0.001	1.3	1.3	1.4	< 0.001
Fracture type (reference: lower extremity fracture)								
Fracture of neck and trunk	2.1	2.0	2.2	< 0.001	–	–	–	–
Fracture of upper extremity	1.9	1.8	1.9	< 0.001	–	–	–	–
Infection type (reference: carbuncle and furuncle)								
Cellulitis and abscess	–	–	–	–	1.3	1.2	1.5	< 0.001
Osteomyelitis	–	–	–	–	1.2	1.0	1.4	0.001
Necrotizing fasciitis	–	–	–	–	0.50	0.43	0.58	< 0.001
Infective myositis	–	–	–	–	0.84	0.67	1.0	0.11
Teaching hospital (reference: nonteaching hospital)	0.86	0.83	0.88	< 0.001	0.81	0.80	0.82	< 0.001
Urban hospital (reference: rural hospital)	1.3	1.2	1.4	< 0.001	1.6	1.5	1.6	< 0.001
Hospital bed size (reference: small)								
Medium	1.3	1.2	1.3	< 0.001	1.1	1.1	1.2	< 0.001
Large	1.2	1.1	1.2	< 0.001	1.0	1.0	1.0	0.056
Hospital geographic region (reference: South)								
Northeast	1.7	1.6	1.8	< 0.001	1.6	1.6	1.6	< 0.001
Midwest	0.85	0.81	0.89	< 0.001	0.99	0.97	1.0	0.34
West	1.2	1.1	1.2	< 0.001	1.2	1.2	1.3	< 0.001
Model performance								
Area under the ROC curve (95% CI)		0.81 (0.80–0.82)				0.81 (0.80–0.81)		
Nagelkerke R^2		0.11				0.15		

AMA = against medical advice; OR = odds ratio; CI = confidence interval; ROC = receiver-operating characteristic.

Because the NIS data contain no personal identifiers, validation through crossreferencing medical records was not possible. However, validation of the NIS data is routinely performed by the Agency for Healthcare Research and Quality [22]. Second, the retrospective nature of the NIS data does not allow ascertainment of the exact reasons for which patients left AMA. We were therefore unable to differentiate discharges that reflected expressions of genuine patient preference from those that reflected patient reactions to suboptimal treatment or mistreatment [19, 32]. Third, we lacked data on social support (such as marital status), employment status, medications, and tobacco use, all of which could have influenced self-discharge. Another limitation was our inability to document postdischarge consequences of leaving AMA, which limits the interpretation of the clinical relevance of the issue in orthopaedic patients. Additional research is needed to determine postdischarge outcomes and resource use among orthopaedic patients who self-discharge. Fifth, because each record in the NIS is for a single hospitalization and not a patient, it is likely that there are multiple records for the same patient with several admissions [32]. Finally, the observational nature of our study does not allow causal inference.

We found that approximately one in 333 (0.30%) patients hospitalized for an isolated fracture and one in 47 (2.1%) patients with musculoskeletal infection left the hospital AMA. A 2002 NIS analysis encompassing all US hospital admissions reported that 1.4% of patients self-discharged [19]. Rates of premature discharge have been shown to vary depending on the cause for hospitalization. With the exception of postpartum patients (0.10%) [14], the prevalence of self-discharge in orthopaedic trauma patients was below reported rates for other patient populations [3, 4, 13, 22, 32], perhaps because patients with fractures are less mobile. The rate of premature discharge in patients with musculoskeletal infection was higher than rates reported in hospitalizations for general internal medicine conditions (0.60%) [43], myocardial infarction (1.1%) [13], and inflammatory bowel disease (1.3%) [22], but lower than rates observed in patients hospitalized for cirrhosis (2.8%) [32] and asthma (4.9%) [4]. Although the observed frequency of self-discharge episodes—particularly among hospitalizations for fractures—could be considered small, the clinical and economic burden to healthcare systems may be substantial. On the basis of available evidence, it is likely that more than 21,000 patients who left prematurely after a fracture ended up having more adverse events and readmissions, ultimately resulting in higher healthcare costs—some of which are often not reimbursed to hospitals by insurance companies [6, 17, 44]. Aliyu [2] calculated the readmission cost resulting from a self-discharge at 56% higher than expected from the original hospitalization.

We identified several patient-related factors associated with an increased likelihood of leaving AMA in the orthopaedic acute care setting. In agreement with previous studies [4, 10, 22, 32, 36], younger age, male sex, and low income level were independent predictors of self-discharge. Patients with Medicaid or Medicare, and those without insurance coverage were approximately three times more likely to leave the hospital AMA compared with privately insured patients. The relationship between insurance status and the propensity to self-discharge has been noted in other acute care settings [4, 13, 22, 32]. Black race/ethnicity was associated with an increased risk for premature discharge in both fracture and infection hospitalizations. The effect of Hispanic race/ethnicity on self-discharge seemed to be more limited, because it was linked to higher risk of leaving the hospital after fractures but lower risk after musculoskeletal infections. Patients with mental health and substance abuse disorders were at increased odds of leaving AMA, thus confirming the generalizability of previous study findings to patients admitted for orthopaedic trauma and musculoskeletal infection [4, 13, 22, 32]. Notably, rates of self-discharge were particularly high in opiate abusers; for infection admissions, one in eight patients with opioid use disorders left AMA. Reasons for the increased tendency to self-discharge among disenfranchised populations remain largely unexplored and merit further research. It has been shown that Hispanic and black patients, and the uninsured, are more likely to be distrustful of their healthcare providers and thus to decline recommended care [25, 41]. Moreover, it is likely that disadvantaged populations have lower levels of health literacy and are thus less aware of the postdischarge implications of leaving AMA [9]. Pressing domestic, economic, and social concerns—known to be more common among disadvantaged populations—may also contribute to self-discharge [19]. From the physician's perspective, strategies to enhance communication skills with patients, improve cultural sensitivity, and proactively address substance abuse issues early during hospital admission may aid in preventing discharge dilemmas [1].

Among orthopaedic trauma hospitalizations, patients with an isolated fracture of the neck and trunk, or of the upper extremity, were at higher risk of leaving AMA than those sustaining a fracture of the lower extremity. It is intuitive to think that patients with lower limb fractures experienced more difficulties with ambulation and were consequently less likely to walk out of the hospital AMA. Cellulitis and osteomyelitis were the two infections associated with the highest odds of leaving AMA, whereas necrotizing fasciitis was the condition associated with the lowest risk of self-discharge. These findings suggest that patients admitted for more severe musculoskeletal infections with systemic involvement (eg, necrotizing fasciitis)

are less likely to leave the hospital against advice. The observation that severity of the admitting diagnosis correlates with the likelihood of self-discharge has also been recently noted in patients admitted for gastrohepatic disorders [22, 32].

Consistent with prior studies [19, 39], self-discharges tended to be more common at urban hospitals than rural hospitals and at community hospitals than teaching hospitals. The Northeast exhibited the highest risk of self-discharge after both fracture and infection hospitalizations, which is in line with a recent study by Myers and colleagues [32] in hospitalizations associated with cirrhosis. The higher rates of self-discharge—and, consequently, readmissions—may partly explain why the Northeast has the highest per-capita spending in health care [26]. Based on our data, quality efforts aimed at reducing self-discharges after common emergency orthopaedic conditions should target large, urban hospitals in the Northeast that function as "safety net" providers treating a disproportionate share of disenfranchised patients. Future studies should explain the observed association between provider characteristics and the patients' risk of premature discharge [19].

In conclusion, understanding the characteristics of patients leaving AMA is an important first step toward developing strategies to reduce self-discharges in the orthopaedic setting. Quality initiatives targeting this at-risk population should strive to enhance patient-physician communication through the use of motivational interviewing and shared decision-making and the implementation of clearer communication techniques for patients with limited health literacy or language barriers. It is important that low health-literate patients fully comprehend the clinical and financial implications of leaving AMA. Substance abuse should also be addressed promptly on admission and perhaps also involve a consultation-liaison psychiatrist or a patient advocate. More research is needed to (1) gain insight into the actual motivations for patients to sign out AMA; and (2) evaluate postdischarge outcomes.

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