

Temporal Trends and Predictors of Pancreatitis Patients Who Leave Against Medical Advice: A Nationwide Analysis

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Abstract

Background: Acute pancreatitis is the leading gastrointestinal cause of hospital admissions. Our study aims to determine the trends and predictors of discharge against medical advice (AMA).

Methods: We utilized the Nationwide Inpatient Sample (2003 - 2016) to identify patients admitted with pancreatitis. We compared in-hospital complications and determined predictors of discharge AMA using a multivariate logistic regression.

Results: A total of 7,158,894 patients were admitted with pancreatitis. Of those, 199,351 left AMA. Discharge AMA increased over time from 2.3% to 3.2%. Patients who left AMA were more likely to be younger, male, black, and a lower socioeconomic status (SES). They had a greater prevalence of depression, cirrhosis, smoking, drug abuse, and human immunodeficiency virus (HIV) infection. Alcohol use was the most likely etiology of pancreatitis among those leaving AMA. In a multivariate regression, patients more likely to leave AMA included: age 18 - 44, male, and black. Patients with a history of depression, drug abuse, and HIV infection were also more likely to be discharged AMA.

Conclusions: Discharges AMA increased over time. Predictors of AMA include patients who are younger, male, black, lower socioeconomic status, and have a history of depression, HIV infection, alcohol and drug use. Future studies are necessary to examine the reasons for discharge AMA among this population.

Keywords: Pancreatitis; Discharge; Against medical advice; Predictors

Introduction

Acute pancreatitis (AP) is the leading gastrointestinal cause of hospital admissions, accounting for more than 275,000 admissions per year in the USA [1, 2]. Up to 75% of patients that present with AP to the emergency department require admission, which leads to an annual healthcare expenditure estimated at \$2.5 billion dollars [1-3]. Furthermore, nearly half of all readmissions are related to pancreatitis [4]. In the USA, alcohol and biliary disease are the most common causes of AP. With alcohol consumption in the USA on the decline in recent years, gallstone-related causes of pancreatitis are increasing, presumably due to a rise in obesity rates and an aging population [5, 6].

Nearly 0.6% of all hospitalizations result in discharge against medical advice (AMA) [7-10]. Historically, patients with low socioeconomic status (SES), a history of substance abuse, and mental illness have been found to have the highest rates of AMA discharges [7, 10-15]. The incidence and predictors of AMA discharge have been previously studied in patients with human immunodeficiency virus (HIV) infection, asthma, acute myocardial infarction, and inflammatory bowel disease (IBD), however this topic is yet to be studied in patients with pancreatitis. Patients with pancreatitis often have a wide variety of symptoms that are difficult to manage, which may lead to patient dissatisfaction. Leaving AMA results in incomplete treatment, increased rate of readmission, and increased health care utilization [7, 14]. Our study aims to determine the prevalence and trends of discharge AMA in patients with pancreatitis. Additionally, we sought to assess the predictors associated with discharge AMA.

Materials and Methods

Data source

The Nationwide Inpatient Sample (NIS) of the Healthcare Cost and Utilization Project (HCUP) was used to derive patient-relevant information between January 1, 2003 and December 31, 2016. The NIS is the largest publicly available all-payer claims-based database that contains clinical and resource utilization information on patient discharges from approximately

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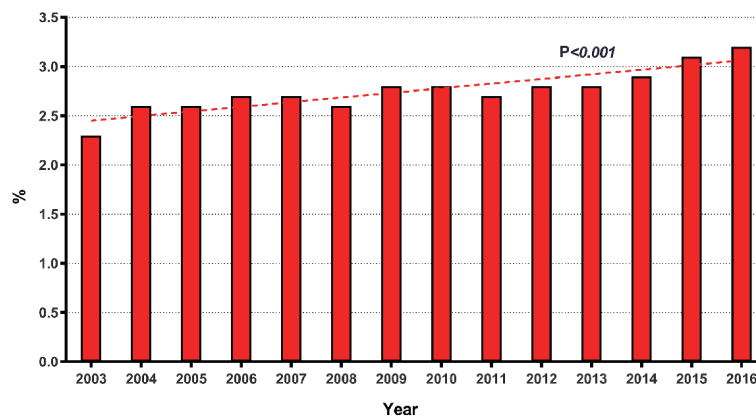


Figure 1. Trends of discharge AMA in patient admitted with acute pancreatitis (2003 - 2016). AMA: against medical advice.

1,000 non-federal hospitals in 46 states. These data are stratified to represent approximately 20% of US inpatient hospitalizations across different hospital and geographic regions (random sample). National estimates of the entire US hospitalized population were calculated using the Agency for Healthcare Research and Quality (AHRQ) and weighting methods. The study was exempt by the institutional review board because the NIS is a publicly available and de-identified database.

Study sample

Our study sample included patients aged 18 years or older who were hospitalized with a primary diagnosis of acute or chronic pancreatitis. We excluded patients with missing data on their discharge disposition, who were transferred out of the hospital, and those who died. Patients were identified using International Classification of Diseases-Ninth and Tenth Revision-Clinical Modification (ICD-9-CM and ICD-10-CM) codes (Supplementary Material 1, www.gastrores.org). The final sample included 7,158,894 pancreatitis hospitalizations.

Study endpoints

The primary outcome was disposition at discharge, specifically, whether a patient left the hospital AMA or was routinely discharged. Covariates included age, sex, race (white, black, Hispanic), insurance status (Medicare, Medicaid, private, or uninsured), income, bed size, weekend admission, and hospital location (urban, rural). In-hospital complications studied were urinary tract infection (UTI), acute kidney injury (AKI), acute dialysis requirement, septic shock, respiratory failure, length of stay (LOS), and cost.

Statistical analysis

Weighted national estimates were used in all statistical analyses. The Cochran-Armitage test was used to assess the statistical significance of the temporal trend incidence of AMA

discharge in patients admitted with pancreatitis. Patients were categorized into patients with pancreatitis who left AMA and those who were routinely discharged. Descriptive statistics were presented as frequencies with percentages for categorical variables. Mean, standard deviation, median, 25th and 75th percentiles were reported for continuous measures. Baseline characteristics were compared using Pearson Chi-squared test and Fisher's exact test for categorical variables and an independent-samples *t*-test for continuous variables. Univariate and multivariate logistic regression was performed to estimate odds ratios (ORs) with 95% confidence intervals (CIs) to determine significant predictors for discharge AMA. A type I error of < 0.05 was considered statistically significant. To analyze monotonic trend data over time, the Mann-Kendall trend test was employed with significance level at $< 5\%$. All statistical analyses were performed with SPSS version 25 (IBM Corporation, Armonk, NY).

Results

Between 2003 and 2016, a total of 7,158,894 admissions for pancreatitis were identified in the NIS. Of those, 199,351 (2.8%) left AMA. The incidence of discharge AMA has increased over time from 2.3% in 2003 to 3.2% in 2016 ($P < 0.001$) (Fig. 1). Patients who left AMA were more likely to be younger (49.4% vs. 5.8%, $P < 0.001$), male (68.2% vs. 50.2%, $P < 0.001$), black (24.4% vs. 17.5%, $P < 0.001$), and of a lower SES (38.6% vs. 14.7%, $P < 0.001$) compared to those who were routinely discharged (Table 1). Patients who left AMA had a greater prevalence of depression (10.6% vs. 7.1%, $P < 0.001$), cirrhosis (10.9% vs. 8.6%, $P < 0.001$), smoking (44.4% vs. 22.6%, $P < 0.001$), drug abuse (18.4% vs. 6.8%, $P < 0.001$), and HIV infection (3.0% vs. 1.4%, $P < 0.001$). These patients' etiology of pancreatitis was more likely to be a result of alcohol use (52.3% vs. 23.5%, $P < 0.001$) rather than biliary (9.5% vs. 22.3%, $P < 0.001$) or other non-alcoholic causes (16% vs. 26.6%, $P < 0.001$) (Table 2). The trends in etiology of pancreatitis over the study time period is shown in Figure 2.

However, in-hospital complications including AKI, AKI-requiring hemodialysis, respiratory failure, and septic shock,

Table 1. Baseline Characteristics of the Study Population

Baseline characteristics	AMA	No AMA	P value
Patient characteristics			
Age range			< 0.001
18 - 44	49.4%	32.2%	
45 - 64	44.8%	40.7%	
> 65	5.8%	27.1%	
Male	68.2%	50.2%	< 0.001
Income			< 0.001
0 - 25th percentile	38.6%	32.2%	
26th - 50th percentile	26.6%	26.4%	
51th - 75th percentile	20.1%	23.0%	
76th - 100th percentile	14.7%	18.4%	
Race			< 0.001
White	58.4%	64.7%	
Black	24.4%	17.5%	
Hispanic	11.9%	12.2%	
Payer			< 0.001
Medicare	21.2%	36.0%	
Medicaid	32.6%	18.3%	
Private insurance	17.6%	31.0%	
Self-pay/no charge/other	28.6%	14.7%	
Hospital characteristics			
Weekend admission	26.8%	24.8%	< 0.001
Bed-size			< 0.001
Small	15.4%	14.8%	
Medium	30.0%	26.6%	
Large	54.6%	58.6%	
Urban	75.3%	72.8%	< 0.001
Rural	24.7%	27.2%	< 0.001
LOS (median (25%, 75%))	2 (1, 3)	4 (3, 7)	< 0.001
Cost (mean ± SD (\$ in dollars))	21,090 (34,274)	43,556 (88,764)	< 0.001
Cost (median (25%, 75%) (\$ in dollars))	13,329,578 (7,588, 23,354)	22,419 (12,205, 43,448)	< 0.001

AMA: against medical advice; N: number; SD: standard deviation; LOS: length of stay.

and those receiving interventions such as endoscopic retrograde cholangiopancreatography (ERCP) were less frequently seen in patients who left AMA (Table 2).

In a multivariate logistic regression analysis, pancreatitis patients with the following characteristics were more likely to leave AMA: age 18 - 44 (OR: 4.14, 95% CI: 4.04 - 4.24, $P < 0.001$), age 45 - 64 (OR: 3.21, 95% CI: 3.14 - 3.29, $P < 0.001$), male (OR: 1.58, 95% CI: 1.56 - 1.60, $P < 0.001$), black (OR: 1.06, 95% CI: 1.05 - 1.07, $P < 0.05$), and weekend admission (OR: 1.08, 95% CI: 1.07 - 1.09, $P < 0.001$). Patients with alcoholic pancreatitis were more likely to leave AMA (OR: 1.81, 95% CI: 1.79 - 1.83, $P < 0.001$), than those with admissions secondary to biliary pancreatitis (OR: 0.85, 95% CI: 0.84 -

0.87, $P < 0.001$). Patients who had history of depression (OR: 1.05, 95% CI: 1.03 - 1.07, $P < 0.001$), drug abuse (OR: 1.44, 95% CI: 1.42 - 1.46, $P < 0.001$) and HIV infection (OR: 1.25, 95% CI: 1.21 - 1.29, $P < 0.001$) were more likely to be discharged AMA (Table 3).

Discussion

This study describes the prevalence of discharge AMA among patients who were admitted with acute and chronic pancreatitis and evaluates associated predictors. Additionally, our study reports the trend of discharge AMA over time. To our knowl-

Table 2. Patient Comorbidities, Complications and Interventions

Comorbidities, complications and interventions	AMA	No AMA	P value
Comorbidities			
Diabetes mellitus	20.6%	26.3%	< 0.001
Hypertension	40.6%	48.4%	< 0.001
Dyslipidemia	13.7%	24.1%	< 0.001
Coronary artery disease	6.8%	12.0%	< 0.001
Peripheral vascular disease	2.1%	4.1%	< 0.001
Atrial fibrillation/flutter	2.1%	6.2%	< 0.001
Inflammatory bowel disease	1.0%	1.4%	< 0.001
Liver cirrhosis	10.9%	8.6%	< 0.001
Chronic kidney disease	5.7%	8.7%	< 0.001
Anemia	17.6%	21.8%	< 0.001
COPD	13.6%	14.6%	< 0.001
Smoking	44.4%	22.6%	< 0.001
Drug abuse	18.4%	6.8%	< 0.001
Depression/psychosis	10.6%	7.1%	< 0.001
HIV infection	3.0%	1.4%	< 0.001
Alcohol	52.3%	23.5%	< 0.001
Biliary pancreatitis	9.5%	22.3%	< 0.001
Other cause of pancreatitis	16.0%	26.6%	< 0.001
Complications			
Acute kidney injury	7.3%	12.0%	< 0.001
Respiratory failure	1.8%	5.0%	< 0.001
Sepsis	0.5%	2.1%	< 0.001
Urinary tract infection	0.4%	0.7%	< 0.001
Gastrointestinal bleeding	4.1%	3.0%	< 0.001
Interventions			
ERCP	1.8%	9.7%	< 0.001
Endoscopy	4.9%	9.8%	< 0.001
EGD	4.7%	9.0%	< 0.001
Colonoscopy	0.8%	2.1%	< 0.001
Acute kidney injury requiring hemodialysis	1.4%	2.6%	< 0.001
Blood transfusion	3.0%	6.0%	< 0.001

AMA: against medical advice; COPD: chronic obstructive pulmonary disease; HIV: human immunodeficiency virus; EGD: esophagogastroduodenoscopy; ERCP: endoscopic retrograde cholangiopancreatography.

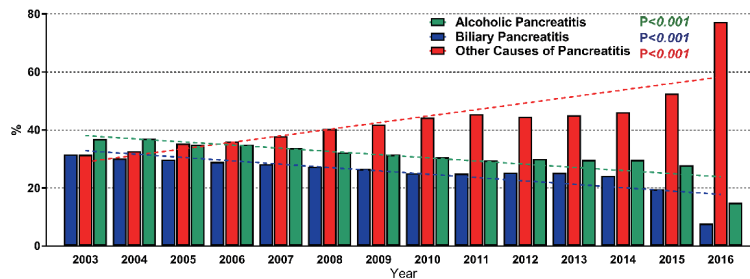


Figure 2. Trends in pancreatitis admissions overall and by etiology (alcohol, biliary, and other).

Table 3. Multivariate Logistic Regression Analysis for Predictors of Discharge Against Medical Advice Among Patients Admitted With Pancreatitis

Predictors for AMA discharge	OR	95% CI for OR		P value
		Lower	Upper	
Age range				
18 - 44	4.138	4.037	4.243	< 0.001
45 - 64	3.214	3.139	3.292	< 0.001
> 65	Ref	Ref	Ref	Ref
Male	1.582	1.564	1.599	< 0.001
Race				
White	Ref	Ref	Ref	Ref
Black	1.059	1.045	1.072	0.043
Hispanic	0.929	0.914	0.945	0.001
Urban	1.22	1.206	1.235	0.001
Rural	Ref	Ref	Ref	Ref
Payer				
Medicare	Ref	Ref	Ref	Ref
Medicaid	1.159	1.142	1.177	< 0.001
Private insurance	0.5	0.491	0.508	< 0.001
Self-pay/no charge/other	1.074	1.057	1.092	< 0.001
Weekend admission	1.082	1.07	1.094	< 0.001
Income				
0 - 25th percentile	1.096	1.079	1.114	< 0.001
26th - 50th percentile	1.053	1.036	1.07	< 0.001
51th - 75th percentile	0.962	0.946	0.979	< 0.001
76th - 100th percentile	Ref	Ref	Ref	Ref
Diabetes mellitus	0.915	0.903	0.927	< 0.001
Hypertension	0.941	0.931	0.951	< 0.001
Dyslipidemia	0.747	0.736	0.758	< 0.001
Coronary artery disease	1.054	1.033	1.076	< 0.001
Peripheral vascular disease	0.794	0.768	0.821	< 0.001
Atrial fibrillation/flutter	0.76	0.735	0.786	< 0.001
Inflammatory bowel disease	0.8	0.762	0.841	< 0.001
Liver cirrhosis	0.912	0.897	0.927	< 0.001
Anemia	0.792	0.782	0.803	< 0.001
COPD	0.974	0.959	0.988	< 0.001
Smoking	1.532	1.515	1.548	< 0.001
Drug abuse	1.443	1.424	1.463	< 0.001
Depression/psychosis	1.048	1.031	1.065	< 0.001
HIV infection	1.251	1.212	1.291	< 0.001
ERCP	0.362	0.348	0.376	< 0.001
Etiology				
Alcohol	1.806	1.785	1.827	< 0.001
Biliary pancreatitis	0.851	0.835	0.867	< 0.001
Other cause of pancreatitis	Ref	Ref	Ref	Ref

AMA: against medical advice; COPD: chronic obstructive pulmonary disease; HIV: human immunodeficiency virus; ERCP: endoscopic retrograde cholangiopancreatography; OR: odds ratio; CI: confidence interval; Ref: reference.

edge, this is the first and largest nationwide analysis to study AMA trends in pancreatitis patients. The main findings of our study were: 1) The number of discharges AMA increased over time; 2) Nearly 1 in 36 pancreatitis admissions leave AMA; 3) The predictors of AMA are patients that are younger, male, black, lower socioeconomic status, and have a history of depression, alcohol use, drug use, and HIV infection.

The trend of discharge AMA among patients admitted for pancreatitis has increased from 2003 - 2016 (Fig. 1). Despite improvements in the management of pancreatitis which has led to decreased mortality over time, our study shows that AMA rates have continued to increase [6]. This may be explained by patients' lack of insurance, higher financial burdens, poor education, and increased dependence on drugs and alcohol among this cohort.

We found a rate of AMA discharge to be 2.8%, which is a notable increase compared to that of all-cause admissions (1.2-1.4%) [10, 16]. Naturally, discharge AMA rates vary by admission diagnosis. AMA rates for general medicine services have been reported to be 0.6%, while other conditions studied include: IBD (1.3%), cirrhosis (2.8%), pneumonia (1.3%), and HIV infection (13%) [16-19]. Comparatively, patients with a diagnosis of drug use carry a discharge AMA rate of 17%, while those with alcohol use disorder were found to leave AMA at a rate of 14% [12, 20]. In patients with HIV infection, asthma, acute myocardial infarction, and IBD the predictors of AMA discharge include recent drug use, dissatisfaction with narcotic prescriptions, family obligations, male sex, and financial constraints in those with low socioeconomic status [7, 11, 21, 22].

In a multivariate analysis, our findings suggest that there are several patient and socioeconomic factors associated with discharge AMA in pancreatitis patients. These factors include: younger age, male sex, black, insured by Medicaid, and lower household income (Table 3). Pancreatitis patients between the ages of 18 - 44 were four times more likely to discharge AMA compared to elderly patients (> 65 years). Males also had a greater than 1.5-fold increased likelihood to discharge AMA. Those suffering from substance abuse with alcohol, drugs, and tobacco were nearly 1.5 times more likely to discharge AMA. Similarly, we also found socioeconomic status to have a bearing on the rate of discharge AMA [10, 11, 13, 14, 17]. These factors have been previously described as predictors for higher AMA rates in other populations [7, 10-15]. Based on these studies, patients of various diagnoses self-discharge for similar reasons, lending to the generalizability of our results. Interestingly, the etiology of pancreatitis was also predictive of whether a patient would leave AMA, such as those with alcohol as an etiology being approximately 1.8 times more likely to discharge AMA, while those with a biliary etiology were nearly 1.2 times less likely.

Understanding the reasons for patients discharging AMA is critical due to these patients having potentially worse outcomes and higher rates of readmission [13]. Patients are believed to discharge themselves AMA for a variety of reasons including personal or financial obligations, patient sense of improvement, lack of improvement, dissatisfaction with care, expectation of a shorter stay, underlying addiction with desire to use, and lack of a primary care physician [23-26]. Interestingly, studies have reported high-risk populations such as

those with HIV infection and intravenous drug user (IVDU) to be less likely to leave AMA if they are receiving methadone or have social support from family and friends [27].

The LOS and cost of hospitalization in the AMA population was half that of patients who did not leave AMA (Table 1). Further studies are needed to determine the burden of AMA discharge in patients with pancreatitis who may present for a later readmission and with a more severe and complicated course.

Our study is not without limitations. First, the NIS is derived from hospital claims data and subject to the shortcomings of other administrative data sets. Inconsistencies related to over- or under-coding are possible, but AHRQ quality control measures should minimize those possibilities. Also, the ICD-9 codes used in our study have been used and/or validated in several prior studies [28-30]. Second, we used the principle diagnosis of pancreatitis to identify our study cohort. Hence, our data may not reflect the incidence or outcomes of pancreatitis among patients, who were admitted for another reason and developed pancreatitis during the hospitalization or were diagnosed with pancreatitis after admission. Moreover, due to the nature of the NIS database, each record accounts for a single hospitalization and not for an individual, which may lead to within-patient correlation. Third, NIS does not allow us to capture more granular information regarding the timing and severity of pancreatitis. Our data do not allow us to determine the reasons for discharge AMA, for example, differentiating between discharges due to inadequate symptom control and treatment versus dissatisfaction for other reasons (i.e. providers, hospital characteristics, etc.). Despite these limitations, we believe this study offers important insights into factors that may help prevent discharge AMA and therefore improve overall outcomes in patients with pancreatitis.

Future studies are necessary to examine the reasons for discharge AMA among this patient population. Improvements in treatment and symptoms control as well as identification of patients at high risk for discharge AMA may help to reduce self-discharge, readmissions, hospital costs, and subsequent morbidity.

Supplementary Material

Suppl 1. ICD9/10 Codes.

Acknowledgments

None to declare.

Financial Disclosure

None to declare.

Conflict of Interest

None of the authors has any conflict of interest to disclose.

Informed Consent

Not applicable.

Author Contributions

FC, RA, and FA designed the study, acquired the database and performed the statistical analysis. FC, RA, FA, NL, and WH performed the background search and drafted the manuscript. WH supervised the study and made critical revisions of the manuscript. FC, RA, FA, and MA constructed all tables and figures.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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