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Time-trends, Predictors and Outcome of Emergency Department Utilization for Gout: A Nationwide U.S. Study

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Abstract

Objective—To assess gout-related emergency department (ED) utilization/charges and discharge disposition.

Methods—We used the U.S. National ED Sample (NEDS) data to examine the time-trends in total ED visits and charges and ED-related hospitalizations with gout as the primary diagnosis. We assessed multivariable-adjusted predictors of ED charges and hospitalization for gout-related visits using the 2012 NEDS data.

Results—There were 180,789, 201,044 and 205,152 ED visits in years 2009, 2010 and 2012 with gout as the primary diagnosis, with total ED charges of \$195, \$239 and \$287 million, respectively; these accounted for 0.14-0.16% of all ED visits. Mean/median 2012 ED charges/visit were \$1,398/\$956. Of all gout-related ED visits, 7.7% were admitted to the hospital in 2012. Mean/median length of hospital stay was 3.9/2.6 days and mean/median inpatient charge/admission was \$22,066/\$15,912 in 2012. In multivariable-adjusted analyses, older age, female gender, highest income quartile, being uninsured, metropolitan residence, Western U.S. hospital location, heart disease, renal failure, congestive heart failure (CHF), hypertension, diabetes, osteoarthritis and chronic obstructive pulmonary disease (COPD) were associated with higher ED charges. Older age, Northeast location, Metropolitan teaching hospital, higher income quartile, heart disease, renal failure, CHF, hyperlipidemia, hypertension, diabetes, COPD, and osteoarthritis were associated with higher odds where as self-pay insurance status was associated with lower odds of hospitalization following an ED visit for gout.

Conclusions—Absolute ED utilization and charges for gout increased over time, but relative utilization remained stable. Modifiable comorbidity factors associated with higher gout-related utilization should be targeted to reduce morbidity and healthcare utilization.

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Keywords

Gout; emergency room; utilization; outcomes; charges; hospitalization; discharge disposition; hospital admission; inpatient utilization; healthcare utilization

Gout is the commonest inflammatory arthritis in adults. The prevalence of gout is increasing in the U.S.; according to the NHANES 2007-08, 3.9% of the U.S. population reported physician-diagnosed gout (1). Associated comorbidity burden makes gout a challenging disease to treat, at least partially related to contraindications to the use of gout medications and drug-drug interactions in the presence of renal failure, heart failure etc. (2). Appropriate treatment can help achieve target serum urate <6 mg/dl and lead to disease remission (i.e. “cure”) (3). The exact opposite of this excellent outcome is the suboptimal quality of care (4, 5), associated with frequent flares with significant decrement in mobility, function and quality of life (6).

Uncontrolled gout can lead to frequent emergency department (ED) and inpatient visits (7-9). Higher healthcare costs due to ED/inpatient visits compared to lower cost outpatient visits are undesirable. In a single tertiary care center retrospective case-control study (n=48 each) of recurrent hospital admissions for gout, medical comorbidity, hyperuricemia and inadequate allopurinol use were associated with recurrent admissions in unadjusted analyses (10); this study did not study gout admissions after an ED visit, or perform analyses adjusted for potential confounders. In a two-nation descriptive epidemiology study, Robinson et al. reported an increase in hospitalizations with gout as primary reason/diagnosis over time both in New Zealand and the UK (11). Comorbidities were common in these patients, but no analyses were performed to assess whether they predicted ED charges, or the risk of hospitalization (11).

In a recent study of the U.S. Nationwide Emergency Department Sample (NEDS; now “National”) data from 2006-08, gout accounted for approximately 0.2% of all ED visits in the U.S., with slight increase in gout-related ED utilization from 2006 to 2008 (7). The previous study only examined predictors of ED charges and patient characteristics of gout vs. non-gout visits (7); specific comorbidities were not examined as predictors and the study did not examine patient disposition after an ED visit for gout or the predictors of hospitalization after an ED visit for gout (7). Therefore, it is not known which subgroups of gout patients should be the highest priority for reduction of health care utilization for gout in the future. Hospitalization is one of the most expensive types of health care treatment in the U.S., with only 7% of Americans hospitalized accounting for 29% of all healthcare expenses (12). To our knowledge, there are no studies of gout-related hospitalization following an ED visit using a representative sample.

A rapidly increasing prevalence of gout in the U.S. (1) raises the question whether gout-related utilization is also increasing rapidly over time. Given the knowledge gap in this area, a contemporary analysis of gout-related ED and inpatient utilization is needed. Knowledge of modifiable factors associated with hospitalization after an ED visit can allow us to potentially develop interventions to reduce it in the future. Our objective was to use contemporary U.S. NEDS data to perform a comprehensive study to: (1) study whether

specific comorbidities are associated with ED charges for gout; (2) assess the predictors of inpatient admission, including specific comorbidities, among patients presenting to ED with gout; and (3) obtain updated estimates of ED visits and ED charges due to gout.

Methods

Data Source and Study population

We used the discharge data from the NEDS, Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality for years 2009, 2010 and 2012 (2011 data were not available at the time of study conduct due to data duplication) (13). The NEDS describes emergency department (ED) visits in the U.S. and produces national estimates about ED visits across the country. NEDS is the largest, publicly available, all-payer U.S. ED database that contains a 20-percent stratified sample of ED visits from across the U.S. (13). Weights are used to calculate national estimates. For example, 31 million ED visits were weighted to calculate the national estimates related to 134 million ED visits in 2012 in the U.S. (13). The representativeness of NEDS makes it a great resource for conducting health services and outcomes research.

NEDS was constructed using the HCUP State Emergency Department Databases (SEDD) and the State Inpatient Databases (SID) (13). Between 24 states in 2006 and 30 states in 2012 contributed data that included 950 U.S. hospitals. The SEDD capture discharge information on ED visits that do not result in a hospital admission; the SID have information on patients initially seen in ED and then admitted to the same hospital (13). NEDS contains event-level data but not unique identifiers so that individuals may be represented by multiple visits in any given year. The Institutional Review Board at the University of Alabama at Birmingham approved the study.

For this study, we limited major analyses to ED visits with gout as the primary diagnosis, using the International Classification of Diseases, Common Modification (ICD-9-CM) code of 274.xx, a validated approach to identify gout ED visit (14). In addition, we estimated inpatient and total charges for admissions for visits with gout as primary or secondary diagnosis to assess the overall burden of gout.

Covariates

In addition to providing information related to the reasons for ED visit (diagnoses and procedures performed), NEDS includes several other important patient and hospital characteristics. Patient variables include age, sex, insurance status, residence [urban vs. rural], annual median household income estimated using residential zip code. Hospital characteristics include geographical region, metropolitan or non-metropolitan, and whether teaching vs. non-teaching hospital. For each visit in NEDS, up to 15 ICD-9-CM diagnostic codes, nine ICD-9-CM procedures and 15 additional procedures coded using Current Procedural Terminology (CPT) are provided.

Outcomes of Interest

We examined predictors of two outcomes of interest, ED charges and ED discharge to inpatient setting, i.e., hospitalization (reference, discharge to home or other) with gout as the primary diagnosis. Time-trends in ED utilization and ED charges for ED visits, and inpatient and total (ED + hospital) charges for hospitalizations due to gout as the primary diagnosis after an ED visit for gout, were also assessed.

Statistical analysis

We calculated weighted national frequency of gout visits for each study year (2009, 2010 and 2012) with gout as the primary diagnosis. We also examined summary statistics for gout-visit ED charges, absolute and proportion of all ED charges.

We undertook analyses of factors associated with outcomes of gout-related ED visits (charges, disposition) using data from NEDS 2012, i.e. the most recent year. We included patient- and hospital characteristics as potential predictors of outcomes in these two groups of patients presenting with gout as the primary diagnosis for their ED visit. We performed multivariable-adjusted logistic regression (disposition) or linear regression (charges, length of stay) using SAS version 9.3 (SAS corporation, Cary, NC, USA).

Results

Gout-related ED visits: Patient Characteristics, Burden, Time trends and Outcomes

In 2009, 2010 and 2012, gout was responsible for 0.14%, 0.16% and 0.15% of all ED visits (Table 1); the total numbers of ED visits in these years were 130, 130 and 134 million, respectively. Characteristics were similar across various years for people with ED visits with gout as the primary diagnosis (Table 1). Mean age was 55 years, 23% were female, 75% were seen at a metropolitan area hospital and 14% were in the highest quartile of household income. We did not note any time-trends in patient characteristics, except the proportion seen at teaching hospitals, which increased from 25% in 2009 to 39% in 2012.

There were 180,789, 201,044 and 205,152 ED visits in years 2009, 2010 and 2012 with gout as primary diagnosis, respectively (Table 2). Total ED charges for gout were \$195 million in 2009 and \$287 million in 2012. For ED visits with gout as primary diagnosis that resulted in inpatient admission, total charges were \$299 million in 2009 and \$350 million in 2012 (Table 3). Total (ED + hospital) charges for patients admitted to the hospital with gout as primary or secondary diagnosis after an ED visit were \$14.1 billion in 2009 and \$18.3 billion in 2012 (Table 2).

Of the ED visits with gout as the primary diagnosis in 2012, 91.3% resulted in discharge to home and 7.7% in hospital admissions (Table 3). Mean and median 2012 ED charges/inpatient visit were \$1,398 and \$956, respectively. For gout-related hospitalization after ED visit, the median length of hospital stay was 2.6 days (interquartile range, 1.46-4.24; mean, 3.9 days) and median total hospital charges were \$15,912 (interquartile range, 9,655-26,764; mean, \$22,066) in 2012 (Table 3).

Predictors of Gout-related ED charges

In multivariable-adjusted analyses, older age, female gender, highest quartile of household income, uninsured/no charge insurance status, metropolitan area patient residence and hospital location in Western U.S. were associated with higher ED charges (Table 4). The presence of heart disease, congestive heart failure (CHF), hypertension, diabetes or chronic obstructive pulmonary disease (COPD) were each associated with higher ED charges, ranging \$117-\$196 more for each comorbidity, but not hyperlipidemia. Renal failure in patients with gout was associated with \$647 higher and osteoarthritis with \$551 higher ED charges, compared to their absence, for gout-related ED visits (Table 4).

Predictors of Gout-related hospital admission

In univariate analyses, older age, female sex, higher household income, Medicare insurance status, patient residence in metropolitan area, hospital location in the Northeast region, or status as a metropolitan teaching hospital and presence of chronic conditions were associated with a higher risk of hospital admission among patients with gout-related ED visits (Table 5).

Multivariable-adjusted analyses showed that compared to age <50, older age was associated with increasing higher odds of hospitalization, while sex was no longer associated (Table 5). Compared to Medicare coverage, a self-pay status was associated with lower odds of hospitalization. Location of hospital in regions other than Northeast was associated with lower odds of hospitalization, where as or Metropolitan teaching hospital status and higher income quartile were associated with higher odds (Table 5). The presence of coronary heart disease (CHD), hyperlipidemia, congestive heart failure, hypertension, diabetes, COPD were each associated with 1.38-2.41 times higher odds of hospitalization in those presenting to the ED with gout as the primary diagnosis (Table 5). The presence of renal failure was associated with 8-times higher odds of hospitalization and osteoarthritis was associated with 4.25-times higher odds of hospitalization for gout (Table 5).

Discussion

We used 2009-2012 NEDS data to study time-trends in ED and inpatient charges/utilization due to gout and assessed whether specific comorbidities predicted ED charges and hospitalization using the 2012 NEDS data. To our knowledge, this study is the first to provide U.S. national estimates of overall charges for (not just ED charges) and the first study to examine the predictors of inpatient utilization for gout after an ED visit using a representative U.S. sample. Specific comorbidities were examined as potential predictors of ED charges. We updated the estimates of gout-related ED utilization and charges, from 2008 to current (7). Our current study fills several knowledge gaps. Several study findings regarding gout-related utilization in a U.S. national sample merit further discussion.

A novel study observation was the identification of factors predictive of hospitalization after an ED visit for gout as the primary diagnosis in a national U.S. representative cohort. Other single- or multi-center studies have shown that more frequent gout attacks, higher serum urate, higher non-emergent gout-related utilization and heart disease were associated with

higher gout-related emergency/urgent care visits (8, 9, 15). However, these studies did not include a representative sample or were focused on time-trends in hospitalization (11) or recurrent gout hospitalizations at a tertiary care center (10). Our study showed that compared to age <50, older age was associated with higher odds, while self-pay, location of hospital in a region other than Northeast or Metropolitan teaching hospital status, were each associated with lower odds of hospitalization. Presence of heart disease, hyperlipidemia, congestive heart failure, hypertension, diabetes, COPD, renal failure and osteoarthritis were each significantly associated with the risk of hospitalization, but sex was not.

Thus, our study identified several new correlates of gout-related hospitalization after an ED visit for gout. Of note, renal failure was associated 8-times odds, osteoarthritis with 4.5-times, while heart disease and other comorbidities with 1.5-2.5 times odds of gout-related hospitalization after an ED visit for gout. The risk imparted by renal failure of 8-times for gout-hospitalization after an ED visit for gout in 2012 was much higher than the 3.1-times higher odds of hospital admission after an ED visit due to renal failure in chronic obstructive pulmonary disease (COPD) visits in 2012, using the same set of covariates in multivariable models (16). This finding identifies renal failure as a highly significant comorbidity in patients with gout, and establishes its impact on health care utilization related to gout ED visits and subsequent health care utilization. The associations of comorbidities with hospitalization are novel findings, and illustrates that not all comorbidities are created equal, as it relates to hospitalization risk in patients with gout. This finding can also allow for identification of groups at the highest risk of hospitalization for gout. This information can be utilized in two ways.

This new knowledge may allow risk prediction and prognostication for clinical care and health care policy and planning. Policy makers can use this information for resource allocation and quality improvement. Researchers can use this information to develop interventions targeting modifiable factors, such as comorbidities, to reduce healthcare utilization in patients with gout. It remains to be seen whether optimization of treatment of specific comorbidities such as renal failure, osteoarthritis, COPD etc. in the outpatient settings can reduce gout-related ED utilization. Several factors associated with a higher risk of hospitalization and ED charges, such as age, gender, residence, the type of hospital where patients are seen, are not modifiable; however, knowledge of these associations adds to the current knowledge and our understanding of gout-related ED and subsequent inpatient utilization. Our study extends a similar finding of association of comorbidities with higher hospitalization risk after ED visits for other conditions (17, 18) to ED visits for gout.

In our study, we found that ED charges for gout increased from \$195 million in 2009 to \$287 million in 2012; a previous study using the same dataset reported ED charges of \$128 million in 2006 (7). Thus, total ED visit charges for gout in the U.S. have increased 47% and 124% over the last four and seven years, respectively. This important finding indicates an increasing public health burden of gout. This increase may be due to a higher gout medication cost (19), a higher cost of ED services (20, 21) and/or a higher complexity of patients (22) over the study period. The median charges/ED visit increased from \$749 in 2009 to \$956 in 2012, a 28% increase in 4 years. Similarly, hospital charges for those admitted with gout as primary diagnosis increased from \$13,609 to \$15,902, a 17% increase

from 2009 to 2012. The total charges for patients who were admitted with gout (primary or secondary diagnosis) were \$14.1 billion in 2009 and \$18.3 billion in 2012, a 30% increase. Thus, our findings in conjunction with the earlier NEDS study (7) provide an analysis of time-trends in gout-related ED and inpatient utilization and charges in the U.S.. Gout-related ED visits accounted for 0.14% of all ED visits, which mirrors the earlier NEDS data from 2006-2008 (7).

Another novel finding from our study was that all comorbidities except hyperlipidemia predicted higher ED charges for ED visits due to gout. Specifically, the presence of heart disease, CHF, COPD, renal failure, hypertension, diabetes and osteoarthritis each predicted higher ED charges in patients with gout. The increase in adjusted ED charges ranged from \$117 for CHF to \$647 for renal failure, demonstrating the differential effect of various comorbidities on ED charges and the risk of hospitalization in patients presenting to ED with gout as the primary diagnosis. This has a practical implication, i.e., with limited resources, one can focus on comorbidities that are the costliest and/or associated with the highest risk. We also confirmed previously noted findings that Western US location, metropolitan hospital, female sex and older age were associated with higher ED charges in patients with gout (7).

Our study has several limitations, which must be considered while interpreting findings. NEDS counts visits, not people, therefore some patients may have had more than one visit; also repeat ED visits are of great interest from clinical and policy perspective, but can not be studied using NEDS, since data are visit-based, not patient-based. Important gout-related disease severity variables and serum urate were not available in NEDS to adjust in the analyses, which may have led to residual confounding. NEDS does not have medication data or link to outpatient records. Therefore, it was not possible to conduct medication-related analyses that could have provided valuable insight, or assess outpatient treatment of gout or the number of outpatient diagnosis to better understand their relationship to ED visits. Generalizability to other countries may not be possible, since health care settings might differ.

Our study estimated the total charges secondary to ED visits and hospitalizations not the actual healthcare costs. It is likely the charges are inflated and the actual costs are lower. We did not adjust charges for inflation due to a short study period, since inflation was historically low during the course of this study period; however, we recognize this as a potential limitation. One would expect the charges to be higher with comorbidities, since comorbidities may be associated with a poorer health status and/or contraindications to certain treatments for gout. However, we were interested in assessing the impact of specific comorbidities and noted that the adjusted ED charges varied from an additional \$116 for heart failure to \$647 for renal failure in gout patients. Our study findings can not be generalized to hospitalizations due to gout that occur from non-ED settings and NEDS does not capture these data. These hospitalizations may differ in outcomes from hospitalizations after an ED visit for gout that we studied. Study of non-gout ED visits was not a study objective, and therefore detailed comparisons to other types of visits could not be made; separate publications provide similar analyses for chronic obstructive pulmonary disease (16) and for gout vs. non-gout ED visits (7).

Our study has several strengths. NEDS is the largest, representative, U.S. sample of ED visits, therefore the findings are applicable to Americans with gout. We adjusted for several patient, health care access and hospital characteristics including comorbidities common in patients with gout (important covariates and confounders), to obtain unbiased estimates.

In conclusion, in this study of 2009-2012 NEDS data, we estimated the ED and inpatient healthcare burden of gout in the U.S. general population. We described new correlates of ED-to-hospital admission and ED charges for patients with gout. Gout-related ED and inpatient charges have increased dramatically in the last few years in absolute terms. The number of ED visit with gout as the primary diagnosis increased 13% in the last 4 years, though it was stable as a proportion of all ED visits (0.14% across years). The total hospital charges for gout as the primary diagnosis were \$350 million in 2012 and were \$18.3 billion for gout as primary or secondary diagnosis in 2012. Future studies need to examine as to what aspects of comorbidity management are associated with higher charges and higher risk of hospitalization in patients with gout. This will allow us to develop interventions to target this high-risk group and design interventions.

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Table 1
Emergency department (ED) visits for gout as the primary diagnosis in year 2009, 2010 and 2012

	2009 NEDS	2010 NEDS	2012 NEDS
ED visits for gout (% of all ED visits)	180,789 (0.14)	201,044 (0.16)	205,152 (0.15)
Age, in years			
Mean [sd]	55.35 [68.06]	55.35 [71.74]	55.44 [72.47]
Median (IQR)	53.50 (42.68, 66.73)	53.61 (42.84, 66.53)	53.71 (43.31, 66.27)
Sex, n (%)			
Female	41,543 (23.00)	46,213 (22.99)	46,839 (22.83)
Patient location (residence), n (%)			
Micropolitan/not metro	45,778 (25.51)	50,593 (25.32)	47,371 (23.19)
Metropolitan (large or small)	135,683 (74.49)	151,287 (74.68)	158,918 (76.81)
Median house hold income, n (%)			
1st quartile	65,831 (37.46)	79,371 (40.55)	81,588 (40.71)
2nd quartile	49,752 (28.31)	50,845 (25.97)	48,791 (24.35)
3rd quartile	34,935 (19.88)	37,055 (18.93)	40,462 (20.19)
4th quartile	25,208 (14.34)	28,487 (14.55)	29,554 (14.75)
Primary payer, n (%)			
Medicare	62,176 (34.5)	69,960 (34.92)	72,568 (35.41)
Medicaid	19,605 (10.89)	23,724 (11.84)	27,556 (13.45)
Private insurance	55,803 (31)	57,115 (28.51)	51,329 (25.05)
Self-pay	35,608 (19.78)	42,116 (21.03)	44,042 (21.49)
Uninsured/no charge	1,654 (0.92)	1,525 (0.76)	1,199 (0.58)
Other	5,175 (2.87)	5,872 (2.93)	8,254 (4.03)
Hospital Region, n (%)			
Northeast	31,220 (17.27)	34,870 (17.34)	35,976 (17.54)
Midwest	35,146 (19.44)	39,931 (19.86)	40,729 (19.85)
South	87,427 (48.36)	98,323 (48.91)	97,904 (47.72)
West	26,997 (14.93)	27,919 (13.89)	30,543 (14.89)
Teaching status of hospital, n (%)			
Metropolitan non -teaching or non-metro	123,559 (74.77)	124,746 (64.19)	125,106 (60.98)
Metropolitan teaching	57,230 (25.23)	71,997 (35.81)	80,047 (39.02)

IQR, inter-quartile range; SD, standard deviation

Table 2
ED charges for the ED visits with gout as the primary diagnosis and ED disposition

	2009	2010	2012
All Gout ED visits with gout as the primary diagnosis, n (% of total ED visits)	180,789 (0.14%)	201,044 (0.16%)	205,152 (0.15%)
Total ED charges (US\$)	195,460,027	239,407,216	286,714,281
ED charges ^{**} per ED visit, in US\$			
Mean (SD)	1,081 (5,324)	1,190.82 (5,013)	1,398 (6,482)
Median (IQR)	749 (428-1275)	844 (505-1,399)	956 (572-1,063)
ED disposition, n (%)			
Discharged (routine) [*]	163,432 (90.40)	181,781 (90.42)	187,315 (91.31)
Admitted	15,287 (8.46)	17,422 (8.67)	15,870 (7.74)
Transferred	1,051 (0.58)	847 (0.42)	978 (0.47)
Home health care	459 (0.25)	207 (0.10)	375 (0.18)
Against medical advice	428 (0.24)	422 (0.21)	533 (0.26)
Unknown	133 (0.07)	364 (0.18)	82 (0.04)

ED, emergency department; \$, US dollar; SE, standard error; IQR, inter-quartile range

* routine discharge indicates discharge from the ED to home

** Numbers were rounded to the nearest whole digit for charges

Table 3
Charges and characteristics of Inpatient admission for gout as primary diagnosis after an ED visit and charges for Inpatient admission with gout as primary or secondary diagnosis

	2009 NEDS	2010 NEDS	2012 NEDS
Gout as the primary diagnosis for hospitalization after an ED visit			
All Gout inpatient admissions with gout as primary diagnosis * for those with ED visits	15,287	17,422	15,870
Total inpatient charges (\$)	264,984,858	321,435,900	313,448,370
Length of hospital stay, in days			
Mean (SD)	4.15 (4.42)	4.00 (4.13)	3.86 (3.38)
Median (IQR)	2.82 (1.65-4.89)	2.75 (1.53-4.53)	2.58 (1.46-4.24)
Total charges (ED and inpatient) for admitted patients (US\$)	299,472,330	357,098,734	350,187,420
Total charges ** (ED and inpatient) per visit for admitted patients, US\$)			
Mean (SD)	19,590 (35,000)	20,497 (38,073)	22,066 (17,070)
Median (IQR)	13,609 (8,093-23,246)	14,862 (8,888-24,429)	15,912 (9,655-26,764)
Gout as primary or secondary diagnosis for hospitalization after an ED visit			
All Gout inpatient admissions with gout in any position (primary or secondary) after an ED visit	445,934	472,470	498,296
Total inpatient charges (US\$)	12,671,214,610	13,896,287,640	16,118,879,008
Length of hospital stay, in days mean (SE)	4.96 (14.93)	4.81 (12.29)	4.69 (15.78)
Total charges for ED and inpatient services (US\$)	14,150,823,622	15,375,118,740	18,314,869,480

ED, emergency department; \$, dollar; SE, standard error IQR, inter-quartile range

* Gout ICD-9-CM code 274.x or 274.xx listed as the primary diagnosis

** Numbers were rounded to the nearest whole digit for charges

Table 4
Predictors of ED hospital charges among patients presenting to ER with gout using linear regression

	Univariate		Multivariable-adjusted	
	B-estimate* (95% CI)	P-value	B-estimate* (95% CI)	P-value
Age				
<50	Ref		Ref	
50- <65	135.32 (91.77, 178.87)	<0.0001	34.96 (-7.66, 77.58)	0.1077
65- <80	432.69 (373.31, 492.06)	<0.0001	194.44 (126.28, 262.59)	<0.0001
80	629.29 (529.00, 729.59)	<0.0001	297.27 (190.66, 403.88)	<0.0001
Gender				
Female (ref)	Ref		Ref	
Male	-189.66 (-233.35, -145.97)	<0.0001	-47.91 (-93.72, -2.10)	0.0404
Median household annual income				
Lowest quartile (< \$38,999)	Ref		Ref	
2nd quartile (\$39,000 to \$47,999)	15.52 (-59.21, 90.25)	0.6836	-10.64 (-82.12, 60.85)	0.7703
3rd quartile (\$48,000 to \$62,999)	161.60 (47.12, 276.08)	0.0057	61.75 (-38.56, 162.06)	0.2272
Highest quartile (\$63,000 or more)	326.75 (175.69, 477.82)	<0.0001	163.24 (20.22, 306.26)	0.0253
Primary payer				
Medicare (ref)	Ref		Ref	
Medicaid	-287.55 (-355.54, -219.56)	<0.0001	-38.93 (-111.09, 33.24)	0.29
Private insurance	-288.14 (-353.26, -223.02)	<0.0001	-36.32 (-101.06, 28.43)	0.2712
Self-pay	-407.62 (-466.61, -348.63)	<0.0001	-64.21 (-135.71, 7.29)	0.0783
Uninsured/no charge	41.58 (-231.89, 315.06)	0.7654	331.83 (48.95, 614.72)	0.0216
Other	-445.00 (-542.37, -347.64)	<0.0001	-182.50 (-284.05, -80.95)	0.0004
Patient residence				
Micropolitan/not metro	Ref		Ref	
Metro (large or small)	399.80 (302.92, 496.69)	<0.0001	297.62 (195.46, 399.79)	<0.0001
Hospital Region				
Northeast	Ref		Ref	
Midwest	-152.64 (-359.63, 54.35)	0.1481	-67.25 (-266.14, 131.65)	0.507
South	-164.93 (-358.25, 28.40)	0.0944	-25.11 (-218.92, 168.69)	0.7993
West	207.08 (16.56, 397.60)	0.0332	456.24 (263.16, 649.31)	<0.0001
Teaching status of hospital				
Metropolitan non-teaching or non-metro	Ref		Ref	
Metropolitan teaching	265.81 (130.46, 401.15)	0.0001	120.67 (-25.82, 267.16)	0.1063
Comorbidities				
CHD (ref: no)	612.59 (490.46, 734.73)	<0.0001	187.85 (64.28, 311.42)	0.0029
Hyperlipidemia (ref: no)	476.23 (383.64, 568.82)	<0.0001	79.03 (-8.63, 166.70)	0.0771
Renal failure (ref: no)	1038.97 (871.53, 1206.40)	<0.0001	646.76 (484.36, 809.16)	<0.0001
Heart failure (ref: no)	602.79 (480.09, 725.49)	<0.0001	116.96 (2.97, 230.95)	0.0443

	Univariate		Multivariable-adjusted	
	B-estimate* (95% CI)	P-value	B-estimate* (95% CI)	P-value
Hypertension (ref: no)	380.15 (320.33, 439.97)	<0.0001	121.65 (65.82,177.48)	<0.0001
Diabetes (ref: no)	466.90 (384.78, 549.03)	<0.0001	196.34 (120.43, 272.25)	<0.0001
COPD (ref: no)	571.87 (414.57, 729.16)	<0.0001	164.54 (10.59, 318.50)	0.0362
Osteoarthritis (ref: no)	901.13 (723.85, 1078.41)	<0.0001	551.31 (384.74, 717.89)	<0.0001

CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.

Significant beta estimates and odds ratios are in bold.

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Table 5
Predictors of hospital admission among patients presenting to ER with primary diagnosis of gout using logistic regression (reference, discharge to home)

	Univariate		Multivariable-adjusted	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Age				
<50	Ref		Ref	
50- <65	2.30 (2.02, 2.62)	<0.0001	1.25 (1.08, 1.44)	<0.0001
65- <80	4.69 (4.16, 5.29)	<0.0001	1.40 (1.19, 1.64)	<0.0001
80	9.25 (7.99, 10.73)	<0.0001	2.26 (1.87, 2.72)	<0.0001
Gender				
Female	Ref		Ref	
Male	0.61 (0.56, 0.66)	<0.0001	0.99 (0.90, 1.10)	0.8514
Median household annual income				
Lowest quartile (< \$38,999)	Ref		Ref	
2nd quartile (\$39,000 to \$47,999)	1.17 (0.99, 1.38)	0.0698	1.20 (1.01, 1.43)	0.0351
3rd quartile (\$48,000 to \$62,999)	1.36 (1.14, 1.62)	0.0007	1.19 (0.99, 1.43)	0.0584
Highest quartile (\$63,000 or more)	1.88 (1.54, 2.31)	<0.0001	1.22 (0.96, 1.54)	0.0982
Primary payer				
Medicare	Ref		Ref	
Medicaid	0.44 (0.36, 0.53)	<0.0001	1.01 (0.84, 1.23)	0.8844
Private insurance	0.34 (0.30, 0.38)	<0.0001	0.87 (0.75, 1.00)	0.0574
Self-pay	0.16 (0.14, 0.20)	<0.0001	0.72 (0.59, 0.87)	0.0007
Uninsured/no charge	0.31 (0.20, 0.48)	<0.0001	1.41 (0.88, 2.25)	0.1515
Other	0.38 (0.29, 0.50)	<0.0001	1.07 (0.77, 1.49)	0.686
Patient location (residence)				
Micropolitan/not metro	Ref		Ref	
Metro (large or small)	2.46 (2.08, 2.91)	<0.0001	1.60 (1.32, 1.95)	<0.0001
Hospital Region				
Northeast	Ref		Ref	
Midwest	0.60 (0.45, 0.78)	0.0002	0.49 (0.38, 0.63)	<0.0001
South	0.42 (0.33, 0.55)	<0.0001	0.47 (0.36, 0.60)	<0.0001
West	0.50 (0.38, 0.65)	<0.0001	0.33 (0.21, 0.52)	<0.0001
Hospital: Teaching status and location				
Metropolitan non-teaching or non-metro	Ref		Ref	
Metropolitan teaching	2.26 (1.88, 2.72)	<0.0001	1.41 (1.15, 1.73)	0.0008
Comorbidities				
CHD (ref: no)	6.81 (6.08, 7.64)	<0.0001	1.89 (1.65, 2.16)	<0.0001
Hyperlipidemia (ref: no)	5.98 (5.33, 6.70)	<0.0001	1.82 (1.59, 2.08)	<0.0001
Renal failure (ref: no)	21.51 (18.34, 25.22)	<0.0001	8.00 (6.82, 9.38)	<0.0001
CHF (ref: no)	8.50 (7.43, 9.72)	<0.0001	2.28 (1.95, 2.65)	<0.0001

	Univariate		Multivariable-adjusted	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Hypertension (ref: no)	6.45 (5.75, 7.24)	<0.0001	2.41 (2.11, 2.75)	<0.0001
Diabetes (ref: no)	3.87 (3.53, 4.24)	<0.0001	1.38 (1.23, 1.55)	<0.0001
COPD (ref: no)	6.40 (5.48, 7.47)	<0.0001	2.34 (1.93, 2.85)	<0.0001
Osteoarthritis (ref: no)	8.38 (7.16, 9.81)	<0.0001	4.25 (3.43, 5.26)	<0.0001

CHD, Zcoronary heart disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; Ref, reference category

Significant odds ratios and p-values are in bold.

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