Trends in Emergency Department Visits and Charges for Gout in the United States between 2006 and 2012

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ABSTRACT. ***Objective.*** To examine temporal trends in the rate of gout emergency department (ED) visits and charges in the United States between 2006 and 2012.

Methods. A serial cross-sectional analysis of the Nationwide Emergency Department Sample.

Results. The rate of ED visits for gout in adults overall increased from 75.0 to 85.4 per 100,000 persons over the study period (14% increase, $p < 0.001$), and increased 29% for those aged 45–54 years. Nationwide ED charges increased from $156 million to $281 million (80% increase, $p < 0.001$).

Conclusion. Between 2006 and 2012, the rate of gout ED visits increased among US adults, most notably in those aged 45–54 years. (J Rheumatol First Release June 1 2016; doi:10.3899/jrheum.151432)

Key Indexing Terms:
GOUT EPIDEMIOLOGY OUTCOME ASSESSMENT

Gout is a major public health concern in the United States, with a prevalence of 3.9%, or 8.3 million individuals[1]. Acute gout is an excruciatingly painful and disabling inflammatory arthritis that causes some patients to present to the emergency department (ED), incurring significant healthcare costs[2,3,4]. Despite its public health importance, to our knowledge, only 1 study examined the trends in ED visits for gout in the United States, reporting that gout accounted for 0.2% of all ED visits and $166 million in ED charges in 2008[2]. It is speculated that gout ED visits will continue to rise as a result of an increasing elderly population, which is at higher risk of acute gout attack[1]. Additionally, trends in healthcare use may have been affected by recent changes in gout medication availability. Most importantly, colchicine was patented in 2009; however, febuxostat was approved in 2009 and peglotricase in 2010. These changes could contribute to an increase in ED visits for gout because significant costs may make patients unable to access the medication. Despite these changes, contemporary data on trends in healthcare use for gout are lacking. Here, we examined temporal trends in the rate of acute gout ED visits and charges in adults between 2006 and 2012 using a nationally representative sample according to age and sex.

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MATERIALS AND METHODS

We conducted a cross-sectional analysis of data from the 2006 to 2012 Nationwide Emergency Department Sample (NEDS), a component of the Healthcare Cost and Utilization Project, sponsored by the US Agency for Healthcare Research and Quality[5]. NEDS is nationally representative of all community hospital–based ED in the United States (excluding VA hospitals)[5].

For our current analysis, we identified all ED visits for patients aged ≥ 18 years who had an International Classification of Diseases, 9th ed, Clinical Modification (ICD-9-CM) code for gout (274.xx) in the primary diagnosis fields. The institutional review board of the Massachusetts General Hospital approved this analysis (2013P002545).

NEDS contains patient demographics, ED visit date(s), diagnoses, procedures, total ED charges, and ED disposition. Primary insurance types were categorized into Medicare, Medicaid, private, and others (including uninsured). Socioeconomic status was estimated using national quartiles for median household income based on the patient's postal code and primary health insurance[5]. Elixhauser comorbidity was calculated using ICD-9-CM codes[6]. Urban-rural status for each patient residence was defined based on the National Center for Health Statistics[7]. Hospital characteristics included US region, urban–rural status, and teaching status. Geographic regions were defined according to the Census Bureau boundaries[8].

The primary outcome was the rates of gout ED visits calculated using population estimates obtained from the US Census Bureau[9]. ED visit rates were expressed as the number of estimated ED visits per 100,000 US adults of the corresponding age group per year. The secondary outcome was charges for ED services, which reflected the total facility fees reported for each ED discharge.

Statistical analysis. We examined the trends in the outcomes from 2006 through 2012 by constructing negative binominal regression models. In the sensitivity analysis, we also fitted ordinary least squares models with heteroscedasticity-robust standard errors[10]. Analyses were performed with Stata software version 13.1 (StataCorp).

To test for trends in ED charges, we fitted unadjusted linear regression models for log-transformed charge because ED charges were not normally distributed. To facilitate direct comparisons for ED charges over time, we

converted charges to 2012 US dollars using the medical care component of the Consumer Price Index[11]. We estimated total charges as a weighted sum of case-level charges based on the hospital sampling ratios.

RESULTS

Patient and ED characteristics. We identified a total of 293,913 ED visits with a primary diagnosis of gout in NEDS between 2006 and 2012 corresponding to a US national estimate of 1,309,448 ED visits. A primary diagnosis of gout accounted for 0.19% (95% CI 0.18–0.19) of all ED visits for adults aged ≥ 18 years. The patient and ED characteristics are shown in Table 1. Adults aged 18–64 years accounted for about 70% of overall gout ED visits; 77% were men. Patients with the lowest quartile for median household income contributed about 40% of ED visits. Although Medicare health insurance coverage was stable during the study period (about 35% of total subjects), the proportion of subjects of other insurance varied. Additionally, patients were more likely to have comorbidities including hypertension, diabetes, renal failure, and obesity (all p for trend < 0.01) in recent years. Patients who had at least 1 comorbidity contributed half of the gout ED visits in 2012.

The overall number of ED visits for gout increased from 75.0 to 85.4 per 100,000 US adults during the study period (14% increase, p for trend < 0.001; Table 2). There was no significant difference in the rate of ED visits between the

Table 1. Patient and hospital characteristics in adults presenting to the emergency department with gout. Data are % (95% CI) unless otherwise specified.

Variables	2006	2007	2008	2009	2010	2011	2012	p
Unweighted sample, n	36,117	37,825	40,131	40,012	44,379	47,599	47,850	
Weighted sample, n	168,410	171,743	174,823	180,789	201,044	207,487	205,152	
Patient characteristics*								
Age, yrs								0.22
18–64	70.0 (69.0–70.9)	69.8 (69.0–70.7)	71.6 (70.7–72.5)	70.2 (69.4–71.1)	70.8 (70.0–71.6)	69.9 (69.0–70.8)	71.3 (70.4–72.2)	
≥ 65	30.0 (29.1–31.0)	30.2 (29.3–31.0)	28.4 (27.5–29.3)	29.8 (28.9–30.6)	29.2 (28.4–30.0)	30.1 (29.2–31.0)	28.7 (27.9–29.6)	
Male	78.1 (77.4–78.7)	77.2 (76.6–77.8)	77.6 (76.9–78.2)	77.0 (76.3–77.7)	77.0 (76.4–77.6)	77.1 (76.5–77.8)	77.2 (76.6–77.7)	0.07
Primary health insurance								
Medicare	35.9 (34.9–36.9)	34.8 (33.9–35.8)	33.7 (32.7–34.6)	34.5 (33.6–35.5)	34.9 (34.0–35.8)	36.4 (35.3–37.5)	35.4 (34.5–36.3)	0.23
Medicaid	11.4 (11.0–11.7)	9.5 (9.0–10.2)	9.7 (9.0–10.4)	10.7 (10.0–11.4)	10.9 (10.2–11.6)	11.8 (11.1–12.6)	12.7 (12.1–13.4)	< 0.001
Private	29.8 (29.3–30.4)	33.0 (31.7–34.2)	33.0 (32.0–34.1)	33.0 (31.8–34.1)	31.0 (30.0–32.4)	28.5 (27.4–29.6)	27.0 (25.8–28.2)	< 0.001
Other	23.7 (23.0–24.4)	21.6 (20.5–22.8)	22.5 (21.3–23.7)	22.7 (21.6–23.8)	23.6 (22.0–25.2)	24.7 (23.5–26.0)	23.9 (22.4–25.5)	< 0.001
Median household income, $								
1–38,999	35.9 (33.3–38.5)	38.8 (36.2–41.3)	37.0 (34.5–39.7)	37.5 (34.4–40.7)	40.6 (37.1–44.1)	39.3 (36.8–41.8)	40.7 (38.0–43.5)	0.01
39,000–47,999	25.7 (24.0–27.4)	26.2 (24.6–27.9)	28.3 (26.5–30.2)	28.3 (26.3–30.5)	26.0 (23.8–28.3)	24.5 (22.8–26.3)	24.4 (22.7–26.0)	0.04
48,000–63,999	21.2 (19.7–22.8)	19.7 (18.3–21.2)	19.1 (17.6–20.6)	19.9 (18.2–21.7)	18.9 (17.1–20.9)	21.3 (19.8–23.0)	20.2 (18.3–22.2)	0.81
64,000 or more	17.3 (15.4–19.3)	15.4 (13.5–17.5)	15.6 (13.7–17.7)	14.4 (12.5–16.4)	14.6 (12.6–16.8)	14.9 (13.2–16.8)	14.8 (13.0–16.8)	0.11
Elixhauser comorbidity†	41.1 (39.5–42.8)	44.7 (43–46.3)	45.5 (43.7–47.2)	47.5 (45.5–49.5)	49.9 (47.9–52)	51.6 (49.7–53.5)	49.1 (47.2–51.1)	< 0.001
Congestive heart failure	4.0 (3.7–4.4)	4.2 (3.9–4.5)	4.1 (3.7–4.5)	4.1 (3.7–4.4)	4.2 (3.8–4.6)	4.8 (4.3–5.2)	4.1 (3.7–4.6)	0.14
Hypertension	32.8 (31.2–34.4)	35.6 (34.1–37.2)	36.8 (35.1–38.5)	38.6 (36.7–40.6)	41.5 (39.5–43.5)	42.9 (41.2–44.8)	40.5 (38.8–42.3)	< 0.001
Diabetes without complications	12.1 (11.5–12.7)	13.5 (12.8–14.1)	13.4 (12.7–14.1)	13.7 (13.0–14.5)	15.1 (14.3–15.9)	15.5 (14.7–16.3)	14.6 (13.9–15.4)	< 0.001
Diabetes with complications	0.9 (0.8–1.0)	1.0 (0.9–1.2)	1.1 (0.9–1.2)	1.1 (1.0–1.3)	1.1 (1.0–1.3)	1.3 (1.1–1.5)	1.3 (1.1–1.5)	0.003
Renal failure	4.5 (4.1–5.0)	5.1 (4.7–5.5)	5.0 (4.5–5.5)	5.4 (5.1–5.9)	5.8 (5.3–6.3)	6.6 (6.1–7.2)	6.1 (5.6–6.7)	< 0.001
Obesity	1.7 (1.5–1.9)	1.8 (1.6–2.0)	2.2 (1.9–2.4)	2.2 (2.0–2.5)	2.6 (2.4–2.9)	2.9 (2.6–3.2)	2.9 (2.5–3.3)	< 0.001
Alcohol abuse	1.0 (0.8–1.1)	0.8 (0.7–1.0)	0.9 (0.8–1.1)	1.0 (0.8–1.1)	0.9 (0.8–1.1)	1.0 (0.9–1.2)	1.1 (0.9–1.2)	0.08
Patient residence								0.45
Rural area	24.2 (21.5–27.1)	25.3 (22.9–27.9)	25.3 (22.8–28.1)	25.5 (22.1–29.3)	25.3 (21.6–29.4)	24.2 (21.8–26.8)	23.2 (20.9–25.7)	
Urban area	75.8 (72.9–78.5)	74.7 (72.1–77.2)	74.7 (71.9–77.2)	74.5 (70.7–77.9)	74.7 (70.6–78.4)	75.8 (73.2–78.2)	76.8 (74.3–79.1)	
Hospital characteristics								
Region								
Northeast	20.6 (17.3–24.2)	18.7 (15.9–21.9)	17.7 (15.0–20.9)	17.3 (14.6–20.3)	17.3 (14.7–20.4)	17.6 (15.0–20.5)	17.5 (14.6–20.9)	0.18
Midwest	17.5 (14.9–20.6)	18.3 (15.7–21.2)	18.8 (16.1–21.7)	19.4 (16.4–22.8)	19.9 (16.7–23.4)	19.8 (16.7–23.2)	19.9 (16.8–23.4)	0.24
South	47.4 (43.6–51.3)	49.1 (45.3–52.8)	48.5 (44.7–52.3)	48.4 (44.1–52.7)	48.9 (44.4–53.5)	48.6 (45.0–52.2)	47.7 (43.5–52.0)	0.99
West	14.5 (12.2–17.2)	13.9 (11.7–16.5)	15.0 (12.8–17.6)	14.9 (12.6–17.6)	13.9 (11.7–16.4)	14.0 (12.0–16.3)	14.9 (12.7–17.4)	0.97
Location/teaching status								
Urban nonteaching	40.6 (37.0–44.3)	42.7 (39.1–46.4)	43.5 (39.9–47.2)	43.1 (39.2–47.2)	39.7 (35.7–43.9)	41.0 (37.6–44.6)	38.7 (34.9–42.7)	0.40
Urban teaching	35.6 (31.6–39.8)	32.8 (29.0–36.9)	32.2 (28.4–36.2)	31.7 (27.7–35.9)	35.8 (31.5–40.4)	35.5 (31.9–39.3)	39.0 (34.6–43.7)	0.08
Rural	23.8 (20.8–27.1)	24.5 (21.8–27.4)	24.3 (21.5–27.4)	25.2 (21.3–29.7)	24.5 (20.3–29.2)	23.5 (21.0–26.2)	22.3 (19.7–25.0)	0.40

* Percentages may not equal 100 due to rounding. † Comorbidity was defined as at least 1 Elixhauser comorbidity measure.

Table 2. Rate of ED visits and charges for ED services among US adults presenting to the ED with gout, 2006–2012. Data are % (95% CI) unless otherwise specified.

Variables	2006	2007	2008	2009	2010	2011	2012	p*
All ED visits, any complaint, per 100,000 population								
	41,680	41,968	42,843	43,219	43,983	43,825	44,347	< 0.001
Visits for gout per 100,000 population								
	75 (69–81)	76 (70–81)	76 (70–82)	78 (71–84)	86 (78–93)	87 (81–94)	85 (78–93)	< 0.001
Visits for gout in both sexes, stratified by age, yrs								
18–34	24 (22–26)	23 (21–25)	24 (22–26)	24 (22–26)	26 (24–28)	24 (22–26)	26 (23–28)	0.001
35–44	76 (69–82)	78 (72–84)	82 (75–89)	81 (73–88)	90 (81–100)	89 (82–96)	87 (79–96)	< 0.001
45–54	87 (80–95)	88 (80–95)	92 (85–100)	94 (85–102)	104 (94–114)	109 (100–118)	112 (102–122)	< 0.001
55–64	97 (89–106)	98 (90–106)	97 (89–105)	99 (89–108)	109 (98–119)	112 (102–121)	110 (99–120)	< 0.001
≥ 65	136 (125–147)	137 (126–148)	128 (118–138)	136 (124–148)	145 (132–158)	151 (140–162)	137 (125–148)	0.16
Visits for gout in women, stratified by age, yrs								
18–34	5.8 (5.0–6.5)	5.4 (4.7–6.2)	5.4 (4.7–6.1)	5.6 (4.8–6.4)	5.9 (5.1–6.7)	5.4 (4.7–6.1)	6.8 (5.9–7.6)	0.30
35–44	13 (12–15)	13 (12–15)	15 (13–17)	16 (13–18)	16 (14–18)	17 (15–19)	17 (15–19)	< 0.001
45–54	25 (22–27)	25 (22–27)	27 (24–29)	27 (24–30)	29 (26–32)	31 (28–34)	32 (28–36)	< 0.001
55–64	45 (41–50)	46 (42–50)	47 (42–51)	48 (42–53)	52 (46–58)	54 (48–59)	53 (47–58)	< 0.001
≥ 65	90 (82–98)	97 (89–105)	90 (82–98)	95 (87–104)	106 (96–116)	104 (96–112)	96 (87–104)	0.14
Charges for ED services per visit, $, median (IQR)								
	926 (886–967)	979 (938–1019)	1069 (1023–1115)	1176 (1115–1237)	1245 (1189–1300)	1400 (1321–1479)	1370 (1308–1432)	< 0.001
Total charges, $ (millions), median (IQR)	156 (149–163)	168 (161–175)	187 (179–195)	213 (202–224)	250 (239–261)	291 (274–307)	281 (268–294)	< 0.001

* P value was calculated using negative binominal regression models. ED: emergency department; IQR: interquartile range.

2006–2009 and the 2010–2012 periods (p = 0.24). Table 2 shows the comparison of the rate of ED visits for gout across different age groups. Adults ≥ 65 years had the highest rate of ED visits for gout, and there was a significant increase in the rate of ED visits until 2011 (from 136.0 to 151.2 per 100,000, 11% increase, p for trend = 0.006). However, the rate of ED visits dropped between 2011 and 2012 (from 151.2 to 136.5 per 100,000). Among adults aged 18–64 years, the ED visit rate increased most significantly among adults aged 45–54 years (from 87.4 to 112.0 per 100,000, 29% increase, p < 0.001), followed by adults aged 35–44 years (from 75.6 to 87.4 per 100,000, 16% increase, p < 0.001) and adults aged 55–64 years (from 97.1 to 110 per 100,000, 13% increase, p for trend < 0.001). Although the majority of ED visits occurred in men, this trend was also seen among women aged 45-54 years (from 25 to 32.3 per 100,000, 32% increase, p < 0.001), 35-44 years (from 13.2 to 16.6 per 100,000, 26% increase, p < 0.001), and 55–64 years (from 45.3 to 52.7 per 100,000, 16% increase, p < 0.001).

Between 2006 and 2012, the median ED charges increased from $926 per visit [interquartile range (IQR) $886–967] to $1370 (IQR $1308–1432, 48% increase, p for trend < 0.001; Table 2). Likewise, the nationwide charges for gout ED visits increased $125 million over the study period, from about $156 million to $281 million (80% increase, p < 0.001; Table 2).

DISCUSSION

In our analysis of a large, nationally representative database for US ED visits, rates of ED visits for gout among adults increased by 14% from 2006 to 2012. The rate of ED visits for gout did not decrease after 2009, suggesting that the management of chronic gout remains suboptimal despite new gout drug approvals since 2009. As expected, adults aged ≥ 65 had the highest rate of ED visits for gout, indicating that elderly patients substantially contribute to national healthcare costs for gout. Concurrent with the overall increase in gout ED visit frequency was an 80% increase in the national charges for gout ED visits. Our findings build upon studies that reported substantial charges attributable to ED use because of gout[2,3,4]. Together, these findings suggest an important effect of suboptimal gout care in the outpatient setting, and reinforce the urgent need to improve gout management in the context of existing effective therapies to limit further increases in healthcare use owing to gout.

Of interest in our finding is that the rate of ED visits for gout significantly increased among middle-aged adults, including women. Although women are thought to develop gout at a later age than men[12], our results suggest that middle-aged women are also at increased risk of developing gout. The reasons for this pattern are not entirely clear, but may include increasing gout incidence/severity, increasing prevalence of gout risk factors, and differences in gout management or healthcare use for chronic gout[13,14,15]. We observed greater prevalence of comorbidities including obesity, hypertension, diabetes, and renal failure over the study period, suggesting that an increasing burden of risk factors for gout may have contributed to the increased healthcare use for gout. We were unable to assess whether

change of insurance within the study population contributed to the study findings, although distribution of insurance coverage did not change drastically during the study period. We could not evaluate whether treatment for gout was optimal across different age groups because NEDS does not contain these data. Interestingly, our finding that mean charges for gout increased over the study period are in contrast to a simultaneous decline in median household income in the United States during the study period, which adjusted for inflation declined from $54,894 to $51,017[8]. While ED visits for gout increased 14% during the study period, there was only a 6.4% increase in ED visits overall, suggesting that the increase in gout visits is not solely attributable to increased use in general. Further studies are warranted to determine the reasons for increased incidence for ED visits among middle-aged men and women and to assess the use of specific gout management strategies.

Our present study had several limitations. Diagnoses of gout relied on ICD-9 code and we were unable to confirm through laboratory data such as presence of monosodium urate crystals in synovial fluid. Additionally, we were not able to examine changes in coding/billing practices over time. It is theoretically possible that diagnostic transfer may partly explain an increase in application of gout as a primary diagnosis, but this alone would not affect the large increase in charges reported in our study. Second, NEDS contains event-level records, not patient-level records. Therefore, we could not perform patient-level analyses such as adjustment for patient-level gout risk factors. Third, we estimated charges attributable to gout-related ED visits and not the actual health costs because charge-cost ratios are not available in NEDS. Fourth, NEDS does not include laboratory or medication data, prohibiting further analysis of acute gout management patterns.

Despite the limitations, our study provides valuable insight into the patterns of healthcare use for gout. The increasing number and rate of ED visits has implications for healthcare systems and providers. The 80% increase in charges for patients with gout during the study period likely reflects an important effect on patients, payers, and society in general.

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