Qual Life Res (2008) 17:815–822
DOI 10.1007/s11136-008-9355-0

The disutility of chronic gout

Dinesh Khanna · Mansoor Ahmed · Dustin Yontz · Shaari S. Ginsburg · Grace S. Park · Anthony Leonard · Joel Tsevat

Accepted: 28 April 2008 / Published online: 24 May 2008

Abstract
Introduction Gout is a chronic painful inflammatory arthritis. Data regarding the impact of gout on health-related quality of life, however, are limited.
Methods We interviewed patients with chronic stable gout. Health status was measured by using the Short Form 36 (SF-36) physical component summary (PCS) and physical component summary (MCS) and the Health Assessment Questionnaire-Disability Index (HAQ-DI). Direct preference-based measures included a health rating scale (RS), the time tradeoff (TTO), and standard gamble (SG) for one's current health state with gout and current health state without gout; indirect preference-based measures included the SF-6D and the EQ-5D. Disutilities for gout were assessed by subtracting preference scores for current health states with gout from those for current health without gout and were compared between patients ranking gout as their top health concern versus the rest of the patients.
Results Of the 80 interviewees, 72 (90%) were male, 55 (69%) were Caucasian, and the mean (SD) age was 60 (11) years. The mean SF-36 PCS and MCS scores were 38.9 and 48.6, respectively. The mean (SD) SF-6D score was 0.68 (0.13) and the mean (SD) EQ-5D score was 0.73 (0.23). The mean (SD) RS disutility for gout was 0.05 (0.12), the mean TTO disutility was 0.03 (0.12), and the mean SG disutility was 0.02 (0.11). The RS disutilities of subject patients who ranked gout as their top concern ($n = 17$) trended towards being statistically significantly larger than those of the remaining patients, $P = 0.06$ but their TTO and SG disutilities were similar to those of the remaining patients.
Conclusion Although physical functioning of patients with gout is often compromised, patients with chronic stable gout do not assign a large disutility to gout per se. Still, patients who rank their gout as their top health concern tend to assign greater RS disutility to gout than do other patients.

Keywords Gout · Preference-based measures · Health status · Health utility · Health-related quality of life

D. Khanna (✉) · G. S. Park
Division of Rheumatology, Department of Medicine, David Geffen School of Medicine, University of California at Los Angeles, 1000 Veteran Avenue, Rm 32-59 Rehabilitation Building, Los Angeles, CA 90095, USA
e-mail: dkhanna@mednet.ucla.edu

D. Khanna
Department of Health Services, School of Public Health, University of California at Los Angeles, Los Angeles, CA, USA

M. Ahmed · S. S. Ginsburg · J. Tsevat
Department of Internal Medicine, University of Cincinnati, Cincinnati, OH, USA

D. Yontz · J. Tsevat
University of Cincinnati College of Medicine, Cincinnati, OH, USA

A. Leonard · J. Tsevat
Institute for the Study of Health, University of Cincinnati, Cincinnati, OH, USA

J. Tsevat
Veterans Affairs Medical Center, Cincinnati, OH, USA

Gout is a common chronic disorder of uric acid metabolism punctuated by acute painful arthritis attacks [1, 2]. Although acute gout attacks are seemingly debilitating, information on the overall impact of gout on patients'

health-related quality of life (HRQOL) is limited. A recent literature review revealed only one study, which showed that, after adjusting for various comorbidities, gout was associated with poor physical functioning but had no effect on other aspects of HRQOL [3].

There are two standard approaches to assessing HRQOL: (a) the health status approach, which describes functioning and the impact of illness on specific domains of health, e.g., physical functioning and mental health [4], and (b) the preference/utility/value approach, which assesses the value or desirability of health states [5]. Preference-based measures can be determined either directly via a face-to-face interview with a subject (direct preference measures) or indirectly by applying community preference judgments to an individual's health state (indirect preference measures) [6]. Preference-based measures serve as quality-adjustment factors for calculating quality-adjusted life years (QALYs) in decision analysis and cost-effectiveness analysis.

The most commonly used health status instruments in arthritis are the SF-36 [4, 7] and the Health Assessment Questionnaire-Disability Index [8]. The most common direct preference measures are the standard gamble (SG), which assesses one's willingness to risk a bad outcome in order to improve one's health state; the time tradeoff (TTO), which assesses preferences regarding length versus quality of life; and the health rating scale (RS) [9–11]. The SF-6D and EQ-5D are examples of indirect preference measures [12, 13].

The purposes of this study were to assess health status and health utility in patients with chronic gout, and to compare the disutility for gout in patients who identified gout as their main health concern versus those who did not.

Methods

Study subjects

As part of a larger study to develop a new HRQOL measure for gout [14], we recruited participants aged 18 years or older with chronic stable gout, as defined by the American College of Rheumatology classification criteria [15], from the University of Cincinnati, the Cincinnati Veterans Affairs Medical Center, and a private rheumatology practice in Cincinnati. In order to assess HRQOL for chronic gout per se, patients who had an episode(s) of acute gouty arthritis during the previous 4 weeks were excluded. Participants were recruited from the general medicine and rheumatology clinics and were paid US $25 for their time and effort. The University of Cincinnati Institutional Review Board approved the study protocol, and all patients provided informed consent before participating.

Questionnaires

Demographic and clinical data

Patients provided information regarding their age, sex, annual income, education, and type of health insurance. Laboratory data including serum uric acid and serum creatinine levels, when available, were obtained from patients' medical records. We collected data on gout medications from patients. In addition, patients were asked to list all their relevant comorbidities and to rank them, including gout, from most concerning to least concerning. Patients were also asked to rate their gout severity on a 0 (not severe at all) to 100 (gout as severe as you can imagine) visual analog scale (VAS).

Health status

We administered HRQOL questionnaires in structured interview sessions. Health status was assessed by using two self-administered instruments: the SF-36 [4] and the Health Assessment Questionnaire-Disability Index (HAQ-DI) [8].

The SF-36 is a generic health status measure consisting of 36 items assessing eight domains [4, 7]. Each of the SF-36 subscales is scored from 0–100, with a higher score representing better health. The 8 SF-36 subscales can be summarized into a physical component summary (PCS) and a mental component summary (MCS) score. The subscales and summary scores are normed to the US general population, where the mean score is 50 and the standard deviation is 10. We used version 2 of the SF-36 and a standard (4-week) recall period [16].

The HAQ-DI [8] is a self-administered 20-question arthritis-specific instrument that assesses a patient's level of upper and lower extremity functioning. The overall HAQ-DI score is determined by summing the highest item score in each of the eight domains and dividing the sum by 8, yielding a score from 0 (no disability) to 3 (severe disability).

Preference-based measures

Direct. We elicited three direct preference-based assessments by using U-Maker, a computer-assisted utility assessment software package [17]. Patients were first asked to rate and value their current health state with all their medical problems including gout. Then, patients were asked to rate and value their current health state without gout. Although patients who had an acute gout attack during the previous 4 weeks were excluded, when assigning utilities, we did ask patients to consider their previous acute gout attacks and the pain and functional disability associated with them.

Patients rated their current health on an RS, which was presented as a "feeling thermometer" with scores ranging from 0 (dead) to 100 (perfect health). For ease of comparison with other preference-based measures, we normalized the RS scores to 0.0–1.0 by dividing them by 100. Next, participants completed a TTO exercise, represented graphically as a choice between two horizontal bars, one representing the patient's life expectancy in current health (followed by death) and the other representing a given number of years (less than or equal to the life expectancy) in perfect health followed by death. U-Maker utilized the life expectancy reported in US life tables based on the age of the patient [18], rounding the life expectancy to the nearest 5 years. The number of years in perfect health was varied in a bisection fashion until the patient did not have a clear preference between living in current health or living the given amount of time in perfect health [19].

The final utility task was the SG, which assessed the individual's willingness to risk immediate death in exchange for the complementary chance of perfect health. Participants were shown two circles: the first was labeled "current health with [without] gout" and remained the same on all of the screens; the second circle was labeled "perfect heath." The patient was offered a choice between living the remainder of their life in their current state of health versus taking a gamble in which the two outcomes were perfect health for the remainder of life or immediate death [20]. The SG score was calculated as 1.0 minus the maximum acceptable probability of death. The TTO and SG assessments did not allow for respondents to value their health state as worse than dead.

Indirect. The SF-6D [21] derives preference-based scores from the SF-36 by assigning population-derived utilities for specific health states created from six SF-36 dimensions: physical function, role limitations, social function, pain, mental health, and vitality [22]. An SF-6D health state is defined by selecting one level from each dimension; a total of 18,000 health states are thus defined. We used the SF-6D scoring algorithm to calculate SF-6D–based preferences scores from the SF-36 scores [22]. The SF-6D is scored from 0.29 to 1.00, where 1.00 corresponds to perfect health [22].

The EQ-5D has five domains: mobility, usual activities, self-care, pain, and anxiety, with three levels of function for each domain [13]. To assess preferences, the scale developers used an interviewer-administered TTO to obtain population-based utilities for EQ-5D states. Using the US scoring version, possible scores on the EQ-5D range from −0.11 (worse than dead) to 1.0 (perfect health) [23].

Statistical analysis

Normality of preference-based measures was assessed by using the Shapiro-Wilk test; the RS, SF-6D, and EQ-5D were approximately normally distributed whereas the TTO and SG were not (negatively skewed). Therefore, for the RS, SF-6D, and EQ-5D scores, we report means and standard deviations and used parametric tests for statistical significance, while for the TTO and SG scores we report medians and 25th and 75th percentiles and used nonparametric tests for statistical significance. We also assessed the proportion of subjects with floor and ceiling effects (percentages of respondents scoring at the lowest and highest possible scale level).

Disutilities for gout were calculated by subtracting direct preference scores for patients' current health with gout from scores for current health without gout. Because disutilities had skewed distributions, we report medians and used nonparametric tests for statistical significance, but we also report means, as means are the preferred point estimates for decision analyses and cost-effectiveness analyses.

Disutility scores among patients ranking gout as their top health concern were compared with those who did not rank gout as the top health concern by using the Wilcoxon test. To assess the impact of comorbidities, we assessed Spearman rank correlation coefficients for the number of comorbidities versus TTO and SG scores for current health including gout, and Pearson correlation coefficients for the number of comorbidities versus RS scores for current health including gout, SF-6D scores, and EQ-5D scores. The correlation coefficients were interpreted as proposed by Colton [24]: 0–0.25 indicating little to no relationship, 0.25–0.50 indicating a fair degree of relationship, 0.50–0.75 indicating a moderate to good relationship, and 0.75–1.0 indicating a very good to excellent relationship.

Analyses were performed by using STATA software, version 9.2 (College Station, Tex.). P values <0.05 were considered statistically significant and P values between 0.05–0.10 were considered indicative of trends towards statistical significance.

Results

Subjects' characteristics

Of the 80 patients, 72 (90%) were male; 55 (69%) were Caucasian, and 22 (28%) were African-American (Table 1). The average (SD) age of the patients was 60 (11) years and most graduated from high school, were insured, and had incomes less than $50,000 per year. Most had comorbidities: 56 (70%) had associated hypertension, 35 (44%) had hyperlipidemia, 20 (25%) had diabetes mellitus, and 19 (24%) had cardiovascular and/or peripheral arterial disease. A total of 45 (56%) patients were taking allopurinol daily, 27 (34%) were taking colchicine daily, 13

Table 1 Demographics and clinical characteristics of study participants

Variables	Total sample ($n = 80$)
Mean (SD) age, years	60 (11)
Gender	
Male, *n* (%)	72 (90)
Race	
Caucasian, *n* (%)	55 (69)
African-American, *n* (%)	22 (28)
Others, *n* (%)	3 (3)
Annual income[a]	
< $12,000, *n* (%)	14 (18)
$12,000–25,000, *n* (%)	19 (24)
> $25,000–50,000, *n* (%)	15 (19)
> $50,000–75,000, *n* (%)	9 (12)
> $75,000, *n* (%)	7 (9)
Chose not to report, *n* (%)	14 (18)
Education[b]	
< High school, *n* (%)	9 (11)
High-school graduate, *n* (%)	19 (24)
College graduate, *n* (%)	28 (35)
Graduate degree, *n* (%)	11 (15)
Postgraduate degree, *n* (%)	12 (15)
Insurance[b]	
Preferred provider organization, *n* (%)	21(27)
Health maintenance organization, *n* (%)	10 (13)
Medicare, *n* (%)	14 (18)
Medicaid, *n* (%)	2 (2)
Veterans Health Administration, *n* (%)	21 (26)
None, *n* (%)	11 (14)
Other self-reported comorbidities	
Hypertension, *n* (%)	56 (70)
Hyperlipidemia, *n* (%)	35 (44)
Diabetes mellitus, *n* (%)	20 (25)
Coronary heart disease/peripheral arterial disease, *n* (%)	19 (24)
Gastroesophageal reflux disease, *n* (%)	12 (15)
Chronic obstructive pulmonary disease, *n* (%)	10 (13)
Prostrate cancer/benign prostrate hyperplasia, *n* (%)	8 (10)
Congestive heart failure, *n* (%)	4 (5)
Clinical data[b]	
Mean (SD) 0–100 gout visual analog scale score	58 (33)
Number of gout attacks over last year	
None, *n* (%)	15 (19)
1–2, *n* (%)	27 (34)
3–5, *n* (%)	20 (25)
6–10, *n* (%)	5 (6)
> 10, *n* (%)	12 (15)
Patients with at least one tophus, *n* (%)	12 (15)
Mean (SD) serum uric acid level, mg/dl	7.13 (2.0)
Mean (SD) serum creatinine level, mg/dl	1.8 (1.9)
Current gout medications	
Allopurinol, *n* (%)	45 (56)
Colchicine, *n* (%)	27 (34)
Prednisone, *n* (%)	13 (16)
Nonsteroidal anti-inflammatory agents, *n* (%)	15 (19)

[a] Data not available for two patients; [b]data not available for one patient

(16%) were taking prednisone daily, and 15 (19%) were taking nonsteroidal anti-inflammatory drugs daily for their gout.

Seventeen (21%) patients ranked gout as their top health concern. Patients who ranked gout as their top health concern showed a trend towards reporting a higher (worse) gout disease severity on the 0–100 VAS (mean [SD]: 78.0 [28.9]) compared with others (mean [SD]: 54.8 [33.3]; $P = 0.09$), and were somewhat more likely to report having had six or more gout attacks over the last year (7 [41%] versus 9 [14%], $P = 0.06$).

Health status

The mean (SD) SF-36 PCS and MCS scores were 38.9 (10.9) and 48.6 (11.1): 1.1 SD below and 0.1 SD below US general population mean scores, respectively (Table 2). The median HAQ-DI score was 0.3 (0.0, 1.1), indicating mild disability. On the SF-36 subscales, 17 (21%) patients on the role physical subscale, 20 (25%) patients on the social functioning subscale, and 25 (31%) patients on the role emotional subscale scored at the upper scale limit (Appendix Table). A ceiling effect was also manifested on the HAQ-DI by the fact that 22 (28%) patients scored at the upper scale limit, signifying no functional disability.

Preference-based measures

Direct preference-based measures

Current health state with gout. Two patients, one each in the RS and SG group, had negative disutility scores (indicative of a higher utility for gout than for the gout-free state). Those patients were excluded from the utility and disutility analyses of the RS and SG. The mean (SD) RS score for current health including gout was 0.69 (0.21; Table 2). The median (25th, 75th percentile) TTO and SG scores were 0.94 (0.75, 1.00) and 0.88 (0.60, 0.99), respectively. For all three preference-based measures, there

Table 2 Health status and preference-based scores

	Total sample	
	Mean (SD)	Median (25th, 75th percentile)
Health status		
SF-36, $n = 80$		
Physical component summary	38.9 (10.9)	38.1 (30.1, 48.5)
Mental component summary	48.6 (11.1)	51.3 (40.7, 60.0)
Physical functioning	37.7 (12.6)	33.9 (27.6, 51.8)
Role physical	40.6 (11.8)	37.3 (32.4, 52.0)
Bodily pain	41.8 (10.1)	39.5 (35.3, 50.3)
General health	42.8 (10.1)	43.4 (35.8, 51.0)
Vitality	47.6 (10.6)	49.0 (41.2, 55.2)
Social functioning	43.7 (11.1)	45.9 (35.0, 54.1)
Role emotional	42.4 (12.0)	44.2 (32.5, 55.8)
Mental health	48.5 (12.0)	50.0 (38.7, 58.4)
HAQ-Disability Index, $n = 80$	0.6 (0.6)	0.3 (0.0, 1.1)
Health utilities		
SF-6D, $n = 80$	0.68 (0.13)	0.65 (0.58, 0.80)
EQ-5D, $n = 80$	0.73 (0.23)	0.79 (0.68, 0.84)
Current health including gout		
Rating scale, $n = 79$	0.69 (0.21)	0.70 (0.60, 0.82)
Time tradeoff, $n = 80$	0.80 (0.27)	0.94 (0.75, 1.00)
Standard gamble, $n = 79$	0.78 (0.26)	0.88 (0.60, 0.99)
Current health excluding gout		
Rating scale, $n = 79$	0.74 (0.20)	0.80 (0.60, 0.90)
Time tradeoff, $n = 80$	0.83 (0.24)	0.94 (0.75, 1.00)
Standard gamble, $n = 79$	0.79 (0.26)	0.92 (0.63, 1.00)

For SF-36 summary scores and scales, the possible scores range from 0 to 100; for the SF-6D, the possible scores range from 0.29 to 1.00; for EQ-5D, the possible scores range from −0.11 to 1.00; for the rating scale, time tradeoff, and standard gamble, the possible scores range from 0.00 to 1.00

was a relatively minor floor effect (1–3% of patients; Appendix Table). One percent of patients scored at the upper scale limit for the RS; the corresponding rates on the TTO and the SG were 25% and 22%, respectively.

Current health state without gout. The mean RS score for current health without gout was 0.74 (0.20; Table 2). The median TTO and SG scores were 0.94 (0.75, 1.00) and 0.92 (0.63, 1.00), respectively.

Disutility of Gout: The mean (SD) disutility as determined by the RS was 0.06 (0.11); 45 (52%) patients had 0 disutility for gout, whereas 21 (26%) had disutilities of 0.10 or greater. The mean (SD) TTO disutility was 0.03 (0.12); 69 (86%) patients had no disutility and 5 (6%) had a disutility ≥0.10. The mean (SD) SG disutility was 0.02 (0.09); 63 (59%) patients had no disutility and 4 (5%) had disutilities ≥0.10.

Indirect preference-based measures

The mean (SD) SF-6D score was 0.68 (0.13) and the mean (SD) EQ-5D score was 0.73 (0.23). Eighteen (23%) patients had the maximum possible score on the EQ-5D and one (1%) patient had the maximum possible score on the SF-6D.

Impact of gout as a health concern

For the patients who ranked gout as their top health concern ($n = 17$), the mean RS disutility was 0.08 and the median was 0.06; the mean TTO disutility score was 0.04 and the median was 0.00; and the mean SG disutility was 0.07 and the median was 0.00 (Fig. 1). Their RS disutilities trended towards being statistically significantly larger than those of the remaining 62 patients (mean score, 0.05; median score, 0.00; $P = 0.06$), but their TTO and SG disutilities were similar to those of the remaining patients (mean TTO disutility 0.03; median TTO disutility 0.00; $n = 63$; mean SG disutility 0.004; median SG disutility 0.00; $n = 62$; $P =$ NS for both comparisons).

Patients who ranked gout as their top concern had a mean (SD) SF-6D score of 0.67 (0.13) and EQ-5D score of 0.67 (0.29). Their utilities were similar to those of the remaining 63 patients (mean SF-6D score 0.68 [0.14]; mean EQ-5D score 0.75 [0.21]; $P =$ NS for both comparisons).

Impact of comorbidities

Comorbidities had a modest inverse association with direct and indirect preference-based scores. For direct measures

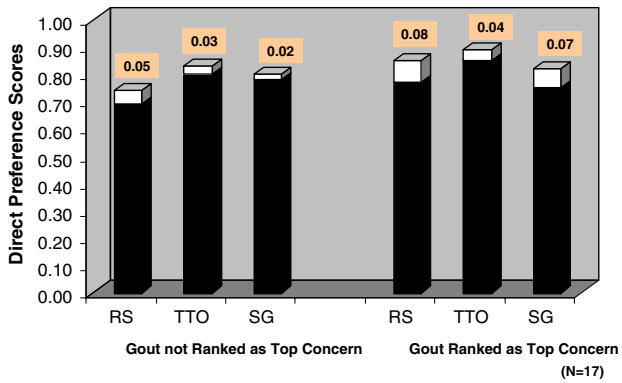

Fig. 1 Preference-based scores for health states including and excluding gout, and the disutility associated with gout, for patients' who rated their gout as their top health concern vs. those who did not. The full height of the bars represents the mean preference scores without gout. The black portion of the bars represents mean preference scores including gout and the white portion represents the disutility of gout. RS—rating scale, TTO—time tradeoff, SG—standard gamble

for current health with gout, the degree of correlation between the number of comorbidities and RS scores was little to fair: for the RS, the correlation coefficient was −0.24; for the TTO, it was −0.23; and for the SG, it was −0.11. Corresponding degrees of correlations for the SF-6D and EQ-5D were also little to fair: −0.28 and −0.08, respectively.

Discussion

Gout is a form of chronic arthritis with episodic painful flares. Given the prevalence of gout, it is surprising that, relative to other rheumatic diseases, HRQOL in gout has received very little attention. A recent PubMed search on "quality of life" or "health-related quality of life" and "gout" turned up only one publication [3]. By contrast, rheumatoid arthritis, which has a similar prevalence, had 238 publications dealing with HRQOL indexed in PubMed.

Our challenge was to capture the disutility of chronic gout per se, as distinct from the effect of the multiple comorbidities that patients with gout often have. To assess disutility, we asked patients to provide their health rating or utility for their current health state including their gout and then for their current health state excluding their gout. All subjects except for two seemed to understand the task based on higher or equal utilities for current health without gout as compared with current health with gout. An alternative method to assess health utilities for such health states is the chained approach [25;26], which involves two separate assessments. For example, the first step would be to compare gout (plus one's comorbidities) vis-à-vis dead (value of 0.0) and a gout-free state (plus one's comorbidities; temporary value of 1.0), and then compare the gout-free state vis-à-vis dead (0.0) and perfect health (definitive value of 1.0). One could then mathematically derive the utility or disutility for gout on a health scale from dead to perfect.

Because gout is not a life-threatening illness and perhaps because no patient had had an acute attack in the prior 4 weeks, we found that gout had only a modest effect on RS scores and minimal to no impact on TTO and SG scores. Another recent observational study administered the WHOQOL-Bref instrument to assess overall QOL in patients with gout and compared their QOL to that of patients being followed at the same outpatient general medicine clinics in the United Kingdom [3]. In that study, in unadjusted analyses, patients with gout had significantly more comorbidities and poorer overall QOL, satisfaction with health, and physical functioning compared with controls. But after controlling for comorbidities, gout per se was only associated with poorer physical functioning; poor QOL and satisfaction with health resulted mainly from associated comorbidities.

In our study, 17 patients ranked gout as their top health concern; those patients had relatively more severe gout on a self-rated VAS and relatively more gout attacks over the past year than their counterparts. The RS disutility for gout among the 17 patients tended to be greater than the mean disutility for the remaining patients, whereas the TTO and SG disutilities were similar between groups. Because the two indirect preference-based measures, the SF-6D and EQ-5D, did not specifically differentiate between health states with and without gout, scores for patients ranking gout as their top health concern were similar to those of patients not ranking gout as their top health concern.

Comorbidities generally had a negative association with direct and indirect utilities. Although correlations were weak to moderate, they were all in the right direction (i.e., the greater the number of comorbidities, the lower the utility [and the greater the disutility]), providing further construct validity for the preference-based measures.

The mean (SD) SF-6D score was 0.68 (0.13) and the mean EQ-5D score (using the US scoring system) was 0.73 (0.23) in our sample, which had a mean age of 60.2 years. By comparison, these utilities are lower than those found in the 2001 Medical Expenditures Panel Survey [27], a nationally representative sample of the US noninstitutionalized civilian population, where for persons aged 60–69 years, the mean SF-6D score was 0.80 and the mean EQ-5D score was 0.84.

Data regarding ceiling and floor effects support the use of the RS and SF-6D to assess health states with gout. For the RS and the SF-6D, only 1% of patients scored at the scale limit, compared with 22–25% with the other preference-based measures. Data from previous studies have also

shown a high ceiling effect on the EQ-5D [6, 28, 29]. The ceiling effect with the EQ-5D may be due to that scale having just three response categories per item as opposed to 3–5 response categories per item on the SF-6D [29]. Overall, the RS is a good indicator of HRQOL, but in the strictest sense is not a utility measure because it does not involve tradeoffs against external metrics such as time or risk. Because ceiling effects may affect the responsiveness of an instrument [30], the HAQ-DI, EQ-5D, TTO, and SG may not be as useful as other HRQOL measures in longitudinal studies of chronic gout.

Our study has several strengths. First, we included patients with proven gout seen by rheumatologists from three different settings: a university hospital, a Veterans Affairs Medical Center, and a community rheumatology practice. Our patients are representative of gout in general and also demonstrate the heterogeneity associated with gout. Gout is predominantly a disease of males, with males having a fourfold greater rate than females. The proportions of Caucasians (69%) and African-Americans (28%) is representative of the city in which the study took place. Nineteen percent of patients had no gout attack over the past year, 34% had 1–2 attacks, and 19% had $\geq$6 attacks over the last year; 15% had tophi on clinical examination; and 56% and 34% were on daily allopurinol and colchicine therapy, respectively.

Second, we captured health status and preference-based HRQOL comprehensively. To our knowledge, this is the first paper describing the disutility associated with chronic gout. To assess disutility associated with gout, we used a new method, which could serve as a template to assess disutility for other non-life-threatening illnesses.

Our study also had some limitations, most notably that, although all of our patients met American College of Rheumatology criteria for gout, they had no acute gouty attacks over the prior 4 weeks. We chose 4 weeks as the cutoff because the SF-36 uses a 4-week time frame and because we did not want acute attacks to potentially distort ratings of chronic gout. Second, the health exclusion for acute events was only applied to gout; patients were not excluded if they had acute health problems other than acute gout within the prior 4 weeks. It is possible that HRQOL and rankings of health concerns might have been affected among any such patients. Third, our power to detect differences in disutilities between subjects ranking gout as their top health concern versus those not ranking it as their top health concern was limited. Assuming mean disutilities of 0.08 versus 0.05 and assuming a common SD of 0.09, we would have needed approximately 142 patients in each group to achieve 80% power (two-sided test with $\alpha = 0.05$). Next, although we specifically advised patients to consider their health during the acute gouty attacks, it is possible that patients did not consider (or remember) their health state during acute gout attacks. Also, although we did ask patients whether they understood the HRQOL questions, we did not formally debrief them about what they were considering when assigning utilities. Our results regarding the disutility of gout corroborate those found by Roddy and colleagues, who found that gout per se was not associated with worse overall QOL or satisfaction with health and was associated only with worse physical functioning. Still, disutilities may be greater among patients with recent acute attacks or among patients who fail treatment. Disutility might also be greater in younger patients with more active lifestyles.

These findings have implications for decision analysis and cost-effectiveness analysis in patients with gout. With regards to cost-effectiveness analysis, consider for example an average TTO disutility of 0.03 for chronic gout, as we found in this study. If one uses a $50,000/QALY threshold as a metric of cost-effectiveness, then the annual incremental cost of treatment to relieve the disutility would have to be $\leq$$1,500, or $125 per month. In a separate analysis, we asked a subgroup of these patients ($n = 78$) how much money they would be willing to pay every month out-of-pocket or as a co-pay to cure their gout [31]. The median (25th, 75th percentile [range]) amount that patients were willing to pay was $25 ($0, $75 [$0–$350]) per month, which would effectively translate into an incremental cost-effectiveness ratio of $10,000/QALY gained (=$25 $\times$ 12/0.03). By comparison, the average wholesale price of allopurinol, the most common antihyperuricemic agent used for chronic gout, is approximately $15/month supply [1], which is much lower than the incremental cost of $125/month for a treatment to be considered cost-effective using a $50,000/QALY threshold, but allopurinol therapy only alleviates gout, it does not cure it.

In conclusion, although physical functioning of patients with gout is often compromised, patients do not assign a large disutility to gout per se. Still, patients who rank gout as their top health concern tend to assign greater RS disutility to gout than do other patients. Future studies should confirm our observations in a larger patient population.

Acknowledgements Dr. Khanna was supported by a National Institutes of Health Award (NIAMS K23 AR053858-01A1). Mr. Yontz was supported by a grant from the American Federation of Aging, Ohio Chapter. Dr. Tsevat was supported in part by a National Center for Complementary and Alternative Medicine award (grant # K24 AT001676). TAP Pharmaceuticals Products Inc. provided funding for the study but had no role in data collection, analysis, manuscript preparation, and the decision to submit the manuscript for publication.

[1] Accessed www.drugstore.com (Internet Communication).

Appendix

Ceiling and floor effects of health status and preference-based scores

Health status instrument	Ceiling effect	Floor effect
SF-36		
Physical component summary, *n* (%)	0 (0)	0 (0)
Mental component summary, *n* (%)	0 (0)	0 (0)
Physical functioning, *n* (%)	9 (11)	0 (0)
Role physical, *n* (%)	17 (21)	3 (4)
Bodily pain, *n* (%)	6 (8)	1 (1)
General health, *n* (%)	1 (1)	1 (1)
Vitality, *n* (%)	3 (4)	0 (0)
Social functioning, *n* (%)	20 (25)	1 (1)
Role emotional, *n* (%)	25 (31)	2 (2)
Mental health, *n* (%)	7 (8)	1 (1)
HAQ-DI, *n* (%)	22 (28)	0 (0)
Preference-based measure		
RS,[a] *n* (%)	1 (1)	1 (1)
TTO,[a] *n* (%)	20 (25)	2 (3)
SG,[a] *n* (%)	18 (22)	1 (1)
SF-6D, *n* (%)	0 (0)	1 (1)
EQ-5D, *n* (%)	18 (22)	0 (0)

[a] Current health with gout. HAQ-DI, health assessment questionnaire-disability index; RS, rating scale; TTO, time tradeoff; SG, standard gamble

References

1. Saag, K. G., & Choi, H. (2006). Epidemiology, risk factors, and lifestyle modifications for gout. *Arthritis Research & Therapy, 8*(Suppl 1), S2.
2. Terkeltaub, R. A. (2003). Clinical practice. Gout. *The New England Journal of Medicine, 349*(17), 1647–1655.
3. Roddy, E., Zhang, W., & Doherty, M. (2007). Is gout associated with reduced quality of life? A case–control study. *Rheumatology (Oxford), 46*(9), 1441–1444.
4. Ware, J. E. Jr., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care, 30*(6), 473–483.
5. Khanna, D., & Tsevat, J. (2007). Health-related quality of life—an introduction. The *American Journal of Managed Care, 13*(Suppl 9), S218–S223.
6. Kopec, J. A., & Willison, K. D. (2003). A comparative review of four preference-weighted measures of health-related quality of life. *Journal of Clinical Epidemiology, 56*(4), 317–325.
7. Ware, J. E. J., Kosinki, M., & Keller, S. (1994). *SF-36 Physical and mental health summary scales: A user's manual*. Boston, Mass: Health Institute, New England Medical Center.
8. Fries, J. F., Spitz, P., Kraines, R. G., & Holman, H. R. (1980). Measurement of patient outcome in arthritis. *Arthritis and Rheumatism, 23*(2), 137–145.
9. Torrance, G. (1986). Measurement of health state utilities for economic appraisal. *Journal of Health Economics, 5*, 1–30.
10. Von Neumann, J., & Morgenstern, O. (1953). *Theory of games and economic behavior*. New York: Wiley.
11. Froberg, D. G., & Kane, R. L. (1989). Methodology for measuring health-state preferences–II: Scaling methods. *Journal of Clinical Epidemiology, 42*(5), 459–471.
12. Brazier, J., Usherwood, T., Harper, R., & Thomas, K. (1998). Deriving a preference-based single index from the UK SF-36 Health Survey. *Journal of Clinical Epidemiology, 51*(11), 1115–1128.
13. The EuroQol Group (1990) EuroQol–a new facility for the measurement of health-related quality of life. *Health Policy, 16*(3):199–208.
14. Hirsch, J., Lee, S., Terkeltaub, R., Khanna, D., Singh, J., Sarkin, A., et al. (2006). Evaluation of the psychometric properties of a gout-specific patient reported outcomes (PRO) instrument. *Arthritis Rheumatism, 54*(9), S102 (Abstract).
15. Wallace, S. L., Robinson, H., Masi, A. T., Decker, J. L., McCarty, D. J., & Yu, T. F. (1977). Preliminary criteria for the classification of the acute arthritis of primary gout. *Arthritis Rheumatism, 20*(3), 895–900.
16. Ware, J., Kosinski, M., & Dewey, J. (2000). *How to score version two of the SF-36 health survey*. Lincoln, RI: QualityMetric Incorporated.
17. UMaker user's manual (1999). UMDNJ technical report.
18. Arias, E. (2004). United States life tables, 2002. *National Vital Statistics Reports, 53*(6), 1–38.
19. Stalmeier, P. F., Goldstein, M. K., Holmes, A. M., Lenert, L., Miyamoto, J., Stiggelbout, A. M., et al. (2001). What should be reported in a methods section on utility assessment? *Medical Decision Making, 21*(3), 200–207.
20. Torrance, G. W. (1987). Utility approach to measuring health-related quality of life. *Journal of Chronic Diseases, 40*(6), 593–603.
21. Brazier, J., Usherwood, T., Harper, R., & Thomas, K. (1998). Deriving a preference-based single index from the UK SF-36 Health Survey. *Journal of Clinical Epidemiology, 51*(11), 1115–1128.
22. Brazier, J., Roberts, J., & Deverill, M. (2002). The estimation of a preference-based measure of health from the SF-36. *Journal of Health Economics, 21*(2), 271–92.
23. Shaw, J. W., Johnson, J. A., & Coons, S. J. (2005). US valuation of the EQ-5D health states: Development and testing of the D1 valuation model. *Medical Care, 43*(3), 203–220.
24. Colton, T. (1974), *Statistics in medicine*. Boston: Little, Brown and Company.
25. Spencer, A. (2004). The implications of linking questions within the SG and TTO methods. *Health Economics, 13*(8), 807–818.
26. Stalmeier, P. F. (2002). Discrepancies between chained and classic utilities induced by anchoring with occasional adjustments. *Medical Decision Making, 22*(1), 53–64.
27. Hanmer, J., Lawrence, W. F., Anderson, J. P., Kaplan, R. M., & Fryback, D. G. (2006). Report of nationally representative values for the noninstitutionalized US adult population for 7 health-related quality-of-life scores. *Medical Decision Making, 26*(4), 391–400.
28. Marra, C. A., Esdaile, J. M., Guh, D., Kopec, J. A., Brazier, J. E., Koehler, B. E., et al. (2004). A comparison of four indirect methods of assessing utility values in rheumatoid arthritis. *Medical Care, 42*(11), 1125–1131.
29. Bharmal, M., & Thomas, J. III (2006). Comparing the EQ-5D and the SF-6D descriptive systems to assess their ceiling effects in the US general population. *Value Health, 9*(4), 262–71.
30. Hays, R. D. (2005). Reliability and validity (including responsiveness). In P. Fayers & R. D. Hays (Eds.), *Assessing quality of life in clinical trials* (2nd ed., pp. 25–39). New York: Oxford.
31. Khanna, D., Ahmed, M., Yontz, D., Ginsburg, S. S., & Tsevat, J. Willingness to pay for a cure in patients with chronic gout. *Medical Decision Making* 2008. Mar 18; [Epub ahead of print].