The Effect of Chronic Disease Management on the Treat-to-Target of Gout: A Cross-Sectional Study

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Abstract

Background: The treat-to-target (T2T) strategy is essential for patients with gout. However, the rate of T2T is low. This study aimed to explore doctor-led chronic disease management on the T2T of gout, survey the rate of T2T and assess the predictors associated with poor control of serum urate levels (SUA) in a large population of patients with gout receiving urate-lowering treatment (ULT).

Methods: A multi-center, cross-sectional study was conducted. We surveyed the relevant information of outpatients who received ULT for more than six months using electronic questionnaires, including demographics, disease-related conditions, comorbid conditions, and management. The patients with gout were divided into the SUA > 360 $\mu\text{mol/L}$ and $\leq 360 \mu\text{mol/L}$, and the patient characteristics between the two groups were compared. We analyzed the predictors of SUA > 360 $\mu\text{mol/L}$ and poor disease control.

Results: We collected 425 (90.8% of the patients) valid questionnaires. There were significant differences in the gender, education level, regular visits, medication adherence, diabetes, economic burden and community doctor's help between the SUA > 360 $\mu\text{mol/L}$ (n=311, 73.18%) and $\leq 360 \mu\text{mol/L}$ (n=114, 26.82%) groups. The predictors of SUA >360 $\mu\text{mol/L}$ were general medication adherence (OR=2.35; 95% CI 1.17–4.77; p=0.016), poor medication adherence (OR=4.63; 95% CI 2.28–9.51; p<0.001) and community doctor's help (OR=0.60; 95% CI 0.37–0.97; p=0.036 for full model, OR=0.58; 95% CI 0.36–0.93; p=0.023 for simplified model). There were significant differences in the gender, regular visits, medication adherence, gout popular science, established health files, and community doctor's help between the not well controlled (n=361, 84.94%) and well controlled (n=61, 14.35%) groups. The predictors of not well controlled were Tophi (OR=2.48; 95% CI 1.17–5.61; p=0.023), general medication adherence (OR=2.78; 95% CI 1.28–6.05; p=0.009), poor medication adherence (OR=6.23; 95% CI 2.68–14.77; p<0.001) and no gout popular science (OR=4.07; 95% CI 1.41–13.91; p=0.015).

Conclusion: The T2T and well controlled rates were very low. The medication adherence, the community doctor's help and gout popular science which was the doctor-led chronic gout management should be further improved to increase the T2T and well controlled rate.

Trial registration: ChiCTR, ChiCTR2000034700, Registered 15 July 2020.
<http://www.chictr.org.cn/showproj.aspx?proj=55778>

1. Introduction

Gout is a common arthritic condition that results from monosodium urate (MSU) crystal deposition. The prevalence of gout is 3–4% among adults in the USA[1], and the prevalence of gout increases with age[2]. Obesity, cardiovascular disease (CVD)[3], and chronic kidney disease (CKD)[4-6] are associated with gout. Gout is an independent risk factor for all-cause and cardiovascular mortality[7].

Urate-lowering treatment (ULT) is essential for patients with gout. It can reduce the frequency of gout attacks, reduce the number of joints involved, reduce urate deposition, and protect articular cartilage and

kidneys[8]. European League Against Rheumatism (EULAR) and American College of Rheumatology (ACR) guidelines recommended the treat-to-target (T2T) strategy for gout in 2016[9]. However, the rate of T2T was unsatisfactory. A prevalence survey in France found that 22.3% patients had reached the target of 6 mg/dL SUA, and the rate was only 11% for the ULT in more than 12 months.

The EULAR guidelines recommend that the optimum long-term management of gout should include patient education and lifestyle modifications[10]. However, similar to other chronic diseases, the treatment of chronic gout appears to be inadequate, and long-term adherence to ULTs is suboptimal[11-13]. Despite the availability of ULT, under-recognition of gout and its societal burden contribute to inadequately controlled SUA levels and its management failure as a chronic disease[14, 15]. Inadequately controlled SUA leads to substantially negative disease burden of chronic gout, both socially and financially. Hence, patients need to realize the importance of adherence to ULT and maintain the SUA target level for long-term[16]. Although nurse[17] and pharmacist[18, 19] led interventions to improve T2T have been reported, the panel recognized the necessity for the treating physician to educate the patient and implement a T2T protocol[20], but there is no relevant study. Hence, this study aimed to explore doctor-led chronic disease management on the T2T of gout, survey the rate of T2T and assess the predictors associated with poor control of SUA in a large population of patients with gout who received ULT for more than six months.

2. Methods

2.1 Participants

This cross-sectional study was conducted in seven centers between July 2020 and May 2021 (chictr.org.cn ChiCTR2000034700). This study was approved by the Institutional Medical Ethics Committee of the Fourth Clinical Medical College of Guangzhou University of Chinese Medicine. Informed written consent was obtained from all study participants. Male and female outpatients aged 18-80 years were enrolled. The patients met the 1977 American College of Rheumatology (ACR) criteria for acute arthritis of gout[21] or the 2015 ACR/European League Against Rheumatism gout classification criteria[22]. The patients received ULT for more than six months, and could complete the questionnaire independently. Patient exclusion criteria were as follows: secondary gout (chronic kidney disease, blood disorders, etc.), refusal to provide information. The state of well-controlled disease was defined as treatment target reached and no flare or use of anti-inflammatory medication for one month[23]. A total of 468 gout patients were successively invited to participate in this study and complete the questionnaire under the researchers' supervision in a clinical setting, and 425 (90.8% of the patients) valid questionnaires were collected for statistical analysis.

2.2 Assessments

For representativeness, each participating physician could not include more than five consecutive patients. We used electronic questionnaires to conduct surveys. Patients with gout were asked to complete a set of standardized self-report questionnaires as follows: Demographic variables such as age,

gender, body mass index (BMI), education, mental work, and family history. Disease-related conditions such as disease duration, highest creatinine level in a month, Tophi, acute flares in preceding 1-year, medicine used, attitude to gout and eight-item Morisky Medication Adherence Scale (MMAS-8)[24]. Comorbid conditions such as hypertension, diabetes, hyperlipidemia, kidney stones and coronary atherosclerotic heart disease. Management including information provided by the doctor, diet management, exercise, gout popular science, patient communication, own expense, economic burden, established health files and community doctor's help.

2.3 Sample size

The sample size was estimated using the nQuery Advisor software. According to the 2016 Chinese Rheumatism Data Center (CRDC), the rate of target SUA achieved for six-month was 38.20%, assuming the rate was 0.4, the allowable error was 0.05, and the estimated sample size was 369.

2.4 Statistical analysis

Demographic variables were described as mean $\pm$ standard deviation (SD) for continuous variables or as frequency and percentage for categorical variables. The characteristics of the subjects in the achieved target SUA group and the none achieved target SUA group were compared using independent t-tests or Mann-Whitney U tests for normal and non-normal data, respectively. Univariate analysis was performed to identify variables associated with SUA > 360 $\mu\text{mol/L}$ and well controlled. Multivariable logistic regression was used to develop the risk model. We selected predictors using both statistical significance ($p < 0.05$) and clinical importance criteria. The predictive accuracy of the model was assessed using calibration slope. All statistical analyses were performed using SAS version 9.4 (SAS Institute, Inc, Cary, NC) and R Package Regression Modeling Strategies.

3. Results

3.1 Demographics and clinical characteristics associated with target SUA

The characteristics of the patients with gout were compared between the SUA > 360 $\mu\text{mol/L}$ ($n=311$, 73.18%) and ≤ 360 $\mu\text{mol/L}$ ($n=114$, 26.82%) groups (Table 1). The majority of participants were male (99.4% vs. 96.5%, $p=0.047$). Surprisingly, there were more patients with a college education or higher in the SUA > 360 $\mu\text{mol/L}$ group (70.4%) than in the SUA ≤ 360 $\mu\text{mol/L}$ group (59.6%). A total of 425 participants suffered from at least one comorbid condition, of which hyperlipidemia was the most common, followed by kidney stones, hypertension, and coronary atherosclerotic heart disease. Comorbidity with diabetes was statistically different for attaining ideal SUA level (1.6% vs. 6.1%, $p=0.02$). For medication adherence (good 7.4% vs. 23.7%, general 30.5% vs. 39.5%, poor 62.1% vs. 36.8%, $p=0.001$) and regular visits (good 54.3% vs. 67.5%, general 26.4% vs. 20.2%, poor 62.1% vs. 36.8%, $p=0.014$), significant differences were found between the achieved target SUA group and the none achieved target SUA group. There were significant differences in economic burden (32.8% vs. 44.7%, $p=0.03$) and community doctor's help (32.5% vs. 46.5%, $p=0.009$) between the two groups.

3.2 Predictors of uric acid > 360 µmol/L for patients with gout

Next, multivariable logistic regression was used to develop the risk model and select predictors using both statistical significance ($p < 0.05$) and clinical importance criteria. We examined factors associated with a SUA level ≥ 360 µmol/L among patients with gout (Table 2). There were statistical differences in general medicine adherence (OR= 2.35; 95% CI 1.17–4.77; $p=0.016$) and bad (OR=4.63; 95% CI 2.28–9.51; $p < 0.001$) and community doctor's help (OR=0.60; 95% CI 0.37–0.97; $p=0.036$) between the two groups of patients with gout. However, age, gender, body mass index (BMI), education, regular visits, diet management, diabetes and economic burden were not the predictors of SUA > 360 µmol/L for patients with gout ($p \geq 0.05$). Nomogram for predicting high SUA > 360 µmol/L among patients with gout is shown in Figure 2. Then, bootstrapping with 1000 repetitions was used for model validation, and the bias-corrected measures of accuracy were Brier score of 0.177, calibration slope of 0.99, and c-index of 0.726, respectively (Figure 1). Generalized variance inflation factors (GVIF) for candidate predictors of high SUA > 360 µmol/L and well-controlled among patients with gout are shown in the Supplementary Table 1.

3.3 Characteristics of well controlled or not well controlled SUA

The demographic and clinical characteristics of patients with well controlled and not well controlled SUA are presented in Table 3. Patients with well-controlled SUA level ≤ 360 µmol/L did not have an acute flare of gout and did not use anti-inflammatory drugs in the past one month. Of the 361 patients comprising the not well controlled SUA group, the mean age was 42 years, which was similar to the average age of 41 years in the well-controlled group. It is important to note that patients in the well-controlled group were mostly male (99.2% vs. 95.1%, $p=0.041$), and there were statistical differences in regular visits (good 54.9% vs. 75.4%, moderate 26.4% vs. 14.8%, poor 18.7% vs. 9.8%, $p=0.004$), medicine adherence (good 8.5% vs. 31.1%, moderate 31.3% vs. 42.6%, poor 60.2% vs. 26.2%, $p < 0.001$) and gout popular science (helpful 19.5% vs. 36.1%, general 61.0% vs. 55.7%, none 19.5% vs. 8.2%, $p=0.001$). The patients with well-controlled SUA were likely to established health files (30.5% vs. 44.3%, $p=0.039$) and community doctor's help (34.1 vs. 49.2%, $p=0.03$).

3.4 Nomogram prediction of not well controlled SUA

Multivariate logistic regression models were used to assess predictors of not well controlled SUA and build the nomogram. In the multiple logistic regression model (Table 4), tophi (OR=2.48; 95% CI 1.17–5.61; $p=0.023$) and none gout popular science at target (OR=4.07; 95% CI 1.41–13.91), $p=0.015$), especially general compliance (OR=2.78; 95% CI 1.28–6.05; $p=0.009$) and bad (OR=6.23; 95% CI 2.68–14.77; $p < 0.001$) were associated with a greater risk of not well controlled SUA in patients with gout. Age, gender, BMI, course of disease, tophi, regular visits, propaganda, exercise, established health files and community doctor's help were not independent predictors. Nomogram for predicting not well controlled SUA among patients with gout is shown in Figure 3.

4. Discussion

There is no relevant research on the effect of chronic gout management to T2T in China. It is easy to reach the target SUA level in the short-term. However, long-term control of the target SUA level remains a challenge. This study found that the rate of T2T was low. Patients with $\text{SUA} \leq 360 \mu\text{mol/L}$ were compared with those $> 360 \mu\text{mol/L}$ to determine factors associated with achieving target SUA level. Our findings substantiate the importance of medicine adherence. Significant differences were found in medicine adherence, regular visits and community doctor's help between the $\text{SUA} \leq 360 \mu\text{mol/L}$ and $\text{SUA} > 360 \mu\text{mol/L}$ groups as well as between the well-controlled and not well-controlled groups in this study. Consistent with known epidemiology, we observed susceptibility to gout among males in our study, especially those over 40 years of age[25]. Notably, patients with lower education were more likely to achieve SUA target in this study. As the use of ULT most directly influences SUA, it is important to emphasize the significance of maintaining SUA target when educating patients about the disease[26]. Our study suggested that patients with community doctor's help tend to have stronger belief about the necessity of ULT. Education and disease management information provided by doctors may improve the patient's medicine adherence and regular visits.

Low awareness of the disease, lack of appropriate knowledge about gout and poor understanding of the need for long-term treatment reduced the patients' compliance of treatment. Some doctors did not have sufficient time to offer appropriate education about gout and ULT to their patients, which led to acute flares of gout, and patients did not adhere to the ULT for long-term effective control of SUA levels[14]. Furthermore, few patients receive clear education to reduce risk factors and co-morbidities or personalized lifestyle advice about chronic gout[11, 13]. Consequently, only a minority of patients are relieved of gout, which leads to an increasing disease burden[27]. Recently, there were management measures led by nurses and pharmacists, but the 2020 ACR guidelines recommended that treating physicians should provide education and management[20]. Hence, doctors are very important for the chronic gout management in patients. Since gout is a chronic disease that is susceptible to relapse, the daily self-management and treatment of patients are equally important. Clinically, the education about gout and management principles underpin successful treatment. A healthy lifestyle is always recommended and patient education is critical to support self-management and long-term adherence. Therefore, health education should be strengthened for gout patients with recurrent and long-term ULT to eliminate the root cause of gout pain and disease progression[28].

The present study had some limitations. First, the universality of the sample population and the research centers involved in the trial were limited. Although this was a multi-center study, the discrepancies due to developed and underdeveloped regions, different regions in East and West China, and different eating habits, may require a larger sample size to confirm. Second, we only studied the compliance rate for more than six months, so our study highlights the need for ≥ 1 year compliance research to provide support for future clinical treatment. Lastly, this was a cross-sectional study, and our results confirmed the importance of doctor-led chronic disease management.

Conclusions

In summary, the T2T and well controlled rate were very low. The medication adherence, the community doctor's help and gout popular science which was the doctor-led chronic gout management should be further improved to increase the T2T and well controlled rate.

Abbreviations

T2T: The treat-to-target; SUA: Serum urate levels; ULT: Urate-lowering treatment; MSU: Monosodium urate; CVD: Cardiovascular disease; CKD: Chronic kidney disease; EULAR: European League Against Rheumatism; ACR: American College of Rheumatology; BMI: Body mass index; MMAS-8: Morisky Medication Adherence Scale; CRDC: Chinese Rheumatism Data Center; SD: Standard deviation; GVIF: Generalized variance inflation factors.

Declarations

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None.

Authors' contributions

EJ, JZ and WM designed the trial. EJ, SH and HG drafted the manuscript. HZ processed the figures. LZ, XY, JW, JX, YX, YJ, XQ, MX, YZ and DT conducted the research. EJ and ZZ was responsible for the statistical analyses. All authors participated in the manuscript revision.

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Conflict of Interest:

The authors declare they have no conflicts of interest.

Availability of data and materials

Data are available upon reasonable request. For inquiries about data sharing, please send request at sailing1980@126.com.

Ethics approval and consent to participate

This study was approved by the Institutional Medical Ethics Committee of the Fourth Clinical Medical College of Guangzhou University of Chinese Medicine (K2020-022-01). Informed written consent was obtained from all study participants.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1 Characteristics of the patients with gout between the SUA > 360 umol/L and $\leq$ 360 umol/L.

Characteristics	Uric acid level		P
	> 360 umol/L (N=311)	≤ 360 umol/L (N=114)	
Demographics			
Age, years	42.0 (33.0–50.0)	45.0 (37.0–51.0)	0.057
Sex, male	309/311 (99.4)	110/114 (96.5)	0.047
BMI			0.090
General	71/311 (22.8)	31/114 (27.2)	
Overweigh	147/311 (47.3)	59/114 (51.8)	
Obesity	93/311 (29.9)	24/114 (21.1)	
Education, university	219/311 (70.4)	68/114 (59.6)	0.047
Mental work	244/311 (78.5)	84/114 (73.7)	0.300
Family history	82/311 (26.4)	37/114 (32.5)	0.224
Disease-related conditions			
Disease duration, years	6.0 (3.0–10.0)	5.0 (2.2–14.0)	0.884
Max creatinine in a month, umol/L	90.0 (77.0–101.0)	90.0 (75.0–106.8)	0.989
Use of uric acid lowering drugs, years	3.0 (1.0–5.0)	2.0 (1.0–5.0)	0.111
Tophi	108/311 (34.7)	35/114 (30.7)	0.488
Acute gout event	149/311 (47.9)	46/114 (40.4)	0.188
Used medicine			
Painkillers	151/311 (48.6)	47/114 (41.2)	0.189
Allopurinol	31/305 (10.2)	14/110 (12.7)	0.476
Febuxostat	281/305 (92.1)	98/110 (89.1)	0.328
Benzbromarone	42/305 (13.8)	20/110 (18.2)	0.277
Attitude to gout, valued	207/311 (66.6)	83/114 (72.8)	0.241
Regular visits			0.014
Good	169/311 (54.3)	77/114 (67.5)	
Moderate	82/311 (26.4)	23/114 (20.2)	
Poor	60/311 (19.3)	14/114 (12.3)	
Medication adherence			<0.001

Good	23/311 (7.4)	27/114 (23.7)	
Moderate	95/311 (30.5)	45/114 (39.5)	
Poor	193/311 (62.1)	42/114 (36.8)	
Comorbid conditions			
Hypertension	62/311 (19.9)	33/114 (28.9)	0.065
Diabetes	5/311 (1.6)	7/114 (6.1)	0.020
Hyperlipidemia	94/311 (30.2)	35/114 (30.7)	1.000
Kidney stones	70/266 (26.3)	34/103 (33.0)	0.200
Coronary Heart Disease	4/311 (1.3)	1/114 (0.9)	
Management			
Propaganda			0.772
Detailed	243/311 (78.1)	91/114 (79.8)	
General	65/311 (20.9)	20/114 (17.5)	
None	3/311 (1.0)	3/114 (2.6)	
Diet management			0.060
Strict	63/311 (20.3)	36/114 (31.6)	
Moderate	231/311 (74.3)	70/114 (61.4)	
Loose	17/311 (5.5)	8/114 (7.0)	
Exercise			0.219
Strong	83/311 (26.7)	34/114 (29.8)	
Moderate	76/311 (24.4)	33/114 (28.9)	
Easy	152/311 (48.9)	47/114 (41.2)	
Gout popular science			0.101
Helpful	63/311 (20.3)	30/114 (26.3)	
General	188/311 (60.5)	68/114 (59.6)	
None	60/311 (19.3)	16/114 (14.0)	
Patient communication	159/311 (51.1)	64/114 (56.1)	0.382
Own expense	128/311 (41.2)	52/114 (45.6)	0.439
Economic burden	102/311 (32.8)	51/114 (44.7)	0.030

Established health files	94/311 (30.2)	44/114 (38.6)	0.128
Community doctor's help	101/311 (32.5)	53/114 (46.5)	0.009

Table 2 Results of multivariate logistic regression models to assess predictors of uric acid > 360 umol/L for patients with gout

Variables	Full model		Simplified model	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Age, years	1.00 (0.98– 1.02)	0.932	–	–
Sex, male	5.19 (0.89–41.98)	0.079	5.68 (0.97–45.65)	0.064
BMI				
General	Ref	–	–	–
Overweigh	1.11 (0.62– 1.96)	0.714	–	–
Obesity	1.62 (0.82– 3.23)	0.166	–	–
Education, university	1.62 (0.96– 2.74)	0.069	1.59 (0.97– 2.60)	0.064
Regular visits				
Good	Ref	–	–	–
Moderate	1.24 (0.67– 2.33)	0.500	–	–
Poor	1.40 (0.68– 3.01)	0.367	–	–
Medication adherence				
Good	Ref	–	Ref	–
General	2.35 (1.17– 4.77)	0.016	2.35 (1.18– 4.72)	0.016
Bad	4.63 (2.28– 9.51)	<0.001	5.07 (2.56–10.16)	<0.001
Diet management				
Strict	Ref	–	Ref	–
Moderate	1.59 (0.92– 2.74)	0.095	1.67 (0.97– 2.82)	0.060
Loose	0.71 (0.25– 2.06)	0.512	0.82 (0.30– 2.34)	0.706
Diabetes	0.35 (0.09– 1.32)	0.124	0.35 (0.09– 1.27)	0.111
Economic burden	0.67 (0.41– 1.10)	0.109	0.69 (0.43– 1.12)	0.135
Community doctor's help	0.60 (0.37– 0.97)	0.036	0.58 (0.36– 0.93)	0.023

The sample size for fitting the full model and simplified model was 425.

Table 3 Patient, disease, and management at baseline for patients with gout

Characteristics	Not Well controlled (N=361)	Well controlled (N=61)	<i>P</i>
Demographics			
Age, years	42.0 (33.0–50.0)	41.0 (35.0–51.0)	0.813
Sex, male	361/364 (99.2)	58/61 (95.1)	0.041
BMI			0.052
General	81/364 (22.3)	21/61 (34.4)	
Overweigh	179/364 (49.2)	27/61 (44.3)	
Obesity	104/364 (28.6)	13/61 (21.3)	
Education, university	244/364 (67.0)	43/61 (70.5)	0.659
Mental work	278/364 (76.4)	50/61 (82.0)	0.411
Family history	103/364 (28.3)	16/61 (26.2)	0.878
Disease-related conditions			
Course of disease, years	6.0 (3.0–10.0)	5.0 (2.0–10.0)	0.057
Max creatinine in a month, umol/L	90.0 (77.0–103.1)	86.0 (74.0–100.0)	0.196
Use of uric acid lowering drugs, years	3.0 (1.0–5.0)	2.0 (1.0–4.0)	0.101
Tophi	129/364 (35.4)	14/61 (23.0)	0.058
Acute gout event	195/364 (53.6)	0/61 (0.0)	
Used medicine			
Painkillers	198/364 (54.4)	0/61 (0.0)	
Allopurinol	42/355 (11.8)	3/60 (5.0)	0.175
Febuxostat	326/355 (91.8)	53/60 (88.3)	0.332
Benzbromarone	53/355 (14.9)	9/60 (15.0)	1.000
Attitude to gout, valued	243/364 (66.8)	47/61 (77.0)	0.137
Regular visits			0.004
Good	200/364 (54.9)	46/61 (75.4)	
Moderate	96/364 (26.4)	9/61 (14.8)	
Poor	68/364 (18.7)	6/61 (9.8)	
Compliance			<0.001

Good	31/364 (8.5)	19/61 (31.1)	
Moderate	114/364 (31.3)	26/61 (42.6)	
Poor	219/364 (60.2)	16/61 (26.2)	
Comorbid conditions			
Hypertension	80/364 (22.0)	15/61 (24.6)	0.622
Diabetes	9/364 (2.5)	3/61 (4.9)	0.392
Hyperlipidemia	109/364 (29.9)	20/61 (32.8)	0.654
Kidney stones	87/316 (27.5)	17/53 (32.1)	0.511
Coronary Heart Disease	5/364 (1.4)	0/61 (0.0)	
Management			
Propaganda			0.095
Detailed	281/364 (77.2)	53/61 (86.9)	
General	78/364 (21.4)	7/61 (11.5)	
None	5/364 (1.4)	1/61 (1.6)	
Diet management			0.247
Strict	82/364 (22.5)	17/61 (27.9)	
Moderate	259/364 (71.2)	42/61 (68.9)	
Loose	23/364 (6.3)	2/61 (3.3)	
Exercise			0.086
Strong	98/364 (26.9)	19/61 (31.1)	
Moderate	88/364 (24.2)	21/61 (34.4)	
Easy	178/364 (48.9)	21/61 (34.4)	
Gout popular science			0.001
Helpful	71/364 (19.5)	22/61 (36.1)	
General	222/364 (61.0)	34/61 (55.7)	
None	71/364 (19.5)	5/61 (8.2)	
Patient communication	189/364 (51.9)	34/61 (55.7)	0.678
Own expense	154/364 (42.3)	26/61 (42.6)	1.000
Economic burden	126/364 (34.6)	27/61 (44.3)	0.152

Established health files	111/364 (30.5)	27/61 (44.3)	0.039
Community doctor's help	124/364 (34.1)	30/61 (49.2)	0.030

Table 4 Results of multivariate logistic regression models to assess predictors of not well controlled uric acid for patients with gout

Variables	Full model		Simplified model	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Age, years	1.00 (0.97– 1.03)	0.956	–	–
Sex, male	5.79 (0.83–40.66)	0.068	4.32 (0.68–27.69)	0.109
BMI				
General	Ref	–	–	–
Overweigh	1.58 (0.77– 3.22)	0.205	–	–
Obesity	1.58 (0.68– 3.76)	0.292	–	–
Course of disease, years	0.96 (0.91– 1.02)	0.151	–	–
Tophi	2.48 (1.17– 5.61)	0.023	2.16 (1.11– 4.44)	0.028
Regular visits				
Good	Ref	–	–	–
Moderate	1.70 (0.73– 4.35)	0.242	–	–
Poor	1.42 (0.55– 4.21)	0.491	–	–
Compliance				
Good	Ref	–	Ref	–
General	2.78 (1.28– 6.05)	0.009	2.76 (1.30– 5.87)	0.008
Bad	6.23 (2.68–14.77)	<0.001	8.10 (3.66–18.32)	<0.001
Propaganda				
Detailed	Ref	–	–	–
General	1.60 (0.67– 4.35)	0.316	–	–
None	1.54 (0.12–45.03)	0.763	–	–
Exercise				
Strong	Ref	–	–	–
Moderate	0.71 (0.33– 1.52)	0.375	–	–
Easy	1.48 (0.69– 3.18)	0.309	–	–
Gout popular science				
Helpful	Ref	–	Ref	–
General	1.67 (0.82– 3.36)	0.154	1.59 (0.81– 3.06)	0.169

None	4.07 (1.41–13.91)	0.015	3.98 (1.45–12.97)	0.012
Established health files	0.77 (0.35– 1.68)	0.502	0.61 (0.34– 1.13)	0.115
Community doctor's help	0.72 (0.33– 1.56)	0.396	–	–

The sample size for fitting the full model and simplified model was 425.

Figures

Figure 1

Calibration plot (left) and receiving operating characteristic curve (right) for the high uric acid risk model. In calibration plot, dashed line indicates ideal reference line where predicted probabilities would match the observed proportions, and the points with error bars represent the nomogram-predicted probabilities and 95% confidence interval grouped for each of the four quartile groups.

Figure 2

Nomogram for predicting high uric acid > 360 umol/L among patients with gout. The final model for predictors of risk of high uric acid included seven covariates: gender, education, compliance, diet management, diabetes, economic burden and community doctor's help.

Figure 3

Nomogram for predicting not well controlled uric acid among patients with gout. The final model for predictors of risk of not well controlled uric acid included five covariates: gender, tophi, compliance, gout popular science and established health files.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryTable1.docx](#)