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ORIGINAL RESEARCH

Care Gaps in Gout Management Within a Tertiary Academic Health System in Saudi Arabia: Implications for Quality Improvement

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Background: Gout is a common, treatable inflammatory arthritis, yet adherence to guideline-based care remains suboptimal worldwide. Data from Saudi Arabia evaluating real-world gout care processes are limited.

Methods: We conducted a retrospective cohort study of adults with a a physician-documented diagnosis of gout who newly initiated allopurinol within a tertiary academic health system in Riyadh, Saudi Arabia, from January 2022 through December 2024. Pharmacy records were used to identify eligible patients, and electronic medical records were reviewed to extract demographic, clinical, and treatment data. Adherence to American College of Rheumatology (ACR) 2020 guideline-derived quality indicators was assessed, including guideline-concordant initiation of urate-lowering therapy (ULT), serum uric acid (SUA) monitoring, achievement of SUA <6 mg/dL, and use of anti-inflammatory prophylaxis. Multivariable logistic regression was used to identify predictors of adherence.

Results: Among 120 patients, 35.8% met ACR 2020 criteria for ULT initiation. SUA was measured within 6 months of initiation in 41.7% of patients, and at least annually in 61.7% of patients with at least 12 months of follow-up. Among 115 patients with at least 12 months of follow-up and at least one documented SUA measurement, 32.2% achieved SUA <6 mg/dL. Anti-inflammatory prophylaxis was received at ULT initiation by 15 out of 107 eligible patients (14%). Primary care management was independently associated with lower odds of meeting initiation criteria (OR 0.05, 95% CI 0.01–0.16) and of achieving the target SUA (OR 0.23, 95% CI 0.06–0.89) compared with rheumatology. Older age (OR 0.97, 95% CI 0.92–1.00) and male sex (OR 0.29, 95% CI 0.10–0.83) were also associated with lower SUA target attainment.

Conclusion: In this tertiary academic health system, guideline-recommended gout care processes were inconsistently executed across initiation, monitoring, target assessment, and prophylaxis domains. Primary care management was associated with lower odds of appropriate ULT initiation and target SUA attainment, and older age and male sex were also associated with lower target achievement. Standardized treat-to-target pathways supported by pharmacist- or nurse-led titration may improve performance.

Plain Language Summary: Gout is a common and painful form of arthritis. It can be effectively treated when care follows clear medical guidelines. These guidelines recommend starting urate-lowering medicines only when they are truly needed, checking blood uric acid levels regularly, adjusting treatment until a safe target level is reached, and giving short-term anti-inflammatory medicines to prevent early gout attacks.

We studied 120 adults with gout who were newly started on allopurinol at a large academic health system in Riyadh. We reviewed their medical records to see how often these recommended steps were followed in routine care.

We found that only 35.8% of patients met guideline criteria for starting urate-lowering treatment. Serum uric acid was checked within 6 months in 41.7% of patients, and among those with assessable follow-up, 61.7% had at least yearly monitoring of serum uric acid. Among patients with enough follow-up and at least one uric acid test, 32.2% (37 of 115 patients) reached the recommended uric

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acid target of less than 6 mg/dL. Preventive anti-inflammatory treatment at the time allopurinol was started was received by 14.0% of eligible patients (15 out of 107).

Patients managed in primary care were less likely than those managed by rheumatologists to meet guideline standards for treatment initiation and uric acid target attainment. This suggests that the main gaps may relate to how care is organized and followed over time, not just to which medication is prescribed.

Our findings show that many people with gout are not receiving all the recommended steps of care. Standardized care pathways, automatic reminders for uric acid testing, bundled prescribing of prophylaxis, and pharmacist- or nurse-supported follow-up may help improve gout care and reduce avoidable flares.

Keywords: gout, allopurinol, guideline adherence, quality indicators, Saudi Arabia

Introduction

Gout is the most common inflammatory arthritis in men, and its prevalence is increasing globally, driven by population aging and rising rates of obesity, hypertension, and chronic kidney disease (CKD).[1,2] In the United States, gout affects approximately 9.2 million adults, nearly 4% of the population.[3] Data from Saudi Arabia are limited, but available studies suggest a growing burden. In Riyadh, a prospective cohort reported a hyperuricemia prevalence of 8.2% without confirmed gout cases.[4] A hospital-based study found that more than one-third of patients presenting with suggestive symptoms were diagnosed with gout.[5]

Despite effective and low-cost therapies, major gaps in gout care persist worldwide.[6–9] Urate-lowering therapy (ULT), primarily allopurinol, is underused when indicated and is often prescribed inappropriately for asymptomatic hyperuricemia.[9] Even when appropriately initiated, dose titration and serum uric acid (SUA) monitoring are frequently inadequate, and only a minority of patients achieve the treat-to-target goal.[6,10,11] In US electronic quality measures, 32 to 58% of eligible patients received ULT, and only 32 to 54% of those treated achieved their SUA target.[6] Randomized trials show that dose escalation guided by serial SUA testing reduces flares, decreases tophus size, and improves adherence.[12–15] In addition, ULT is often initiated without anti-inflammatory prophylaxis, despite consistent evidence that colchicine, nonsteroidal anti-inflammatory drugs (NSAIDs), or short corticosteroid courses reduce preventable early flares.[16–25]

Prior Saudi Arabian studies have documented specific and recurring deficiencies in gout-related knowledge and prescribing practice. Surveys of primary care physicians in Asir, and Qassim regions found that substantial proportions of providers were uncertain about when to initiate ULT, unfamiliar with recommended SUA targets, and unaware of standard dose escalation protocols.[26,27] Prescription audits at tertiary care centers have similarly identified high rates of allopurinol initiation in the absence of a clear clinical indication and frequent failure to adjust dosing for renal function.[28–30] Collectively, these studies suggest that deficiencies in providers' knowledge translate into measurable prescribing deviations. However, these studies relied on either self-reported questionnaires or single-indicator prescription audits, and none simultaneously evaluated adherence across the multiple process measures that define guideline-concordant gout care. As a result, whether these documented knowledge gaps produce real-world care deficiencies across the full gout care pathway, from appropriate ULT initiation, through SUA monitoring, to prophylaxis use and treat-to-target attainment, has not been established in Saudi Arabia. This gap is particularly relevant given that primary care physicians in Saudi Arabia bear a disproportionate share of the gout management burden: ULT is most commonly initiated by the treating physician at the point of diagnosis, without a systematic protocol for specialist referral or handover of monitoring responsibility to rheumatology. Characterizing care quality across prescribing specialties within an integrated health system is therefore essential for identifying the settings and pathways where improvement efforts are most urgently needed.

To address this gap, we conducted a retrospective cohort study of new allopurinol users with gout at a tertiary academic health system in Riyadh, Saudi Arabia. Our objectives were to evaluate adherence to guideline-concordant gout management, focusing on ULT initiation, SUA monitoring, achievement of SUA targets, and use of anti-inflammatory prophylaxis.

Materials and Methods

Study Design and Setting

We conducted a retrospective cohort study at King Saud University Medical City, a tertiary academic hospital in Riyadh, Saudi Arabia. The study period spanned from January 1, 2022 to December 31, 2024. Reporting followed the Strengthening of Observational Studies in Epidemiology (STROBE) guidelines[31] and the completed checklist is provided in the Supplementary Material.

Study Population

Patients were identified through pharmacy dispensing records for allopurinol during the study period. In our center, allopurinol is the standard first-line and overwhelmingly predominant ULT available within the institutional formulary; febuxostat and other urate-lowering agents were not part of routine prescribing pathways during the study period. We therefore restricted inclusion to new allopurinol users to evaluate the quality of guideline-concordant gout care within the treatment pathway used in routine practice. This approach has an important limitation: by design, it excludes patients who should have received ULT but did not and therefore cannot characterize under-initiation of treatment as a care gap. The electronic medical record (EMR) was reviewed to confirm a physician-documented diagnosis of gout. Inclusion criteria were age 18 years or older, documented gout diagnosis in the EMR, and a new prescription for allopurinol. Patients prescribed allopurinol for non-gout indications, such as tumor lysis syndrome prophylaxis, nephrolithiasis, or urate nephropathy, were excluded. Primary care prescribers included both family medicine and general internal medicine physicians practicing in ambulatory clinics. All included patients received follow-up within King Saud University Medical City during the study window.

Variables, Data Sources and Measurements

Data were abstracted from the EMR using a structured tool. King Saud University Medical City uses a unified EMR across primary care, specialty clinics, emergency services, and inpatient care. This allowed capture of prescribing, laboratory testing, and follow-up occurring within the institution, but not care delivered outside KSUMC. Collected variables included demographics, comorbidities, gout clinical features, baseline serum uric acid (SUA), ULT dose, prescribing clinician specialty, SUA monitoring, achievement of SUA targets, and use and duration of anti-inflammatory prophylaxis. Gout diagnosis was accepted if documented by a treating physician in the EMR, regardless of specialty, reflecting real-world clinical practice. This included patients diagnosed clinically, with crystal confirmation, or with imaging evidence when available. Flare frequency was abstracted from narrative outpatient and emergency department documentation. When flare history was not documented, patients were conservatively classified as not meeting flare-based ACR initiation criteria.

Quality Indicators and Guidelines Development and Selection

The development and validation of gout quality indicators (QIs) used in this study have been described previously.[6,32] For this study, we selected QIs based on clinical relevance and feasibility of ascertainment in the EMR. The indicators evaluated were: meeting indications for ULT initiation among patients with gout, SUA monitoring, achievement of SUA targets, and use of anti-inflammatory prophylaxis.

Quality Indicator Definitions

- *ULT indications*: proportion of patients on ULT who met the 2020 American College of Rheumatology (ACR) initiation criteria.[32] Criteria included one or more of the following: subcutaneous tophi, radiographic damage attributable to gout, two or more flares per year, first flare with chronic kidney disease (CKD) stage 3 or higher, SUA greater than 9 mg/dL, or urolithiasis. Each criterion was operationalized as a binary variable based on documentation in structured EMR fields or clinician notes. When flare history was not documented, patients were conservatively classified as not meeting flare-based criteria.

- *SUA monitoring*: proportion of patients with at least one SUA measurement within 6 months of ULT initiation, and with at least one SUA test per 12-month interval during follow-up.[6]
- **Treat-to-target**: proportion who achieved SUA less than 6 mg/dL at 12 months after ULT initiation.[6,32] Only patients with at least 12 months of follow-up and at least one documented SUA value were included in this analysis.
- **Acute gout prophylaxis**: proportion of patients on ULT who received concomitant anti-inflammatory prophylaxis with colchicine, NSAIDs, or corticosteroids, for 3 to 6 months.[6,32] Patients with documented contraindications to these options were excluded from the denominator. Contraindications were identified through EMR review and included CKD stage 3b or worse, anticoagulation use, peptic ulcer disease or gastrointestinal bleeding, heart failure, and cardiovascular disease when these were judged to limit safe prescribing. Over-the-counter NSAID use and prescriptions issued outside the institution could not be captured.

Bias

Participants were included based on non-probability consecutive sampling. Missing clinical documentation, particularly for flare frequency, may have resulted in misclassification. A conservative approach was used to minimize false-positive classification of inappropriate initiation.

Statistical Analysis

We summarized demographic and clinical characteristics using descriptive statistics. Categorical variables are presented as frequencies and percentages, and continuous variables as means with standard deviations (SD). Binary logistic regression analyses were performed to identify factors associated with four prespecified outcomes: (1) meeting ACR 2020 criteria for ULT initiation, (2) SUA monitoring within 6 months of ULT initiation, (3) achieving SUA <6 mg/dL, and (4) receipt of appropriate anti-inflammatory prophylaxis. Candidate predictors were selected a priori to gout care quality as established in prior literature, without univariate pre-screening to avoid data-driven model building in a small sample (6). Specifically, age and sex were included because both have been associated with differences in gout phenotype, comorbidity burden, and treatment patterns;[33] prescribing specialty was included as the primary structural determinant of care quality in this study; CKD was included because it constrains both ULT dosing and prophylaxis eligibility;[32] baseline SUA was included as a marker of disease severity;[32] and flare frequency was included as the principal criterion for ACR-concordant ULT initiation.[32] Variables with fewer than five outcome events were excluded from all multivariable models, as sparse events preclude stable estimation. Results are reported as odds ratios (ORs) with 95% confidence intervals (CIs). A p value of ≤ 0.05 was considered statistically significant. Given the modest sample size and sparse outcome events for some predictors, all regression models should be considered exploratory and hypothesis-generating rather than confirmatory. Analyses were conducted using SPSS version 29 (IBM Corp., Armonk, NY, USA).

Ethics Approval and Informed Consent

Ethical approval for this study was obtained from the institutional review board of King Saud University and King Saud University Medical City (no. E-24-9367). As this was a retrospective review of existing records, the requirement for individual patient informed consent was waived by the institutional review board. All records were de-identified prior to data extraction, and access was restricted to study personnel. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable institutional data governance standards.

Results

Patient Characteristics

A total of 120 patients with physician-documented gout who were prescribed allopurinol were included. The majority were male (64.2%). The mean serum creatinine was 96.1 ± 62.3 μmol/L. The mean initial allopurinol dose was 189.6 ± 104.13 mg, and the mean baseline SUA level was 7.8 ± 1.6 mg/dL. Subcutaneous tophi were documented in 2 patients (1.7%), and radiographic damage attributable to gout in 3 patients (2.5%). Flare frequency in the preceding 12 months was variably documented: 15% had no reported flares, 10.8% had one flare, and 10.0% had 2 or more flares, with missing

Table 1 Baseline Demographic and Clinical Characteristics of the Study Cohort (N=120)

Variable	Value
Age, years (Mean ± SD)	46.8 ± 13.1
Weight, kg (Mean ± SD)	81.5 ± 20.4
Serum creatinine, µmol/L (Mean ± SD)	96.1 ± 62.3
Allopurinol dose, mg (Mean ± SD)	189.6 ± 104.1
Baseline SUA level, mg/dL (Mean ± SD)	7.8 ± 1.6
Sex, n (%)	
Male	77 (64.2)
Female	43 (35.8)
Gout features, n (%)	
Subcutaneous tophi	2 (1.7)
Radiographic Damage	3 (2.5)
Flares in the preceding 12M, n (%)	
0	18 (15)
1	13 (10.8)
≥ 2	12 (10.0)
Not Documented*	77 (64.2)
Prescriber's Specialty, n (%)	
Primary Care	70 (58.3)
Rheumatology	29 (24.2)
Others**	12 (10.0)
Not documented***	9 (7.5)
Comorbidities, n (%)	
DM	35 (29.2)
Hypertension	43 (35.8)
CKD	18 (15.0)
CVD	8 (6.7)

Notes: Values are presented as mean ± standard deviation (SD) for continuous variables and as number (percentage) for categorical variables. *Not documented indicates that the flare frequency could not be confirmed from the EMR. ** Nephrology (n=5), Emergency Medicine (n=2), Physical Medicine & Rehabilitation (n=1), Urology (n=1), Cardiology (n=1), General Surgery (n=1), Endocrinology (n=1). ***Not documented indicates that the prescribing specialty could not be confirmed from the electronic medical record.
Abbreviations: SUA, Serum uric acid; 12M, 12 months; DM, diabetes mellitus; CKD, chronic kidney disease; CVD, cardiovascular disease.

documentation in 64.2%. Comorbidities were common, with diabetes mellitus (DM) in 29.2%, hypertension (HTN) in 35.8%, CKD in 15%, and cardiovascular disease (CVD) in 6.7%. Most prescriptions originated from primary care (n = 70, 58.3%), followed by rheumatology (n = 29, 24.2%). Baseline characteristics are summarized in Table 1.

Adherence to Guideline-Based Quality Indicators

Adherence to guideline-based quality indicators was suboptimal across all four domains. Among 120 patients, 43 (35.8%) met ACR 2020 indications for ULT initiation, whereas 77 (64.2%) did not. SUA was measured within 6 months of ULT initiation in 50 patients (41.7%), and 66 out of 107 patients with enough follow-up (61.7%) underwent at least one SUA test per 12-month interval. Among 115 patients with at least one documented SUA value during follow-up, 37 (32.2%) achieved the target SUA of <6 mg/dL. Anti-inflammatory prophylaxis was received at ULT initiation in 15 of 107 eligible patients (14.0%). Thirteen patients were excluded from the prophylaxis analysis because of contraindications, all due to CKD stage 3b or worse. (Figure 1).

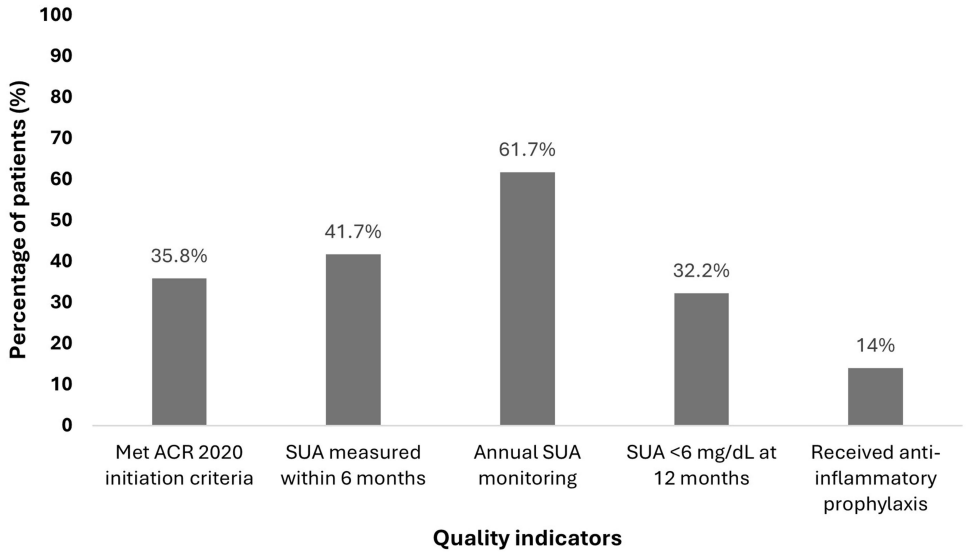

Figure 1 Proportion of patients meeting guideline-based quality indicators.

Predictors of Adherence

Meeting ACR 2020 ULT Indications: Having one or more than one flare in the preceding 12 months was associated with higher odds of meeting ACR ULT initiation criteria (OR 4.71, 95% CI 1.42–15.58, p=0.011). Patients managed in primary care were less likely to fulfill initiation criteria than those managed by rheumatologists (OR 0.05, 95% CI 0.01–0.16, p<0.001). No other variables were significantly associated (Supplementary Table S1A).

SUA Monitoring Within 6 Months: No examined predictors were significantly associated with early SUA monitoring (Supplementary Table S1B).

Achievement of SUA <6 mg/dL at 12 Months: Older age was independently associated with lower odds of achieving target SUA (OR 0.97, 95% CI 0.92–1.00, p=0.042). Male patients were less likely than females to achieve the target (OR 0.29, 95% CI 0.10–0.83, p=0.021). Patients managed in primary care had significantly lower odds of reaching target SUA compared with those treated by rheumatologists (OR 0.23, 95% CI 0.06–0.89, p=0.033). No other predictors were significant (Supplementary Table S1C).

Receipt of Appropriate Anti-inflammatory Prophylaxis: Meeting the ACR 2020 ULT initiation criteria was the only independent predictor of prophylaxis receipt (OR 26.2, 95% CI 3.4–202.7, p=0.002). No other predictors were significantly associated (Supplementary Table S1D).

Discussion

In Saudi Arabia, gout management occurs across a tiered healthcare system. Patients with suspected gout most commonly present initially to primary care physicians, including family medicine and general internal medicine practitioners in Ministry of Health polyclinics or hospital-affiliated ambulatory clinics, or to emergency departments during acute flares. Initial clinical evaluation, including SUA measurement and basic laboratory workup, is routinely ordered by the presenting physician regardless of specialty; however, advanced diagnostic examinations such as joint aspiration for synovial fluid crystal analysis, dual-energy computed tomography, or musculoskeletal ultrasound are generally performed only when rheumatology or orthopedic input is obtained, and are not a standard component of primary care gout evaluation in this setting. ULT is most commonly initiated by the treating physician at the point of diagnosis, and ongoing monitoring is typically the responsibility of the same prescribing specialty, without a systematic handover protocol to rheumatology unless complications arise or targets are not met. Within the public healthcare system, which serves the majority of Saudi nationals, both medications and laboratory investigations are provided without direct cost to the patient, and payment barriers are not a significant obstacle to care for this population. Geographical access to specialist rheumatology services, however, varies considerably: while major urban centers have tertiary academic centers

with rheumatology departments, patients in rural or remote regions may have limited or no access to specialist input, relying entirely on primary care for gout management. This structural context is relevant to interpreting the primary care performance gaps observed in the present study, as primary care physicians in this setting carry a disproportionate share of the gout management burden without the specialist support structures available at academic centers.

In this study of gout patients receiving allopurinol, we identified substantial gaps in the execution of guideline-recommended care processes. Only one-third of patients met the ACR 2020 indications for ULT initiation, fewer than half had early SUA testing, just over half had at least annual SUA surveillance, and only 32.2% achieved the recommended SUA target at 12 months. Documented anti-inflammatory prophylaxis at initiation was present in 14% of eligible patients. Management by primary care was consistently associated with poorer adherence compared with rheumatology.

This study provides novel evidence on real-world gout care in Saudi Arabia. First, nearly two-thirds of treated patients received ULT without meeting initiation criteria, reflecting widespread non–guideline-concordant initiation. To characterize patients who received ULT without meeting ACR 2020 initiation criteria, we compared them with patients who did meet criteria (Table 2). The two groups did not differ significantly in age, and comorbidity prevalence was broadly similar, with the notable exceptions of CVD which was more common among patients who met criteria (14.0% vs 2.6%) and CKD stage ≥3 which was present exclusively among patients meeting criteria (41.9% vs 0%), reflecting its role as an independent ACR initiation criterion. Patients who did not meet criteria had substantially lower mean baseline serum uric acid levels (7.1 ± 1.2 vs 9.1 ± 1.5 mg/dL, $p<0.001$). The most striking difference was in prescriber specialty: 76.6% of patients who did not meet criteria were managed in primary care, compared with only 25.6% of those who did meet criteria, while rheumatology accounted for 48.8% of appropriately initiated prescriptions but only 7.8% of inappropriate ones ($p<0.001$). This pattern is concerning, particularly since inappropriate ULT may expose patients to unnecessary risks without clear benefit.[34–37] Second, flare frequency was undocumented in 64.2% of patients, suggesting that a core clinical parameter of gout assessment was not routinely performed or recorded, thereby limiting appropriate treatment decisions. Missing documentation of flare frequency resulted in conservative classification of patients as not meeting flare-based initiation criteria. To quantify the impact of this assumption, we examined three scenarios. Under the conservative approach (primary analysis), in which undocumented patients are classified as having no flares, 43 of 120 patients (35.8%) meet ACR 2020 initiation criteria. Under an intermediate assumption of one undocumented flare, the proportion is unchanged at 35.8%. Under an optimistic upper-bound assumption in which all undocumented patients are

Table 2 Characteristics of Patients by ACR 2020 Urate-Lowering Therapy Initiation Criteria Status (N=120)

Variable	Met Criteria (n=43)	Did Not Meet Criteria (n=77)	p-Value
Age, mean ± SD (years)	45.9 ± 15.0	47.4 ± 12.1	0.570
Weight (kg), mean ± SD	85.4 ± 18.7	79.2 ± 21.2	0.113
Male sex, n (%)	36 (83.7%)	41 (53.2%)	**0.002**
Baseline SUA, mean ± SD (mg/dL)	9.1 ± 1.5	7.1 ± 1.2	**<0.001**
Prescriber specialty			
Primary care, n (%)	11 (25.6)	59 (76.6)	**<0.001**
Rheumatology, n (%)	21 (48.8)	6 (7.8)	**<0.001**
Other, n (%)	11 (25.6)	12 (15.6)	—
Comorbidities			
DM, n (%)	12 (27.9)	23 (29.9)	0.821
Hypertension, n (%)	17 (39.5)	26 (33.8)	0.527
CKD (stage ≥3), n (%)	18 (41.9)	0 (0.0)	**0.001**
CVD, n (%)	6 (14.0)	2 (2.6)	**0.017**

Notes: Values are presented as mean ± standard deviation (SD) for continuous variables and as number (percentage) for categorical variables. Bold denotes statistical significance ($p<0.05$).
Abbreviations: SUA, Serum uric acid; DM, diabetes mellitus; CKD, chronic kidney disease; CVD, cardiovascular disease.

assumed to have had two or more flares 92 of 120 patients (76.7%) would meet criteria, yielding a plausible range of 35.8–76.74%. Regardless of the assumption applied, a substantial proportion of patients received ULT without meeting ACR criteria, and the direction of the care gap is consistent across all scenarios. The 64.2% inappropriate initiation rate should therefore be interpreted as a conservative upper bound rather than a precise estimate; prospective studies incorporating structured flare history capture are needed to establish more reliable baseline rates in this population. Third, treat-to-target strategies were uncommon. Fewer than half underwent SUA testing within 6 months of initiation, 61.7% had at least one test per 12 months, and most remained above target SUA levels. Finally, anti-inflammatory prophylaxis use was infrequent, potentially increasing the risk of preventable flares after starting allopurinol. Collectively, these findings highlight a profound implementation gap between evidence and practice in this setting.

Our results align with international data, where inappropriate initiation, limited dose escalation, and inadequate monitoring remain common despite clear guidelines.[6–9,11,38] Patients managed in primary care were less likely to meet initiation criteria and less likely to achieve target SUA compared with those managed by rheumatologists, consistent with knowledge and practice gaps among non-specialists. This pattern is consistent with prior Saudi studies showing important knowledge and practice gaps among primary care physicians in the management of hyperuricemia and gout, including uncertainty regarding when to start urate-lowering therapy, target SUA levels, and appropriate treatment escalation.[26–28] Our findings extend this literature by showing that these knowledge gaps translate into measurable deficiencies in real-world initiation and treat-to-target care processes. The consistency between documented knowledge gaps in the regional primary care literature and the specific process measure gaps observed here, particularly in ULT initiation appropriateness and SUA target attainment, suggests that provider education may be the primary lever for improvement in this setting.

Older age was also associated with a lower likelihood of target achievement. This may reflect therapeutic conservatism in the context of multimorbidity, polypharmacy, and perceived toxicity risks, which underscores the need for safe titration protocols in older adults. Male patients were less likely to achieve SUA target than females; a possible explanation is that females with gout in this cohort tended to be older and have more comorbidities, therefore, those who reached the treat-to-target analysis may have been a more closely monitored subgroup. Alternatively, male patients had higher baseline SUA levels requiring more aggressive titration.

Anti-inflammatory prophylaxis was received by only 14% of eligible patients, representing one of the most substantial implementation gaps identified in this study. Meeting ACR 2020 ULT initiation criteria was strongly and positively associated with prophylaxis receipt, indicating that clinicians who correctly identified an indication for ULT were substantially more likely to implement the full initiation pathway, including prophylaxis. Nonetheless, even among patients who met ACR initiation criteria, only 12 of 30 eligible patients (40%) received prophylaxis, underscoring that recognition of a treatment indication does not reliably translate into complete guideline-concordant prescribing. Because prophylaxis was assessed using institutional pharmacy dispensing records, over-the-counter NSAID use may have led to a modest underestimation of the true prophylaxis rate. These findings collectively support the adoption of standardized urate-lowering therapy initiation order sets that embed anti-inflammatory prophylaxis, scheduled serum uric acid follow-up, and dose titration guidance into a single clinical workflow.[39,40]

Key strengths of this study include the structured assessment of guideline-derived indicators, use of both pharmacy and EMR data, and incorporation of prescriber specialty as a key predictor. Several limitations should be acknowledged. First, missing dose titration and adherence data mean that this study captures initiation and monitoring processes but cannot evaluate whether pharmacologic optimization was pursued after the study window. This suggests that the true burden of suboptimal gout control may be greater than the process measure gaps alone indicate. Second, the modest sample size of 120 patients is a limitation for regression modelling, and the exploratory models should be interpreted cautiously. The sample size is, however, appropriate for quality improvement-focused research, which prioritizes the identification of actionable gaps rather than precise prevalence estimates.[41] Third, gout diagnosis was accepted based on physician documentation without requiring crystal or radiographic confirmation, which may have introduced a number of misclassified patients, particularly given the relatively high proportion of female and younger patients in this cohort. Finally, the single-center design limits generalizability; however, given that these gaps were observed within an integrated tertiary academic system with full-spectrum rheumatology support, similar or larger deficiencies may plausibly

exist in Ministry of Health primary care polyclinics, district general hospitals, and private outpatient clinics, which collectively manage the majority of gout patients in Saudi Arabia.

These gaps suggest clear targets for intervention. Multifaceted strategies, supported by prior trials and implementation studies, include structured treat-to-target pathways with scheduled SUA monitoring and protocolized allopurinol titration, automatic order sets that bundle initiation, prophylaxis, and follow-up testing, pharmacist or nurse-led titration clinics encompassing both ULT initiation and titration, and targeted primary care education focused on indications, dose escalation, and prophylaxis.[12,13,42–46] A recently published real-world cohort study of nurse-led gout care in a Danish rheumatology clinic, which included all consecutive crystal-confirmed gout patients without requiring informed consent, demonstrated that 82% of patients in the nurse-led group achieved the SUA target at two years compared with 44% in usual care, with ULT continuation in 98% of nurse-led patients.[46] Future quality improvement studies in Saudi Arabia should similarly prioritise inclusive designs that capture all patients presenting with gout to a given service, including those with significant comorbidities or residing in areas with limited specialist access, to ensure that intervention benefits are generalizable beyond selected academic cohorts.

At a policy level, establishing national quality measures for rheumatology, including gout, would support national benchmarking and improvement. The Rheumatology Informatics System for Effectiveness, RISE, registry offers a model for capturing and reporting performance at scale in the United States.[47] A similar national framework could enable routine measurement, transparent reporting, and targeted quality improvement, while local implementation of structured treat-to-target pathways may help translate evidence-based recommendations into more reliable gout care in routine practice.

Conclusion

Guideline-concordant gout care was suboptimal across all four ACR 2020 quality domains in this cohort: only 35.8% of patients met criteria for ULT initiation, 41.7% had early SUA monitoring, 32.2% achieved the SUA target below 6 mg/dL, and 14.0% received anti-inflammatory prophylaxis. Primary care management was independently associated with lower odds of appropriate ULT initiation (OR 0.05) and SUA target attainment (OR 0.23), identifying primary care as the highest-priority setting for quality improvement intervention. Older age and male sex were additionally associated with failure to achieve SUA targets, suggesting that these subgroups warrant closer monitoring within any structured treat-to-target pathway. Given that fewer than half of patients had early SUA testing and fewer than one-third reached the recommended urate target, dedicated pharmacist- or nurse-led titration protocols with scheduled SUA follow-up represent a practical and evidence-based strategy to close these specific gaps. Embedding prophylaxis and follow-up testing into standardized ULT initiation order sets may further reduce the implementation gap between guideline recommendations and routine practice. Prospective quality improvement studies are needed to evaluate whether these and related interventions produce measurable, sustained improvements in gout care quality across the full spectrum of clinical settings in Saudi Arabia, from tertiary academic centers to primary care polyclinics, where the burden of undertreated gout is likely greatest.

Abbreviations

ACR, American College of Rheumatology; CKD, chronic kidney disease; CVD, cardiovascular disease; DM, diabetes mellitus; EMR, electronic medical record; HTN, hypertension; QIs, quality indicators; SUA, serum uric acid; ULT, urate-lowering therapy; NSAIDs, nonsteroidal anti-inflammatory drugs.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

Aos Aboabat and Mohamed Bedaiwi are co-first authors for this study. The authors declare no conflicts of interest relevant to this article.

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