

Effectiveness of mHealth in Improving Outcomes for Gout Patients: Systematic Review and Meta-Analysis

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Effectiveness of mHealth in Improving Outcomes for Gout Patients: Systematic Review and Meta-Analysis

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Abstract

Background: Long-term management of gout relies on patients' sustained engagement in dietary control, medication adherence, and disease monitoring. Traditional management models often yield poor outcomes due to insufficient doctor-patient interaction and weak patient self-management capabilities. Mobile health (mHealth) overcomes the temporal and spatial limitations of conventional healthcare, promptly addressing issues and concerns encountered by patients during treatment. While increasingly applied to chronic disease management, evidence regarding its feasibility and effectiveness remains limited.

Objective: This study aims to evaluate the effectiveness of mobile health interventions in improving clinical outcomes for gout patients, providing evidence-based support for the digital transformation of gout clinical management.

Methods: This study was conducted in accordance with the PRISMA statement. We searched seven databases: China National Knowledge Infrastructure, Wanfang Database, China Science and Technology Journal Database, China Biomedical Literature Database, Cochrane Library, Web of Science, PubMed, and Embase. The search period spanned from the inception of each database to June 2025. We included randomized controlled trials of electronic health interventions targeting ?1 of the following 4 outcomes: serum uric acid, treatment adherence, self-management capacity, and quality of life. Two researchers independently screened the literature. We used the Cochrane Risk of Bias Assessment Tool for quality assessment.

Results: A total of 20 studies, involving 2,324 gout patients were included. Meta-analysis indicated that eHealth-based interventions significantly reduced serum uric acid levels (MD=32.43, 95% CI 24.25-40.60, $P<.001$), decreased the gout recurrence rate (OR=0.34, 95% CI 0.22-0.53, $P<.001$), increased the rate of achieving target serum uric acid levels (OR = 4.65, 95% CI 1.99–10.89, $P = 0.0004$), and improved treatment adherence (OR = 5.76, 95% CI 2.45–13.55, $P<.001$). Additionally, eHealth significantly improved self-management in diet (SMD=1.25, 95% CI 0.61-1.90, $P<.001$), exercise (SMD=0.91, 95% CI 0.17-1.65, $P=0.02$), medication adherence (SMD = 1.19, 95% CI 0.37–2.01, $P = 0.005$). Regarding quality of life, eHealth significantly improved physical (SMD=0.66, 95% CI 0.13–1.20, $P=0.02$), psychological (SMD=1.21, 95% CI 0.44–1.98, $P=0.002$), and social (SMD=1.41, 95% CI 0.68–2.14, $P=0.0002$) domains. However, no statistically significant difference was observed between the intervention and conventional management groups regarding the “number of missed medication doses.” Subgroup analyses based on intervention tools and duration revealed that the effectiveness of eHealth interventions varied across different intervention durations and tools.

Conclusions: Research indicates that mobile health interventions can help gout patients improve serum uric acid control and enhance treatment adherence. They also boost patients' self-management capabilities and quality of life. Therefore, mobile health-supported interventions serve as an effective adjunct for long-term gout management. However, some patients—particularly those who are older or have limited education—may be unfamiliar with mobile health devices, which can impact treatment outcomes. Future efforts should involve comprehensive assessments of diverse patient populations and further validation through high-quality research. Clinical Trial: PROSPERO International Prospective Register of Systematic Reviews CRD420251153848?https://www.crd.york.ac.uk/PROSPERO/view/CRD420251153848

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Original Manuscript

Review

Effectiveness of mHealth in Improving Outcomes for Gout Patients: Systematic Review and Meta-Analysis

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mobile health-supported interventions serve as an effective adjunct for long-term gout management. However, some patients—particularly those who are older or have limited education—may be unfamiliar with mobile health devices, which can impact treatment outcomes. Future efforts should involve comprehensive assessments of diverse patient populations and further validation through high-quality research.

Trial Registration: PROSPERO International Prospective Register of Systematic Reviews
CRD420251153848 <https://www.crd.york.ac.uk/PROSPERO/view/CRD420251153848>

KEYWORDS

Mobile health; Telemedicine; Gout; Hyperuricemia; Quality of life; Rehabilitation; Meta-analysis

Introduction

Background

Gout is a chronic inflammatory disease caused by abnormal uric acid metabolism, emerging as a pressing public health concern worldwide^[1]. The accelerating aging population, rising obesity rates, widespread consumption of high-purine diets, and high prevalence of comorbidities such as metabolic syndrome have collectively driven a significant increase in global gout incidence and prevalence over the past few decades. Epidemiological data indicate that the prevalence of gout varies between 0.1% and 6.8% across different countries^[2]. The Global Burden of Disease (GBD) 2021 study further highlights that the global gout patient population reached 55.8 million in 2020, with projections indicating it will rise to 95.8 million by 2050—a 72.6% increase^[3]. Notably, China faces a more severe gout epidemic: while the global incidence rate rose from 93.097 per 100,000 people to 109.075 per 100,000 people between 1990 and 2021, China's incidence rate surged from 122.522 per 100,000 people to 151.612 per 100,000 people during the same period^[4]. China's patient base significantly exceeds the global average, with a faster growth rate. The hallmark symptom of gout is recurrent acute arthritis, where joints experience severe pain, redness, swelling, and heat during attacks, severely impacting daily activities. If left uncontrolled long-term, it may progress to chronic gouty arthritis, joint deformities, or even damage organs like the kidneys—all significantly impairing patients' physical function and quality of life^[5].

Patients with gout require long-term standardized management to improve their condition. This includes controlling serum uric acid levels, relieving pain during acute attacks, optimizing dietary patterns, maintaining regular exercise, and adhering to medication schedules. However, gout management currently faces numerous challenges. Studies indicate that adherence to urate-lowering therapy is generally poor, with overall compliance rates around 47%^[6]. Approximately 50% of patients discontinue medication within 6 months of starting treatment, and only 30%-40% maintain serum uric acid within target ranges long-term. About 77.9% of patients demonstrate suboptimal self-management, with only 15.4% achieving clinical remission^[7]. If patients resume medication after a discontinuation period exceeding five days, 60% experience a rebound in serum uric acid levels^[8]. Furthermore, inadequate dietary and lifestyle guidance for patients also impairs treatment outcomes. Traditional follow-up models, reliant on periodic in-person outpatient visits, often struggle to provide timely support, personalized guidance, and real-time feedback, further compromising disease control efficacy and patient prognosis.

The rapid advancement of digital health technologies offers novel approaches to addressing these challenges. Mobile health models centered on smartphones, wearable devices, and mobile applications have emerged as a significant innovative direction in gout management. The application of mobile health in gout management spans multiple dimensions: uric acid monitoring devices can collect real-time data and synchronize it with mobile apps to track serum uric acid fluctuations^[9]. Artificial intelligence algorithms provide personalized dietary recommendations based on individual circumstances and set medication reminders to enhance treatment adherence^[10, 11]. They also guide patients in self-care during acute gout attacks to mitigate symptom severity^[12]. Additionally, patients can exchange experiences and gain support through these platforms. Compared to traditional methods, mobile health offers advantages in real-time responsiveness, personalization, and convenience. It breaks time and space constraints, transforming gout management from “periodic outpatient visits” to “round-the-clock support.” This provides crucial technological support for improving patient treatment outcomes.

Mobile health shows potential in gout management, but relevant evidence remains significantly lacking. Existing studies vary considerably in terms of protocol design, intervention methods, sample sizes, and evaluation metrics, making it difficult to directly compare results across different research. To date, no systematic study has comprehensively assessed the actual effectiveness of mobile health on key gout indicators. This situation makes it difficult for healthcare providers to identify optimal mobile health solutions and hinders the practical application of these tools in clinical settings. While reviews have discussed the role of digital health in rheumatic disease management, systematic summaries of mobile health interventions specifically for gout remain lacking. Therefore, we now need to conduct a systematic review and

comprehensive analysis to thoroughly organize existing evidence, clarify the effectiveness and feasibility of mobile health in gout management, and provide reliable guidance for clinical application and future research.

Methods

Study Design

This systematic review and meta-analysis was registered in PROSPERO (CRD420251153848) and reported according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The PRISMA checklist is provided in Multimedia Appendix 1.

Search Strategy

We conducted a comprehensive systematic search of the following eight databases, covering the period from their inception to June 2025: China National Knowledge Infrastructure (CNKI), Wanfang Database, China Science and Technology Journal Database, SinoMed, Cochrane Library, Web of Science, PubMed, and Embase. We employed a combination of database-specific medical subject headings and free-text terms. Two researchers independently performed all search operations and managed retrieved literature using EndNote software. Details of the search strategy are provided in Multimedia Appendix 2.

Selection Criteria

Our inclusion criteria were: (1) Study Design: Only randomized controlled trials published in Chinese or English were included; (2) Population: Patients aged ≥ 18 years with gout; (3) Intervention: Experimental group utilizing mobile health management tools; (4) Comparison: Management without mobile health support; (5) Outcomes: Primary outcome measures include gout treatment status (gout recurrence rate, serum uric acid levels, and serum uric acid target achievement rate); secondary outcome measures include patient treatment adherence, quality of life, and self-management abilities. The study must report at least one of the above indicators.

The exclusion criteria were: (1) Duplicate publications; (2) Studies lacking complete data; (3) Reviews, conference abstracts, case studies, protocols, and theses; (4) Studies for which full-text access is unavailable.

Data Extraction

Two researchers independently extracted data from the included studies, including details such as authors, publication year, sample size, intervention tools, intervention duration, and outcome measures. They then compared and analyzed these data. In cases of disagreement, a third researcher was consulted to resolve the issue. If the aforementioned data was unavailable, we contacted the corresponding researchers of the relevant studies to clarify and request the missing information.

Quality Assessment of Literature

We used the Cochrane Collaboration's Risk of Bias tool to assess the risk of bias in each study. This tool evaluates 7 domains to address different types of bias: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other potential biases. Each criterion was categorized as low risk, unclear risk, or high risk of bias^[13].

Statistical Methods

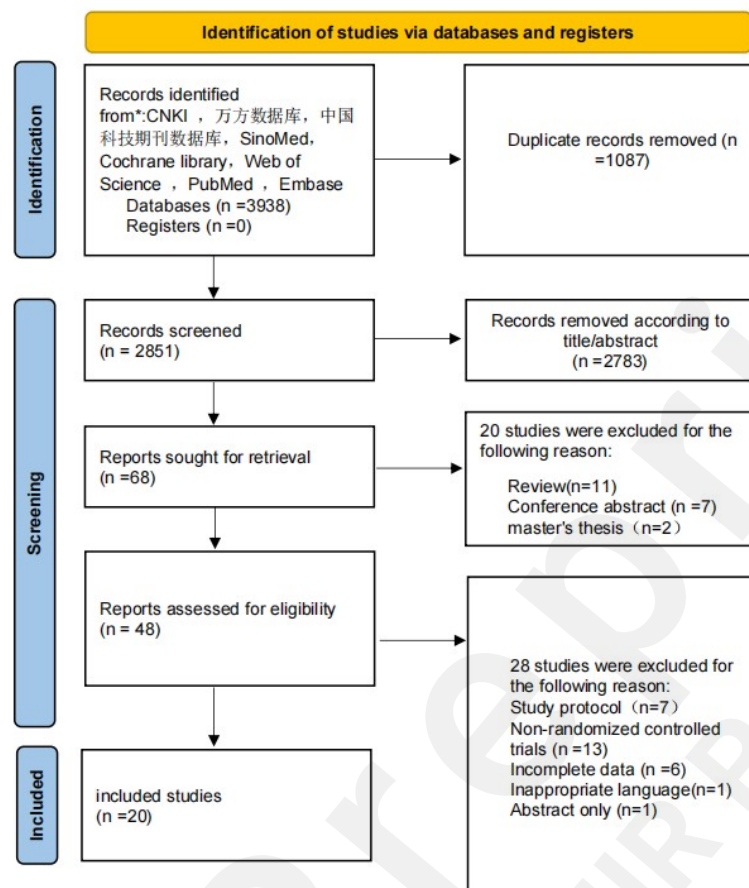
Statistical analyses were performed using RevMan (version 5.4) software and State (version 17) provided by the Cochrane Collaboration. We analyzed continuous and dichotomous variables, reporting odds ratios (OR) and 95% confidence intervals (CI). Given the variations in outcome measures for treatment adherence, self-management ability, and quality of life across all included studies, we calculated the corresponding 95% CIs and standardized mean differences (SMD) to evaluate the intervention effects compared with the control group. Heterogeneity among studies was assessed using the chi-square test and I^2 statistics, where I^2 values of 25%, 50%, and 75% indicated low, moderate, and high heterogeneity levels, respectively. High heterogeneity was anticipated due to differences in specific interventions, participant characteristics, and follow-up durations. A fixed-effects model was applied for outcomes with low heterogeneity, while a random-effects model was used for those with high heterogeneity^[14]. Publication bias was examined using funnel plots and Egger regression test^[15]. Sensitivity analysis was performed using the leave-one-out method to assess the robustness of the pooled results. Subgroup analyses were conducted for the primary outcomes based on intervention duration and intervention tools.

Results

Search Outcomes

A total of 3,938 articles were initially retrieved through literature search, including 104 from CNKI, 134 from Wanfang Database, 102 from China Science and Technology Journal Database, 80 from SinoMed, 106 from Cochrane Library, 1,755 from Web of Science, 476 from PubMed, and 1,181 from Embase. After systematic screening, 20 articles were finally included. The detailed screening process and reasons for exclusion are shown in Figure 1.

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) flow diagram.



Basic Characteristics of Included Studies

The included studies involved three countries: China^[10, 16-32], New Zealand^[33], and the United Kingdom^[34]. Among these 20 trials, three were targeted at patients with gouty arthritis^[30-32], four at patients with hyperuricemia^[17, 24, 27, 29], and the remaining 13 at gout patients. The mobile health tools used in these studies included WeChat calls^[16, 18-20, 23-26, 28, 29, 32, 33], information technology^[17, 20, 22, 27, 29-31], and medical systems^[10, 21, 34]. The intervention periods ranged from 2 weeks to 52 weeks. Detailed information on the number of participants, intervention measures, and outcomes is presented in **Table 1**.

Table 1. Characteristics of the included studies.

Study; Country	Type	Sample size	Intervention tool	Duration	Time of data collection	Outcomes
Chang et al ^[16] ; China	Gout	Treatment group: n=51; control group:	WeChat Official Account	3months	At discharge and 3 months after the intervention	Hyperuricemia- related cognitive behaviors, TA ^d , SUA ^f and GRR ^g

Study; Country	Type	Sample size	Intervention tool	Duration	Time of data collection	Outcomes
		n=51				
Liping Chen et al ^[17] ; China	HUA ^a	Treatment group: n=33; control group: n=33	Modern information technologies such as computer software and fax machines	6 mouths	Before intervention and after intervention	SUA ^f , GRR ^g
Lin Chen et al ^[18] ; China	Gout	Treatment group: n=45; control group: n=45	WeChat	3mouths	At admission, at discharge, and three months after the intervention	MA ^e , QOL ^c , anxiety, depression, and SUA ^f
Yao Chen et al ^[19] ; China	Gout	Treatment group: n=49; control group: n=49	WeChat Official Account	3mouths	Before intervention and after intervention	Quality of continuous nursing, SMA ^h , and QOL ^c
Ge et al ^[20] ; China	Gout	Treatment group: n=150; control group: n=150	WeChat Official Account□WeC hat groups	6 mouths	Before intervention and after intervention	SUA ^f , GRR ^g , SMA ^h , and QOL ^c
Philip et al ^[34] ; UK	Gout	Treatment group: n=40; control group: n=20	Full version GoutSMART smartphone application	24weeks	At baseline, at 24 weeks, and at 52 weeks	Proportion of participants with serum urate ≤0.30 mmol/L, GRR ^g , Days lost at work, Presence and size of tophi at 52 weeks, QoL ^c , Number of medical attendances due to gout, Number of missed medication doses
Huang et al ^[22] ; China	Gout	Treatment group: n=45;	televisions or mobile terminals	6mouths	Before intervention and after	SMA ^h , Self- efficacy, Satisfaction with

Study; Country	Type	Sample size	Intervention tool	Duration	Time of data collection	Outcomes
		control group: n=45			intervention	the nursing mode, GRR ^g
Li et al ^[23] , China	Gout	Treatment group: n=60; control group: n=60	WeChat Official Account	6months	Before the intervention and at 3 months and 6 months after the intervention	SUA ^f , SMA ^h , QoL ^c , nursing satisfaction
Sihuan Lin et al ^[25] , China	Gout	Treatment group: n=60; control group: n=60	WeChat Official Account	3months	Before discharge and 3 months after discharge	Knowledge of gout and QoL ^c
Miao et al ^[26] , China	Gout	Treatment group: n=50; control group: n=50	WeChat Official Account	3months	After 3 months of intervention	Knowledge rate of disease information, TA ^d , SUA-TAR ⁱ
Zhijian Shi et al ^[28] , China	Gout	Treatment group: n=40; control group: n=40	WeChat Official Account combined with phone follow- up	3months	At discharge, 1 month after discharge, and 3 months after discharge	TA ^d , SUA ^f , GRR ^g
Wu et al ^[30] , China	GA ^b	Treatment group: n=50; control group: n=50	WeChat Official Account, Gout Helper App, WeChat Group	2 months	Before the intervention, 2 months after the intervention	SMA ^h , self- efficacy, negative psychology, QoL ^c , TA ^d
Zhang et al ^[32] , China	GA ^b	Treatment group: n=23; control group: n=23	WeChat	6 months	At admission, at discharge and 6 months after discharge	GRR ^g , SUA ^f

Study; Country	Type	Sample size	Intervention tool	Duration	Time of data collection	Outcomes
Feng et al ^[21] ; China	Gout	Treatment group: n=53; control group: n=49	M-G Intelligent Gout Remote Medical Platform, WeChat Official Account	6 mouths	At the time of enrollment and at the 3rd and 6th months after the trial	SUA ^f , the number of joints affected during a gout attack, GRR ^g , and the pain score
Shita Lin et al ^[24] ; China	HUA ^a	Treatment group: n=65; control group: n=65	WeChat official account and WeChat group	6 mouths	Before the intervention and 6 months after the intervention	SUA ^f , cognition and behavior related to hyperuricemia, and QoL ^c
Yang et al ^[31] ; China	GA ^b	Treatment group: n=67; control group: n=65	Telephone, Gout Helper App, WeChat official account, WeChat group and QQ group	1 year	6 months and 12months after discharge	QoL ^c , MA ^e , SUA ^f , number of disease recurrence cases
Yasaman et al ^[33] ; New Zealand	Gout	Treatment group: n=28; control group: n=24	A smartphone application equipped with a compliance- targeted notification function	3 mouths	Baseline, 3 months after intervention, 6 months of follow-up	Feasibility and acceptability, MA ^e , Psychological and treatment-related factors
Pan et al ^[27] ; China	HUA ^a	Treatment group: n=150; control group: n=150	WeChat group	1 year	Before and after the intervention	GRR ^g , SUA- TAR ⁱ , SUA ^f , renal function indicators, and SMA ^h
Wang et al ^[10] ; China	Gout	Treatment group: n=60; control group: n=60	Gout Intelligent Management app Android 1.0	24 weeks	At the baseline, at the 12th week and at the 24th week	Knowledge level of gout, TA ^d , SUA ^f
Hong Shi et al ^[29] ; China	HUA ^a	Treatment group: n=58; control	WeChat official account and WeChat group	6 mouths	Before the intervention and 6 months after the	Dietary and behavioral scores, SUA ^f

Study; Country	Type	Sample size	Intervention tool	Duration	Time of data collection	Outcomes
group: n=58			intervention			

^aHUA: Hyperuricemia
^bGA: Gouty Arthritis
^cQoL: Quality of Life
^dTA: Treatment Adherence
^eMA□Medication Adherence
^fSUA: Serum Uric Acid
^gGRR: gout recurrence rate
^hSMA: Self-Management Ability
ⁱSUA-TAR : Serum Uric Acid

Risk of Bias Assessment

The risk of bias in randomized using the Cochrane tool for the Cochrane criteria, the risks of in **Figures 2 and 3**. Most studies in the "random sequence only 4 studies were judged as the lack of detailed information on nature of the intervention methods feasible to blind participants and "blindness of outcome questionnaire scores are patient-affected the results. In the and "selective reporting" domains,

Figure 2. Overall risk of bias



Target Achievement Rate

controlled trials is evaluated assessing bias. According to bias assessment are shown have a very low risk of bias generation" domain, and having unclear risks due to randomness. Due to the used in all trials, it is not interventionists. In the assessment" domain, all reported, which may have "incomplete outcome data" all studies have a low risk. analysis of included studies.

Meta-Analysis Results

Primary Outcomes

blood uric acid

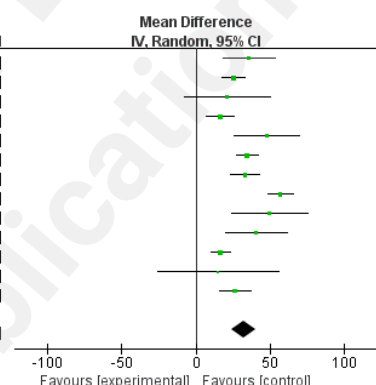
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Figure 4. Forest plot of serum uric acid levels in mHealth.

gout recurrence rate

A total of 8 studies reported gout recurrence rates data^[16, 17, 20-22, 28, 32]. Results indicated that mHealth significantly reduced gout recurrence compared with the control group (OR=0.34, 95% CI 0.22–0.53, $P<.001$), with low heterogeneity ($I^2=0\%$, $P<.001$; Figure 5). Egger regression test indicated publication bias among included studies ($P=0.035$).

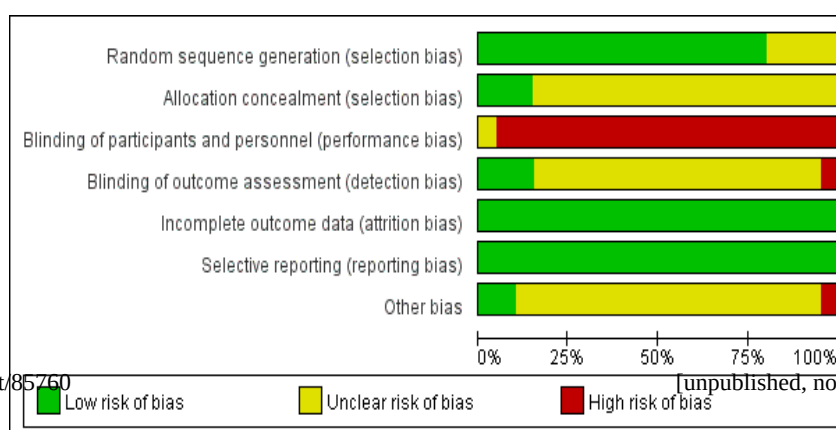
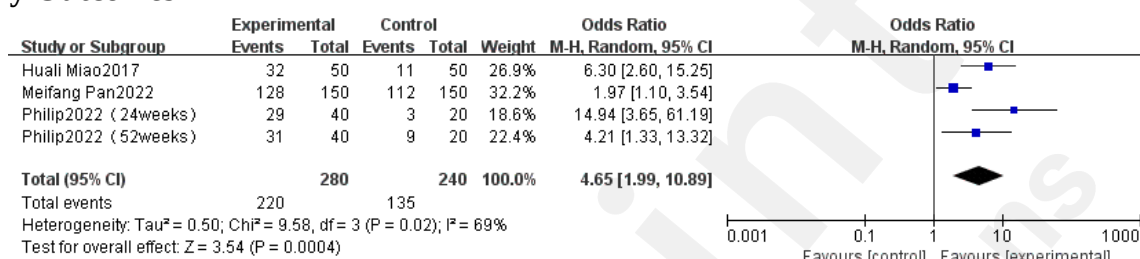


Figure 5. Forest plot of gout recurrence rates in mHealth.**Serum uric acid target achievement rate**

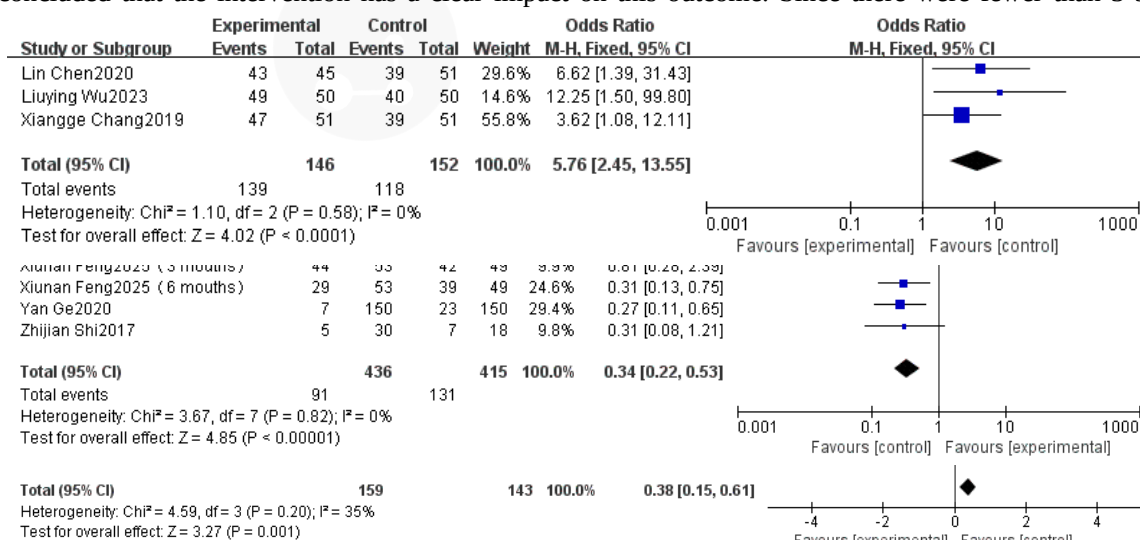
A total of 3 studies reported serum uric acid target achievement rate data^[26, 27, 34], indicating that mHealth significantly improved target achievement rate (OR 4.65, 95% CI 1.99–10.89, $P=0.0004$; Figure 6) with moderate heterogeneity ($I^2=69\%$, $P=0.02$). Egger regression analysis indicated potential publication bias among included studies ($P=0.083$). The number of studies was limited, and no sensitivity analyses or subgroup analyses were conducted.

Figure 6. Forest Plot of mHealth on serum uric acid target achievement rate.**Secondary Outcomes****treatment adherence**

A total of 5 studies reported the impact of mHealth on treatment adherence events among gout patients^[10, 16, 18, 28, 30]. Meta-analysis results for 3 Binary Data sets showed that patients in the eHealth intervention group demonstrated improved treatment adherence compared to the control group (OR=5.76, 95% CI 2.45, 13.55, $P < .001$; Figure 7a), with no significant heterogeneity among studies ($I^2 = 0\%$, $P = 0.58$). Egger regression analysis indicated no significant publication bias among included studies ($P = 0.086$). For 2 meta-analyses of continuous data, mHealth gout treatment adherence showed statistically significant differences compared to conventional treatment (SMD = 0.38, 95% CI 0.15–0.61, $P = 0.001$; Figure 7b), with low heterogeneity ($I^2 = 35\%$, $P = 0.2$). Egger regression analysis indicated no significant publication bias among the included studies ($P = 0.130$). Overall results suggest mHealth significantly improves treatment adherence in gout patients. Due to the limited number of studies, no subgroup or sensitivity analyses were conducted.

Figure 7a. Forest Plot for Treatment Adherence in Binary Data**Figure 7b.** Forest Plot of mHealth on serum uric acid target achievement rate.**Missed medication doses**

A total of 2 studies used self-reported missed medication doses to assess patient treatment adherence^[33, 34]. Results showed no statistically significant difference between the intervention and control groups (MD = -0.21, 95% CI -0.65 to 0.24, $P = 0.35$; Figure 8), with low heterogeneity ($I^2 = 0\%$, $P = 0.78$). However, due to the lack of a significant effect, it cannot be concluded that the intervention has a clear impact on this outcome. Since there were fewer than 3 studies,

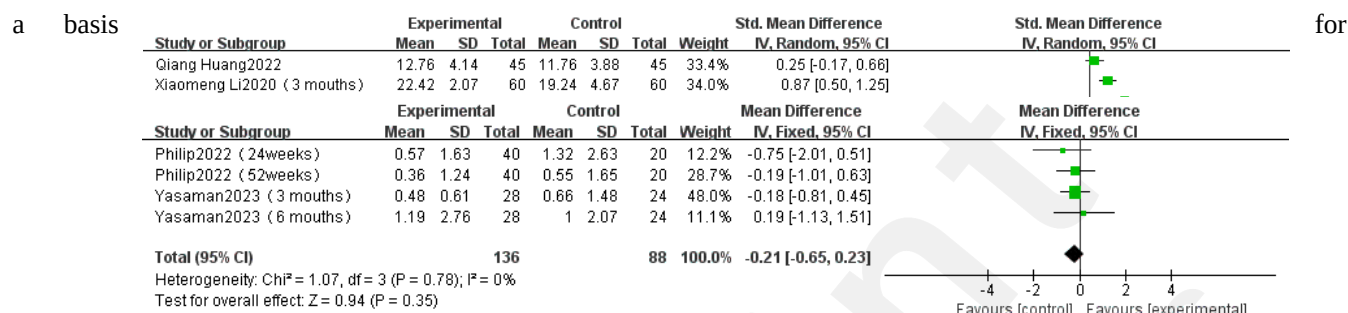


publication bias was not assessed.

Figure 8. Forest Plot of mHealth on missed medication doses rate.

Self-management ability

This study conducted a detailed dimensional analysis of self-management capabilities, encompassing three key dimensions: dietary management, exercise management, and medication management. This dimensional approach facilitates a deeper understanding of patients' performance across different self-management domains, thereby providing



developing targeted intervention strategies.

Dietary Management

A total of 3 studies reported dietary management data^[19, 22, 23]. Due to the use of different scales, analysis was performed using SMD. Results showed that patients in the intervention group had significantly higher dietary management scores than the control group (SMD = 1.25, 95% CI 0.61–1.90, P < .001 [Figure 9]). Heterogeneity was high (I² = 85%, P = 0.0001), likely attributable to differing scoring scales necessitating a random-effects model for meta-analysis. Egger regression indicated no significant publication bias among the included studies (P=0.654).

Figure 9. Forest Plot of mHealth on dietary management.

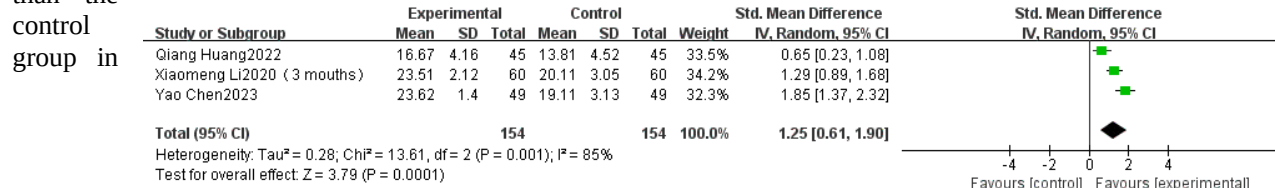
Physical exercise

A total of 3 studies reported physical exercise data^[19, 22, 23]. Results indicated that mHealth was more effective than the control group in improving physical exercise self-management capabilities among gout patients (SMD=0.91, 95% CI 0.17-1.65, P=0.02), with high heterogeneity (I²=89%, P<.001; Figure 10). Egger regression analysis indicated no significant publication bias among the included studies (P=0.671).

Figure 10. Forest Plot of mHealth on physical exercise.

Medication Management

A total of 3 studies reported medication management data^[19, 22, 23]. Results indicated that mobile health was more effective than the control



improving medication management among gout patients (SMD=1.19, 95% CI 0.37-2.01, P=0.005; Figure 11), with high heterogeneity (I²=91%, P<.001). Egger regression test indicated no significant publication bias among the included studies (P=0.743).

Figure 11. Forest Plot of mHealth on Physical Exercise.

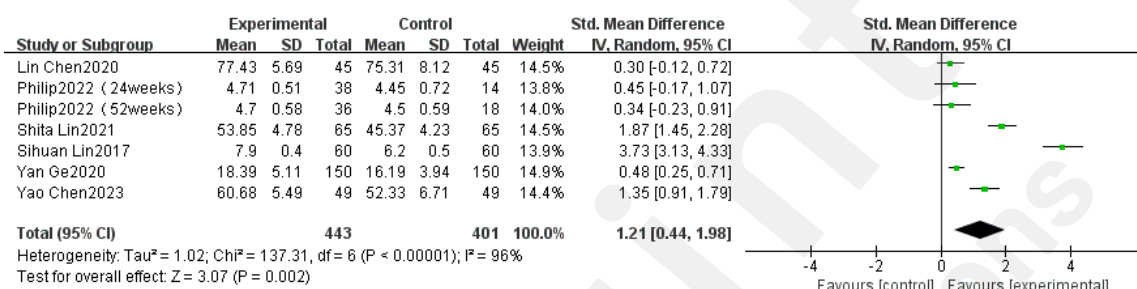
Quality of Life

Pain

A total of 5 studies reported pain-related quality of life data^[18-20, 24, 34]. Three of these studies used the Medical Outcomes Study Short-Form Health Survey (SF-36), one of these studies used the Generic Quality of Life Inventory (GQOLI), and another study used the European Quality of Life Questionnaire (EQ-5D-5L). Results indicated that mHealth was more effective than controls in improving pain among gout patients (SMD=0.66, 95% CI 0.13-1.20, $P=0.02$), with high heterogeneity ($I^2=90\%$, $P<.001$; Figure 12). Egger regression indicated no significant publication bias among included studies ($P=0.440$).

Figure

Forest
Plot of
mHealth
on
Pain.

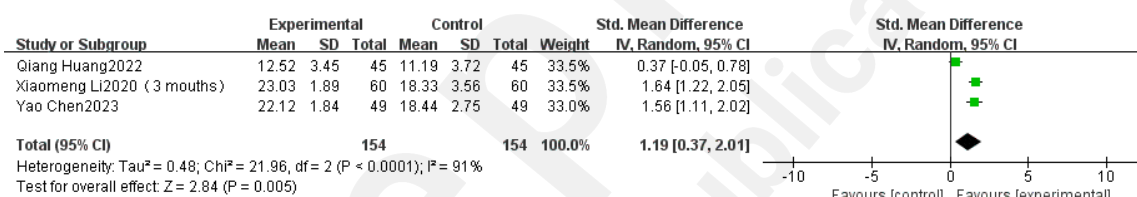


12.

on

Psychological Function

A total of
studies
reported



6

psychological functioning dimension of quality of life^[18-20, 24, 25, 34], with three studies using the Medical Outcomes Study Short-Form Health Survey (SF-36), one study using the European Quality of Life Questionnaire (EQ-5D-5L), one study using the Generic Quality of Life Inventory (GQOLI), and one study using a self-developed quality of life questionnaire. Results indicated that mHealth was more effective than control groups in improving psychological function among gout patients (SMD=1.21, 95% CI 0.44-1.98, $P=0.002$; Figure 13), with high heterogeneity ($I^2=96\%$, $P<.001$). Egger regression test indicated no significant publication bias among the included studies ($P=0.300$).

Figure 13. Forest Plot of mHealth on Psychological Function.

Social Function

A total of 5 studies reported social functioning dimension of quality of life^[18-20, 24, 25]. Three studies used the Medical Outcomes Study Short-Form Health Survey (SF-36), one study used the Generic Quality of Life Inventory (GQOLI), and one study used a self-developed quality of life questionnaire. Results indicated that mHealth significantly improved social functioning in gout patients (SMD=1.41, 95% CI 0.68-2.14, $P=0.0002$; Figure 14), with high heterogeneity ($I^2 = 95\%$, $P < .001$). Egger regression test indicated no significant publication bias among the included studies ($P = 0.209$).

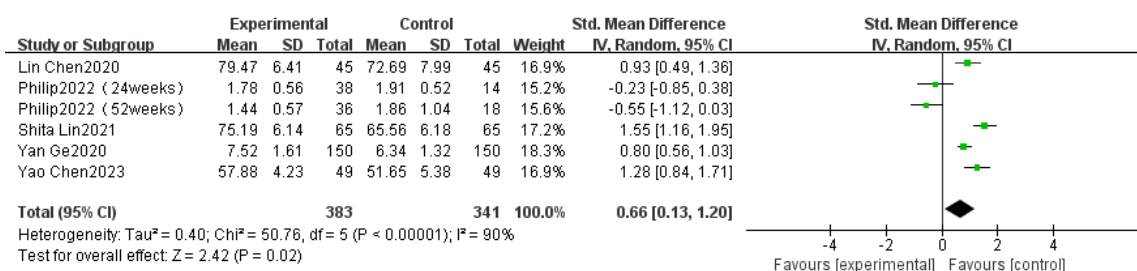


Figure 14. Forest Plot of mHealth on Social Function.**Subgroup Analysis**

Due to differing inclusion criteria across these trials, which resulted in study heterogeneity, subgroup analyses were conducted for primary outcomes based on intervention duration (3 months vs. 6 months) and intervention tools (WeChat/information technology/dedicated medical systems). Results are summarized in the Multimedia Appendix 2. Subgroup analysis of serum uric acid levels indicated that the 6-month intervention showed a marginally greater reduction in serum uric acid compared to the 3-month intervention (MD=32.35, 95% CI 17.40-47.30, $P<.001$). The medical system intervention tool demonstrated a more pronounced effect than the other two (MD=40.59, 95% CI 25.36-55.82). In the gout recurrence rate subgroup analysis, the 6-month gout recurrence rate (OR = 0.27, 95% CI 0.15–0.47, $P < .00001$) and IT tools (OR = 0.25, 95% CI 0.12–0.53, $P = 0.0003$) demonstrated more pronounced advantages. Collectively, these findings indicate that the efficacy of eHealth interventions varies across different intervention durations and tools.

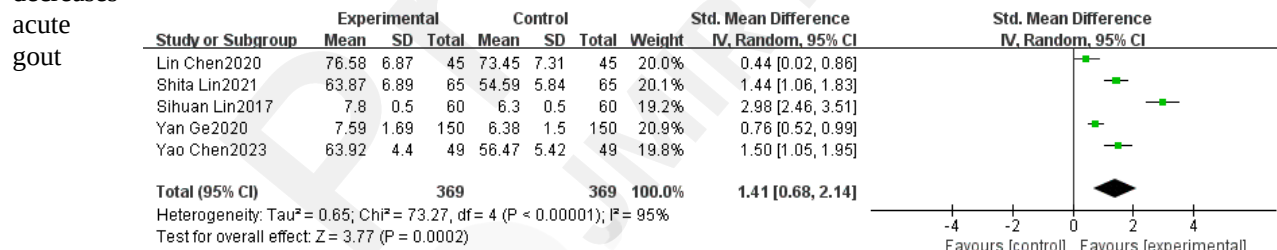
Sensitivity Analysis and Publication Bias

We conducted a sensitivity analysis on the primary outcomes, which included serum uric acid levels, gout recurrence rates, and serum uric acid achievement rates. The analysis employed a stepwise exclusion method. Results showed that after excluding any single study, the overall direction and magnitude of the outcomes did not change significantly. This indicates that our findings are reliable (Multimedia Appendix 3). The funnel plot indicates potential publication bias in the included studies examining gout recurrence rates, while no significant bias was observed in other outcomes. The funnel plot is available in Multimedia Appendix 4.

Discussion**Principal Findings**

This systematic review represents the first comprehensive assessment of the effectiveness of mHealth interventions in supporting the care of gout patients. A total of 20 randomized controlled trials involving 2,324 participants were included. Among these, 1,434/2,324 (62%) were gout patients, 612/2,324 (26%) had hyperuricemia, and 278/2,324 (12%) had gouty arthritis. 62% were gout patients, (612/2324; 26%) had hyperuricemia, and (278/2324; 12%) had gouty arthritis.

This meta-analysis covered various outcome measures, including therapeutic effects on serum uric acid levels, treatment adherence, quality of life, and self-management capabilities. Results demonstrated that mobile health care significantly enhances gout-related health management. Physiologically, it markedly reduces serum uric acid levels, effectively decreases



recurrence frequency, and substantially increases serum uric acid target achievement rates, providing critical support for disease control. In treatment management, it markedly improves patient adherence, facilitating standardized implementation of treatment protocols. Additionally, it positively impacts both the cultivation of patient self-management capabilities and quality of life improvements. It should be noted that this intervention did not yield significant improvements in reducing medication non-adherence. Further exploration of more targeted optimization strategies is required in this dimension.

Serum uric acid

The results of this meta-analysis demonstrated that mHealth-supported interventions significantly improved treatment adherence for serum uric acid levels, consistent with findings from previous studies^[9]. Serum uric acid levels serve as a core biological indicator for the onset, progression, and control of gout. Monitoring these levels throughout gout prevention, treatment, and long-term management is crucial for determining patient health outcomes^[35]. Regarding improvements in core indicators such as serum uric acid levels, gout recurrence rates, and target achievement rates, mobile health effectively addresses the shortcomings of traditional care models through mechanisms like real-time monitoring and personalized guidance. This aligns with the “patient-centered” philosophy driving current digital transformation in healthcare. Research by Jeffrey^[36] from the patient perspective revealed high demand among gout

patients for mobile health-assisted uric acid reduction therapy, particularly in medication reminders, dietary guidance, and side effect monitoring. Studies indicate that mobile health can shift portions of the “monitoring-consultation-follow-up” process online, enabling patients to conduct self-testing and communicate with healthcare providers from home, significantly lowering barriers to disease management participation^[9]. Multiple clinical studies indicate that gout patients managed via mobile healthcare achieve a 20%-30% higher uric acid control rate and over a 30% reduction in recurrence frequency, establishing it as a vital adjunct for long-term gout management. However, significant heterogeneity in serum uric acid metrics across studies suggests that mobile health intervention outcomes may be complexly influenced by detailed intervention protocol factors, necessitating further refinement of intervention specifics. Additionally, publication bias exists in gout recurrence rate studies, necessitating more high-quality, large-sample, long-term follow-up research to validate findings.

Treatment adherence

This study demonstrates that mobile health-supported interventions significantly improve adherence outcomes with low heterogeneity, regardless of whether binary or continuous data is used. Gout patients face ongoing challenges in adherence management due to factors such as the chronic nature of the disease and complex medication regimens. Mobile health (mHealth) breaks the temporal and spatial constraints of traditional healthcare, enabling timely resolution of issues and concerns encountered by patients during treatment. Gout patients require long-term adherence to urate-lowering medications and serum uric acid monitoring. Research indicates that gout patients using mobile health apps with reminder functions experienced a 32.6% reduction in medication non-adherence compared to traditional management groups^[18], alongside a 28.3% increase in achieving target serum uric acid levels during follow-up. This further validates mobile health's capacity to enhance treatment adherence. Additionally, some mobile apps enable patients to independently record serum uric acid values, dietary patterns, and gout flare-up frequency, creating visual health profiles. This not only helps patients intuitively track treatment outcomes but also provides real-time data support for clinicians to dynamically adjust treatment plans, reducing compliance decline caused by unclear treatment efficacy. However, its effectiveness in reducing missed medication doses fell short of expectations. This may stem from most mobile health platforms relying solely on basic reminders without adequately addressing the complex triggers of missed doses in gout patients. Additionally, patient concerns about medication side effects also contribute to poor adherence^[37]. Future research should explore the role of mHealth in reducing medication missed doses among gout patients. More high-quality clinical trials are needed to evaluate the long-term impact of mHealth-supported interventions on treatment adherence, thereby refining intervention strategies for gout patients.

Self-Management Abilities

The findings of this study indicate that gout patients utilizing mobile health applications for self-management demonstrated significant improvements in dietary habits, exercise routines, and medication adherence. Disease self-management capability is not a singular skill but comprises multiple interconnected dimensions. These dimensions work synergistically to support patients' long-term disease management. Patients with strong self-management skills can effectively control disease indicators through consistent medication, healthy eating, and moderate exercise. Mobile health excels in self-management due to its ability to precisely align disease management characteristics with individual patient needs^[38]. Through platforms like mobile applications and social media, mobile health provides gout patients with extensive dietary management knowledge and convenient food tracking tools. Patients can instantly check food purine content, receive personalized dietary recommendations, and log daily meals for feedback. Simultaneously, mobile health offers diverse exercise guidance and monitoring options. Additionally, mobile platforms provide medication knowledge and usage instructions, helping patients better understand drug effects, side effects, and precautions, thereby enhancing treatment confidence and adherence^[39].

The high heterogeneity in self-management outcomes ($I^2 \approx 88\%$) suggests that the effectiveness of mHealth in improving self-management may be influenced by differences in intervention measures, assessment metrics, and patient populations. The outcome measures in this meta-analysis employed diverse assessment tools to evaluate improvements in self-management capabilities, and these varied metrics may be a source of high heterogeneity. Future research should prioritize optimizing study designs, standardizing intervention protocols, selecting appropriate assessment tools, accounting for patient individuality, and exploring influencing factors to provide stronger scientific evidence for the application of mobile health in gout patient self-management.

Quality of Life

Quality of life serves as the “ultimate indicator” for evaluating gout management outcomes, encompassing not only improvements in physical symptoms but also comprehensive enhancements across multiple dimensions including psychological well-being, social functioning, and activities of daily living. Based on the nature of the study's outcome measures, quality of life was analyzed across three dimensions: physical, psychological, and social.

In the physiological dimension, using physical pain (SMD=0.66) as the metric revealed that patients in the mobile health intervention group experienced significantly greater pain relief compared to the control group. This indicates that mobile health effectively advances patients toward the core therapeutic goals of “controlling uric acid levels and reducing gout attacks”^[9]. The observed significant improvement in serum uric acid levels among gout patients highlights the potential of mobile health in addressing critical aspects of home-based care. Changes in serum uric acid levels and reduced gout recurrence frequency can significantly impact quality of life^[40]. While improving physical function, mobile health also transformed patients' psychological attitudes, further highlighting its advantages. Research by Chiara further demonstrated that mobile health can enhance patients' mental health levels^[41]. Mobile health tools possess scalable, cost-effective potential to provide psychological therapy while alleviating the burden of physical symptoms^[42].

Social functioning (SMD=1.41) showed marked improvement through mobile health, indicating its significant impact on social rehabilitation. The positive effects on social functioning may stem from inherent characteristics of mobile healthcare. The intelligent monitoring capabilities of mHealth capture real-time changes in patients' physiological indicators and provide synchronized coping recommendations, optimizing disease management and reducing disruptions to social engagement. Concurrently, mHealth's “peer support communities” rebuild secure social support networks, enabling patients to experience “being supported” rather than “being cared for” in social interactions, thereby enhancing their sense of self-worth within social contexts^[43].

The high heterogeneity in quality of life outcomes ($I^2=93\%$) indicates that quality of life assessments rely heavily on subjective perceptions. The effectiveness of mHealth interventions on quality of life is influenced by multiple overlapping factors, including individual characteristics, study design, and measurement tools. Future research should focus on identifying differences in the use of various scales and determining the appropriateness of specific quality of life scales for gout patients.

Challenges and Limited Use of mHealth In Gout Patients

Compared to other patient groups, the adoption of mobile health tools among gout patients remains relatively limited. Several factors may contribute to this limited usage. There exists a significant mismatch between the age profile and digital literacy of the gout patient population and the use of mobile health tools. Gout patients predominantly comprise middle-aged and elderly individuals, some of whom exhibit low digital literacy, while most mHealth tools lack optimization for this demographic. Additionally, this demographic tends to overlook non-pharmacological interventions within health management tools, resulting in poor compliance. Multiple approaches may be necessary to enhance disease awareness among this group. Furthermore, managing gout at home requires long-term commitment to tracking data such as uric acid levels and dietary intake. However, mHealth tools often lack sustained incentives, leading patients to abandon them due to “cumbersome operations and lack of immediate benefits.” Usage rates decline significantly, especially after symptom relief. Future research should focus on developing mobile health tools tailored to this population, fully considering their unique needs and limitations to ensure the safety and effectiveness of interventions.

Advantages and Limitations

This study presents the first systematic review and meta-analysis comprehensively synthesizing the effectiveness of mobile health (mHealth)-based interventions in supporting gout patient management. It aids in guiding clinical practice to enhance the efficiency and effectiveness of patient care. Through meta-analysis, mHealth tools were found to significantly improve patient adherence and symptom management, offering novel management tools for gout patients. However, several limitations should be acknowledged. First, this review included only peer-reviewed studies published in Chinese or English, potentially introducing publication and language bias. Second, heterogeneity in intervention characteristics—such as duration and use of outcome measurement tools—led to high variability in study results, warranting cautious interpretation.

Future research should design personalized mHealth interventions based on patient characteristics (e.g., age, disease severity, presence of complications) to enhance intervention effectiveness. Concurrently, establishing patient feedback mechanisms to promptly adjust interventions will ensure alignment with actual patient needs.

In this study, we systematically searched multiple core databases worldwide, including PubMed, Cochrane Library, China National Knowledge Infrastructure (CNKI), and Wanfang Data Knowledge Service Platform, to ensure comprehensive coverage of relevant research in this field. Despite extensive literature retrieval, the majority of included studies were in Chinese. Many foreign clinical trials could not provide valid data for analysis due to ongoing research, unpublished data, or lack of full-text publication. This phenomenon may stem from multiple factors, including search strategies that failed to precisely identify relevant studies in certain databases. Such omissions could potentially affect the comprehensiveness and representativeness of our findings. We acknowledge this limitation and recommend that future

studies adopt broader literature search strategies to ensure a more comprehensive understanding of this field, thereby enhancing the breadth and depth of analysis.

Conclusion

This meta-analysis demonstrates that mHealth tools significantly improve patient treatment adherence, enhance self-management capabilities, effectively reduce serum uric acid levels and gout recurrence rates, thereby elevating patients' quality of life. However, most mHealth tools for gout patients currently function as single-purpose communication platforms with limited functionality. Future interventions should adopt targeted gout management platforms to deliver personalized, sustained interventions.

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Data Availability

All data generated or analyzed during this study are included in this published article and Multimedia Appendices 1-4.

Authors' Contributions

SH contributed to writing the original draft, data curation, validation, software, formal analysis, and investigation. ZL contributed to investigation and data curation. YW contributed to conceptualization, methodology, writing-review and editing, and supervision. All authors reviewed subsequent versions of the manuscript and approved the final version.

Conflicts of Interest

None declared.

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Supplementary Files

Multimedia Appendixes

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist.

URL: <http://asset.jmir.pub/assets/39340df4cdda3635b7b5b4717a7ecc45.doc>

Forest plots of the subgroup analysis of primary outcomes in patients with gout.

URL: <http://asset.jmir.pub/assets/d4bb9a5711cd10f95f852e7cc3d070ee.doc>

Sensitivity Analysis of Primary Outcomes.

URL: <http://asset.jmir.pub/assets/7e2b94fe0b1500b2d29d96e629e7e2a0.docx>

Funnel plots of All Results.

URL: <http://asset.jmir.pub/assets/820bcd51dd45e9879063df2119f91dbc.doc>

Search strategy.

URL: <http://asset.jmir.pub/assets/b20d671871096f70f68e9dadae656f50.doc>