Digital Innovations for Clinical Decision-Making in the Prevention and Treatment of Urinary Tract Infections in Menopausal Women: A Systematic Review

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REVIEW TITLE AND BASIC DETAILS

Review title
Digital Innovations for Clinical Decision-Making in the Prevention and Treatment of Urinary Tract Infections in Menopausal Women: A Systematic Review

Condition or domain being studied
Menopause ; Urinary Tract Infection; Digital health technologies

Rationale for the review
To identify, evaluate, and synthesize the available evidence on digital health technologies developed to support the prevention and management of urinary tract infections (UTIs) in menopausal women, assessing their clinical effectiveness, impact on quality of care and antimicrobial stewardship, implementation strategies, and their specificity according to menopausal stage, in order to inform clinical practice, health policy, and future research.

Review objectives
Main Review Question

How do digital health technologies support clinical decision-making in the prevention and management of urinary tract infections (UTIs) in women across all stages of menopause?

Secondary Review Questions

- What types of digital health technologies (e.g., clinical decision support systems, telemedicine platforms, mobile applications, AI-based tools) are currently used to support the prevention and treatment of UTIs in menopausal women?
- How effective are these digital technologies in improving clinical outcomes, prevention strategies, and treatment appropriateness for UTIs in menopausal women?
- To what extent do digital tools enhance quality of care, antibiotic stewardship, and adherence to clinical guidelines in the management of UTIs during the menopausal transition and postmenopause?
- How do digital innovations support healthcare professionals in evidence-based decision-making across different menopausal stages?
- What are the barriers and facilitators to implementing digital health technologies for UTI management in menopausal women?

- What is the impact of digital technologies on patient-reported outcomes, including satisfaction, engagement, and adherence to preventive measures?

Keywords
Menopause; Genitourinary syndrome of menopause; Woman; Urinary tract infections; Cystitis; Pyelonephritis; Recurrent UTI; Digital health technologies; Clinical Decision Support Systems CDSS; CDSS; AI; Telemedicine; Mobile apps; Wearables

Country
Italy

ELIGIBILITY CRITERIA

Population

Included
Population-related inclusion

Women across all stages of menopause:

Women across all stages of menopause:

Perimenopause (presence of menstrual irregularities + age ≥40 years)

Menopause (amenorrhea ≥12 consecutive months)

Postmenopause (any time since menopause)

Women aged ≥45 years with or at risk of UTIs, even when menopausal status is not explicitly reported, as this age threshold is consistent with the expected menopausal transition period

Women aged ≥40 years with documented menopausal symptoms or GSM, regardless of explicit menopausal staging

Healthcare professionals managing UTIs in menopausal women

Excluded
Population-related exclusions:

Studies exclusively on pre-menopausal women (age <40 years without menopausal status)

Studies with mean age <45 years and no menopausal stratification

Studies exclusively on men (unless included as comparator group)

Studies on premature ovarian insufficiency (POI) as primary condition, unless menopausal women are also included

Intervention(s) or exposure(s)

Included
Clinical Decision Support System; Telemedicine ; Smartphone app; mHealth

Intervention/Exposure-related inclusions:

Clinical Decision Support Systems (CDSS) integrated in Electronic Health Records (EHR)

Standalone or EHR-integrated alert systems

Telemedicine platforms for remote consultation and monitoring

Mobile applications (apps) for symptom self-monitoring or clinical guidance

AI-based tools for risk prediction, diagnosis, or treatment optimization

Chatbots or automated triage systems

Remote monitoring systems

Web-based platforms for patient education and management

Wearable devices for physiological monitoring related to UTI prevention/detection

Excluded
Intervention-related exclusions:

Studies on non-digital interventions only (e.g., pharmacological treatments, surgical procedures without digital component)

Studies on general telemedicine platforms not specifically addressing UTI prevention or management

Comparator(s) or control(s)

Included
PICO tags selected: Usual Care; Digital health intervention

Comparator-related inclusions:

Standard care without digital technology support

Alternative digital health technologies (comparative effectiveness)

Historical controls (pre-implementation data)

Usual care in different settings or systems

No comparator required for purely descriptive or observational studies

Excluded
Comparator-related exclusions:

Studies that do not include any digital health intervention when an intervention is required.

Studies that only compare interventions outside the scope (e.g., interventions not aimed at UTI prevention or management in menopausal women).

Descriptive or observational studies outside the target population (e.g., only men or premenopausal women) may also be excluded if they cannot inform the specific research question.

Study design

Both randomized and nonrandomized study types will be included.

Included
Study Designs:

Randomized and no controlled trials

Quasi-experimental studies

Observational cohort studies (prospective or retrospective)

Case-control studies

Cross-sectional studies

Before-after studies (pre-post intervention)

Pilot and feasibility studies

Implementation studies

Excluded
Publication type exclusions:

Case reports and case series (n<10)

Editorials, letters, commentaries without original data

Conference abstracts without sufficient data for extraction (authors will be contacted for full data)

Systematic reviews and meta-analyses (will be used for backward citation searching but not included as primary studies)

Consensus statements and guidelines (used as reference but not as primary evidence)

Protocols without results

Context

Setting:

Community settings

Primary care

Hospital settings (inpatient and outpatient)

Specialty clinics (urology, gynecology, menopause clinics)

Long-term care facilities

Home care settings with remote monitoring

SIMILAR REVIEWS

Check for similar records already in PROSPERO

PROSPERO identified a number of existing PROSPERO records that were similar to this one (last check made on 14 May 2025). These are shown below along with the reasons given by that the review team for the reviews being different and/or proceeding.

- The effects of yoga on sleep quality and menopausal symptoms in menopausal women: a systematic review and meta-analysis of randomized controlled trials [published 30 September 2023] [CRD42023464468]. The review was judged **not to be similar**
- A systematic review on the impact of cannabis use on menopausal symptoms in menopausal women [published 4 September 2020] [CRD42020200434]. The review was judged **not to be similar**
- Prevalence and Risk Factors of Urinary Incontinence in Menopausal Women in Turkey: Systematıc Review and Meta-Analysis [published 20 June 2022] [CRD42022338643]. The review was judged **not to be similar**
- Vaginal Estradiol for Menopausal Women Experiencing Urinary Symptoms: A Systematic Review [published 7 September 2024] [CRD42024583906]. The review was judged **not to be similar**
- Systematic Review and Meta-Analysis of Periodontal Treatment Outcomes in Menopausal Versus Non-Menopausal Women [published 14 May 2025] [CRD420251050964]. The review was judged **not to be similar**
- Does menopausal hormone therapy have a preventive impact on menopausal depression? A systematic review. [published 13 February 2023] [CRD42023392860]. The review was judged **not to be similar**
- Non-Pharmacological Interventions for Prevention of Sarcopenia in Menopausal Women: A protocol for Systematic Review and Meta-Analysis [published 19 May 2022] [CRD42022331216]. The review was judged **not to be similar**
- The Effect of Kegel Exercise on Sexual Function in Menopausal Women: A Systematic Review and Meta-analysis [published 12 September 2024] [CRD42024585027]. The review was judged **not to be similar**
- Androgen treatment efficacy for post-menopausal women [published 2 July 2018] [CRD42018099414]. The review was judged **not to be similar**
- Non-Pharmacological Interventions for Prevention of Sarcopenia in Menopausal Women: A Systematic Review and Meta-Analysis [published 10 May 2022] [CRD42022329273]. The review was judged **not to be similar**
- Immigrant women's experiences and perceptions of the menopausal transition: a systematic literature review [published 5 October 2016] [CRD42016047271]. The review was judged **not to be similar**
- Effect of Fenugreek on vasomotor symptoms in menopausal women: Protocol for a systematic review and meta-analysis [published 5 July 2020] [CRD42020179173]. The review was judged **not to be similar**
- Exploring the factors influencing physical activity engagement for menopausal women [published 20 November 2021] [CRD42021286517]. The review was judged **not to be similar**
- Identifying the experiences of urinary incontinence in women who are post menopausal: A qualitative systematic review [published 7 June 2024] [CRD42024551738]. The review was judged **not to be similar**
- The Effect of Homeopathy Intervention in Menopausal Women on Menopause Symptom Severity and Quality of Life: Systematic Review and Meta-analysis of Randomized Controlled Trials. [published 2 June 2024] [CRD42024550063]. The review was judged **not to be similar**
- The effects of aromatherapy on sleep quality in menopausal women: a systematic review and meta-analysis [published 27 March 2025] [CRD420251020194]. The review was judged **not to be similar**
- A systematic review to assess the efficacy and safety of subcutaneous hormone therapy via implant in menopausal women [published 4 January 2024] [CRD42024485466]. The review was judged **not to be similar**

TIMELINE OF THE REVIEW

Date of first submission to PROSPERO

This record has not been submitted.

Review timeline

Start date: 15 April 2026. End date: 30 June 2026.

Date of registration in PROSPERO

This record has not been published.

AVAILABILITY OF FULL PROTOCOL

Availability of full protocol
A full protocol has been written and uploaded to PROSPERO. The protocol will be made available after the review is completed.

SEARCHING AND SCREENING

Search for unpublished studies
Only published studies will be sought.

Main bibliographic databases that will be searched
The main databases to be searched are *CENTRAL - Cochrane Central Register of Controlled Trials*, *PubMed* and *Scopus*.

Other important or specialist databases that will be searched
Web of science

Search language restrictions
There are no language restrictions.

Search date restrictions
Databases will be searched for articles published from 1 January 2000 and before by 1 April 2026.

Other methods of identifying studies
Other studies will be identified by: *contacting authors or experts*, *searching conference proceedings* and *searching trial or study registers*.

Link to search strategy
A full search strategy is available in the full protocol as described in the *Availability of full protocol* section

Selection process
Studies will be screened independently by at least two people (or person/machine combination) with a process to resolve differences.

Other relevant information about searching and screening
None

DATA COLLECTION PROCESS

Data extraction from published articles and reports
Data will be extracted independently by at least two people (or person/machine combination) with a process to resolve differences.

Authors will be asked to provide any required data not available in published reports.

Study risk of bias or quality assessment
Risk of bias will be assessed using: *ROBINS-I*

Data will be assessed independently by at least two people (or person/machine combination) with a process to resolve differences.

Additional information will be sought from study investigators if required information is unclear or unavailable in the study publications/reports.

Reporting bias assessment
Risk of bias from missing results will be assessed using RoB 2 (Sterne et al., 2019), JBI – Cohort (Hilton, 2024), JBI – Quasi-Experimental (Hilton, 2024), JBI – Cross-Sectional (Hilton, 2024) and MMAT (Hong et al., 2018).

Certainty assessment

The certainty (or confidence) in the body of evidence will be assessed using the GRADE approach. For each outcome, evidence will be evaluated across the domains of risk of bias, inconsistency, indirectness, imprecision, and publication bias. Summary of Findings tables will be generated to present overall certainty. Sensitivity analyses and risk of bias assessments will inform judgments. Evidence will be rated as high, moderate, low, or very low certainty.

OUTCOMES TO BE ANALYSED

Main outcomes

Primary Outcomes

- Incidence of UTIs
- Recurrence rate of UTIs
- Time to diagnosis and treatment initiation
- Healthcare utilization metrics
- Re-hospitalization
- Mortality

Additional outcomes

Secondary/Additional Outcomes:

Patient adherence

Antibiotic stewardship indicators

Healthcare professional decision-making

Patient satisfaction and engagement

Patient-reported outcomes

Quality of care indicators

Pathogen and antimicrobial resistance patterns

Cost-effectiveness

Technology implementation factors

Safety outcomes

PLANNED DATA SYNTHESIS

Strategy for data synthesis

Data will be combined through descriptive and narrative synthesis. Where ≥3 sufficiently homogeneous studies report the same outcome, a meta-analysis will be performed using a random-effects model. Effect measures will include risk ratios or odds ratios for dichotomous outcomes, mean differences for continuous outcomes, and hazard ratios for time-to-event outcomes.

CURRENT REVIEW STAGE

Stage of the review at this submission

Review stage	Started	Completed
Pilot work	✓	✓
Formal searching/study identification	✓	✓
Screening search results against inclusion criteria	✓	✓
Data extraction or receipt of IPD		
Risk of bias/quality assessment		
Data synthesis		

Review status

The review is currently planned or ongoing.

Publication of review results
Results of the review will be published in English.

REVIEW AFFILIATION, FUNDING AND PEER REVIEW

Review team members
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No conflict of interest declared.

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No conflict of interest declared.

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No conflict of interest declared.

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No conflict of interest declared.

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No conflict of interest declared.

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Review affiliation
none

Funding source
Review has no funding and no agreed support from an academic institution and is done in authors' own time.

Peer review
There has been no peer review of this planned review.

ADDITIONAL INFORMATION

Review conflict of interest
Declared individual interests are recorded under team member details.. No additional interests are recorded for this review.

Medical Subject Headings
Menopause; Postmenopause; Urinary Tract Infections; Telemedicine; Mobile Applications; Decision Support Systems, Clinical; Artificial Intelligence; Primary Prevention

PROSPERO version history
No preview available

Disclaimer

Any enquiries about the record should be referred to the named review contact