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The importance of prevention, screening, and medical advice in maintaining menstrual health in women

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Abstract

Menstrual health is a multidimensional indicator of reproductive, somatic, psychological and social well-being. Although menstruation is a physiological process, menstrual symptoms and disorders are among the most frequent reasons for gynaecological consultation and are closely linked with iron-deficiency anaemia, chronic pelvic pain, endometriosis, polycystic ovary syndrome, infertility, impaired school or work participation and reduced quality of life. This IMRAD-based integrative review analyses the role of prevention, screening and medical counselling in maintaining menstrual health among women and adolescents, with a specific emphasis on real-world data (RWD), real-world evidence (RWE), digital health and artificial intelligence (AI). Literature was identified from PubMed/MEDLINE, Scopus, Web of Science, Embase, Cochrane Library, WHO, UNICEF, ACOG, FIGO, NICE, FDA and EMA sources, prioritising publications and guidance from 2020–2026. The review found that systematic menstrual history-taking, early identification of abnormal uterine bleeding using FIGO PALM–COEIN concepts, screening for anaemia in heavy menstrual bleeding, adolescent-sensitive assessment of irregular cycles, and timely counselling on pain, contraception, fertility, hygiene and red-flag symptoms are core clinical measures. RWD sources such as electronic health records, e-prescriptions, laboratory databases, registries, pharmacovigilance systems, insurance data, wearable devices and menstrual tracking applications can strengthen longitudinal monitoring and personalised prevention. AI methods, including machine learning, natural language processing, deep learning and explainable clinical decision support, may improve risk stratification and symptom triage but require robust validation, privacy safeguards and bias control. In Uzbekistan, ongoing digital health reforms, e-prescription initiatives and reproductive health services provide an opportunity to build integrated menstrual health surveillance and counselling pathways.

Keywords: menstrual health; prevention; screening; medical counselling; abnormal uterine bleeding; heavy menstrual bleeding; dysmenorrhea; endometriosis; polycystic ovary syndrome; real-world data; real-world evidence; artificial intelligence; digital health; pharmacovigilance; Uzbekistan.

1. Introduction

Menstrual health has moved from the margins of reproductive medicine to the centre of global women's health policy. The contemporary definition extends beyond the mechanical occurrence of monthly bleeding and frames menstruation as a state of physical, mental and social well-being in relation to the menstrual cycle. This broader view is clinically important because many menstrual complaints are dismissed as normal variation, while in practice they may represent anaemia,

ovulatory dysfunction, endometriosis, adenomyosis, fibroids, thyroid disease, coagulopathy, pregnancy complications, infection or adverse effects of medicines.

Prevention in menstrual health includes education before menarche, menstrual hygiene support, nutrition and iron deficiency prevention, vaccination and infection prevention when relevant, safe contraception counselling, early recognition of dysmenorrhea and heavy bleeding, and reduction of stigma. Screening includes structured menstrual history, assessment of cycle regularity, duration and volume, pain scoring, pregnancy testing when indicated, complete blood count and ferritin in heavy bleeding, endocrine evaluation for persistent irregular cycles, and imaging or specialist referral when red flags are present.

Real-world data (RWD) refers to routinely collected health-related information derived outside the restrictive environment of classical clinical trials. In menstrual health, RWD may come from electronic medical records, outpatient gynaecology notes, laboratory databases, electronic prescriptions, emergency department visits, school health services, pharmacy dispensing records, mobile period-tracking applications and wearable devices. These sources capture the everyday complexity of menstrual symptoms, co-morbidities, treatment adherence, cultural barriers and access limitations.

Real-world evidence (RWE) is the clinical evidence generated by analysing RWD with transparent epidemiological and statistical methods. For menstrual health, RWE can help answer questions that randomised controlled trials (RCTs) rarely address: How many women stop non-steroidal anti-inflammatory drugs because of gastrointestinal symptoms? Which adolescents with irregular cycles later meet criteria for PCOS? How often are women with heavy menstrual bleeding screened for anaemia? Which referral pathways reduce diagnostic delay in endometriosis?

RCTs remain the strongest design for estimating efficacy under controlled conditions. However, menstrual health interventions are often behavioural, educational, diagnostic or service-based, and their outcomes depend on real access, adherence, affordability, privacy and trust. Therefore, RCT evidence and RWE should be considered complementary. Efficacy describes whether an intervention works under ideal circumstances; effectiveness describes whether it works in the diverse population seen in routine care.

International regulators increasingly recognise this complementarity. FDA and EMA frameworks support the use of RWD/RWE when data provenance, quality, traceability and analytic validity are sufficient. WHO has emphasised ethical governance of AI in health, including transparency, accountability, safety, inclusiveness and protection of autonomy. These principles are particularly relevant to menstrual health because menstrual data are intimate, longitudinal and potentially sensitive in legal, social and employment contexts.

Artificial intelligence may support menstrual health by predicting cycle irregularity, identifying abnormal bleeding patterns from patient-reported data, extracting symptoms from free-text medical records, stratifying endometriosis risk, flagging anaemia risk in heavy menstrual bleeding, detecting adverse drug reactions to hormonal therapy, and supporting counselling through clinical decision support systems. Yet AI cannot replace a respectful clinical encounter. Algorithms trained on incomplete or biased datasets may reproduce underdiagnosis, minimise pain, or misclassify symptoms in populations not represented in the training data.

The relevance of this topic is strengthened by three converging trends: the persistence of menstrual stigma and underdiagnosis, the rapid growth of digital menstrual tracking, and the transition of

health systems toward electronic records and data-driven quality measurement. For Uzbekistan and other countries modernising digital health infrastructure, menstrual health offers a practical field in which prevention, screening, counselling and real-world analytics can be integrated into primary care, adolescent health and gynaecology services.

2. Materials and Methods

This article was designed as an integrative narrative review with structured search logic rather than as a new patient-level clinical study. The aim was to synthesise evidence relevant to prevention, screening and counselling in menstrual health and to interpret this evidence through RWD, RWE and AI perspectives.

Sources included PubMed/MEDLINE, Scopus, Web of Science, Embase, Cochrane Library, WHO, UNICEF, World Bank, ACOG, FIGO, NICE, FDA, EMA, ICH and selected high-impact journals including The Lancet, JAMA, New England Journal of Medicine, Nature Medicine, BMJ and Human Reproduction. Priority was given to publications from 2020–2026, while landmark definitions and classification systems published earlier were retained when still authoritative.

Inclusion criteria were: peer-reviewed systematic reviews, meta-analyses, clinical guidelines, consensus statements, epidemiological studies, digital health studies and regulatory documents addressing menstrual health, abnormal uterine bleeding, dysmenorrhea, endometriosis, PCOS, anaemia, menstrual hygiene, counselling, RWD/RWE, AI, pharmacovigilance or digital health governance. Exclusion criteria were non-medical opinion pieces, sources without traceable methodology, commercial app marketing material and unsupported statistical claims.

The methodological framework distinguished descriptive evidence, causal evidence and predictive evidence. Descriptive synthesis mapped clinical problems and care pathways. Causal inference methods relevant to RWE were considered, including propensity score matching, inverse probability weighting, marginal structural models, Cox regression, Kaplan–Meier survival curves, target trial emulation and sensitivity analysis for unmeasured confounding. Predictive analytics were discussed through machine learning, deep learning, natural language processing and explainable AI.

Propensity score matching attempts to balance treated and untreated groups on measured covariates, for example comparing women receiving levonorgestrel intrauterine system with those receiving oral therapy for heavy menstrual bleeding in routine care. Inverse probability weighting creates a pseudo-population in which treatment allocation is independent of measured confounders. Cox regression and Kaplan–Meier analysis are useful for time-to-event outcomes such as time to endometriosis diagnosis, time to treatment discontinuation or time to recurrence of heavy bleeding.

Target trial emulation was considered a particularly useful design because it forces observational analyses to specify eligibility criteria, treatment strategies, assignment time, follow-up, outcomes and analytic plan as if a pragmatic trial were being conducted. This approach reduces immortal time bias and unclear temporal ordering, two common problems in analyses of routine gynaecological data.

AI-related evidence was organised according to task type: classification, prediction, clustering, temporal modelling, free-text extraction and decision support. Machine learning methods may include logistic regression with regularisation, random forests, gradient boosting, support vector machines and neural networks. Deep learning may be applied to ultrasound images, histopathology

or longitudinal cycle data. Natural language processing can extract symptoms such as dysmenorrhea, dyspareunia, intermenstrual bleeding and treatment intolerance from clinical notes. Reinforcement learning remains experimental in menstrual health and is more appropriate for adaptive intervention design than for unsupervised patient-facing advice.

3. Results

3.1 Core domains of prevention in menstrual health

Primary prevention begins with menstrual literacy. Girls should receive accurate information before menarche, including what is normal, when to seek care, how to manage hygiene safely, and how menstruation relates to general health rather than shame. School-based and family-based education reduces fear and can improve help-seeking.

Nutritional prevention is essential because heavy menstrual bleeding can contribute to iron-deficiency anaemia. Preventive care should include diet counselling, recognition of fatigue and dizziness, and laboratory testing when bleeding is heavy or prolonged. In communities with high anaemia burden, menstrual health programmes should be linked with adolescent nutrition and maternal health strategies.

Secondary prevention includes early detection of abnormal patterns. A cycle shorter than 21 days or longer than 45 days in adolescents beyond early post-menarcheal maturation, bleeding lasting more than seven days, soaking through products rapidly, severe pain limiting daily activities, intermenstrual bleeding, postcoital bleeding and amenorrhea require structured assessment.

Tertiary prevention aims to reduce complications in women with established disorders such as endometriosis, PCOS, adenomyosis, fibroids or bleeding disorders. This includes pain control, fertility counselling, metabolic risk reduction, psychological support and avoidance of unnecessary procedures.

3.2 Screening: from symptom recognition to diagnostic pathways

The menstrual cycle can serve as a practical clinical vital sign. A respectful menstrual history should document age at menarche, cycle length, regularity, duration, estimated volume, clots, pain intensity, school or work absence, sexual activity when appropriate, contraception, pregnancy possibility, medication use, family history of bleeding disorders and symptoms of endocrine disease.

Abnormal uterine bleeding should be classified using standard terminology. FIGO PALM–COEIN separates structural causes such as polyps, adenomyosis, leiomyoma, malignancy and hyperplasia from non-structural causes such as coagulopathy, ovulatory dysfunction, endometrial disorders, iatrogenic causes and not otherwise classified conditions. This improves communication and reduces vague labels.

Heavy menstrual bleeding should be assessed according to its effect on quality of life, not only by estimated blood volume. A complete blood count is appropriate when bleeding is heavy, prolonged or associated with fatigue, pallor, dizziness or tachycardia. Pregnancy testing, thyroid assessment, coagulation studies, pelvic ultrasound and endometrial assessment should be guided by age, risk factors and clinical presentation.

Adolescents require particular caution. Irregular cycles are common soon after menarche, but persistent irregularity, hyperandrogenism, obesity, acne, hirsutism or metabolic features may

indicate PCOS risk. Current international PCOS recommendations emphasise diagnostic care in adolescents because overdiagnosis can cause anxiety, while delayed recognition can miss metabolic and reproductive risks.

3.3 Medical counselling as a clinical intervention

Counselling is not an accessory to menstrual health care; it is a therapeutic intervention. Effective counselling validates symptoms, explains uncertainty, corrects myths, improves adherence and supports shared decision-making. For dysmenorrhea, women should know that severe pain causing functional impairment is not something they must simply tolerate.

Counselling should cover self-care, safe use of non-steroidal anti-inflammatory drugs, hormonal treatment options, contraception benefits and risks, fertility intentions, privacy in digital tracking, red flags and follow-up. Women using hormonal medicines require counselling on expected bleeding changes, warning symptoms, adherence and drug interactions.

In endometriosis, counselling should include the possibility of diagnostic delay, the value of symptom diaries, when imaging is useful, and the rationale for empirical treatment or referral. In PCOS, counselling should avoid blame and include cycle regulation, skin symptoms, metabolic screening, mental health and long-term cardiometabolic risk.

Culturally competent counselling is essential in societies where menstruation remains stigmatised. The clinician should use clear language, protect confidentiality and adapt explanations to age, marital status, literacy, disability and social context.

3.4 Real-world data sources for menstrual health

Electronic medical records capture diagnoses, menstrual histories, prescriptions, referrals and outcomes. Their value depends on structured fields for cycle length, bleeding volume, pain score and red flags. Without structured documentation, menstrual symptoms remain hidden in free text and cannot support population-level quality improvement.

Electronic prescription systems can reveal patterns of hormonal therapy, NSAID use, tranexamic acid, iron therapy and treatment discontinuation. Linking prescriptions with laboratory and visit data can identify gaps, such as women treated repeatedly for heavy bleeding without haemoglobin testing.

Laboratory databases are particularly important for anaemia surveillance. Haemoglobin, ferritin, thyroid-stimulating hormone, pregnancy testing, androgen profile and coagulation tests can support screening algorithms when interpreted with symptoms and age.

National registries can monitor endometriosis surgery, fibroid procedures, infertility treatment, adolescent health indicators and maternal outcomes. Pharmacovigilance data can detect adverse reactions to hormonal treatments, NSAIDs, tranexamic acid and other medicines used for menstrual symptoms.

Insurance and claims data are useful for service utilisation, but they often lack symptom severity and patient-reported outcomes. Wearable devices and mobile applications can provide longitudinal cycle and symptom data, but privacy, representativeness and validation remain major limitations.

3.5 Artificial intelligence in screening and counselling

Machine learning can combine age, cycle features, pain scores, laboratory results and prescription history to identify women at high risk for anaemia, PCOS, endometriosis or treatment failure.

Gradient boosting and random forest models are often useful for structured clinical data, while recurrent neural networks or transformer models may better capture longitudinal cycle patterns.

Deep learning may assist image-based tasks such as ultrasound interpretation for ovarian morphology, endometriomas or fibroids, but menstrual health decisions should not rely on images alone. Clinical symptoms and patient priorities remain central.

Natural language processing can extract symptoms from unstructured notes: heavy bleeding, dysmenorrhea, dyspareunia, pelvic pain, infertility, school absence and adverse effects. This is valuable because many gynaecological complaints are recorded narratively rather than coded.

Large language models may support patient education and clinician documentation, but their outputs require governance. They should not deliver autonomous diagnosis or treatment decisions. Safe use requires evidence-based content, local language adaptation, escalation rules for red flags and audit of errors.

3.6 Prediction of treatment effectiveness and safety

In heavy menstrual bleeding, RWE can compare real-life effectiveness of levonorgestrel intrauterine system, combined oral contraceptives, progestins, tranexamic acid, NSAIDs and surgical pathways. Outcomes should include bleeding reduction, haemoglobin improvement, quality of life, discontinuation, adverse effects and need for additional treatment.

For dysmenorrhea, RWD can identify delayed escalation when first-line NSAIDs fail. Persistent severe pain despite adequate NSAID or hormonal therapy should trigger evaluation for secondary causes, especially endometriosis.

In PCOS, prediction models may help identify adolescents requiring follow-up rather than immediate labelling. RWE can also evaluate long-term metabolic screening uptake and adherence to lifestyle or pharmacological interventions.

For endometriosis, survival analysis can quantify time from first documented symptom to specialist referral, imaging, treatment or diagnosis. This provides a measurable quality indicator for health systems.

3.7 Pharmacovigilance and adverse drug reaction detection

Menstrual health care often uses medicines over long periods. Adverse drug reactions may include gastrointestinal and renal risks with NSAIDs, thromboembolic risk in susceptible users of combined hormonal contraceptives, mood changes, irregular bleeding, liver-related concerns with some historical fibroid therapies, and interactions with other medicines.

Drug safety signal detection in menstrual health should integrate spontaneous reports, electronic prescriptions, laboratory values, emergency visits and patient-reported outcomes. Pharmacovigilance analytics can detect unexpected patterns, but every signal requires clinical review because confounding by indication is common.

Counselling should include realistic expectations of bleeding pattern changes after hormonal initiation, because unanticipated irregular bleeding is a frequent reason for discontinuation. Better counselling can therefore improve both safety and effectiveness.

3.8 Personalised medicine and biomarkers

Personalised menstrual health care combines symptoms, age, reproductive plans, co-morbidities, laboratory results, imaging, genetics when relevant and patient preferences. Pharmacogenomics is

not yet routine for most menstrual therapies, but precision medicine principles are already applicable through risk stratification.

Biomarkers such as haemoglobin and ferritin guide anaemia care. Androgen profile, metabolic markers and ultrasound findings support PCOS assessment when used appropriately. In endometriosis, no single non-invasive biomarker is sufficiently definitive for universal screening, making symptom-based triage and imaging pathways important.

Precision medicine should avoid reducing women to algorithmic risk scores. The patient's lived experience, pain burden, fertility goals, religious and cultural context, and affordability of treatment must remain part of decision-making.

3.9 Uzbekistan-focused implementation considerations

Uzbekistan is developing digital health infrastructure, including electronic prescription initiatives and broader digital medicine reforms. These reforms could support menstrual health by linking primary care, women's consultation services, laboratories, pharmacies and specialist gynaecology centres.

A practical national approach would include structured menstrual history fields in electronic medical records, automated reminders for anaemia testing in heavy menstrual bleeding, referral criteria for suspected endometriosis, adolescent-friendly PCOS follow-up pathways, and pharmacovigilance reporting for hormonal medicines.

Implementation challenges include fragmented data systems, variable digital literacy, privacy concerns, limited specialist access in some areas, inconsistent coding of menstrual disorders and cultural barriers to open discussion. Training family physicians, nurses, school health staff and gynaecologists in standard menstrual screening would be a high-yield intervention.

AI implementation in Uzbekistan should begin with low-risk decision support: red-flag prompts, anaemia screening reminders, referral pathway checklists and patient education materials in Uzbek and Russian. High-risk predictive models should be used only after local validation and ethical review.

Domain	Screening indicator	Suggested action
Heavy menstrual bleeding	Bleeding >7 days, flooding, clots, reduced quality of life	CBC/ferritin, pregnancy test if relevant, FIGO PALM-COEIN assessment, treatment counselling
Severe dysmenorrhea	Pain causing absence or not responding to first-line treatment	NSAID optimisation, hormonal options, evaluate endometriosis/red flags
Irregular cycles	Persistent irregularity after early adolescence or new adult irregularity	Pregnancy exclusion, thyroid/prolactin/androgen assessment as indicated, PCOS-sensitive counselling
Intermenstrual/postcoital bleeding	Bleeding between periods or after intercourse	Cervical/infection assessment, pregnancy test, imaging or specialist referral according to risk
Digital tracking data	Repeated abnormal patterns or symptom clusters	Clinician review; do not use app predictions as diagnosis

4. Discussion

The synthesis shows that menstrual health is best protected when prevention, screening and counselling are treated as a continuous pathway rather than as isolated clinical tasks. International guidance increasingly supports structured menstrual assessment, standard terminology for abnormal bleeding and patient-centred management. The strongest practical message is that menstrual symptoms should not be normalised when they impair daily life or indicate systemic disease.

Compared with classical RCTs, RWE offers broader insight into adherence, discontinuation, diagnostic delay and equity. For example, trials can estimate the efficacy of a hormonal intervention, but routine data can show whether women actually continue it, whether they receive anaemia screening, and whether adverse effects lead to unplanned visits. This difference between efficacy and effectiveness is central to menstrual health because acceptability, privacy, cost and counselling quality strongly shape outcomes.

AI adds value when it augments clinical judgement. It can screen large datasets, identify hidden patterns, prioritise high-risk patients and standardise documentation. However, AI in menstrual health faces specific risks. Menstrual data are intimate and may reveal pregnancy intentions, sexual activity, infertility, miscarriage, contraception use or gynaecological disease. Weak privacy governance can transform health-support tools into instruments of surveillance or discrimination.

Algorithmic bias is a major concern. If training data underrepresent adolescents, rural women, low-income groups or women whose symptoms were previously dismissed, models may reproduce existing inequities. Missing data are equally problematic: absence of a recorded symptom does not mean absence of disease. Explainable AI is therefore not optional. Clinicians need to understand why a system flags endometriosis risk or anaemia risk, and patients need clear information about how their data are used.

WHO’s AI guidance emphasises ethical governance, transparency, inclusiveness, safety and accountability. FDA’s evolving approach to AI/ML-enabled medical devices highlights lifecycle management and real-world performance monitoring. EMA’s RWE work and DARWIN EU illustrate how federated data networks can support regulatory and clinical decisions. Menstrual health can benefit from these trends if data standards, consent, interoperability and validation are built from the start.

For Uzbekistan, the central opportunity is integration. Electronic prescription systems can be connected with menstrual indications, laboratory monitoring and pharmacovigilance. Electronic medical records can include structured menstrual fields. National registries can capture endometriosis surgery, fibroid treatment and adolescent reproductive health indicators. Clinical pharmacology services can support safe use of hormonal medicines and monitor adverse effects.

The key limitation of the present review is that it does not analyse patient-level Uzbek clinical data. It therefore proposes an evidence-informed framework rather than estimating national prevalence. Future studies should develop local RWD cohorts, validate screening algorithms in Uzbek clinical settings, and evaluate whether structured counselling improves outcomes such as anaemia detection, pain control, treatment adherence and referral time.

5. Conclusion

Maintaining menstrual health requires more than access to menstrual products or episodic treatment of pain. It requires prevention through education and nutrition, systematic screening for abnormal

bleeding and related disorders, respectful counselling, safe pharmacotherapy, and timely referral. RWD and RWE can reveal gaps that conventional trials do not capture, while AI can support risk stratification and clinical decision support when ethically governed and locally validated. For Uzbekistan, digital health reforms create a timely opportunity to build structured menstrual health monitoring into primary care, adolescent health, women's consultation services, laboratories, pharmacies and specialist gynaecology. The most realistic first steps are standardised menstrual history fields, anaemia screening prompts, referral algorithms for suspected endometriosis and PCOS, privacy-preserving digital education, and pharmacovigilance for commonly used menstrual health medicines.

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