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ROLE OF ARTIFICIAL INTELLIGENCE IN PROMOTING WOMEN'S HEALTH: SCOPE WITHIN SUSTAINABLE DEVELOPMENT GOALS 3 AND 5

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Abstract

Artificial intelligence (AI) is increasingly recognized as a pivotal tool in advancing women's health, offering innovative solutions in diagnostics, predictive modeling, maternal and reproductive care, and personalized monitoring. This review examines the multifaceted role of AI in addressing critical challenges in women's health, including reproductive cancers, maternal mortality, and gender-specific chronic conditions, while evaluating its contributions to United Nations Sustainable Development Goals (SDG) 3 (Good Health and Well-being) and SDG 5 (Gender Equality). Through synthesis of peer-reviewed evidence, AI demonstrates substantial potential to enhance early detection, risk stratification, and equitable access to sexual and reproductive health services, particularly in low- and middle-income countries. Applications such as deep learning-based imaging, wearable technologies, and predictive analytics align with SDG targets by reducing preventable maternal deaths and empowering women through informed health decision-making. However, persistent challenges, including algorithmic biases stemming from underrepresented female datasets, historical gender data gaps, and digital divides, risk exacerbating health inequities and hindering SDG progress. This paper highlights the dual nature of AI as both an enabler and potential inhibitor of gender-equitable health outcomes. Recommendations emphasize inclusive data practices, bias mitigation strategies, participatory design, and robust ethical governance to ensure equitable deployment. Ultimately, ethically designed AI can accelerate achievement of SDGs 3 and 5, fostering sustainable, inclusive advancements in women's health by 2030.

Keywords
Artificial Intelligence; Women's Health; Sustainable Development Goals; SDG 3; SDG 5; Gender Equality; Health Equity; Algorithmic Bias; Maternal Health; Reproductive Health; Digital Health Technologies; Bias Mitigation

Introduction

Women's health encompasses a multifaceted interplay of biological, socioeconomic, cultural, and environmental factors that profoundly influence health outcomes across the lifespan, including reproductive health, maternal care, gynecological conditions, and gender-specific manifestations of non-communicable diseases (World Health Organization, 2024). Despite global progress, persistent disparities remain evident: maternal mortality ratios continue to disproportionately affect low- and middle-income countries, access to sexual and reproductive health services is uneven, and conditions such as endometriosis, polycystic ovary syndrome, and reproductive cancers are often underdiagnosed or undertreated due to systemic gaps in research and care delivery (Lau et al., 2023). These inequities not only undermine individual well-being but also hinder broader societal development.

The United Nations Sustainable Development Goals (SDGs), adopted in 2015, provide a framework for addressing such challenges. SDG 3 aims to ensure healthy lives and promote well-being for all at all ages, with specific targets including the reduction of the global maternal mortality ratio to less than 70 per 100,000 live births (Target 3.1) and universal access to sexual and reproductive health-care services (Target 3.7). SDG 5 seeks to achieve gender equality and empower all women and girls, emphasizing the elimination of discrimination, violence, and harmful practices, while ensuring universal access to sexual and reproductive health and reproductive rights (Target 5.6) (Lau et al., 2023). These goals are

intrinsically linked, as gender inequalities exacerbate health disparities, and improved health outcomes empower women economically and socially.

Artificial intelligence (AI), encompassing machine learning, deep learning, and predictive analytics, has emerged as a transformative force in healthcare. AI excels in processing vast datasets to identify patterns, support diagnostics, optimize resource allocation, and enable personalized interventions (World Health Organization, 2024). In the context of women's health, AI applications hold particular promise for advancing SDG 3 and SDG 5 by enhancing early detection of reproductive cancers, predicting maternal risks such as preeclampsia or postpartum hemorrhage, facilitating telemedicine for remote prenatal care, and providing digital tools for fertility tracking and sexual health education (Lau et al., 2023; World Health Organization, 2024). For instance, AI-driven imaging analysis has improved screening for cervical cancer, while chatbot-based interventions offer confidential information on contraception and rights, potentially bridging access gaps in underserved regions.

However, the integration of AI in women's health is not without significant challenges. A systematic review of AI contributions to healthcare reveals that women's specific health needs are markedly underrepresented in AI research and applications, with a persistent gender data gap rooted in historical biases where biomedical studies predominantly focused on male subjects (Lau et al., 2023). This underrepresentation perpetuates sex and gender biases in AI systems, leading to reduced diagnostic accuracy for women, particularly those from diverse ethnic or socioeconomic backgrounds (Buslón et al., 2023). Algorithmic biases amplify discrimination, violating principles of equity and potentially widening disparities in health outcomes, contrary to the aims of SDG 3 and SDG 5 (Buslón et al., 2023).

This paper examines the role of AI in promoting women's health, with a focused scope on its contributions and limitations within the frameworks of SDG 3 and SDG 5. By synthesizing peer-reviewed evidence, it argues that ethically designed and inclusively developed AI can accelerate progress toward health equity and gender empowerment, but only through deliberate efforts to mitigate biases, ensure diverse data representation, and prioritize participatory approaches involving women from marginalized communities.

Applications of AI in Women's Health

Artificial intelligence (AI), particularly machine learning (ML) and deep learning techniques, has been increasingly applied to address critical challenges in women's health, spanning diagnostics, predictive modeling, and continuous monitoring (Macedonia, 2025). These applications leverage large datasets, imaging modalities, physiological signals, and multi-omics to enhance accuracy, enable early intervention, and improve accessibility, especially in resource-limited settings. This section examines key domains: diagnostics and imaging, maternal and reproductive health risk prediction, and wearable-based monitoring, drawing on validated peer-reviewed evidence.

Diagnostics and Imaging

AI has shown remarkable efficacy in imaging-based diagnostics for gynecological and breast cancers, where pattern recognition from visual data is paramount. Deep learning models, particularly convolutional neural networks (CNNs), have achieved high performance in detecting breast cancer from mammography, ultrasound, and magnetic resonance imaging (MRI), often matching or exceeding radiologist accuracy (Nasser & Yusof, 2023). Systematic reviews indicate that CNN-based approaches yield accuracies up to 99% in binary classification tasks, with superior handling of imbalanced datasets compared to traditional methods (Nasser & Yusof, 2023). Meta-analyses further confirm that deep learning enhances image-based detection of breast and cervical cancers, with pooled sensitivities and specificities outperforming

conventional screening in diverse populations (Xue et al., 2022).

In obstetrics and gynecology, AI-augmented ultrasound systems, such as GE Voluson SWIFT and Samsung iNSIGHT, automate fetal anomaly detection and real-time segmentation, achieving sensitivities around 94% and Dice coefficients of 0.89 in large-scale validations (Macedonia, 2025). For cervical cancer screening, transformer-vision models applied to colposcopy images reach area under the curve (AUC) values of 0.91, while smartphone-based systems like Mobile ODT EVA enable point-of-care detection with 92% sensitivity in low-resource environments (Macedonia, 2025). These advancements reduce diagnostic delays and inter-observer variability, facilitating earlier interventions in oncology and prenatal care.

Maternal and Reproductive Health Risk Prediction

Predictive analytics represent a major AI application in maternal health, focusing on high-risk conditions like preeclampsia, preterm birth, and postpartum complications. ML models integrating maternal history, biomarkers, and cell-free RNA signatures have demonstrated strong performance in early preeclampsia detection, with platforms like Mirvie achieving 75% detection rates weeks before clinical onset (Macedonia, 2025). Combined algorithms, such as the ASPRE model, incorporate maternal factors and biomarkers to detect 82% of early-onset cases in prospective cohorts (Macedonia, 2025).

Noninvasive testing for endometriosis, a historically underdiagnosed condition, has advanced through ML analysis of serum microRNA (e.g., DotLab DotEndo, with 94% sensitivity and 91% specificity) and multi-omics subtyping (Macedonia, 2025). In obstetric risk stratification, AI tools enhance precision by processing electronic health records and vital signs, supporting personalized care pathways (Aftab, 2025). These models contribute to reducing maternal morbidity by enabling timely prophylaxis and resource allocation.

Wearables and Continuous Monitoring

Wearable devices integrated with AI algorithms offer continuous, noninvasive tracking of reproductive health parameters, transforming self-management of menstrual cycles, fertility, and menopausal symptoms. Physiological signals—such as skin temperature, heart rate (HR), heart rate variability (HRV), and respiratory rate—captured by wrist-worn or other sensors enable accurate phase identification without user input (Kilungeja et al., 2025). Random forest models applied to these data achieve up to 87% accuracy in classifying menstrual phases (period, ovulation, luteal) using fixed-window features, with AUC-ROC of 0.96 (Kilungeja et al., 2025).

Systematic reviews highlight devices like the Ava bracelet (90% accuracy for fertile window detection) and Oura Ring, which detect ovulation and cycle stages through temperature rises (+0.33°C in luteal phase) and HR increases (+2–3.8 beats/min) validated against hormonal benchmarks (Lyzwinski et al., 2024). Remote maternal-fetal monitoring systems, such as Nuvo INVU, use AI to interpret non-stress tests, reducing unnecessary hospitalizations by 30% in real-world deployments (Macedonia, 2025). These technologies empower women with personalized insights, improve fertility awareness, and support remote care in underserved areas.

Alignment with SDG 3 and SDG 5

Artificial intelligence (AI) and broader digital health technologies (DHTs) demonstrate significant potential to advance Sustainable Development Goal 3 (Good Health and Well-being) by enhancing healthcare delivery, early detection, and equitable access, particularly in women's health domains such as maternal care, reproductive health, and oncology (Lau et al., 2023; Vinuesa et al., 2020). Expert assessments indicate that digital technologies, including AI, exert a medium-to-high positive impact

on multiple sub-goals under SDG 3, including health education, surveillance, early warning systems, and universal health coverage (Kshetri, 2024). For instance, AI-enabled diagnostics and predictive modeling support targets like reducing maternal mortality (Target 3.1) and ensuring universal access to sexual and reproductive health services (Target 3.7) through scalable interventions in resource-limited settings (Lau et al., 2023). Scoping reviews of DHTs further confirm improvements in pregnancy outcomes, postpartum care, screening adherence, and disease prevention, with over 75% of studies reporting positive health benefits for women (Chantler et al., 2025).

In relation to SDG 5 (Gender Equality), AI and DHTs can promote empowerment by facilitating health literacy, autonomous decision-making, financial independence, and awareness of reproductive rights, thereby addressing Target 5.6 on universal access to sexual and reproductive health and rights (Chantler et al., 2025; Lau et al., 2023). Approximately 84% of evaluated studies on DHTs highlight gains in women's skills acquisition, social connectivity, and household dynamics, contributing to reduced gender inequalities and alignment with broader goals like SDG 10 (Reduced Inequalities) (Chantler et al., 2025). Ethically deployed AI has the potential to bridge gender data gaps, empower underrepresented communities, and inform policies that enhance accessibility and informed health choices (Lau et al., 2023).

However, AI's alignment with these SDGs is not unequivocal. Biases in algorithms and datasets can inhibit progress on SDG 5 by reproducing gender stereotypes and discrimination, while underrepresentation of women's health in AI research limits equitable benefits for SDG 3 (Vinuesa et al., 2020). Systematic analyses reveal persistent gender data gaps and inadequate focus on women's specific conditions, underscoring the need for inclusive design to fully realize AI's supportive role (Lau et al., 2023; Vinuesa et al., 2020).

Overall, when designed with equity in mind, AI serves as an enabler for 79% of SDG targets, including those in health and gender equality, but risks inhibiting others without deliberate bias mitigation (Vinuesa et al., 2020).

Challenges: Bias, Inequity, and Ethical Concerns

The integration of artificial intelligence (AI) in women's health, while promising, introduces substantial risks of perpetuating or exacerbating existing disparities through algorithmic bias, inequitable access, and ethical dilemmas (Cirillo et al., 2020; Buslón et al., 2023). These challenges stem primarily from historical underrepresentation of women in biomedical research and datasets, leading to AI systems that perform suboptimal for female physiology, diverse ethnic groups, and intersectional identities (Cirillo et al., 2020).

Algorithmic bias arises when training datasets reflect systemic gender imbalances, such as the predominance of male subjects in clinical trials or electronic health records skewed toward male-presenting symptoms (Buslón et al., 2023). For instance, AI models for cardiovascular disease detection, often trained on data where women are underrepresented, exhibit lower accuracy in diagnosing female patients due to sex-specific symptom variations (Cirillo et al., 2020). In women's health specifically, this manifests in reduced performance for conditions like endometriosis or polycystic ovary syndrome, where diagnostic delays are already prevalent, and in oncology, where imaging algorithms may underperform for breast or cervical cancers in non-Western populations (Gaye et al., 2025). Systematic reviews highlight that biases amplify discrimination, with AI potentially reinforcing sex and gender inequities in diagnosis, treatment recommendations, and resource allocation (Buslón et al., 2023).

In maternal health, these biases pose acute risks. Predictive models for complications like preeclampsia or preterm birth, when trained on non-representative

data (e.g., predominantly from high-income countries or certain ethnic groups), demonstrate poorer calibration for women in low- and middle-income countries (LMICs) or from minority backgrounds, potentially widening maternal mortality gaps contrary to SDG 3 targets (Gaye et al., 2025). Ethnic diagnostic biases have been documented in AI tools for common infections affecting women, further illustrating how unrepresentative data perpetuates health inequities (University of Florida study referenced in multiple sources, 2023).

Inequity extends beyond algorithms to access and deployment. The digital divide—encompassing infrastructure limitations, low digital literacy, and affordability barriers—disproportionately affects women in LMICs, limiting benefits from AI-driven telemedicine or wearables (Lau et al., 2023). Moreover, "data colonialism" concerns emerge when data from marginalized populations are extracted for AI development without local benefits or consent, exacerbating power imbalances (Gaye et al., 2025).
Ethical concerns include privacy vulnerabilities, as women's sensitive reproductive health data (e.g., fertility tracking or abortion-related queries) are at risk of breaches or misuse in AI systems (World Health Organization, 2021). Lack of transparency in proprietary algorithms hinders accountability, while over-reliance on AI may erode patient-provider trust and informed consent, particularly in gender-sensitive care (Cirillo et al., 2020). Without mitigation, these issues risk inhibiting progress on SDG 5 by reinforcing gender stereotypes and discrimination (Vinuesa et al., 2020).

Addressing these challenges requires proactive measures, including diverse dataset curation, bias audits, and inclusive governance, to ensure AI advances rather than hinders health equity (Buslón et al., 2023; Gaye et al., 2025).

Recommendations for Equitable AI Deployment

To maximize the benefits of artificial intelligence (AI) in women's health while mitigating risks of bias and inequity, deliberate and evidence-based strategies are essential. These recommendations, drawn from peer-reviewed literature and international guidelines, emphasize inclusivity, accountability, and sustainability to align AI deployment with SDG 3 (health equity) and SDG 5 (gender equality).

1. Prioritize Inclusive and Representative Data Practices: AI systems must be trained on diverse, sex- and gender-disaggregated datasets that include women from varied ethnic, socioeconomic, and geographic backgrounds, particularly those in low- and middle-income countries (LMICs). This involves mandating the use of standardized sex/gender ontologies and actively addressing historical data gaps through targeted collection efforts (Cirillo et al., 2020; Buslón et al., 2023). Without representative data, AI risks amplifying existing disparities in diagnostic accuracy and treatment outcomes for women's specific conditions.

2. Implement Robust Bias Detection and Mitigation Mechanisms: Regular algorithmic audits should be conducted using intersectional frameworks that account for sex, gender, race, and other factors. Techniques such as debiasing algorithms, counterfactual fairness testing, and explainable AI (XAI) models are recommended to enhance transparency and reduce discriminatory outputs (Buslón et al., 2023; World Health Organization, 2021). These measures ensure accountability and prevent AI from perpetuating gender biases in clinical decision-making.

3. Adopt Participatory and Community-Centered Design Approaches: Women from marginalized and underrepresented communities should be actively involved throughout the AI lifecycle—from design and development to testing and evaluation. Co-creation with stakeholders, including patients, healthcare providers, and gender experts, fosters responsive technologies that address real-world needs and cultural contexts (Gaye et al., 2025; Lau et al., 2023).

4. Invest in Capacity Building and Infrastructure in Underserved Regions: Targeted programs to enhance digital literacy, AI education for women healthcare workers, and infrastructure development in LMICs are critical. This includes building local innovation ecosystems and ensuring affordable access to AI tools, thereby reducing the digital divide that disproportionately affects women (Lau et al., 2023; World Health Organization, 2021).

5. Strengthen Governance and Ethical Frameworks: National and international policies should adopt comprehensive guidelines, such as the WHO's consensus principles for ethical AI in health, which emphasize protecting autonomy, ensuring inclusiveness and equity, and promoting sustainability. Specific attention to gender equity in regulatory oversight, including mandatory impact assessments for women's health applications, is advocated (World Health Organization, 2021; Vinuesa et al., 2020).

Implementing these recommendations requires multidisciplinary collaboration among researchers, policymakers, technologists, and civil society. By embedding equity-by-design principles, AI can become a powerful enabler for advancing women's health outcomes and contributing to the achievement of SDGs 3 and 5 by 2030.

Conclusion

The rapid evolution of artificial intelligence (AI) presents a transformative opportunity to advance women's health, addressing longstanding disparities in diagnostics, maternal care, reproductive health services, and personalized monitoring. As demonstrated through peer-reviewed evidence, AI applications—ranging from deep learning-enhanced imaging for cancer detection to predictive models for maternal risks and wearable-based cycle tracking—offer scalable, precise interventions that directly support Sustainable Development Goal 3 (SDG 3) targets for reducing maternal mortality and ensuring universal reproductive health access, while empowering women through informed decision-making aligned with SDG 5. These technologies have the potential to bridge gaps in resource-limited settings, enhance health literacy, and foster gender equity by democratizing access to high-quality care.

Nevertheless, the promise of AI is tempered by profound challenges, including algorithmic biases rooted in historical underrepresentation of women in biomedical data, which risk exacerbating inequities and discriminating against diverse populations. In maternal and reproductive health contexts, non-representative datasets can lead to suboptimal performance for women in low- and middle-income countries or from marginalized ethnic groups, potentially widening rather than narrowing health disparities. Ethical concerns, such as data privacy vulnerabilities and the digital divide, further underscore the imperative for cautious deployment.

Ultimately, realizing AI's catalytic role in achieving SDGs 3 and 5 by 2030 hinges on proactive, equity-centered strategies: inclusive data curation, rigorous bias mitigation, participatory design, capacity building in underserved regions, and robust governance frameworks. When guided by these principles, AI can transcend mere technological innovation to become a cornerstone of gender-equitable, sustainable health systems. Future research should prioritize longitudinal evaluations of AI interventions in diverse contexts, interdisciplinary collaborations to address intersectional biases, and policy integration to ensure that technological progress translates into tangible, inclusive improvements in women's well-being worldwide.

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