Empowering Women in the Digital Age: A Narrative Review of Technological Opportunities and Barriers

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Abstract

Digitalization profoundly impacts women's lifestyles, presenting both opportunities and challenges. While access to online platforms empowers women with knowledge, education, and economic opportunities, the digital divide deepens existing inequalities and limits the participation of women in disadvantaged communities in the digital economy. Furthermore, issues such as cyberbullying and gender-based violence online negatively affect women's participation in digital spaces. Digital technologies also play an important role in healthcare, and artificial intelligence applications have the potential to improve women's health outcomes and reduce health inequalities. Digitalization in occupational therapy practice focuses on providing opportunities and proactive solutions to better meet women's health needs, and digital applications for women's health are increasing access to information on menstrual and reproductive health. However, there is a need for standardized guidelines for reliability and effectiveness.

Keywords: Digital technology, women's health, lifestyle, artificial intelligence.

Dijital Çağda Kadınların Güçlendirilmesi: Teknolojik Fırsatlar ve Engellerin Anlatısal Derlemesi

Öz

Dijitalleşme, kadınların yaşam tarzlarını derinden etkileyerek hem fırsatlar hem de zorluklar sunmaktadır. Çevrimiçi platformlara erişim, kadınları bilgi, eğitim ve ekonomik fırsatlarla güçlendirirken, dijital uçurum mevcut eşitsizlikleri derinleştirmekte ve dezavantajlı topluluklardaki kadınların dijital ekonomiye katılımını sınırlamaktadır. Ayrıca, çevrimiçi ortamda siber zorbalık ve cinsiyete dayalı şiddet gibi sorunlar, kadınların dijital alanlardaki katılımlarını olumsuz etkilemektedir. Dijital teknolojiler, sağlık hizmetlerinde de önemli bir rol oynamakta; yapay zekâ uygulamaları, kadınların sağlık sonuçlarını iyileştirmekte ve sağlık eşitsizliklerini azaltma potansiyeli taşımaktadır. Ergoterapi pratiğinde dijitalleşme, kadınların sağlık ihtiyaçlarını daha iyi karşılamak için fırsatlar sunmaya ve proaktif çözümler üretmeye odaklanmaktadır. Kadın sağlığına yönelik dijital uygulamalar, menstrüel sağlık ve üreme sağlığı konularında bilgiye erişimi artırmakta, ancak güvenilirlik ve etkililik açısından standartlaştırılmış kılavuzlara ihtiyaç duyulmaktadır.

Anahtar Sözcükler: Dijital teknolojiler, kadın sağlığı, yaşam tarzı, yapay zeka.

Introduction

The advent of online platforms has facilitated unprecedented access to information, education, and economic opportunities for women, while simultaneously exacerbating pre-existing inequalities[1]. The digital divide, characterized by unequal access to technology and the internet, has a disproportionate impact on women in disadvantaged communities, impeding their capacity to participate fully in the digital economy and hindering their social and economic mobility[2]. Furthermore, the online environment is

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characterized by incidents of gender-based violence, including cyberbullying, harassment, and the dissemination of misogynistic content, which not only suppresses women's voices but also generates a hostile environment that limits their participation in online spaces. The idealized portrayals and constant comparisons often found on social media platforms can have a detrimental effect on women's body image, self-esteem, and subjective well-being. The increasing ubiquity of technology has the potential to blur the boundaries between work and private life, leading to increased stress and burnout, particularly for women who bear a disproportionate burden of domestic responsibilities[3–6]. The constant connectivity provided by technology can lead to a sense of pressure to always be available, which can have a detrimental effect on mental and physical health. In addition, the rapid pace of technological progress can exacerbate women's feelings of inadequacy and anxiety, creating a sense of pressure to keep up[7,8]. It is therefore vital to address these challenges, including the digital divide and online violence against women, to ensure that the transformative potential of digitalization is fully realized for all women[9].

Recent studies have demonstrated artificial intelligence (AI), together with digitalization, has the potential to reduce health inequalities and increase access to healthcare in resource-constrained settings. A recent systematic review and meta-analysis of empirical studies found that AI chatbots effectively improved women's physical, psychological, and cognitive health outcomes and significantly reduced anxiety levels. These chatbots addressed a range of health issues, including breast cancer care, prenatal mental health, and eating disorders, demonstrating their versatility and potential to support women with different health needs[10]. However, to fully realize this potential, approaches should be adopted that aim to build the capacity of health workers and develop pragmatic implementation strategies that prioritize equity and inclusion[11]. Another study demonstrated that, although an AI model trained on a large-scale dataset achieved a balanced accuracy of 74.62% in Visual Inspection with Acetic Acid (VIA)-based cervical cancer screening, its current performance remains limited for clinical reliability. The findings suggest promising potential, yet emphasize the need for expanded data, improved labeling consistency, and further system enhancements to ensure real-world effectiveness[12].

This includes addressing concerns around data privacy, algorithmic bias, and the responsible development and use of AI in healthcare[11,12].

Given these developments, digital technology is also increasingly recognized as a vital component of contemporary occupational therapy practice, offering new opportunities to address women's health needs within evolving digital landscapes. Fischl et al. argue that current occupational therapy practice models should be updated to incorporate digital technology, noting that such integration can increase literacy engagement among individuals[13]. Larsson-Lund and Nyman further support this perspective, stating that occupational therapists should proactively embrace digitalization to promote literacy, justice, and health in a rapidly changing society[14]. Margot-Cattin emphasizes the growing importance of digital literacy among clients and highlights the increasing incorporation of digital literacy training into therapy plans by occupational therapists to better serve their clients[15]. These developments enhance the efficiency of occupational therapy

services and empower women to achieve recovery and participation in activities of daily living[16]. Consequently, from an occupational therapy perspective, digitalization presents both opportunities and challenges for improving the care offered to women. By integrating digital tools into therapy processes and promoting digital literacy, occupational therapists can more effectively address the specific health needs of women, particularly in the context of recovery. In light of the ongoing evolution of the field, it is crucial for occupational therapists to proactively adapt their practice to leverage the benefits of digitalization.

Increased access to health services has the potential to improve health outcomes, reduce health inequalities, and improve women's overall health[17,18]. Telemedicine platforms and health apps are empowering women by offering them greater autonomy in the management of their health through the provision of personalized services, the facilitation of appointment scheduling, and the offering of tools for self-monitoring and disease management[18]. For instance, a study by Lyons et al. (2024) tested a telephone-based counselling intervention based on behavioral activation therapy and problem solving for nine sessions over 20 weeks to increase activity participation. Among 284 women who had completed breast cancer treatment within the last year and reported participation limitations, the intervention significantly increased self-selected activity participation and satisfaction, but overall recovery and quality of life outcomes did not show significant differences compared to the control group[19]. Similarly, Akechi et al. (2022) investigated a fully decentralized smartphone-based intervention providing problem-solving therapy and behavioral activation to 447 breast cancer survivors[20]. The intervention led to a substantial reduction in fear of cancer recurrence, depression, and unmet psychological needs in comparison to the control group. Another study evaluated the feasibility and efficacy of smartphone-based problem-solving therapy (PST) in reducing fear of cancer recurrence (FCR) among breast cancer survivors, finding significant reductions in FCR after 8 weeks and achieving high engagement and completion rates[21]. The existing body of research has demonstrated the potential of scalable digital therapies to address psychological challenges in cancer survivors[20]. In addition, digital platforms have been shown to play an important role in disseminating information and raising awareness on reproductive health issues, facilitating access to information on contraception, family planning, and safe abortion practices[17,18]. In particular, the proliferation of mobile applications that provide contraception education demonstrates the potential offered by digital solutions in this field. However, these applications are currently unable to provide comprehensive information on the effectiveness, side effects, and contraindications of different contraceptive methods, resulting in a significant information gap in existing systems. This highlights the need for the development of standardized guidelines to enhance the reliability and effectiveness of digital solutions. Recent studies have demonstrated the efficacy of combining urine pregnancy testing with telephone counselling in reliably detecting ongoing pregnancies and reducing unnecessary clinic visits[22]. Furthermore, integrating semi-quantitative pregnancy tests and symptom checklists into remote follow-up protocols has been shown to provide reassurance to patients and offer a highly effective solution by increasing access[23].

The utilization of menstrual health applications has seen a surge in popularity, with these digital tools now playing a pivotal role in women's health management. A pilot randomized controlled trial was conducted to assess the efficacy of the Flo mobile application in enhancing menstrual health outcomes. The study involved two groups: women who solely monitor their cycles and women experiencing Premenstrual Syndrome (PMS) or Premenstrual Dysphoric Disorder (PMDD) and who also track their cycles. The study appraised a range of health outcomes before and after a three-month period of app usage. The findings indicated substantial enhancements in health literacy, menstrual health awareness, and subjective well-being in both groups. Notably, women afflicted with PMS/PMDD exhibited a marked reduction in symptom burden. Secondary outcomes included an increased sense of control over health, improved health-related communication, reduced menstrual cycle stigma, reduced fear of unplanned pregnancy, and reduced absenteeism from work or education due to PMS/PMDD[24]. In another study evaluating menstrual tracking apps, researchers evaluated 34 apps from both the healthcare provider and consumer perspectives using the Mobile App Rating Scale (MARS). The study revealed that most apps were found to predict menstrual cycles, but only a few provided information on health screening. The apps with high MARS scores typically offered symptom recording and personalized notifications. The study found no significant correlation between healthcare provider and consumer assessments of app quality, highlighting the need for collaborative development processes that include input from both groups[25]. In a further study, an online survey of 330 women aged 14-54 years explored experiences with menstrual tracking apps[26]. This mixed-methods study utilized 50 multiple-choice and open-ended questions to understand user attitudes, motivations for app use, perceptions of ovulation prediction accuracy, and the emotional and behavioral effects of inaccurate menstrual onset date predictions. The study's key findings indicated that the primary motivator for app usage was ovulation prediction, yet it was observed that prediction errors were prevalent. Specifically, 54.9% of participants reported that their menstrual cycle commenced earlier than the predicted date, while 72.1% reported a later start than the predicted date. Subsequent qualitative analysis unveiled a spectrum of emotional responses to these discrepancies, encompassing frustration, anxiety, stress, pregnancy-related concerns, and exasperation. These findings underscore the necessity for enhancing the accuracy and transparency of such applications to mitigate adverse emotional consequences and optimize user support[26]. Although menstrual tracking applications offer notable advantages such as enhanced health literacy, self-management, and emotional empowerment, substantial deficiencies persist. Future research should prioritize the following: firstly, ensuring the accuracy of the algorithms employed; secondly, designing the user interface in a way that is centered on the needs of the individual user; and thirdly, aligning the features of the app with both clinical standards and the diverse needs of the user. It is only by realizing the potential of these technologies for women's health that we can begin to address the challenges currently faced by many women in relation to their menstrual health.

Building on the growing success of digital health tools in menstrual health, emerging evidence also supports the viability of remote methods in other aspects of women's healthcare. For instance, telephone follow-up after medical abortion has been shown to constitute a robust alternative to conventional clinic-based approaches. A significant

proportion of women express a preference for remote follow-up methods over in-person clinic visits, citing the reduction in logistical and financial burdens as a key factor in this preference[27,28]. A study conducted in South Africa offers an illustrative example of this preference. The study utilized mobile phone text messages as a means of providing psychological support following abortion, resulting in a reduction in anxiety levels and an enhancement in preparedness for symptom management. This finding underscores the potential of straightforward, cost-effective interventions to enhance the quality of medical abortion care[29]. In the context of family planning, telemedicine has demonstrated efficacy in promoting contraceptive continence and accessibility. However, the full potential of these approaches in direct-to-patient models of care remains to be fully realized.

The digitalization of women's health has brought meaningful changes in how women access information, understand their own bodies, and care for their families. With the growing availability of genomics, transcriptomics, and electronic health records, it has become increasingly possible to investigate female-specific conditions such as endometriosis and preterm birth which are areas that have long been underrepresented in clinical research[30]. Yet, not all women have equal access to these technologies. Concerns about privacy, limited infrastructure, financial hardship, and gender-based inequalities continue to prevent many from benefiting fully from digital health tools[31]. Even so, many women actively use resources ranging from search engines and health websites to mobile applications, social media platforms, and wearable devices—not only to manage their own health but also to monitor the health of their children, partners, and elderly family members[32]. This highlights that digital health is not only a tool for personal empowerment but also a reflection of women's broader caregiving roles within both private and social spheres.

Digital technologies hold considerable promise in enhancing women's safety and security by facilitating access to assistance, resources, and resilience-building opportunities. Mobile applications offering features such as real-time location sharing, emergency alerts and self-defense training can empower women to navigate their environments more safely[33]. Tools like WoSApp enable discreet location transmission to authorities, addressing barriers such as delayed police response or victims' inability to seek help[34]. Additionally, platforms such as AyudaMujer offer survivors of gender-based violence access to counselling, support networks and chatbot-based assessments, contributing to a 19.43% reduction in the risk of violence within weeks[35]. Systematic reviews affirm that digital interventions effectively reduce depression, anxiety, and physical violence among intimate partner violence victims. Nonetheless, such tools should complement, rather than replace, traditional care methods, with ongoing research needed to refine intervention components and adapt them to diverse sociocultural contexts[33].

Digital technologies present important opportunities for advancing women's participation in education and employment. Online learning platforms offer flexible and accessible pathways for skill development and career advancement, particularly for women facing geographic or socioeconomic barriers. Research on the digital transformation of households emphasizes the positive impact of internet-based learning on women's employment outcomes, notably through gains in human capital and more

efficient job search processes[36]. However, persistent challenges remain. The digital divide continues to limit access for women in low-income and rural settings, while gendered design in educational technologies often reinforces existing inequalities. Security and privacy risks, including cyberbullying and data breaches, pose additional obstacles to women's full engagement in online learning. Addressing these issues requires systemic and evidence-based approaches. Community-driven initiatives that provide subsidized internet access and shared digital devices have been effective in expanding women's access to education[37]. Programs focusing on digital literacy and online safety have further strengthened women's ability to engage meaningfully with digital platforms. Moreover, the integration of gender-sensitive content and increased representation of women in STEM fields have been linked to improved enrolment and retention. Ensuring privacy through secure platforms and data protection policies remains essential to creating inclusive and supportive digital learning environments.

The digital age has significantly expanded opportunities for women in the labor force by offering previously unattainable flexibility and accessibility. Digital technologies are facilitating women's participation in the labor force by enabling remote work, stimulating the growth of the gig economy, and providing access to online markets for entrepreneurship. The study also demonstrates that digital transformation has the potential to reduce gender discrimination in employment by reducing knowledge inequalities and leveraging women's soft skills, which are highly relevant for sectors that require interpersonal communication and adaptability[36]. Taken together, digital technologies help to bridge the gender gap in education and employment by fostering a more equitable and inclusive economic environment for women. For instance, teleworking allows women to balance caring responsibilities with professional pursuits, thereby enabling greater participation in the labor market. Furthermore, the emergence of the digital economy has given rise to new sectors that are conducive to the flourishing of careers for women, including e-commerce, digital marketing, and remote healthcare. The advent of digital tools and platforms has also served to reduce barriers to entrepreneurship, thereby empowering women to start and develop their own businesses. Additionally, the proliferation of online courses and resources has encouraged personal and professional development by offering accessible avenues for women to acquire new skills.

However, it is important to acknowledge that digitalization also poses significant challenges for women in the workforce. The flexibility offered by remote work is beneficial, but it can also result in a blurring of boundaries between professional and personal life, which can lead to increased workload and challenges in achieving a healthy work-life balance. These challenges underline the need for targeted interventions to ensure that the benefits of digitalization are accessible to all women, such as ensuring equal access to technology, implementing mentoring programs, and formulating policies that promote work-life balance.

In this context, targeted interventions have been proposed and examined in order to address the challenges women face in the digital workforce. A scoping review by Tricco et al. (2024) examined various strategies aimed at promoting gender equality in workplace settings. The research emphasized the importance of interventions that are

flexible and take into account the diversity among women and suggested moving away from a 'one-size-fits-all' approach[38]. In a similar manner, Quesenberry and Trauth (2012) emphasized that organizational interventions should be adaptable to the diverse career values of women in the IT workforce and suggested that tailored strategies are more effective in supporting women's participation and retention in digital roles[39]. Furthermore, Guthridge et al. (2022) conducted a systematic review identifying effective interventions that show promise in reducing gender bias and promoting equality, such as mentoring programs, cognitive and behavioral change strategies, and social justice initiatives[40]. These studies underline the need to implement multifaceted and adaptive interventions to effectively support and empower women in the digital economy.

Figure 1. Women and digitalization: key areas of domain
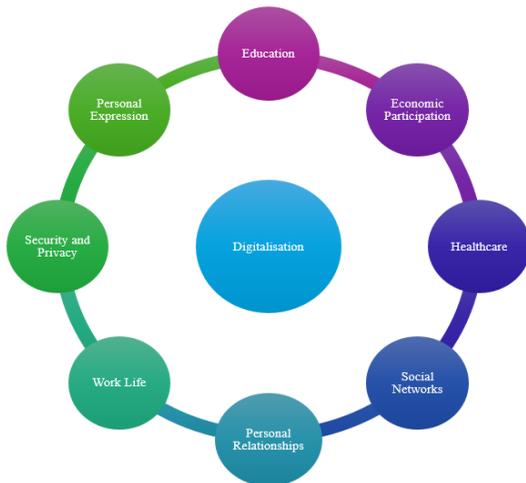
Conclusion

As digital transformation accelerates, it becomes increasingly evident that digitalization presents both opportunities and challenges for women's access to healthcare, education, safety, and labor market participation. Digital health tools, remote services, and artificial intelligence-based applications hold considerable potential to improve healthcare accessibility, particularly for women living in rural or underserved areas. These tools contribute to enhancing health literacy, facilitating individual monitoring, and enabling women to manage their overall and reproductive health more effectively. Solutions such as menstrual tracking applications and remote follow-up after medical abortion support the personalization and accessibility of healthcare services. However, data privacy concerns, infrastructural deficiencies, and disparities in digital literacy continue to pose significant barriers, especially for women from vulnerable groups.

Moreover, women often assume responsibility not only for their own health but also for the health of family members, shouldering a disproportionate burden of digital caregiving. While this may foster empowerment, it also increases the risk of digital fatigue and mental overload. Additionally, online gender-based violence, appearance-related pressures, and the expectation of constant connectivity can have adverse effects on women's psychological and physical well-being. Therefore, gender-sensitive and culturally responsive approaches should be integrated into the development and implementation of digital health solutions.

Within the field of occupational therapy, digitalization offers important opportunities to develop innovative and inclusive service models. The integration of digital tools into therapeutic processes, along with the promotion of digital literacy, enables women to become more resilient in the face of challenges encountered in digital environments. Interventions should be designed with attention to women's individual and social roles to ensure meaningful engagement. When these issues are addressed effectively, occupational therapists can assist women in navigating the complexities of the digital age and empower them to thrive in a technology-driven world.

From a health systems perspective, policies that prioritize infrastructure investment, digital literacy training, and data protection are essential to ensure equitable and accessible dissemination of digital health tools. Community-based, culturally sensitive, and trust-oriented digital programs will play a crucial role in fostering sustainable progress in this field.

To overcome barriers to care, especially in low- and middle-income countries, further comprehensive studies are required to facilitate more effective implementation of these methods. For digital solutions to truly benefit women, they must be adapted to their life stages, social circumstances, and specific health needs. Ultimately, digitalization can only become a transformative force in women's lives when it is grounded in principles of accessibility, inclusivity, and dignity.

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