# The Role of Digital Health Tools in Enhancing Sexual and Reproductive Health Services for Sustainable Development

**RESEARCH ARTICLE**

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# ABSTRACT

There is growing global evidence that leveraging digital health tools can significantly enhance reproductive health services. The global digital sexual and reproductive health market was valued at USD 6.5 billion in 2023 and is projected to reach USD 15.4 billion by 2030, growing at a CAGR of 13.1% (Virtue Market Research, 2024). Digital health tools are particularly useful in low-resource and underserved settings. These tools, including mobile health (mHealth), telemedicine, digital platforms, and health information systems, have the potential to bridge gaps by overcoming geographical barriers, reducing costs, and improving access to quality sexual and reproductive health services. This review examines the evidence on digital health tools in enhancing sexual and reproductive health services within the framework of sustainable development goals, particularly SDG 3.7 which aims to ensure universal access to sexual and reproductive health services by 2030.

### Key Focus

Digital health tools enhancing sexual and reproductive health services in underserved populations

### SDG Target

Advancing Target 3.7 for universal access to SRH services by 2030

### Core Contribution

Evidence-based review identifying pathways for equitable deployment of digital health solutions

**Keywords:** Reproductive Health Services, Digital Health Tools, Sustainable Development Goals, Access to Health Care

# INTRODUCTION

The critical Guttmacher-Lancet Commission on Sexual and Reproductive Health and Rights states "Sexual and Reproductive Health and Rights (SRHR) are essential for sustainable development because of their links to gender equality and women's wellbeing, their impact on maternal, newborn, child, and adolescent health, and their roles in shaping future economic development and environmental sustainability. Yet progress towards fulfilling SRHR for all has been stymied because of weak political commitment, inadequate resources, persistent discrimination against women and girls, and other barriers" (Starrs et al., 2018, p. 2642). The integration of digital health tools presents a transformative opportunity to accelerate progress toward these goals by addressing systemic barriers and improving service delivery efficiency.

01

### Global Challenge

4.3 billion people of reproductive age worldwide face inadequate sexual and reproductive health services throughout their lives.

02

### SDG Target 3.7

Achieving universal access to sexual and reproductive health services by 2030, including family planning and integration into national strategies.

03

### Digital Solution

Leveraging technology to deliver essential services as a game changer in bridging inequalities and reaching vulnerable populations.

This challenge is particularly acute in low- and middle-income countries (LMICs), where weak health systems, financial constraints, and sociocultural barriers disproportionately affect access to SRHR for vulnerable populations. This stark reality underscores the urgency of investing in innovative approaches that can address existing gaps in SRHR service delivery, especially in resource-limited and underserved settings. Target 3.7 of the Sustainable Development Goals (SDGs) envisages achieving universal access to sexual and reproductive health services by 2030, including family planning, information, education, and integration of reproductive health into national strategies. (United Nations, 2015). However, meeting this target remains a formidable challenge, particularly in low- and middle-income countries where health systems often face infrastructural, financial, and human resource constraints.

In such contexts, leveraging technology to deliver essential services can serve as a game changer in bridging inequalities and reaching vulnerable populations. Growing global evidence in the use of technology has shown that Digital Health Tools can significantly contribute to achieving SDG target 3.7 by enhancing access to quality healthcare, early recognising of diseases, improving diagnosis accuracy, optimising treatment plans, and most importantly, facilitating remote healthcare delivery. This aligns with national policy frameworks by providing a scalable and cost-effective method to expand healthcare access in resource-limited settings, for example, through mHealth applications that enable remote consultations and data collection in rural clinics.

The World Health Organization (2020) defines digital health as "the use of digital technologies to support health and well-being, including the use of computing platforms, connectivity, software, and sensors for health care and related uses" (World Health Organization, 2020, p. 7). These technologies encompass mobile health (mHealth), telemedicine, digital platforms, and health information systems that can be used for promoting health and preventing diseases, delivering healthcare services, providing training and supervision, facilitating electronic payments, and managing information systems. This review operationalises this definition by investigating the range of tools within the scope of sexual and reproductive health (SRH) education, counselling, contraception, and STI prevention and control as described in the following sections.

Digital health tools span a wide array of platforms and innovations, including mobile health (mHealth) applications, telemedicine platforms, wearable devices, and electronic health records (EHRs), all of which contribute to streamlining healthcare processes and improving user engagement. Digital health tools break the various geographical, socioeconomic and sociocultural barriers and improve access to Reproductive Health Services, especially in underserved populations. Leveraging the widespread use of mobile phones, internet connectivity, cutting-edge technological tools, growing use of Telemedicine and Artificial Intelligence presents a promising avenue to overcome these barriers and enhance Sexual and Reproductive Health Services for sustainable development.

### Digital Health Definition

Use of digital technologies (computing platforms, connectivity, software, sensors) to support health and well-being, encompassing mHealth, telemedicine, and health information systems, for promotion, prevention, delivery, training, and management.

### Scope of Application

SRH education, counselling, contraception, STI prevention and control through various digital platforms and innovations

As the world becomes increasingly digital, integrating these tools into national reproductive health strategies can lead to more equitable, responsive, and resilient health systems. Their role is not only pivotal in achieving universal health coverage but also in ensuring that no one is left behind in the pursuit of reproductive justice and sustainable development.

# METHODOLOGY

A literature review was conducted to examine the digital health tools in improving the services of sexual and reproductive health (SRH) in the context of sustainable development. This review builds upon recent systematic evidence, including the 2024 umbrella review by Borji-Navan et al., which analysed multiple systematic reviews on digital health interventions for adolescent sexual health, demonstrating significant improvements in contraceptive knowledge, safer sexual behaviours, and healthcare service utilisation (Borji-Navan et al., 2024). The review is particularly timely given the rapid expansion of digital health technologies and their increasing integration into healthcare systems globally. Recent implementation studies from developed healthcare systems, such as the Stockholm digital SRH services showing 23.96% utilisation among youth aged 12-22 (Zettergren et al., 2024), provide valuable insights for scaling digital health interventions globally.

## Search Strategy and Selection Criteria

The literature search employed a comprehensive strategy using Boolean operators and MeSH terms including: ("digital health" OR "mHealth" OR "telemedicine" OR "digital intervention") AND ("sexual health" OR "reproductive health" OR "family planning" OR "contraception" OR "STI prevention") AND ("effectiveness" OR "outcomes" OR "impact" OR "cost-effectiveness"). The search focused on literature published between 2010 and 2025, with the 1994 landmark policy documents (like the ICPD) forming the background context. The articles were retrieved from PubMed and Google Scholar digital libraries.

## Inclusion Criteria

The following criteria were used for inclusion:

- Peer-reviewed articles published in English between 2010-2025
- Studies focusing on digital health interventions for sexual and reproductive health
- Research conducted in any geographic setting with clear outcome measures
- Systematic reviews, randomised controlled trials, cohort studies, and economic evaluations
- Studies reporting quantitative outcomes or cost-effectiveness data

## Exclusion Criteria

The following types of works were excluded from the review:

- Conference abstracts, editorials, and opinion pieces without original data
- Studies focusing solely on general health without specific SRH outcomes

- Research with insufficient methodological detail or unclear outcome measures
- Duplicate publications or studies with overlapping datasets
- Works unrelated to SRH, non-digital interventions, or publications without an accessible full text.

# Quality Assessment

The methodological quality of included studies was assessed using appropriate tools: the Cochrane Risk of Bias tool for randomised trials, the Newcastle-Ottawa Scale for observational studies, and the CHEERS checklist for economic evaluations. Studies were **categorised** as high, moderate, or low quality based on **standardised** criteria.

# Data Synthesis

Given the heterogeneity of interventions and outcome measures, a narrative synthesis approach was employed, with quantitative meta-analysis conducted where appropriate for comparable outcomes. Effect sizes were calculated using **standardised** mean differences for continuous outcomes and odds ratios for dichotomous outcomes.

A total of 25 studies and reports met the inclusion criteria and were **analysed** for their contributions, limitations, and relevance to achieving Sustainable Development Goal (SDG) Target 3.7.

### Time Frame

Literature from 2010-2025, with 1994 ICPD providing background context for policy development

### Databases

PubMed and Google Scholar for peer-reviewed articles, systematic reviews, and reports

### Selection Criteria

Digital tools in SRH outcomes including mHealth, telemedicine, and online platforms with full text access

### Final Sample

25 studies and reports **analysed** for contributions, limitations, and relevance to SDG Target 3.7

# SEXUAL AND REPRODUCTIVE HEALTH: DEFINITION AND OVERVIEW

The International Conference on Population and Development (United Nations, 1994) defined reproductive health as a state of complete physical, mental, and social well-being in all matters relating to the reproductive system, not merely the absence of disease. This definition emphasises individuals' rights to make informed choices about reproduction and access safe, affordable, and acceptable family planning and maternal health services (United Nations, 1994, p. 30, para. 7.2). Closely linked is the concept of sexual health, which can be described as requiring a positive and respectful approach to sexuality, free from coercion, discrimination, and violence.

Beyond definitions, the World Health Organisation stresses that access to comprehensive sexual and reproductive health (SRH) services is essential for dignity, equity, and full participation in society. Evidence shows that investing in a package of SRH services, including family planning, maternal and newborn care, and treatment of sexually transmitted infections, reduces unintended pregnancies, unsafe abortions, and maternal deaths while improving broader social and economic outcomes. Conversely, lack of access has severe consequences. In this context, digital health tools can play a transformative role by expanding the reach of SRH services, overcoming barriers of geography, stigma, and limited resources, and thereby helping to mitigate the negative effects of inaccessibility.

### Complete Well-being

Physical, mental, and social well-being in reproductive system matters, not merely absence of disease.

### Informed Rights

Individuals' rights to make informed reproduction choices and access safe, affordable family planning services.

### Transformative Role

Digital tools expand SRH services reach, overcoming geography, stigma, and resource barriers.

# DIGITAL TOOLS IN SRH EDUCATION AND COUNSELLING SERVICES

Digital tools are technological resources or applications used in the provision of information, support, and resources related to SRH. These tools use digital technology to enhance access, outreach, and effectiveness in the delivery of SRH education and services. They are available through a variety of digital platforms, such as websites, mobile apps, and social media platforms (Hubert et al., 2021). The use of such tools has become increasingly prevalent in recent years as they offer a convenient and efficient means of accessing SRH information, particularly for young people who may face barriers to traditional healthcare services. Recent studies have shown that digital educational tools are particularly effective in Sub-Saharan Africa, where they help overcome sociocultural barriers and limited educational resources (Laar et al., 2024).

Women experience major challenges in getting accurate and comprehensive sexual and reproductive health (SRH) information because of sociocultural norms, stigma, and limited SRH educational resources. Challenges impacting access to sex education and information also include taboos regarding the open discussion of topics such as family planning, menstruation, and contraception (Soehnchen et al., 2023). Additionally, comprehensive sexuality education programmes have been constrained by inconsistent funding and poor accountability (Achen et al., 2023). In Stockholm, Sweden, the implementation of digital SRH services for youth showed promising results, with 23.96% of adolescents and young adults (aged 12-22) utilising these services between 2018-2022, demonstrating the scalability of digital health approaches in developed healthcare systems (Zettergren et al., 2024).

### Accessibility Enhancement

Digital platforms including websites, mobile apps, and social media provide convenient and efficient access to SRH information and resources.

### Barrier Mitigation

Digital tools address sociocultural norms, stigma, and taboos that limit access to comprehensive SRH education and family planning information.

# DIGITAL TOOLS IN CONTRACEPTIVE AND FAMILY PLANNING COUNSELLING SERVICES

The use of digital tools for health has expanded rapidly over the last decade. From personal health tracking to referral coordination to data collection and analysis for management and monitoring, digital tools support a growing array of health system functions and users (Agarwal et al., 2025). Digital contraceptive counselling platforms have demonstrated significant effectiveness in improving contraceptive uptake, with systematic reviews showing 15-25% increases in modern contraceptive use compared to standard care (Aung et al., 2020). Mobile-based interventions have proven particularly effective, with studies demonstrating improved family planning outcomes through interactive communication, tailored information, and motivational messaging approaches.

The global digital sexual and reproductive health market demonstrates rapid expansion, valued at USD 6.5 billion in 2023 and projected to reach USD 15.4 billion by 2030, with a compound annual growth rate of 13.1% (Virtue Market Research, 2024).

Despite their potential to address barriers such as distance, stigma, and shortages of trained providers, SRH-focused digital innovations remain underrepresented in LMIC contexts, reflecting both funding imbalances and limited integration into national health strategies. Among digital health tools aimed at individuals using or seeking family planning commodities or services, most tools initially sought to improve users' knowledge of family planning methods and services; recently, new digital tools aim to modify users' or potential users' behaviours by integrating features related to service provision (Smith et al., 2015; WHO, 2016; Aung et al., 2020).

**<7%**

### Digital Gap

Of nearly 100,000 digital health tools created by 2015, less than 7% were linked to family planning and SRH

**100K**

### Total Tools

Nearly 100,000 digital health tools were created, showing massive growth in digital health innovation

Economic analyses demonstrate that digital contraceptive interventions offer substantial cost savings compared to traditional service delivery models. A systematic review of economic evaluations found that digital family planning interventions achieve cost-effectiveness ratios ranging from $12-35 per disability-adjusted life year (DALY) averted, significantly below the WHO cost-effectiveness threshold for most low- and middle-income countries (Sharma et al., 2023).

Mobile-based contraceptive counselling programmes show particularly strong economic returns, with implementation costs of $2-8 per user served, compared to $15-25 for facility-based counselling sessions. The scalability of digital platforms enables these interventions to reach marginal costs as low as $0.50 per additional user once initial development costs are amortised (Ladi-Akinyemi et al., 2025).

Furthermore, digital contraceptive services generate substantial healthcare system savings through reduced unintended pregnancies. Economic modelling studies indicate that every dollar invested in digital family planning interventions yields $3-7 in healthcare cost savings through prevention of unintended pregnancies and associated complications. These cost-effectiveness ratios make digital health interventions highly attractive for resource-constrained healthcare systems seeking to maximise health outcomes within limited budgets.

Digital health tools can increase the effectiveness of family planning service delivery and campaigns (Assessment, 2022; Opatunji and Sowunmi, 2024), and they have the potential to address gender barriers that restrict family planning access and use among hard-to-reach populations. Such barriers may include cultural or social norms that restrict women's mobility or ability to access services, young women's fear of stigma or disapproval for using family planning, gender norms around masculinity that limit men's health-seeking behaviours for family planning or their support for partners' family planning use, and the view that health centres are a part of women's space and less that of men, among others (McCleary-Sills et al., 2012).

The implementation of digital family planning platforms in Sub-Saharan Africa has shown measurable impact, with mobile-based contraceptive counselling programmes achieving 60% higher engagement rates among young women compared to facility-based services alone.

The World Health Organisation (WHO) classifies digital health interventions into four overarching categories based on the type of users: interventions for clients, healthcare providers, managers, and data services. Using digital technologies for health promotion has become a prominent practise for utilising both routine and innovative information and communications technology in addressing health needs (Hameed et al., 2014). Various reviews focusing on sexual and reproductive health interventions showed that mobile technologies can improve the uptake of services.

# DIGITAL HEALTH TOOLS IN THE PREVENTION AND MANAGEMENT OF SEXUALLY TRANSMITTED INFECTIONS (STIS)

Sexually transmitted infections (STIs) continue to pose a major public health burden worldwide, particularly in low- and middle-income countries (LMICs) where access to prevention, testing, and treatment remains limited. According to the World Health Organisation (2023), over one million STIs are acquired daily worldwide, with digital health interventions showing 20-30% improvements in early detection and treatment initiation rates compared to traditional screening approaches. The WHO (2024) has reported major increases in STI incidence globally, with syphilis cases among adults aged 15-49 years increasing by over 1 million in 2022, reaching 8 million cases. Digital health tools offer promising solutions to address these growing challenges through improved access to testing, treatment, and prevention services.

Digital platforms, including mobile applications, SMS-based campaigns, and online forums, are being used to deliver targeted information about STI prevention and safe sex practices. These platforms are particularly beneficial in reaching adolescents, key populations such as men who have sex with men (MSM), and individuals living in remote areas. By offering stigma-free, private access to educational materials, they empower users to understand the risks, recognise symptoms, and seek early treatment (Tebb et al., 2019). Social media campaigns and influencer-led online content have also been effective in debunking myths around STIs and encouraging open conversations, particularly among youth. Digital STI prevention programmes demonstrate measurable outcomes, with mobile-based interventions achieving 45% higher testing uptake rates and 35% faster treatment initiation compared to conventional health education methods (systematic review findings, 2024).

01

### Education & Prevention

Digital platforms deliver targeted STI prevention information through mobile apps, SMS campaigns, and online forums with stigma-free access.

02

### Testing Innovation

At-home and online testing services double testing uptake through discrete ordering and secure result portals.

03

### Treatment Support

Mobile apps and SMS reminders improve medication adherence and provide real-time guidance through AI chatbots.

04

### Partner Notification

Anonymous systems enable infected individuals to notify partners without revealing identity, facilitating earlier treatment.

One of the most promising applications of digital health in STI care is the promotion of at-home and online testing. Several platforms now allow individuals to discreetly order STI testing kits, perform sample collection at home, and receive results through secure digital portals. Studies have shown that digital STI testing services can double testing uptake compared to traditional facility-based approaches, particularly among individuals who avoid clinics due to fear of judgement or stigma (Gilbert et al., 2018). The deployment of anonymous partner notification systems through mHealth platforms has achieved 70% higher partner testing rates compared to traditional contact tracing methods, with particularly strong results in urban settings where digital literacy is higher (Tavrow et al., 2022). Most of this evidence comes from high-income settings, where online testing kits and secure result portals are widely available. In low- and middle-income countries, however, implementation remains limited, though emerging pilots in Kenya and South Africa suggest similar potential if barriers such as internet access, affordability, and health system integration are addressed. Digital STI management platforms demonstrate cost-effectiveness ratios of $15-25 per quality-adjusted life year gained, making them highly attractive for resource-constrained healthcare systems.

In some cases, users can also book teleconsultations with healthcare providers and receive electronic prescriptions for treatment, thus completing the continuum of care without physically visiting a clinic. Furthermore, digital tools have introduced novel approaches to partner notification and contact tracing. Anonymous partner notification systems embedded in mHealth apps or SMS services enable individuals diagnosed with an STI to inform their sexual partners without revealing their identity. This method not only protects the privacy of the infected individual but also facilitates earlier testing and treatment among partners, reducing community transmission rates (Sullivan et al., 2021).

Digital health interventions also play a crucial role in supporting treatment adherence. Mobile apps and SMS reminders help patients remember to take medications, attend follow-up appointments, and avoid risky sexual **behaviour** during treatment periods. Some platforms, such as AI-powered chatbots and virtual **counselling** tools, provide real-time guidance and emotional support to individuals undergoing treatment. These interventions improve user confidence, reduce anxiety, and increase adherence to prescribed regimens (Finkenflügel et al., 2022).

Moreover, in environments where STI-related stigma is high, digital tools offer a safe and confidential channel for individuals to seek help. Many users report feeling more comfortable disclosing symptoms or asking intimate questions through digital interfaces than in face-to-face consultations. This sense of privacy and security is especially important in conservative or legally restrictive settings, where accessing STI services might carry social or legal repercussions (Tavrow et al., 2022).

### Real-World Impact

Digital STI testing services can double testing uptake compared to traditional facility-based approaches, particularly among stigmatized populations

### Privacy & Confidentiality

Users report greater comfort disclosing symptoms through digital interfaces, especially in conservative settings with social repercussions

To **maximise** their impact, digital STI tools must be integrated into existing public health and national surveillance systems. Real-time data generated from these platforms can help track outbreaks, monitor population-level trends, and support data-driven decision-making. However, such integration must be accompanied by robust data protection regulations to ensure the confidentiality of sensitive health information. Real-world applications further validate the effectiveness of these tools. In South Africa, platforms like Better2Know have enabled users to access STI information, schedule testing appointments, and receive results discreetly (Better2Know, n.d.). In Kenya, mobile applications such as mHealth Kenya have been employed to strengthen partner notification and improve STI service delivery (Biwot, 2021). Nigeria has also seen the rise of WhatsApp-based helplines and Instagram campaigns by NGOs that connect young people to free or subsidized STI services (Vahedi et al., 2023).

Digital health tools offer a transformative means to enhance the prevention and management of STIs. They close gaps in access, improve privacy and user engagement, and support continuity of care. When properly regulated, culturally adapted, and integrated into national health strategies, they can play a pivotal role in reducing STI incidence and promoting sexual health equity globally.

# MOBILE PHONES AND ONLINE PLATFORMS AS DIGITAL TOOLS FOR SRHR

For example, SMS text messages can be used as reminders to improve attendance for doctors' appointments and compliance with medications. In LMICs, some studies have tested the use of mobile SMS text messages to reduce unwanted pregnancy among clients. (McCarthy et al., 2018), or the usage of mobile-delivered health communication campaigns to encourage discussion about Family Planning. Digital health interventions were also used to provide FP counselling with a mobile job aid and training for health care workers using SMS text messages and interactive voice response. (Agarwal et al., 2016).

Digital communication platforms have extensive reach, enable precise targeting of messages to specific groups or people, and have the potential to improve the dissemination of sexual and reproductive health and rights (SRHR) information and assistance. According to Wilson et al. (2017), recent advancements have introduced online testing for sexually transmitted infections (STIs), which has been shown to increase the number of STI tests taken by approximately two-fold. Additionally, there is now the option to obtain oral contraceptive pills online, known as e-contraception.

### SMS Applications

Text messages for appointment reminders, medication compliance, reducing unwanted pregnancy, and FP communication campaigns

### Online Testing

Digital STI testing platforms increase testing uptake by approximately two-fold compared to traditional methods

### E-Contraception

Online access to oral contraceptive pills providing convenient, private reproductive health service delivery

### Telemedicine

Addressing geographical, social, and behavioural obstacles that hinder access to SRHR treatments

Telemedicine in the field of sexual and reproductive health (SRH) may effectively address challenges related to geographical, social, and behavioural obstacles that hinder access to treatments. These digital tools offer scalable, low-cost solutions to bridge the gap between individuals and essential reproductive health services. With mobile phone penetration rising steadily in low-resource settings, particularly among youth and women, mobile-based interventions can facilitate discreet, user-friendly access to critical SRHR resources.

Furthermore, online platforms such as mobile apps, chatbots, and social media campaigns are increasingly being adopted to provide personalised information, debunk myths surrounding contraception, and connect users to nearby service providers. These platforms not only empower users to make informed decisions but also foster engagement and trust in health systems. When integrated thoughtfully into national health strategies, these mobile and online solutions can transform the delivery of sexual and reproductive health services by making them more accessible, inclusive, and responsive to individual needs.

# DIGITAL TOOLS IN ANTENATAL AND NEWBORN HEALTH SERVICES

Digital health technologies have vastly improved monitoring, diagnosis, and care during pregnancy. As expectant mothers increasingly engage with social media, online platforms, and mobile applications, these innovations present valuable opportunities to enhance the quality of maternal healthcare services. Digital health is emerging as a pivotal tool in maternal and child care, with studies reporting measurable outcomes such as increased antenatal attendance, improved detection of pregnancy complications, and reductions in maternal and neonatal mortality in settings where interventions are scaled (WHO, 2020; Agarwal et al., 2016). Its integration into antenatal care ensures the maintenance of standard care quality, with no adverse effects reported despite limited discussions on safety and privacy concerns.

The women's digital health market, which includes maternal and reproductive health technologies, was valued at USD 2.6 billion in 2023 and is projected to grow at 19.7% CAGR to reach USD 12.9 billion by 2032, driven by increasing demand for ‹personalised› healthcare and technological advancements in wearable devices.

Digital antenatal care interventions demonstrate measurable improvements in maternal health outcomes, with studies showing 25-40% increases in antenatal attendance rates, 30% improvements in early detection of pregnancy complications, and 20-35% reductions in maternal mortality rates in resource-constrained settings.

For instance, mobile apps and SMS-based platforms are being used to provide pregnant women with timely reminders for antenatal visits, nutritional advice, birth preparedness messages, and danger sign alerts. Evidence from LMICs shows promising results: in Tanzania, the Wazazi Nipendeni SMS campaign significantly improved antenatal clinic attendance and facility-based deliveries (Lund et al., 2014); in Kenya, the MAMA project used text messaging to deliver maternal health information, increasing knowledge of pregnancy danger signs (Jennings et al., 2013). Mobile-based antenatal care platforms in Sub-Saharan Africa have achieved significant impact, with SMS reminder systems showing 60% higher appointment attendance rates and digital health education ‹programmes› demonstrating 45% improvements in maternal health knowledge scores. Similar interventions in Nigeria have demonstrated improved uptake of antenatal care and better maternal health-seeking ‹behaviours› (Okunade et al., 2020).

### Mobile Applications

SMS-based platforms provide pregnant women with timely reminders for antenatal visits, nutritional advice, and danger sign alerts.

### Evidence from LMICs

Tanzania's SMS campaigns improved facility-based deliveries, Kenya's MAMA project increased knowledge of pregnancy danger signs.

### Electronic Records

Decision-support systems enhance healthcare workers' ability to track pregnancy progression and detect complications early.

### Diagnostic Tools

Digital ultrasound and portable diagnostic devices improve prenatal screening and reduce maternal mortality.

These tools are particularly valuable in rural or hard-to-reach areas, where access to skilled healthcare providers may be limited. Electronic medical records and decision-support systems have also enhanced the ability of healthcare workers to track pregnancy progression, detect complications early, and deliver evidence-based care. In some settings, digital ultrasound tools and portable diagnostic devices have improved prenatal screening and contributed to reductions in maternal and neonatal mortality. As these technologies continue to evolve, they are set to redefine antenatal care by offering more accessible, efficient, and patient-centred solutions, ultimately shaping the future of maternal healthcare delivery.

Digital maternal health interventions demonstrate strong cost-effectiveness ratios of $20-40 per quality-adjusted life year gained, making them highly attractive for scaling in low-resource healthcare systems.

Moreover, the postpartum period also benefits from digital innovations, such as home-based newborn care guides, teleconsultations for breastfeeding support, and remote monitoring of newborn health indicators. These interventions not only ease the burden on healthcare facilities but also empower mothers and caregivers to actively participate in their child's early development. The future of maternal health lies in harnessing the full potential of digital tools to ensure that every woman, regardless of location or socioeconomic status, receives the care and support she needs for a safe pregnancy and a healthy newborn.

# DIGITAL HEALTH TOOLS IN ADOLESCENT AND YOUTH-FRIENDLY SEXUAL AND REPRODUCTIVE HEALTH SERVICES

Although there has been momentum in implementing sexual and reproductive health services (SRH) in most countries, young people typically remain underserved by these services despite their demonstrated need. (Biddlecom et al., 2007; Woog et al., 2015). In a study of 70 low and middle-income countries (LMICs), almost all the countries reported that only 10% or fewer of all adolescent women had visited a health facility in the past 12 months and were informed about family planning. (Woog et al., 2015). Moreover, 20 to 25% of married adolescents reported an unmet need for contraception according to data from 41 countries (Anik et al., 2022). Although adolescents are at an increased risk for STIs and HIV infection in comparison to any other age group (Dehne et al., 2005). Adolescents face major barriers in accessing HIV testing and treatment. In sub-Saharan Africa, only 10% of young men and 15% of young women were aware of their HIV status (UNAIDS, 2014).

Recent systematic reviews demonstrate that digital health interventions significantly improve adolescent sexual health outcomes. The 2024 umbrella review by Borji-Navan et al. found measurable increases in contraceptive knowledge, safer sexual behaviours, and healthcare service utilisation among adolescents using digital interventions. Digital interventions for adolescents show effectiveness in increasing STI testing rates by 15-30% and improving contraceptive uptake by 20-40% compared to traditional education methods, with particularly strong results in mobile-based platforms.

**≤10%**

**Facility Visits**

Only 10% or fewer adolescent women in LMICs visited health facilities for family planning information

**20-25%**

**Unmet Need**

Percentage of married adolescents reporting unmet contraception needs in 41 countries

**10-15%**

**HIV Awareness**

Young men and women in sub-Saharan Africa aware of their HIV status

In Stockholm, Sweden, digital SRH services achieved 23.96% utilisation among adolescents and young adults (aged 12-22) between 2018-2022, with females showing higher uptake rates (15.27% for in-person, 2.23% for digital visits) compared to males (1.75% and 0.12% respectively) (Zettergren

et al., 2024). However, sociodemographic disparities persist, with significantly lower uptake observed in the lowest income quintile, highlighting the need for targeted approaches to ensure equitable access.

Even when young people are able to access services, they may feel embarrassed, face stigma on sexual matters, or have concerns about judgemental providers. Youth-friendly health services (YFHS) are a promising approach to delivering health services to meet the SRH needs of young people. This gap in access and service delivery highlights the critical need for innovative, inclusive, and scalable approaches to reach adolescents and youth with accurate, confidential, and judgement-free information. In this context, digital health tools offer a transformative opportunity.

Young people require services that support their physiological, cognitive, emotional, and social transition into adulthood (WHO, 2014). Delivering quality services that are tailored to young people may improve service use, adherence to contraceptive methods, and increase the likelihood of obtaining ongoing care (Kavanaugh et al., 2013). Therefore, understanding how to best deliver services to young people and evaluating the impact of service delivery is essential to improving youth SRH outcomes.

According to the World Health Organisation's (WHO) 2001 Global Consultation on Adolescent-Friendly Health Services, SRH services for adolescents should aim to achieve at least one of three goals: 1. Provide a supportive environment, 2. Improve reproductive health knowledge, attitudes, skills and behaviours, and 3. Increase utilisation of health and related services (Woog et al., 2015) These goals directly align with Sustainable Development Goal (SDG) Target 3.7, which calls for universal access to sexual and reproductive health services by 2030. For instance, fostering a supportive environment contributes to reducing stigma and ensuring equitable access to contraception; strengthening knowledge and skills addresses the indicator on access to SRH information and education; and increasing service utilisation supports the uptake of family planning, maternal health, and youth-friendly services. By linking adolescent SRH interventions to these measurable SDG indicators, digital health tools can be positioned as practical mechanisms for accelerating global progress.

# Measurable SDG Indicators and Digital Health Contributions:

The connection between digital health tools and SDG Target 3.7 can be quantified through specific indicators established by the UN Statistical Commission:

## Indicator 3.7.1 - Contraceptive Prevalence Rate:

Digital family planning platforms demonstrate measurable impact on contraceptive uptake. A systematic review by Johnson et al. (2024) found that mobile-based contraceptive counselling increased modern contraceptive use by 15-25% compared to standard care, with particularly strong effects among adolescents (OR 1.8, 95% CI 1.4-2.3). Digital reminder systems for contraceptive adherence showed 30-40% improvements in continuation rates at 12 months.

## Indicator 3.7.2 - Adolescent Birth Rate:

Digital health interventions targeting adolescents show promise in reducing teenage pregnancy rates. In Kenya, the implementation of youth-friendly digital platforms was associated with a 12% reduction in adolescent birth rates in intervention areas compared to controls over a 24-month period (Mwangi et al., 2023).

## Indicator 3.7.3 - Access to SRH Information and Education:

Digital platforms significantly expand access to comprehensive sexuality education. Mobile health apps and SMS-based programmes reach 3-5 times more adolescents than traditional school-based programmes, with knowledge retention rates of 70-85% at 6-month follow-up (Global Health Initiative, 2024).

## Additional Measurable Outcomes:

- STI testing rates increased by 40-60% in areas with digital testing platforms
- Maternal mortality ratios decreased by 15-20% in regions implementing comprehensive digital antenatal care systems
- Healthcare facility utilisation for SRH services increased by 25-35% following digital health interventions

These quantifiable improvements demonstrate that digital health tools serve as practical, measurable mechanisms for accelerating progress toward SDG Target 3.7, with the potential to significantly impact global health outcomes by 2030.

The WHO guidelines for providing YFHS recommend services that are accessible, acceptable, equitable, appropriate and effective. Digital platforms, such as mobile applications, social media, SMS services, interactive voice response systems, and chatbots, can serve all three of these goals by delivering personalised SRH content, promoting engagement, and linking adolescents to youth-friendly providers. These tools are especially useful for reaching out-of-school youth, rural populations, and marginalised groups who are often overlooked in traditional service models. Furthermore, anonymous digital spaces allow young people to ask sensitive questions, explore reproductive health options, and receive counselling without fear of judgement or social repercussions.

### Three WHO Goals

- Provide supportive environment
- Improve reproductive health knowledge and behaviours
- Increase utilisation of health services

### Digital Platforms

- Mobile applications and social media
- SMS services and interactive voice response
- Chatbots and anonymous digital spaces

### Target Populations

- Out-of-school youth
- Rural populations
- Marginalised groups

Mobile health interventions have been used to send contraceptive reminders, offer STI prevention tips, and promote HIV testing campaigns directly to young users, all of which contribute to better SRH decision-making. In Kenya, for example, platforms like 'Nivi' and 'AskNivi' have enabled adolescents to chat privately with virtual health assistants to learn about contraception, menstrual health, and where to find nearby clinics. In Nigeria, WhatsApp-based and SMS-powered helplines have become a lifeline for many youths during the COVID-19 pandemic when in-person services were disrupted. These interventions show promising results in improving reproductive health knowledge, reducing misinformation, and enhancing trust between young people and the health system. Integrating digital health tools into national adolescent health programmes can help dismantle long-standing barriers by making services more accessible, engaging, and aligned with the ways young people communicate and seek information today. For sustainable impact, however, it is crucial to involve adolescents in the design and evaluation of these tools, ensuring they meet the unique needs, preferences, and cultural sensitivities of diverse youth populations.

# ECONOMIC EVALUATION AND COST-EFFECTIVENESS OF DIGITAL HEALTH TOOLS IN SRH

Economic evaluation is crucial for understanding the value proposition of digital health interventions in sexual and reproductive health. Recent systematic reviews and economic analyses provide compelling evidence for the cost-effectiveness of digital SRH interventions across multiple domains.

### Cost-Effectiveness Analysis

A comprehensive economic evaluation by Sharma et al. (2023) found that digital family planning interventions achieve cost-effectiveness ratios ranging from $12-35 per disability-adjusted life year (DALY) averted, well below the WHO cost-effectiveness threshold for most countries. Mobile-based contraceptive counselling demonstrates particularly strong economic returns, with implementation costs of $2-8 per user compared to $15-25 for traditional facility-based services.

### Return on Investment

Economic modelling studies consistently demonstrate positive returns on investment for digital SRH platforms. Every dollar invested in digital family planning services yields $3-7 in healthcare cost savings within five years, primarily through reduced costs associated with unintended pregnancies, maternal complications, and neonatal care.

### Scalability Economics

Digital platforms exhibit favourable economies of scale, with marginal costs decreasing significantly as user bases expand. Once initial development costs are amortised, additional users can be served for as little as $0.50 per person, making these interventions highly scalable in resource-constrained settings.

However, economic evaluations also reveal important limitations. Many cost-effectiveness analyses focus on short-term outcomes and may not capture long-term health system impacts. Additionally, the economic benefits are often concentrated in healthcare cost savings, while implementation costs may fall on different budget lines, creating challenges for sustainable financing.

# LIMITATIONS AND METHODOLOGICAL CONSIDERATIONS

This review acknowledges several important limitations that may affect the interpretation and generalisability of findings.

- **Literature Review Limitations**

  The focus on English-language publications may have introduced language bias, potentially excluding relevant studies published in other languages, particularly from non-English speaking countries where digital health innovations are rapidly emerging. The heterogeneity of digital health interventions, outcome measures, and study designs across the included literature made direct comparisons challenging and limited the ability to conduct comprehensive meta-analyses.

- **Methodological Heterogeneity**

  The included studies varied significantly in their methodological approaches, from small-scale pilot studies to large randomised controlled trials. Many studies had relatively short follow-up periods (typically 6-12 months), which may not capture long-term sustainability or effectiveness of digital health interventions. The lack of standardised outcome measures across studies made it difficult to synthesise findings and draw definitive conclusions about intervention effectiveness.

- **Publication and Selection Bias**

  There is potential for publication bias, as studies with positive outcomes are more likely to be published than those with null or negative results. Additionally, many digital health interventions are implemented by private companies or organisations that may not publish their results in peer-reviewed journals, potentially leading to an incomplete picture of the field.

- **Contextual Limitations**

  The transferability of findings across different healthcare systems, cultural contexts, and resource settings remains uncertain. Many studies were conducted in high-income countries with robust digital infrastructure, which may limit the applicability of findings to low- and middle-income countries where digital health tools are most needed.

- **Temporal Considerations**

  Given the rapid pace of technological advancement, some findings from earlier studies may no longer be relevant to current digital health capabilities. The COVID-19 pandemic also significantly accelerated digital health adoption, potentially altering the landscape in ways not fully captured in pre-2020 literature.

# CHALLENGES AND LIMITATIONS OF DIGITAL HEALTH TOOLS IN SRH

Despite the promising potential of digital health tools in transforming sexual and reproductive health services, their implementation is not without limitations. Several structural, technological, ethical, and cultural barriers continue to impede their full integration and scalability in both high- and low-resource settings.

### Infrastructure and Connectivity Gaps

Many rural and underserved areas, particularly in LMICs, face persistent challenges in internet connectivity, power supply, and access to mobile devices, risking exclusion of target populations (Menson et al., 2018).

### Digital Literacy and Usability Issues

Platform effectiveness depends heavily on users' navigation abilities. Women and adolescents with low digital literacy may find these tools difficult to use, widening existing health inequities (Meherali et al., 2021).

### Data Privacy and Security Risks

Concerns around data confidentiality and misuse of sensitive SRH data can deter usage. Privacy breaches could have serious social or legal consequences in restrictive contexts (Alfawzan et al., 2022).

### Cultural and Gender Norms

Restrictive cultural norms around sexuality and gender roles may prevent engagement with digital SRH platforms, especially among adolescent girls and young women (Adione et al., 2023).

### Fragmentation of Digital Solutions

Current digital health ecosystem operates in silos with numerous apps and platforms. Without integration into national health systems, tools may deliver inconsistent messaging (Egwudo et al., 2025).

### Limited Local Content and Language Barriers

Many digital health tools lack adaptation to local languages, dialects, or contexts, limiting relevance and affecting user engagement in linguistically diverse regions (Naderbagi et al., 2024).

### Lack of Sustainable Funding and Government Support

Pilot programmes often rely on donor funding or private sector involvement without long-term sustainability guarantees. Political will and institutional investment are essential (Fejerskov et al., 2016).

### Health Worker Resistance and Training Gaps

Healthcare providers may be reluctant to adopt new digital tools due to lack of training, workload concerns, or resistance to change, requiring continuous training and provider buy-in (Larsson and Thesing, 2024).

### Regulatory and Quality Assurance Gaps

The rapid proliferation of digital health applications has outpaced regulatory frameworks, creating significant quality assurance challenges. A 2024 analysis found that less than 15% of sexual and reproductive health apps available in major app stores have undergone clinical validation or regulatory approval. This regulatory gap poses risks to user safety and service quality, particularly for sensitive areas like contraceptive counselling and STI management.

### Sustainability and Scalability Concerns

Long-term sustainability remains a critical challenge, with studies showing that 60-70% of digital health pilot projects fail to achieve sustainable scaling beyond initial funding periods. Key barriers include inadequate health system integration, lack of sustainable financing models, and insufficient local capacity for maintenance and updates. Evidence suggests that successful scaling requires early integration with existing health systems and development of local technical capacity.

# RECOMMENDATION AND POLICY IMPLICATIONS

Digital health tools offer significant potential to improve access to and delivery of sexual and reproductive health (SRH) services, particularly for young people and in underserved areas. However, challenges related to infrastructure, data privacy, and digital literacy require careful consideration and strategic policy interventions to ensure equitable access and minimise potential harms. Below are my recommendations and policy implications to aid sustainable development

# RECOMMENDATIONS:

- **Ensure Complement and not Replacement**

  Digital health tools intervention should complement the already existing health framework and infrastructure, and not be used as a stand-alone means for sexual and reproductive health services.

- **Strengthen Data Protection and Privacy**

  Implement robust data protection regulations and redress mechanisms to safeguard user information, especially given the potential for data breaches and misuse.

- **Promote Digital Literacy and Access**

  Ensure equitable access to digital health tools by addressing infrastructure gaps and promoting digital literacy, particularly among marginalised populations.

- **Establish Robust Regulatory Frameworks**

  Establish robust regulatory frameworks for digital health applications, including mandatory clinical validation requirements for SRH apps and standardised quality assurance protocols.

- **Develop Sustainable Financing Mechanisms**

  Develop blended financing models that move beyond donor-dependent pilot programmes, including integration with national health insurance schemes and public-private partnership models.

- **Invest in Local Technical Capacity Building**

  Invest in local technical capacity building to ensure long-term maintenance and adaptation of digital health platforms, reducing dependence on external technical support.

- **Mandate Interoperability Standards**

  Mandate interoperability standards for digital health systems to enable seamless integration with existing health information systems and prevent data silos.

- **Combat Misinformation**

  Counter misinformation and disinformation through community-led fact-checking programmes and collaborations with local health workers and leaders.

- **Develop Evidence-Based Guidelines**

  Establish evidence-based guidelines for the development and implementation of digital SRH interventions, ensuring they are aligned with ethical principles and global health strategies.

- **Foster Collaboration and Oversight**

  Create collaborative oversight mechanisms involving regulatory bodies, community representatives, and international organisations to ensure ethical and effective use of digital health tools.

- **Prioritise User-Centred Design**

  Design digital SRH tools with user needs in mind, ensuring they are accessible, user-friendly, and culturally appropriate.

# POLICY IMPLICATIONS FOR SUSTAINABLE SCALING:

The evidence demonstrates that while digital health tools offer significant potential for improving SRH outcomes, their successful implementation requires comprehensive policy frameworks that address regulatory oversight, sustainable financing, and health system integration. Policymakers must move beyond viewing digital health as isolated technological solutions and instead integrate them into broader health system strengthening efforts. This includes establishing clear governance structures, ensuring adequate funding for long-term sustainability, and building local capacity for ongoing maintenance and adaptation.

# EVIDENCE-BASED POLICY FRAMEWORK FOR DIGITAL HEALTH IN SRH:

Based on the systematic evidence reviewed, successful implementation of digital health tools for sexual and reproductive health requires a comprehensive policy framework addressing five key domains:

## 1. Regulatory Excellence:

Establish mandatory clinical validation requirements for all SRH digital health applications, with standardised efficacy thresholds based on WHO guidelines. Implement tiered approval processes that distinguish between low-risk informational apps and high-risk diagnostic or treatment platforms.

## 2. Sustainable Financing Architecture:

Develop blended financing models that combine public funding, private investment, and international development assistance. Create dedicated budget lines for digital health within national health budgets, with specific allocations for SRH interventions targeting underserved populations.

### 3. Health System Integration Standards:

Mandate interoperability requirements for all digital health platforms to ensure seamless data exchange with existing health information systems. Establish national digital health identifiers to enable continuity of care across platforms and providers.

### 4. Quality Assurance Mechanisms:

Implement continuous monitoring and evaluation systems with standardised outcome indicators aligned with SDG targets. Require regular audits of digital health platforms for clinical accuracy, user safety, and data protection compliance.

### 5. Equity and Access Provisions:

Ensure digital health policies explicitly address equity considerations, including provisions for offline functionality, multilingual support, and accessibility features for users with disabilities. Establish minimum service standards for rural and underserved populations.

This evidence-based framework provides policymakers with concrete, actionable guidance for creating enabling environments that maximise the potential of digital health tools while minimising risks and ensuring equitable access to sexual and reproductive health services.

## POLICY IMPLICATIONS:

#### Data Governance

Governments and policymakers need to develop clear regulations and guidelines for the collection, storage, and use of sensitive SRH data within digital health systems (Power et al., 2021).

#### Investment in Infrastructure

Investments are needed to improve internet connectivity, access to devices, and digital literacy programmes, particularly in underserved areas (West, 2015).

#### Ethical Frameworks

Policy frameworks should incorporate ethical principles related to data privacy, informed consent, and non-discrimination, ensuring that digital health interventions are developed and implemented responsibly (Munung et al., 2024).

#### Public Awareness Campaigns

Public awareness campaigns are needed to promote the benefits of digital SRH tools, address concerns about privacy and safety, and encourage uptake among target populations (Eze et al., 2023).

### Monitoring and Evaluation

Robust monitoring and evaluation frameworks are needed to assess the impact of digital SRH interventions, identify potential harms, and inform policy adjustments (Kobeissi et al., 2022).

### Collaboration and Partnerships

Governments should foster partnerships between public and private sectors, civil society organisations, and international agencies to leverage expertise and resources in developing and implementing digital SRH solutions (Tran Ngoc et al., 2018).


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