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Midwife-led telemedicine models to improve cervical cancer screening in remote communities: A narrative review

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Abstract

Cervical cancer remains a largely preventable disease; however, women living in remote and underserved regions continue to face significant barriers to screening and early detection. Geographic isolation, shortages of specialized healthcare professionals, limited healthcare infrastructure, socioeconomic constraints, and cultural factors contribute to persistent disparities in access to preventive services.

This narrative review aims to examine the structural and contextual barriers affecting cervical cancer screening in rural and remote communities and to evaluate the potential of midwife-led, telemedicine-supported models in improving screening uptake, follow-up, and continuity of care. A targeted search of peer-reviewed literature published between 2011 and 2025 was conducted using databases including PubMed and Google Scholar.

The findings suggest that midwives serve as trusted frontline healthcare providers who can effectively deliver community-based screening, culturally sensitive education, and patient-centered counseling. Telemedicine technologies—such as remote consultations, telecolposcopy, and digital cervicography—enhance these services by enabling specialist support and reducing geographical barriers. Additionally, HPV self-sampling has emerged as a promising strategy to increase participation among underserved populations.

Evidence from diverse rural and international settings demonstrates high acceptability of these approaches and improved adherence to follow-up recommendations. Integrated models combining midwife-led care with telemedicine represent a feasible and scalable strategy to reduce screening inequalities and strengthen cervical cancer prevention efforts in geographically isolated populations.

Keywords: Cervical Cancer Screening; Telemedicine; Midwifery; Rural Health Services; Human Papillomavirus

1. Introduction

Cervical cancer is one of the most preventable forms of cancer, yet it remains a major public health concern, particularly in underserved and geographically isolated regions. Regular screening with Pap smears and HPV DNA testing, together with HPV vaccination programs, has significantly reduced incidence and mortality in many high-income countries [1, 2].

However, women in remote areas, such as rural villages, mountainous regions, or isolated islands, face structural and systemic barriers to accessing healthcare services. Geographic isolation, financial constraints, cultural beliefs, stigma, and under-resourced healthcare systems limit timely screening and follow-up [3, 4]. Addressing these inequities requires innovative, community-based strategies with midwives playing a central role.

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Midwives, often the first point of contact for women in primary care, are uniquely positioned to bridge these gaps. Their ability to deliver clinical services alongside culturally sensitive health education makes them vital agents in promoting cervical cancer prevention [5]. This role enables them to support cervical cancer screening through methods such as visual inspection with acetic acid (VIA), HPV self-sampling, and patient education [6, 7]. However, for optimal impact, midwives often require ongoing support and training, especially when integrating emerging technologies.

Telemedicine and telehealth, the remote delivery of healthcare services via telecommunications, are emerging as powerful tools to improve access and continuity of care in remote areas [8, 9]. While not a replacement for in-person examinations, telemedicine can support midwives and primary care providers through virtual consultations, remote interpretation of Pap smear and HPV test results, patient education, and coordination with specialists.

Studies on mobile-phone-based telecolposcopy, digital cervicography, and remote cytology suggest that remote evaluation can enhance diagnostic accuracy and expand screening reach [10-12]. Together, midwives and telemedicine may provide a scalable, sustainable, and equitable model to close cervical cancer screening gaps in remote settings.

This narrative review explores the role of midwives in cervical cancer screening and examines how telemedicine can complement their work to improve access, follow-up, and outcomes. For clarity and consistency, this review uses the term telemedicine to refer to all forms of remote healthcare delivery, including services often described as telehealth.

2. Methods

A targeted narrative review of peer-reviewed literature was conducted using electronic databases, including PubMed and Google Scholar, as well as selected open-access journals (e.g., BMC series), covering publications from 2011 to 2025. The search strategy included combinations of the following keywords: “cervical cancer screening,” “midwives,” “telemedicine,” “telehealth,” “remote areas,” and “HPV self-sampling.”

Given the narrative nature of this review, studies were selected based on their relevance to the topic, as determined through title and abstract screening, and their contribution to key thematic areas. A range of study designs was included, such as randomized controlled trials, pilot studies, implementation studies, qualitative research, and review articles.

The selected literature was analyzed and synthesized thematically across four main domains: (1) barriers to cervical cancer screening in remote settings, (2) the role of midwives in screening delivery, (3) applications of telemedicine, and (4) integrated care models. This approach allows for a descriptive synthesis of current evidence, identification of promising practices, and recognition of existing gaps in the literature.

This study did not involve primary data collection or human participants and therefore did not require ethical approval. AI-assisted language tools were used to enhance clarity and readability. The author takes full responsibility for the content and interpretation of the manuscript.

3. Results

3.1. Barriers to cervical cancer screening in remote areas

3.1.1. Geographic and Infrastructural Challenges

Women living in remote areas often live far from hospitals or gynecology clinics, and frequently face limited public transportation options and poor road infrastructure. In regions with mountainous terrain or on isolated islands, adverse weather conditions-such as snow, heavy rainfall, or rough seas-can isolate entire communities for days or even weeks, making access to healthcare particularly difficult. Traveling to larger urban centers for routine screening requires time, money, and logistical support, resources that many rural women may lack. These challenges are consistent with evidence showing that increased distance and travel time significantly reduce access to healthcare services in rural and remote settings [13].

3.1.2. Healthcare Workforce Shortages

Many remote health centers face chronic understaffing, particularly of specialized staff such as gynecologists and cytologists, which hampers access to essential services like cervical cancer screening and maternal care [14]. While general practitioners, midwives, and nurses may be present, access to specialized services including gynecological exams, ultrasounds, or colposcopies, is often limited or absent. These staffing shortages create significant challenges for

rural health delivery. According to the WHO (2020) [14], retention of healthcare workers in rural and remote areas is a major challenge, and comprehensive strategies-including education, professional support, and community engagement-are essential to ensure continuity of critical services. Strengthening the capacity of primary care staff, including midwives, through training and support is essential to maintain continuity of care in underserved areas [15].

3.1.3. Socioeconomic and Cultural Barriers

Lower-income populations are less likely to participate in preventive health programs. Transportation barriers such as lack of access to a vehicle, absence of a driver's license, the cost of private or public transport**,** and inadequate public transportation have been described as key patient-level barriers to cervical cancer screening [16]. Education is also a well-established determinant, with women of lower educational attainment being less likely to undergo regular screening [17]. Moreover, loss of income due to absence from work or lack of childcare may further discourage attendance at screening appointments [16, 18]. Furthermore, cultural attitudes toward gynecological health-particularly among older women-may contribute to feelings of shame, fear of abnormal results, or denial regarding cervical cancer screening. In small, tight-knit communities, concerns about privacy and fear of judgment can further reduce participation, highlighting the need for culturally sensitive approaches to screening and community engagement [4].

3.1.4. Lack of Awareness and Health Literacy

Women living in rural areas experience later detection of cervical cancer, lower participation in screening programs, reduced access to treatment, and poorer survival compared to urban women [19]. A major contributing factor is limited awareness regarding cervical cancer and the purpose of screening, while knowledge about HPV vaccination may also be limited depending on national programs. Medical knowledge is generally lower among older women, particularly those from rural areas with limited educational backgrounds, exacerbating disparities in timely healthcare engagement [19]. Misinformation and myths about cervical cancer further delay initial visits to midwives or gynecologists, reducing screening participation [19]. Public education campaigns are often not tailored to the specific needs of rural communities, and national cancer screening programs may be insufficient or fail to reach isolated areas [20].

3.1.5. Telemedicine-Specific Barriers

Beyond the barriers faced by women, telemedicine implementation in remote regions encounters additional challenges. These include limited or unreliable internet connectivity, unstable electricity, and insufficient telecommunications infrastructure [21]. Healthcare workers may also face resistance due to limited digital literacy, inadequate training, and uncertainty about the quality and safety of remote consultations [22]. Cost barriers arise both from the high initial investment in equipment and ongoing expenses such as data plans or technical support [21]. Finally, regulatory and policy gaps including ambiguous telemedicine guidelines and concerns regarding data privacy, can further complicate adoption [22].

3.2. The critical role of midwives in expanding screening reach

In this context, midwives play a crucial role in bridging these gaps by providing community-based education, visiting schools, and organizing local awareness events to improve knowledge and encourage participation in preventive care. Beyond their core role in obstetrics- delivering comprehensive care during pregnancy, childbirth, and the postpartum period-midwives play a crucial role in reproductive health by offering routine examinations, Pap and HPV screenings, contraceptive counseling, and support for menopausal women [23]. In remote and underserved areas, midwives are often the most accessible and trusted healthcare professionals, providing first-line cervical screening that helps reduce logistical and financial barriers and increases the likelihood of early detection. They also serve as key health educators, promoting the benefits of regular screening through small group sessions, participation in local events, and school-based sexual and reproductive health programs. Their close, long-term relationships with women and families allow them to provide culturally sensitive, personalized counseling, which is essential for addressing taboos, correcting misinformation, and raising body awareness, particularly in conservative communities where their approach is more readily accepted [24, 25].

The effectiveness of midwife-led initiatives is further supported by national and international evidence. In Greece, the GRECOSELF program, successfully implemented HPV-based cervical screening combined with self-sampling using a midwifery network, reaching women in rural areas who might otherwise have limited access to screening services [7].

Globally, mobile health units staffed by midwives have been successfully implemented in specific settings, such as Tanzania, where they improved utilization of antenatal and preventive services [26]. The WHO (2025) [27] recommends the broader adoption of community-based midwifery models, including mobile units, as a scalable

approach to expand access to reproductive health services in underserved areas. According to WHO guidelines, HPV DNA testing is suitable even in low-resource settings and can be effectively delivered by trained health providers such as midwives [28].

In addition to these community-based approaches, midwives' engagement with digital health solutions, including telemedicine, further enhances their capacity to reach underserved populations and deliver reproductive health services effectively. Notably, a 2021 study on clinical Nurses' and Midwives' Attitudes and Awareness towards telenursing and telemedicine indicated that midwives showed a higher understanding and more positive attitudes toward telemedicine than nurses, highlighting their potential to adopt and integrate digital solutions into reproductive health care [29].

3.3. Telemedicine in cervical cancer screening

3.3.1. The Promise of Telemedicine: Modalities and Applications

Telehealth refers to technology-enhanced health care delivery models that include virtual visits, remote patient monitoring, and mobile health services. While the term *telemedicine* typically refers to clinical services such as diagnosis, monitoring, and treatment delivered remotely, *telehealth* encompasses a broader scope, including patient management, health education, and other supportive components of healthcare delivery [30].

Notably, Greece has implemented telemedicine policies in its islands since 2016 recognizing the need for remote healthcare solutions in geographically challenged regions [31]. The Greek National Telemedicine Network (EDIT), launched in the same year, initially connected health centers on remote islands and mainland regions [32, 33]. While most consultations currently focus on mental health and chronic disease management, this infrastructure could potentially support midwives in delivering cervical cancer screening, counseling, and follow-up in underserved areas. Although telemedicine cannot fully replace in-person gynecological care, it serves as a valuable adjunct, particularly for follow-up, counseling, and timely referrals, ensuring continuity of care in settings where access to professionals is limited.

3.3.2. Enhancing Access and Patient Satisfaction

The COVID-19 pandemic highlighted the critical role of telemedicine in delivering healthcare to all, particularly to people living in remote areas and underserved communities [34]. To ensure quality care and patient safety, healthcare providers must have access to appropriate hardware and software, as well as a reliable and secure internet connection [30].

Research indicates high patient satisfaction with telemedicine models in obstetrics and gynecology, including hybrid prenatal visits, surgical consultations in female pelvic medicine and reproductive surgery, and medication abortion [35]. Telemedicine allows patients to access high-quality gynecologic and obstetric care without attending appointments in person, reducing logistical and financial burdens such as time off work, transportation, and childcare. These advantages are particularly significant for patients in remote areas, those with limited resources, or individuals with prior negative experiences in traditional care settings.

In Greece, hybrid telemedicine consultations in pediatric and adolescent gynecology have been successfully implemented, demonstrating feasibility and high patient and family acceptance [36]. This model highlights the potential of telemedicine to expand access to screening, follow-up, and specialized services where in-person visits are limited. Similarly, international studies show that telemedicine interventions-delivered via SMS, mobile applications, or teleconsultations-enhance women's health services across low-and high-risk obstetrics, reproductive health, and general gynecology, while reducing unnecessary hospital visits and easing tertiary center workloads [37, 38].

By integrating technological and organizational elements, telehealth provides a versatile platform to extend gynecologic and cervical cancer screening services to patients in remote or underserved areas, improving both access and patient satisfaction.

3.3.3. Telecolposcopy and Remote Diagnostics

Although the Pap test requires direct specimen collection and cannot be performed entirely remotely, telemedicine can effectively support cervical cancer screening by facilitating patient education, appointment scheduling, and remote counseling regarding results, thereby improving adherence to preventive care [39].

Telecolposcopy has been successfully implemented in rural areas of the United States and in low-resource settings internationally. Using camera-equipped colposcopes or smartphone-based devices, community healthcare workers can capture cervical images that are either transmitted in real time or stored for later review by remote specialists. These remote evaluations allow clinicians to assess the need for biopsies, provide treatment guidance, and support clinical decision-making. Studies have shown that diagnostic outcomes achieved through these remote evaluations are comparable to those of in-person assessments [10-12].

Building on the role of midwives in community-based screening, telemedicine further enhances access by supporting remote education, consultations, and diagnostics in underserved areas, potentially expanding the reach and effectiveness of cervical cancer prevention programs.

3.4. Integrated models: midwife-led screening with telemedicine

Building on the role of midwives in community-based screening and the promise of telemedicine, integrated models combine both approaches to overcome barriers in remote and underserved populations. The most effective strategy involves combining midwife-led services with telemedicine technologies, focusing on HPV self-sampling, remote clinical consultations and digital follow-up.

3.4.1. HPV Self-Sampling and Virtual Guidance

Emerging models of HPV self-sampling combined with virtual guidance have been shown to increase participation among women facing geographic or socioeconomic barriers. For example, a pilot study in Estonia demonstrated that offering HPV self-sampling kits significantly increased participation in cervical cancer screening programs compared to standard invitation methods [40]. Similarly, in remote areas of Indonesia, telemedicine-supported HPV self-sampling with clear digital instructions led to higher screening uptake and participant satisfaction [41]. Moreover, the PRESTIS randomized clinical trial in the United States found that mailed self-sampling kits combined with telephone follow-up markedly improved screening participation among underserved women, reducing the need for in-person visits [42].

3.4.2. The Greek Experience (GRECOSELF)

The GRECOSELF study in Greece successfully implemented an HPV-based cervical cancer screening program by distributing self-sampling kits through a midwifery network. Involving over 13,000 women from remote and underserved villages, the program specifically targeted rural populations with limited access to conventional screening services. High acceptance of self-sampling was observed, and adherence to follow-up recommendations for women with positive results was consistently high, demonstrating the feasibility and effectiveness of combining self-collection with follow-up care coordinated by midwives [7].

Subsequent studies further confirmed these findings, showing strong participant satisfaction, comfort, and technical feasibility of self-collected cervicovaginal sampling in rural Greek populations [43-44]. An updated review of both Greek and international studies highlighted that HPV-based self-sampling is generally highly acceptable, technically reliable, and effective in detecting high-risk HPV, reinforcing the potential role of telemedicine-supported follow-up in optimizing cervical cancer prevention programs [45].

3.4.3. Overcoming Professional Isolation and Ensuring Continuity

Telemedicine provides a vital platform for midwives working in remote regions to maintain professional support and ensure continuity of care. By connecting midwives to gynecologists, specialists, and national health networks, telemedicine enables timely guidance on complex cases, review of clinical images, and access to ongoing education and mentorship even in resource-limited settings [46-48].

This connectivity reduces professional isolation, a major challenge in remote areas, while strengthening clinical decision-making, reducing anxiety, and boosting confidence. For example, mobile health (mHealth) interventions have improved communication among healthcare professionals, facilitating remote support and collaboration for midwives and ensuring coordinated, high-quality care for women in underserved areas [49].

By integrating telemedicine into their practice, midwives can sustain continuous patient follow-up, maintain contact with women throughout the perinatal and reproductive periods, and provide timely guidance on screening, vaccination, and reproductive health, even when in-person visits are not possible [47, 48].

4. Discussion

This narrative review underscores the persistent challenges in achieving equitable cervical cancer screening coverage in geographically remote and underserved areas, primarily driven by structural, socioeconomic, and cultural barriers. These findings are consistent with existing literature highlighting disparities in access to preventive healthcare services. Integrated models that leverage the community-embedded role of midwives, when complemented by telemedicine technologies, offer a promising solution.

4.1. Bridging the Access Gap: The Midwife-Led Initiative

Midwives represent the most accessible and trusted healthcare workforce in remote settings, making their expanded role essential for mitigating geographical and infrastructural challenges [14]. Their long-term presence and familiarity with local communities allow them to deliver culturally sensitive education, combat stigma, correct misinformation, and promote preventive care [24]. This community-based engagement is particularly important in settings where formal healthcare access is limited. Evidence from Greece [7, 43] and international studies [41] suggests that shifting initial screening responsibilities to well-trained midwives is a feasible and effective strategy to increase participation where dedicated clinics are scarce, particularly through HPV self-sampling initiatives.

4.2. The Transformative Support of Telemedicine

Telemedicine complements midwife-led screening by overcoming patient-level barriers, facilitating remote consultations, digital follow-up, and telecolposcopy. HPV self-sampling combined with virtual guidance has been shown to increase participation, adherence, and patient satisfaction in cervical cancer screening programs, effectively overcoming logistical, privacy, and socioeconomic barriers in both Greek and international remote populations [7, 41, 42]. However, the effectiveness of these interventions depends on adequate infrastructure, training, and patient acceptance.

Moreover, telemedicine acts as a critical professional support system for midwives themselves. Remote consultations, telecolposcopy, and digital image review connect primary care centers to specialists, reducing professional isolation and enhancing clinical decision-making [10, 46]. In the Quinley study [10], community health workers, including midwives, were involved in remote cervical image assessment, demonstrating the feasibility of midwife engagement in telecolposcopy-supported screening programs. This highlights the potential for task-sharing models supported by digital health technologies. This synergy ensures that community-based care remains both accessible and of high quality, maintaining timely referrals for women with positive results [10, 46, 49].

Mobile health interventions, as reported by White et al. [49], further highlight how digital tools facilitate collaboration, communication, and mentorship for midwives in remote settings, reinforcing the quality and coordination of care. Nevertheless, variability in digital literacy among healthcare providers may influence the successful adoption of such interventions. By combining HPV self-sampling, telemedicine-supported follow-up, and professional connectivity, midwives in remote areas can deliver high-quality, culturally sensitive cervical cancer screening while overcoming both patient-level and professional barriers.

4.3. Telemedicine in Greece

Since the launch of the Greek National Telemedicine Network (EDIT) in 2016, the system has expanded connectivity across remote islands and mountainous regions, providing a solid foundation for improving healthcare access [32-33]. Evaluations of the network indicate growing utilization and positive impacts on care quality and patient safety. However, its application in gynecology, and particularly in midwife-led cervical cancer screening, remains largely unexplored. This gap highlights an important opportunity for future implementation and research. Despite this, the existing infrastructure represents a promising platform to support preventive care initiatives, including HPV-based screening programs, teleconsultations, and follow-up care.

Several challenges persist, such as sustainability issues, inconsistent technological infrastructure and the limited availability of specialized services in remote areas. Strengthening the integration of telemedicine into preventive and reproductive healthcare could leverage existing networks to reduce disparities and enhance access to essential services for underserved populations [32, 33].

Ultimately, strengthening collaboration between community-based midwives and telemedicine-enabled specialist networks may represent a key step toward achieving more equitable cervical cancer prevention worldwide.

4.4. Limitations and Future Considerations

This narrative review synthesizes evidence thematically rather than systematically, and therefore lacks the rigor of a meta-analysis. Direct quantitative comparisons between studies are limited due to the heterogeneity of study designs, populations, and settings. While this approach allows for the identification of key themes and practical insights, it may reduce the transferability of findings across different contexts. Additionally, the implementation of telemedicine depends on overcoming infrastructural challenges, such as reliable internet access and the availability of appropriate hardware and software in all remote areas [30].

Future research should focus on evaluating the long-term sustainability, cost-effectiveness, and integration of midwife-led cervical cancer screening into broader healthcare programs. Further high-quality studies, including randomized controlled trials and implementation research, are needed to strengthen the evidence base. Providing standardized training for midwives in advanced screening techniques, such as telecolposcopy and remote diagnostic tools, could further optimize specialist support and expand the reach and effectiveness of cervical cancer screening initiatives.

5. Conclusion

Cervical cancer screening disparities in remote regions may be effectively addressed by combining midwife expertise with telemedicine support. Midwives, as trusted points of access with strong community ties, can help overcome geographic, socioeconomic, and cultural barriers while providing essential clinical guidance. Complementing these efforts, telemedicine modalities such as HPV self-sampling, telecolposcopy, and virtual consultations offer a scalable infrastructure for continuity of care, timely follow-up, and professional support.

This integrated approach not only increases screening coverage and early detection but also strengthens the healthcare workforce by reducing professional isolation and supporting ongoing education. Overall, the evidence suggests that integrated, midwife-led telemedicine models represent a feasible and scalable strategy for improving cervical cancer prevention in underserved populations. By leveraging midwife-led services together with telemedicine innovations, healthcare systems can establish an equitable, sustainable, and scalable framework for cervical cancer prevention in underserved communities.

Compliance with ethical standards

Disclosure of conflict of interest

The author declares no conflicts of interest.

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