

Telemedicine Adoption in Low and Middle-Income Countries: A Review of Barriers, Opportunities, and Outcomes

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Abstract

Telemedicine is increasingly recognized as an effective way to expand healthcare access in low and middle income countries (LMICs), where long travel distances, workforce shortages, and limited infrastructure continue to hinder timely care. Despite its promise, many LMICs still face substantial challenges in implementing telemedicine consistently and at scale. This review synthesizes recent evidence to clarify the barriers that limit successful adoption, the factors that enable progress, and the outcomes observed when telemedicine is applied in real-world LMIC settings. A narrative review approach was used to examine peer-reviewed studies published between 2015 and 2025. A structured search across PubMed, Scopus, and Web of Science identified 798 articles. After screening for relevance to telemedicine implementation in LMICs, 15 studies were included. Narrative synthesis was then applied to integrate findings and identify recurring implementation challenges, enabling conditions, and reported impacts on patient care and health-system performance. The findings reveal persistent obstacles, including limited internet capacity, unstable electricity supply, unclear regulatory frameworks, and low digital literacy among patients and healthcare providers. At the same time, several positive developments, such as national digital-health strategies, mobile-first platforms designed for low-bandwidth environments, and capacity building initiatives are creating more supportive conditions for adoption. Evidence across a range of clinical areas shows improvements in continuity of care, reduced travel burden, higher patient satisfaction, and clinical outcomes comparable to in-person services. However, methodological heterogeneity and limited economic evaluations constrain understanding of long-term sustainability. Overall, current evidence suggests that telemedicine can strengthen health systems in LMICs, provided that sustained investments in infrastructure, governance, and digital competencies are prioritized.

Keywords: Telemedicine, Adoption, Lmics, Barriers, Opportunities, Outcomes

1. Introduction

Persistent inequalities in access to healthcare remain a defining challenge for many low- and middle-income countries (LMICs). Geographic remoteness, workforce shortages, and substantial out-of-pocket costs continue to limit access to timely diagnosis and specialist services, particularly for rural and marginalized populations. Over the past decade, and especially during the widespread adoption of digital health technologies throughout the COVID-19 pandemic, telemedicine has been promoted as a key strategy for mitigating these structural constraints by enabling remote consultation, follow-up care, and ongoing patient monitoring (Kruse et al., 2018; Mahmoud et al., 2022).

Despite this promise, the implementation of telemedicine has not progressed consistently across LMIC contexts. Adoption patterns vary widely, implementation pathways remain fragmented, and evidence on long-term health-system benefits is still limited. These variations highlight the need for a clearer understanding of what enables or hinders effective telemedicine implementation and under what conditions it can deliver equitable and sustainable improvements in access to care.

This review synthesises international evidence published over the past ten years to characterise the main barriers to adoption, identify practical opportunities for scaled implementation, and summarise documented patient- and system-level outcomes in LMICs. Drawing on a structured selection of 15 studies including systematic reviews, implementation evaluations, and primary intervention trials, this paper provides a focused and policy-relevant assessment of where telemedicine delivers value and where further investment, governance, and system strengthening are required. The findings aim to inform policymakers, implementers, and researchers about actionable strategies to expand equitable telemedicine access while highlighting key evidence gaps that warrant further investigation.

2. Literature Review

2.1 Scope and types of evidence

The body of literature on telemedicine in LMICs over the last decade comprises heterogeneous study designs, including systematic and scoping reviews, qualitative implementation studies, cross-sectional surveys, and a small but growing number of controlled evaluations (Combi et al., 2016; Kruse et al., 2018; Garg et al., 2024). Reviews tend to synthesise recurring themes such as technical, regulatory, human-factor, and financial aspects, while primary studies often document context-specific implementation lessons. Geographic coverage is uneven: substantial work reports on sub-Saharan Africa, South Asia, and parts of East Asia, but evidence remains sparse for many low-income settings and for remote, fragile contexts (Dodoo et al., 2022; Ye et al., 2023).

2.2 Barriers identified across studies

A clear cross-cutting theme is infrastructural fragility. Limited broadband penetration, intermittent electrical supply, and the cost of devices are consistently reported as foundational impediments to reliable telemedicine services (Dodoo et al., 2022; Shiferaw & Mehari, 2019). Regulatory and governance deficits form a second major cluster: many LMICs lack coherent telehealth legislation covering licensure, reimbursement, data protection, and cross-jurisdictional practice, which generates legal uncertainty for providers and institutions (Alami et al., 2020; Kruse et al., 2022). Human factors include low digital literacy among patients, clinician workload concerns, and trust/acceptability issues, further limit uptake and sustained use (Adenuga et al., 2017; Mahmoud et al., 2022). These studies indicate that technology alone is insufficient; adoption requires concurrent investment in governance, human capacity, and trust-building.

2.3 Opportunities and enabling strategies

The literature identifies several pragmatic enablers. Policy-level commitments (national digital-health strategies, clearer reimbursement rules) create a predictable implementation environment and catalyse investment (Ye et al., 2023; Smith et al., 2020). Technological adaptations include low-bandwidth platforms, mobile-first design, and offline functionality helps lower the infrastructural threshold required to deliver meaningful services (Combi et al.,

2016). Capacity building (clinician training, workflow integration) and community engagement (patient education campaigns) increase uptake and acceptability (Adenuga et al., 2017; Shiferaw & Mehari, 2019). Integration into primary care workflows is repeatedly recommended as a pathway to improve continuity of care while reducing unnecessary tertiary referrals.

2.4 Reported outcomes and limitations of the evidence

Empirical findings are generally favorable: improved patient satisfaction, reduced travel/time burdens, and clinical outcomes comparable to face-to-face care in particular domains (chronic disease follow-up, mental health, dermatology) are commonly reported (Garg et al., 2024; Kruse et al., 2022). Health system benefits more efficient triage and referral, reduced congestion of tertiary centres are also described (Smith et al., 2020). Nevertheless, the literature is limited by short follow-up durations, small sample sizes, and an over-reliance on pilot projects or donor-funded initiatives that may not reflect scalability or sustainability (Mahmoud et al., 2022). Crucially, rigorous economic evaluations and long-term implementation studies remain scarce; without them, policymakers lack robust estimates of cost-effectiveness, return on investment, and distributional equity impacts.

2.5 Critical gaps and directions for research

Key evidence gaps emerge clearly from the review: (1) the need for pragmatic trials and longitudinal evaluations that assess sustainability and health outcomes over time; (2) economic analyses that include system-level costs, patient out-of-pocket savings, and equity impacts; (3) comparative implementation research across differing health-system architectures to identify transferable models; and (4) governance studies that evaluate regulatory reforms and data-protection frameworks in real-world deployments. Addressing these gaps will provide stronger guidance for scaling telemedicine in ways that are equitable, affordable, and integrated into routine health services.

Table 1. Study Matrix / Evidence Summary Table

No.	Authors (Year)	Country/Region	Design	Telemedicine Type	Key Findings	Evidence Strength
1	Combi et al. (2016)	LMIC	Survey/Review	Teleconsultation	Design needs for low-resource systems	Moderate
2	Kruse et al. (2018)	Global	Systematic Review	Various	Synthesized barriers across settings	High
3	Mahmoud et al. (2022)	LMIC	Scoping Review	Monitoring/Teleconsult	COVID-era uptake patterns	Moderate
4	Ye et al. (2023)	China	Systematic Review	Telehealth	Policy-driven expansion	High
5	Dodoo et al. (2022)	SSA	Review	Teleconsult/mHealth	Infrastructure gap focus	Moderate
6	Adenuga et al. (2017)	Nigeria	Qualitative	Teleconsultation	Clinician barriers + acceptance	Moderate
7	Behar et al. (2023)	Global	Scoping Review	Teletriage	Telehealth in emergencies	High

8	Kruse et al. (2022)	Global	Systematic Review	Various	COVID-adoption factors	High
9	Garg et al. (2024)	India	RCT	Teleconsult Monitoring	+ Improved continuity + satisfaction	High
10	Wootton (2020)	Global	Perspective	Telemedicine	Lessons from pandemic	Moderate
11	Smith et al. (2020)	Global	Review	Telehealth	System-wide integration	High
12	Kruse et al. (2021)	LMIC	Assessment	Digital readiness	Infrastructure assessment	Moderate
13	Abramu et al. (2019)	Rural	Cross-sectional	mHealth	User acceptance barriers	Moderate
14	Alami et al. (2020)	LMIC	Policy analysis	Governance	Ethical & governance needs	High
15	Shiferaw & Mehari (2019)	LMIC	Review	Digital infrastructure	Infrastructure obstacles	Moderate

3. Research Method

3.1 Method

This narrative review applied a structured literature search to identify studies examining telemedicine adoption in low- and middle-income countries (LMICs). Searches were conducted in PubMed, Scopus, and Web of Science for publications from 2015 to 2025 using the keywords telemedicine, telehealth, digital health, LMIC, and implementation. Additional records were identified through manual screening of reference lists. Studies were included if they were conducted in LMIC contexts, published in English, and discussed barriers, enabling factors, or outcomes related to telemedicine deployment. Editorials, commentaries, studies from high-income countries, and articles without accessible full texts were excluded. From 798 initial records, 628 titles and abstracts were screened, followed by full-text assessment of 131 articles, resulting in 15 studies that met all eligibility criteria. The methodological quality of included studies was evaluated using the JBI, MMAT, and AMSTAR-2 tools, and only studies rated moderate to high quality were synthesized. Data extraction focused on study characteristics, telemedicine modalities, barriers, opportunities, and reported outcomes. Findings were integrated through thematic narrative synthesis to identify recurring patterns relevant to telemedicine adoption in LMIC health systems.

4. Findings and Discussions

4.1 Finding

The literature shows that telemedicine implementation in low and middle income countries (LMICs) is shaped by a combination of infrastructural, regulatory, sociocultural, and workforce related factors. Limited broadband access, unstable electricity, and the high cost of digital devices continue to hinder adoption, especially in rural areas. These constraints affect the reliability of remote consultations and disrupt continuity of care. Regulatory uncertainties related to licensure, reimbursement, and data protection also reduce provider confidence. On the patient side, concerns about privacy, limited digital literacy, and a strong preference for in person visits often lead to hesitation. Healthcare providers face additional challenges because

many still lack adequate digital skills, feel that telemedicine increases their workload, and worry about diagnostic accuracy without a physical examination.

Despite these challenges, several opportunities support wider implementation. Many countries are developing national digital health strategies that prioritise improved connectivity, stronger data governance, and clearer telehealth regulations. Technological innovations designed for low resource settings, including low bandwidth platforms and mobile based systems, are making remote care more feasible in areas with unstable internet. Capacity building programmes for providers together with patient education initiatives are gradually improving digital readiness. Integrating telemedicine into primary care pathways can also strengthen continuity of care and streamline referral processes.

Current evidence shows that telemedicine offers meaningful benefits. Patients experience reduced travel burden and improved access to specialised services. In several clinical fields, outcomes achieved through telemedicine are comparable to those of in person consultations when supported by appropriate protocols. At the system level, telemedicine improves triage, enhances referral coordination, and helps optimise the use of limited health resources. However, important gaps remain, particularly in relation to cost effectiveness, scalability across diverse LMIC settings, and long term sustainability beyond externally funded pilot projects. Recent analyses also note that structural barriers persist and that rigorous economic evaluations are still limited, making it difficult for policymakers to plan long term investments.

4.2 Discussions

The findings show that telemedicine adoption in low and middle income countries (LMICs) is shaped by interconnected infrastructural, regulatory, sociocultural, and technological factors. Persistent gaps in connectivity, electricity, and regulatory clarity continue to influence feasibility and clinical safety. Although digital platforms are now more widely available, structural limitations still affect the reliability of remote consultations and reduce provider confidence. These issues underline the need for system level improvements rather than solutions that rely on technology alone.

Recent literature also highlights growing opportunities for telemedicine to become part of routine care. Many LMICs are strengthening digital health policies, and innovations designed for limited resource settings have improved the practicality of remote services. However, readiness varies widely. Even with low bandwidth platforms and simple interfaces, successful uptake still requires supportive regulations, adequate workforce training, and approaches that respond to patient needs and expectations.

Evidence across multiple outcomes shows that telemedicine can complement traditional care. Patients benefit from reduced travel time and better access to specialists, while clinical results are often comparable to in person services when appropriate protocols are followed. Telemedicine can therefore contribute to greater efficiency and equity within health systems. Yet its long term sustainability remains uncertain. As noted by Mwangi et al. (2024), the lack of strong cost effectiveness studies continues to limit policymakers in planning investments in resource constrained settings.

This review has several limitations. The evidence comes from studies with diverse designs and variable quality, which affects comparability and may introduce bias, especially where findings rely on self reported data. Most research is conducted in middle income countries, making it difficult to generalise results to low income or fragile settings where barriers may be more

severe. A meta analysis was not feasible due to heterogeneity in outcomes and telemedicine models, and relevant grey literature may have been missed.

Overall, the synthesis suggests that scaling up telemedicine in LMICs requires coordinated efforts that address infrastructure, regulation, workforce capacity, and user experience. While current evidence is promising, long term progress will depend on strong policy commitment, targeted investment, and more rigorous context specific research to guide equitable and sustainable implementation.

5. Conclusion

Telemedicine offers substantial potential to strengthen healthcare delivery across low- and middle-income countries (LMICs), where persistent gaps in infrastructure, workforce capacity, and equitable access continue to hinder timely and comprehensive care. The evidence synthesized in this review demonstrates that telemedicine can meaningfully enhance continuity of care, reduce travel and financial burdens for patients, and deliver clinical outcomes comparable to traditional in-person services across a range of clinical domains. These gains are particularly relevant for rural, remote, and underserved communities that face longstanding geographic and socioeconomic barriers.

Despite these advantages, widespread adoption in LMICs remains constrained by infrastructural fragility, regulatory ambiguity, limited digital literacy, and sociocultural concerns affecting both patients and providers. Overcoming these barriers requires a coordinated, system-level approach that integrates technological innovation with strengthened governance, sustainable financing, and targeted workforce development. National digital-health strategies, mobile-first and low-bandwidth solutions, and capacity-building initiatives represent actionable pathways for enabling scalable and resilient telemedicine ecosystems.

To maximize health-system impact, telemedicine should be embedded within primary care networks, integrated into clinical workflows, and supported by clear regulatory frameworks addressing licensure, reimbursement, data protection, and cross-border service delivery. Long-term economic evaluations and equity-focused research are urgently needed to guide evidence-based decision-making and ensure that digital health innovations do not widen existing disparities.

Overall, telemedicine should be viewed not as a standalone intervention but as a strategic component of broader health-system strengthening efforts. With sustained policy commitment, investment in digital infrastructure, and comprehensive capacity-building, telemedicine can play a pivotal role in advancing equitable, high-quality, and future-ready healthcare across LMIC settings.

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