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Advancing telehealth equity: Addressing barriers across social determinants of health

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ABSTRACT

Social determinants of health (SDoH), including economic stability, education, healthcare access, neighborhood environment, and community context, play a critical role in shaping health outcomes. Telehealth, defined as the use of digital and telecommunications technologies to deliver healthcare remotely, presents both opportunities and risks for equity. It can reduce barriers such as transportation costs and distance, yet it may also deepen disparities among populations with limited digital access or literacy. This review highlights lessons from selected global and U.S. telehealth programs to examine how SDoH influence adoption and outcomes. Key challenges include digital literacy gaps, privacy concerns, cultural preferences for in-person care, provider training deficits, infrastructure limitations, and reimbursement inconsistencies. Potential solutions include policy reforms, broadband expansion, digital literacy initiatives, and community-centered approaches. By framing telehealth through an SDoH lens, this review contributes to the literature by clarifying strategies that can advance more equitable and sustainable implementation.

Keywords: telehealth equity, social determinants of health, digital health disparities, health literacy, cultural competency, healthcare access

INTRODUCTION TO SOCIAL DETERMINANTS OF HEALTH

The World Health Organization (WHO) commission on social determinants of health (SDoH) defined them in 2008 as "the conditions in which people are born, grow, live, work and age" [1]. The U.S. Centers for Disease Control and Prevention (CDC) similarly describes SDoH as "the non-medical factors that influence health outcomes" [2]. The 2025 WHO *world report on social determinants of health equity* emphasized that well-being depends not only on genetic factors but also on equitable access to healthcare and supportive environments [3].

SDoH are commonly categorized into five domains: economic stability, education access and quality, healthcare access and quality, neighborhood and built environment, and social and community context (**Figure 1**). Each of these domains exerts a distinct yet interconnected influence on health. Economic stability relates to employment, income, housing security, and food access, with lower socioeconomic conditions consistently linked to poorer outcomes [4]. Education access and quality, including literacy and language proficiency, strongly influence health literacy and the ability to navigate care [5]. Healthcare access and quality determine whether appropriate, affordable services are available within reach of patients [6]. The neighborhood and built environment, encompassing housing, transportation, broadband access, and community safety, shapes opportunities for both preventive and acute care [7]. Finally, social and community context, shaped by factors such as cultural values, social disadvantages, and immigration status, influences the degree of trust patients place in healthcare systems and their willingness to adopt new technologies [8].

National initiatives such as Healthy People 2030 underscore that improving these conditions is essential to advancing equity, noting that SDoH often influence health outcomes more strongly than genetics or medical care alone [9, 10]. As healthcare systems seek innovative approaches to address these disparities, telehealth has emerged as a potential tool to expand access and reduce barriers. At the same time, if implemented without attention to equity, telehealth may also reinforce existing gaps. Telehealth is defined as the use of electronic and telecommunications technologies to support long-distance clinical care, education, health administration, and public health [11]. Closely related, digital health literacy is the ability to seek, understand, and apply health information from electronic sources, which has become a critical determinant of whether patients can effectively benefit from telehealth services [12]. Recognizing these dynamics highlights the importance of examining how social determinants shape both the opportunities and risks of telehealth adoption.

This review contributes to the current literature by synthesizing global and U.S. experiences to show how telehealth simultaneously reduces barriers and creates new inequities linked to SDoH. By integrating patient, provider, and

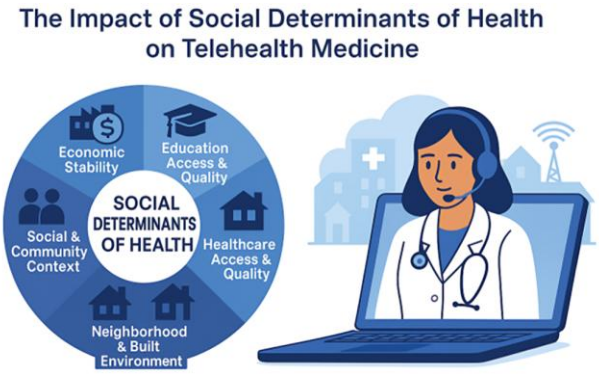

Figure 1. SDoH influencing telehealth medicine (Source: Authors' own elaboration)

system perspectives, it highlights the paradox of telehealth as both an equalizer and a divider, while offering evidence-based policy, technological, and community-centered strategies for more equitable implementation.

THE DUAL ROLE OF TELEHEALTH IN ADDRESSING HEALTHCARE EQUITY

Telehealth uses digital and Internet-based technologies to deliver healthcare remotely through video calls, phone consultations, or online messaging. By removing barriers such as transportation and geographic isolation, it has the potential to improve access across multiple SDoH [13, 14]. At the same time, if equity considerations are overlooked, telehealth may unintentionally deepen disparities, creating new challenges in access to care [15, 19].

On the positive side, telehealth reduces transportation costs and time away from work, directly benefiting patients with limited economic stability who cannot afford frequent travel or time off for medical appointments [13, 14]. It also enhances healthcare access and quality by connecting patients with providers and specialists regardless of location, particularly in rural or underserved regions [15]. In addition, telehealth can mitigate social and community context barriers by providing discreet access to sensitive services such as mental health care, reducing stigma and cultural barriers that may otherwise prevent treatment [17].

Conversely, inequities emerge when patients lack the tools or support needed to engage with telehealth effectively. Technology access gaps prevent participation for those without smartphones, broadband, or digital skills, disproportionately affecting elderly adults, racial minorities, rural residents, non-native English speakers, and lower-income populations [15, 19, 20]. Economic barriers persist when patients cannot afford the required devices or Internet service [14]. Educational barriers surface when individuals with limited literacy or language proficiency struggle to use telehealth platforms [16]. Healthcare access inequities may grow if reimbursement limitations exclude uninsured or underinsured patients [14, 15]. Infrastructure gaps in neighborhoods and rural areas further disadvantage those without reliable broadband [15]. Finally, cultural and social barriers may be reinforced when elderly, immigrant, or diverse communities feel increasingly disconnected from healthcare systems that rely heavily on unfamiliar technologies [19, 20]. Unless these barriers are deliberately addressed, widespread telehealth adoption risks worsening inequities for medically disadvantaged populations [13, 15]. This review, therefore, examines successful telehealth programs that have addressed SDoH barriers, analyzes patient-, provider- and system-level challenges to equitable access, and proposes solutions including policy reforms, technological innovations, and community-centered strategies to ensure telehealth serves as an equalizer in healthcare delivery [16, 19, 20].

MATERIALS AND METHODS

This review used a narrative synthesis approach to examine how SDoH influence the implementation, accessibility, and equity of telehealth services. Relevant studies, program evaluations, and policy reports were identified through targeted searches of PubMed, Scopus, and Google Scholar, complemented by policy and organizational reports from the WHO, CDC, American Medical Association (AMA), Health Resources and Services Administration (HRSA), and the World Telehealth Initiative (WTI).

Search terms included combinations of "telehealth equity," "social determinants of health," "digital divide," "digital literacy," "telemedicine access," "policy barriers," and "health disparities." The search focused on literature published between 2018 and 2025, reflecting the period of rapid telehealth expansion and policy innovation accelerated by the pandemic. Both U.S. and international studies were considered to capture global perspectives on equitable telehealth implementation.

Fourteen representative telehealth programs and case studies were selected based on their relevance, data availability, and diversity of healthcare and geographic settings. These examples were analyzed for key innovations, addressed SDoH domains, implementation challenges, and reported outcomes. Findings were synthesized thematically using the five SDoH domains defined by WHO and CDC: economic stability, education, healthcare access and quality, neighborhood and built environment, and social and community context. This analytic framework provided the basis for identifying recurring themes and cross-cutting patterns in telehealth equity implementation.

CASE STUDIES AND PROGRAMS USING TELEHEALTH

Telehealth has been implemented in diverse settings worldwide, offering insights into how technology can both reduce and reinforce disparities in healthcare access. The following examples highlight program models across rural, global, specialty, and integrated care contexts.

Rural Health Facility in the United States

The White Earth Health Center, a tribal facility in Minnesota, provides an important example of how rural and Indigenous communities adapted to telehealth during the COVID-19 pandemic. Located in a geographically isolated area, the center historically faced challenges such as long travel distances, limited provider availability, and inconsistent access to specialty care. During the pandemic, the facility rapidly transitioned to telehealth, supported by federal policy changes such as expanded Centers for Medicare and Medicaid Services

reimbursement and rapid staff training on digital platforms [21, 22].

This transition reduced the need for patients to travel long distances for care, allowing for continuity of primary care services and supporting infection control at the height of the pandemic [22]. Dedicated appointment slots for telehealth and strong staff engagement helped integrate virtual care into daily operations. Yet uneven broadband access and cultural preferences for in-person visits constrained scalability, reflecting broader rural patterns where infrastructure gaps and digital divides often limit long-term sustainability [22].

Global Health Equity Programs

In Bangladesh, the Hope Foundation connected rural communities and Rohingya refugees with international specialists, enabling nearly 500,000 encounters and strengthening the healthcare workforce, though infrastructure and funding instability posed barriers [23, 24]. Nigeria's Precious Gems program improved diagnosis and training for children with cerebral palsy through remote consultations, but digital literacy barriers and Internet disruptions limited participation [23, 26]. In Ethiopia, the Bahir Dar Outreach program enhanced stroke care through remote neuroscience training, yet cultural tailoring and infrastructure deficits constrained scalability [25].

In high-income countries, the First Nations Telehealth Expansion project (FNTEP) in Canada enabled over 180 providers to deliver care to more than 15,000 Indigenous patients, highlighting the importance of culturally adapted interventions [26]. Similar benefits were observed in Australia, where Aboriginal Community Controlled Health Organization programs improved screening rates and emotional wellbeing while reducing travel burdens [26]. In India, a systematic review showed that telehealth improved follow-up care, reduced hospital overcrowding, and was associated with high patient satisfaction [27]. In Kenya, a project ECHO hub-and-spoke model linked rural clinicians with specialists at Moi Teaching and Referral Hospital, increasing childhood cancer diagnoses by 33 percent over baseline averages [28].

Specialty Access in U.S. Regional Hospitals

Regional hospitals in Kansas and Texas expanded specialty care in neurology, rheumatology, and endocrinology through telehealth, reducing patient travel by up to 50 percent and lowering transfers by 20 to 30 percent [29, 30]. While patient satisfaction improved, integration with electronic health records (EHRs), equitable access among vulnerable groups, and state licensure restrictions remained challenges [29, 30].

Integrated Health System Models

Large U.S. health systems have developed integrated telehealth models. Atrium Health's Hospital at home program reduced readmissions by 20 percent and achieved cost savings of 15 to 25 percent, though device logistics and data security were ongoing concerns [31]. Concert Health embedded behavioral telehealth into primary care, achieving a 30 percent reduction in depression symptoms while relieving providers of mental health management, though coordination across teams was challenging [32]. Ochsner Health's connected MOM program improved maternal health outcomes through remote monitoring, reducing clinic visits by 25 percent, though success depended on access to monitoring devices and adequate training [33].

Specialty Service Telehealth

Targeted initiatives demonstrate telehealth's role in acute and specialty care. Riverside health's tele-stroke program enabled neurologists to evaluate patients in rural emergency departments in real time, reducing treatment times by 20 to 30 minutes [34]. AmplifyMD's outpatient tele-neurology clinic reduced appointment backlogs by 40 percent and improved continuity of care, though EHR integration and patient expectations around virtual care remained barriers [35].

A summary of these telehealth case studies, including program focus, key innovations, addressed SDoH domains, challenges, and references, is presented in **Table 1**.

Cross-Case Analysis and Lessons Learned: Addressing SDoH through Telehealth Innovation

The reviewed telehealth case studies reveal that successful programs are those that directly address barriers rooted in SDoH. Several key lessons emerge across settings:

- **Workflow integration supports healthcare access and quality:** Embedding telehealth into existing clinical workflows, such as through EHR integration, standardized protocols, and remote monitoring, ensures consistent access to care for patients regardless of location. This reduces missed appointments and care fragmentation, directly improving healthcare access and quality for underserved populations [29, 31].
- **Stakeholder engagement builds social and community trust:** Early involvement of clinicians, administrative staff, and community leaders helps design culturally aligned services. Programs such as the White Earth Health Center and the Hope Foundation in Bangladesh demonstrate that co-designing with local stakeholders fosters trust, reduces stigma, and encourages adoption [22, 24].
- **Policy and reimbursement reform advances economic stability in care delivery:** Sustainable telehealth adoption depends on reimbursement parity with in-person visits and the removal of restrictive licensure policies. Stable funding enables providers to maintain telehealth services for patients who cannot afford frequent travel, thereby improving economic stability for both patients and healthcare organizations [21, 30].
- **Digital Equity Initiatives Close the Technology Access Gap:** Providing devices, improving broadband infrastructure, and offering digital literacy training are essential steps toward bridging the technological access divide. Rural programs in the U.S., along with international projects in Nigeria and Ethiopia, show that without addressing these structural barriers, telehealth may unintentionally deepen existing inequities [23, 25].
- **Continuous program evaluation targets high-impact SDoH interventions:** Regular monitoring of utilization patterns, patient satisfaction, and health outcomes helps identify which social determinants, such as transportation barriers, language access, or broadband gaps, most significantly impact telehealth engagement. Programs can then adapt and refine interventions to target those priority areas [29, 34].

Table 1. Telehealth case studies addressing SDoH

Program/location	Focus	Key innovations	SDoH domains addressed	Challenges	References
White Earth Health Center (USA)	Primary care in tribal and rural setting	Telehealth scheduling, CMS reimbursement	Healthcare access, economic stability, technology access	Limited broadband, patient preference for in-person care	[22]
Hope Foundation (Bangladesh)	Maternal and pediatric care	Specialist mentorship, virtual primary care	Healthcare access, technology access, community context	Connectivity, lab infrastructure, sustainable funding	[24]
Bahir Dar Outreach (Ethiopia)	Stroke care and provider education	Tele-neuroscience training and workflows	Healthcare quality, community context, education access	Cultural tailoring, infrastructure gaps	[23, 25]
ACCHO Programs (Australia)	Indigenous health access	Community-controlled telehealth	Healthcare access, community context	Mortality and systemic disease disparities	[23 26]
FNTEP (Canada)	Indigenous health access	Culturally adapted telehealth interventions	Healthcare access, community context	Geographic barriers, resource needs	[23, 26]
Precious Gems (Nigeria)	Cerebral palsy and remote diagnosis	Specialist teleconsults, local provider training	Healthcare access, education quality, technology access	Digital literacy, inconsistent internet	[23, 26]
India Telehealth Studies	Primary and follow-up care	Reduced hospital overcrowding, improved follow-up	Healthcare access, economic stability	Infrastructure gaps, variable adoption	[27]
Project ECHO (Kenya)	Pediatric cancer diagnosis	Hub-and-spoke specialist model	Healthcare quality, community context	Connectivity, training local providers	[28]
Kansas & Texas Hospitals (USA)	Specialty care (neurology, rheumatology, endocrinology)	E-consults, reduced transfers	Healthcare access, economic stability	EHR integration, licensure barriers	[29, 30]
Atrium Health (USA)	Acute care at home	Wearables, home monitoring	Healthcare access, economic stability	Device distribution, data security	[31]
Concert Health (USA)	Behavioral health integration	Virtual mental health in primary care	Healthcare quality, community context	Coordination with in-person teams	[32]
Ochsner Connected MOM (USA)	Maternal health monitoring	Remote fetal and blood pressure tracking	Technology access, healthcare access	Device access, patient training	[33]
Riverside Tele-Stroke (USA)	Emergency stroke care	Real-time neurologist consults	Healthcare quality, geographic access	Connectivity, staff training	[34]
AmplifyMD Tele-Neurology (USA)	Outpatient neurology	Virtual follow-ups, backlog reduction	Healthcare access, technology access	EHR integration, patient expectations	[35]

- **Capacity building strengthens local healthcare systems:** Telehealth's value extends beyond direct patient care when combined with provider education and mentorship. Initiatives like project ECHO in Kenya and the Bahir Dar Outreach in Ethiopia demonstrate that virtual training increases local clinical capacity. This creates long-term improvements in healthcare access and quality while reducing dependence on external specialists [25, 28].

BARRIERS AND CHALLENGES IN TELEHEALTH

While telehealth offers opportunities to reduce health disparities, it can reinforce inequities when barriers across SDoH are not addressed. These challenges span patient, provider, system, and policy levels, intersecting with education, economic stability, healthcare access, and community context.

Patient-Level Barriers (Education, Economic Stability, and Community Context)

A critical challenge for patients is the digital divide, which includes both device availability and broadband connectivity. Approximately one-quarter of older adults and nearly one-third of low-income households in the USA lack reliable broadband, creating disproportionate barriers for rural, elderly, and non-native English-speaking populations [36, 37]. At the White Earth Health Center in Minnesota, broadband gaps constrained telehealth sustainability for Indigenous patients, while in Bangladesh's Hope Foundation program, Rohingya refugee communities struggled with poor Internet infrastructure that limited specialist access [22-24].

Closely tied to access is digital literacy. Many patients, particularly older adults and those with lower education, struggle with portal activation, multi-factor authentication, or troubleshooting video platforms. This "technology anxiety," sometimes described as technophobia, contributes to disengagement from telehealth [37]. Community-based digital navigator programs have shown success in reducing these barriers.

Privacy and trust concerns further affect adoption. Nearly 40% of patients in immigrant and low-income communities report worries about surveillance, data breaches, or lack of confidentiality during telehealth visits [38]. Patients in crowded housing situations may lack private space for consultations, linking privacy concerns directly to housing-related SDoH [38-41].

Cultural values significantly influence patient receptivity to telehealth. In many communities, particularly those with collectivist traditions, there is a strong emphasis on personal relationships with healthcare providers, and virtual consultations may feel less authentic or trustworthy compared to in-person visits [42]. For some Indigenous populations, trust is traditionally established through face-to-face interactions, making remote consultations seem impersonal or culturally misaligned [43]. Similarly, certain immigrant groups may

express skepticism toward video-based platforms due to limited familiarity with digital tools or cultural preferences for direct, in-person care [44]. These examples underscore the importance of addressing social contexts, cultural expectations, and trust dynamics to ensure telehealth fosters equitable healthcare access without compromising patient-provider relationships.

Provider and System-Level Barriers (Healthcare Access and Quality)

Providers face challenges in adapting to equitable telehealth delivery. Only about 30% of U.S. medical schools include telehealth training, leaving many clinicians unprepared for virtual communication and cultural nuances [39]. In Nigeria's Precious Gems program, clinicians struggled with adapting cerebral palsy care to remote consultations, underscoring the importance of provider readiness [23].

Cultural competency training is especially critical. Providers must learn to adapt communication styles, use interpreters effectively, and recognize cultural expectations that shape patient comfort with technology [39]. Skills such as maintaining eye contact with the camera, verbalizing empathy more explicitly, and knowing when to involve family members can improve trust and rapport. Without such training, providers risk reinforcing disparities by alienating patients who already face SDoH-related barriers.

System-level issues also persist. Poor integration between telehealth platforms and EHRs creates fragmented care. In Ethiopia's Bahir Dar Outreach program, lack of integration complicated coordination in stroke care, disproportionately burdening patients with limited literacy or language skills [25]. In the U.S., many hospitals lack dedicated IT support to troubleshoot technical problems, resulting in canceled visits for underserved patients [40]. These systemic barriers compound existing inequities in access and quality of care.

Policy-Level Barriers (Economic Stability and Structural Determinants)

Policy limitations remain one of the most significant obstacles. Historically, limited Medicaid and Medicare reimbursement restricted telehealth adoption. Before COVID-19, Medicare coverage was confined to rural areas and specific facilities, creating financial disincentives for providers serving low-income populations [40]. During the pandemic, temporary waivers expanded reimbursement and increased access, but these policies were not permanent [41]. Without sustained reimbursement parity between telehealth and in-person visits, providers may withdraw services that disproportionately benefit disadvantaged patients.

Licensure restrictions also limit access. Patients in rural states often cannot access specialists across state lines due to inconsistent licensing rules, despite workforce shortages in their communities [40]. Broadband investment remains inadequate in many tribal and rural areas, leaving 35% of Indigenous communities without reliable access [22]. Internationally, similar policy gaps, such as regulatory delays in India and parity inconsistencies in Australia's Aboriginal health programs, show how structural determinants limit equitable adoption [24, 41].

These global and U.S. examples illustrate that sustainable policy reform, including Medicaid parity, interstate licensure compacts, broadband investment, and consistent telehealth coverage, is essential to ensure equitable access.

Equity Implications

These barriers demonstrate that telehealth inequities are deeply connected to SDoH. The digital divide reflects disparities in education and neighborhood environment. Reimbursement and licensure barriers mirror structural and economic inequities. Privacy concerns and cultural mistrust reveal the importance of community and social context. To advance equity, solutions must integrate patient education, provider training, interoperable technology, and policy reform. Without coordinated action, telehealth risks amplifying disparities rather than closing them.

FUTURE DIRECTIONS AND RECOMMENDATIONS

Telehealth's ability to advance equity depends on addressing structural, educational, and technological barriers linked to the SDoH. To ensure it functions as an equalizer rather than a divider, coordinated strategies are needed across policy, practice, infrastructure, technology, and community engagement.

Policy Reforms

One of the most important changes needed is making sure doctors and other providers get paid the same amount for telehealth visits as they do for in-person appointments. When this "payment parity" is guaranteed, providers are more willing to offer telehealth, and patients in underserved areas gain better access to care [45, 46]. Temporary policies during COVID-19 showed how powerful this can be but making them permanent is essential so patients do not lose services once emergency measures end [46].

Another key step is making it easier for providers to treat patients across state lines. Right now, strict licensing rules often prevent patients in rural or under-resourced states from seeing specialists who are available elsewhere. Expanding cross-state licensure agreements would give more patients access to care when local options are limited [47, 48].

Finally, strengthening broadband Internet in rural and low-income areas is critical. Without reliable Internet, many families cannot use telehealth at all, which leaves them at a disadvantage compared to patients in urban or wealthier communities. Federal investment in broadband infrastructure can close this gap and make telehealth a realistic option for everyone [47].

Patient and Provider Training

Helping patients feel confident with technology is key to making telehealth work for everyone. Community-based programs, like "digital navigators" who guide patients through setting up devices, or Telehealth 101 workshops in libraries and senior centers, can make a big difference. These efforts are especially valuable for older adults, low-income families, and anyone with little experience using technology [49].

Providers also need support to deliver telehealth in ways that build trust and respect. Training should cover cultural competency and communication skills that are specific to virtual care. For example, doctors can practice showing empathy through a screen, learn how to use interpreters effectively, and know when it is appropriate to involve family members in a consultation. These skills help ensure that

telehealth visits feel just as personal and supportive as in-person appointments [50, 51].

Infrastructure Expansion

Access to reliable Internet and devices is the foundation of successful telehealth. Without these, patients simply cannot connect with providers. One practical solution is creating local telehealth access points in familiar places such as libraries, schools, and community centers. These spaces can offer private rooms and high-speed Internet for patients who do not have those resources at home.

To make this possible, federal and state funding programs, along with partnerships between governments and private companies, should expand broadband service, provide devices to patients who need them, and set up Wi-Fi hotspots in underserved neighborhoods. These steps would remove cost and connectivity barriers that currently prevent many rural and low-income families from using telehealth [52].

Technological Innovations

Future telehealth platforms should be designed with patients' real-world needs in mind. For many low-income families, a smartphone is their only way to get online. Building mobile-first platforms that work well on phones, even with slow or unstable Internet, is essential for making telehealth available to everyone [53]. Features like low-bandwidth video, simple interfaces, and the ability to use services offline can help patients in rural and underserved areas stay connected.

Technology can also make telehealth more inclusive. Tools such as real-time translation, closed captioning for patients with hearing loss, and voice commands for those with vision impairment allow more people to participate in virtual care. AI-driven assistants could guide patients step by step through scheduling, joining a visit, or asking questions, reducing the stress of navigating unfamiliar technology [54]. Wearable devices like glucose monitors and smartwatches offer another way to close care gaps. They allow patients with chronic conditions to share real-time data with providers, making it easier to track health between visits. For patients who cannot travel frequently for in-person care, this creates a more continuous and proactive approach to managing health [54]. Together, these innovations, if developed with accessibility and cultural sensitivity in mind, can bridge digital divides and make telehealth a more effective tool for improving health equity.

CONCLUSION

Telehealth has enormous potential to reduce health disparities, but it will only succeed if reforms are guided by the SDoH. Strong policies that guarantee fair reimbursement, better training for both patients and providers, expanded infrastructure, and user-friendly technologies are all essential to closing gaps in care.

At the same time, solutions must be grounded in the realities of the communities they serve. Building trust, addressing cultural expectations, and engaging patients and local leaders in program design are just as important as technical fixes. Programs that listen to communities from the start, adapt to their needs, and provide ongoing feedback loops are more likely to succeed and be sustained over time.

With these combined efforts, telehealth can move from being a temporary fix to becoming a permanent tool for health equity, helping ensure that where people live, their income, or their digital skills do not determine the quality of care they receive.

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