



Digital payment adoption in rural healthcare systems: A systematic review of drivers, barriers, theoretical perspectives, and managerial implications

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Abstract

The global transition toward digital health ecosystems has accelerated the integration of financial technologies within healthcare delivery, yet rural populations remain at risk of digital exclusion. This systematic review examines the adoption of digital payment systems in rural healthcare, focusing on the interplay between technological drivers, multidimensional barriers, and the theoretical frameworks that govern user acceptance. Drawing on the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT2), and the Diffusion of Innovation (DOI) theory, this paper analyzes how facilitating conditions, social influence, and personal innovativeness shape behavioral intentions. Results indicate that while digital payments significantly mitigate geographic barriers and enhance financial inclusion—particularly through specialized "health wallets"—adoption is frequently hindered by infrastructural deficits, low digital literacy, and deep-seated concerns regarding data security and trust. The review further incorporates specialized frameworks such as the COM-B model (Capability, Opportunity, and Motivation) and the Technology-Organization-Environment (TOE) framework to provide a deeper understanding of the environmental and organizational determinants of success. Case studies from Kenya's M-TIBA ecosystem and India's public-private partnerships demonstrate that successful implementation requires more than technical deployment; it necessitates an operational redesign that aligns with existing clinical workflows and local cultural values. Managerial implications emphasize the role of institutional leadership in fostering trust, the importance of "digital champions" in community training, and the need for policy frameworks that recognize connectivity as a social determinant of health. Furthermore, the review explores the nascent role of blockchain-based smart contracts and artificial intelligence in automating administrative functions and improving resource allocation in resource-constrained settings. The study concludes that achieving equitable access to digital healthcare financing requires a multi-pronged approach that addresses both technical "opportunity" and human "capability." These findings provide a strategic roadmap for healthcare administrators and policymakers aiming to bridge the urban-rural digital divide and ensure sustainable health system performance in a post-pandemic era.

Keywords: Digital payments, rural healthcare, digital health ecosystems, financial inclusion, healthcare financing, telemedicine payments, mhealth (mobile health), electronic health records

Introduction

The contemporary global healthcare landscape is currently witnessing a paradigm shift as systems transition from traditional, manual administrative frameworks to integrated digital ecosystems. This transformation is particularly poignant in rural and remote regions, where healthcare delivery has historically been constrained by geographical dispersion, limited infrastructure, and professional isolation. Digital health technologies (DHTs), including telemedicine, mobile health (mHealth) applications, and electronic health records (EHRs), are increasingly viewed as essential instruments for mitigating these long-standing disparities. Central to the efficacy of these technologies is the underlying financial mechanism: the adoption of digital payments. By digitalizing the exchange of value between patients, providers, and insurers, healthcare systems can enhance transparency, reduce operational friction, and facilitate more equitable access to services.

In rural environments, the traditional "hub-and-spoke" model of healthcare—where remote clinics serve as spokes to urban tertiary care centers—has often struggled with timely access and high transactional costs. Digital payment systems serve as a critical bridge in this model, allowing for the seamless transfer of funds for teleconsultations,

prescriptions, and follow-up care without the necessity of physical travel. The COVID-19 pandemic acted as a definitive external shock that accelerated this movement, as governments and healthcare facilities globally implemented contactless, real-time payments as a vital public health measure to reduce virus transmission. This shift is not merely a technical upgrade but represents a fundamental reimagining of the healthcare value chain, where financial inclusion and health access are recognized as deeply interconnected goals.

Despite these clear potential benefits, the adoption of digital payments in rural healthcare is not uniform. A significant "digital advanced use divide" persists, where rural hospitals and providers often lag behind their urban counterparts in integrating sophisticated financial and data exchange functionalities. While urban healthcare facilities often benefit from robust broadband connectivity and a more digitally literate patient base, rural systems are frequently "forgotten" in the rapid rush toward digitalization, leading to unintended inequities. Understanding the nuanced drivers and barriers to this adoption is therefore essential for healthcare managers and policymakers who seek to build resilient, sustainable, and inclusive healthcare systems.

Theoretical Foundations of Technology Acceptance

To analyze the adoption of digital payments in rural healthcare, researchers have employed a variety of theoretical frameworks that seek to explain human behavior and organizational change. These models provide a lens through which we can understand why some rural communities embrace digital innovation while others remain resistant.

Individual-Level Acceptance Models

The Technology Acceptance Model (TAM) suggests that an individual's intention to use a new technology is primarily determined by its perceived usefulness and perceived ease of use. In the context of rural clinics, if a digital payment application is perceived as complex or unreliable, patients and staff are likely to revert to cash-based transactions despite the logistical challenges involved. The Unified Theory of Acceptance and Use of Technology (UTAUT2) expand upon this by incorporating social influence, facilitating conditions, and hedonic motivation. In rural settings, where communal and familial bonds are often tighter than in urban centers, the influence of social actors—such as family members, peers, and local opinion leaders—cannot be overstated. If a village elder or a trusted community health worker endorses a digital "health wallet," the perceived trust in that technology increases significantly, overcoming initial skepticism.

Behavioral and Psychological Frameworks

The COM-B model provides a critical psychological framework for understanding behavior change in digital health. Behavior is seen as a result of the interaction between Capability, Opportunity, and Motivation. Capability includes psychological factors like digital literacy and physical factors such as age-related manual dexterity or visual impairment. Opportunity refers to external factors, including physical opportunity (e.g., broadband access, device ownership) and social opportunity (e.g., support from "link workers" or family members). Motivation encompasses reflective processes, like understanding health benefits, and automatic processes, such as fear of fraud or mistrust of digital systems. By identifying specific barriers within these three domains, healthcare managers can focus digital interventions where they are most needed, such as implementing training sessions to boost capability or providing mobile agents to enhance opportunity.

Organizational and Environmental Context

The Technology-Organization-Environment (TOE) framework categorizes adoption into three distinct domains that influence how organizations absorb new systems. The technological context includes the characteristics of the innovation itself, such as relative advantage, compatibility with existing workflows, and complexity. The organizational context considers the firm's characteristics, including size, resource availability, and the degree of leadership commitment to digital transformation. Finally, the environmental context involves industry structure, the availability of technology service providers, and the regulatory environment, such as government mandates or privacy laws. For rural hospitals, the environmental context is often the primary constraint, as a lack of nearby technical consultants or consultants can retard innovation even if the hospital management is willing to invest.

Drivers and Facilitators of Digital Payment Integration

The adoption of digital payments in rural healthcare is driven by a powerful confluence of economic, logistical, and systemic factors.

Cost and Travel Mitigation

One of the most immediate drivers is the reduction of geographic barriers. For patients in remote areas, the cost of accessing healthcare is not limited to medical fees but includes substantial expenses for transportation and the opportunity cost of lost working hours. Digital payment systems, integrated with telemedicine, allow for the completion of health-seeking cycles—from consultation to payment and e-prescription—entirely within the patient's local community. This is particularly critical in regions with fragmented road infrastructure, where "catastrophic health expenditures" often drive families into poverty. Telemedicine can be a "great equalizer" in this regard, but its success is predicated on billing and reimbursement policies being consistent across insurance programs.

Financial Inclusion and Economic Empowerment

Digital payments act as a significant catalyst for financial inclusion. In many developing economies, digital financial services (DFS) for healthcare allow unbanked or underbanked populations to access formal credit, insurance, and savings products. Mobile money platforms, such as Kenya's M-PESA, have paved the way for dedicated healthcare wallets like M-TIBA, which allow users to save specifically for medical needs, receive remittances from relatives for healthcare costs, and enroll in national health insurance schemes. By digitalizing payments, users can build verifiable financial histories that enable access to formal credit and insurance markets, which helps them manage income more effectively and reduces the risk associated with cash handling.

Enhanced Transparency and Operational Efficiency

At the organizational level, digital payments improve the efficiency and effectiveness of rural healthcare facilities. Automated billing and payment verification reduce the administrative burden on clinical staff, who are often already overextended due to workforce shortages. For hospital management, the real-time data generated by these systems allow for better monitoring of patient flows and disease burden. Automation is positively associated with capacity and manpower productivity in hospitals, helping to mitigate the challenges of understaffed rural workforces. Furthermore, high-quality medical insurance data helps to minimize unneeded tests and treatments, maximizing savings at the national level.

Multidimensional Barriers and Resistance Factors

While the drivers of digital payment adoption are compelling, the practical implementation in rural areas faces a formidable set of barriers.

Technical and Infrastructural Deficits

Many rural regions continue to suffer from poor broadband connectivity and limited access to the electricity required to power digital devices. Without a stable "backbone," digital payment platforms become unreliable, leading to a loss of user confidence and a return to cash-based methods. Furthermore, the lack of interoperability between different healthcare IT systems creates "data silos," where payment

information cannot be easily integrated with patient health records, complicating the billing process and frustrating providers. In the United States, rural hospitals often lag behind urban ones in adopting advanced functions like health information exchange (HIE).

Cognitive and Human Capability Factors

Human-level barriers are equally significant and often revolve around digital literacy and trust. Older adults often face physical and cognitive challenges—such as age-related visual impairment or manual dexterity—that make interacting with smartphone interfaces difficult. Lower educational attainment in rural areas also correlates with reduced digital literacy, leading to "early difficulties" with the technology that can result in permanent abandonment. Furthermore, a lack of familiarity with digital tools among healthcare professionals (HCPs) can contribute to reduced confidence and slower adoption across the entire facility.

Psychological Resistance and Motivation

Trust is the bedrock of any financial system. Many rural users harbor deep-seated concerns about the security of their financial and medical data, fearing cybersecurity breaches, fraud, and the "impersonalization" of care. For some users, technology acts as a distressing reminder of illness, which further reduces motivation to engage with digital health tools. In some rural communities, there is also a high satisfaction with traditional face-to-face care, which can paradoxically act as a barrier to adopting digital alternatives that are perceived as less personal.

Organizational and Regulatory Hurdles

Organizational resistance is often driven by the added administrative burden that new digital tools can impose if they are not well-integrated into clinical workflows. Healthcare professionals have reported that digital initiatives often focus on "checkbox-driven documentation" to meet reporting requirements rather than improving patient outcomes. Additionally, workforce constraints, such as staff shortages and outdated equipment, prevent many rural facilities from achieving "Meaningful Use" of their digital systems.

Case Studies: Global Implementation and Lessons Learned

Sub-Saharan Africa: The M-TIBA Ecosystem in Kenya

M-TIBA serves as the definitive model for a digital "health wallet" connecting patients, providers, and payers. It manages healthcare transactions by linking real-time information into a transparent digital pool, allowing patients to save, pay premiums, or receive subsidies. In Kisumu County, M-TIBA data revealed that malaria treatments accounted for 30.1% of visits, and identified significant over-prescription of antibiotics without corresponding diagnoses. This transparency allows county health managers to identify inefficiencies, such as patients visiting higher-level facilities for ailments that could be treated at primary care levels, thereby optimizing the "gatekeeper" function.

Southeast Asia: Indonesia and the Blueprint 2025

Indonesia's "Payment System Blueprint 2025" ^[19] established an instant payment infrastructure creating opportunities for fintech innovation. With over 222 million participants in the national health insurance scheme (JKN), the government is steering the country toward a future

where high-quality healthcare is accessible via digital platforms.⁰ This push is critical given Indonesia's shortage of health workers (0.4 doctors per 1000 population), making telemedicine an essential supplement for a growing base of 32 million active telehealth users.⁰

East Asia: China's Rural Digital Divide

China has implemented a medical payment framework that supports a "total budget for normal growth" and disease category points to guide rational treatment. These reforms aim to optimize hospital management through sophisticated operational management costs and pressures. However, even with high overall adoption, rural physicians have significantly lower odds of adopting certified EHRs than their urban counterparts. Future research in China is focusing on "health insurance literacy" and leveraging cultural values like collectivism to increase trust in digital fintech services.¹

India: Public-Private Partnerships

Public-private partnerships (PPP) in India have emerged as a pivotal model for universal healthcare, successfully deploying technology-enabled remote healthcare (TeRHC) to reach isolated communities. In rural areas like Uttar Pradesh and Madhya Pradesh, facilitating conditions such as mobile phone access and training significantly influence women's intention to adopt digital payments. However, social influence remains the primary driver of attitude, suggesting that perceptions of digital payments are heavily shaped by community norms and familial expectations.

Managerial Implications for Healthcare Administrators Operational Redesign and Leadership

"Digital tools do not become effective simply by existing"; they require operational redesign and an honest understanding of the digital maturity of the patients served. Hospital administrators should prioritize investment in automation and telehealth to realize immediate operational gains.³ Success depends less on the software itself and more on leadership alignment, training, and measurable outcomes.

Training and Capacity Building

Addressing the capability barrier requires a commitment to ongoing, locally delivered, and culturally tailored training programs. For healthcare professionals, a lack of dedicated training contributes to reduced confidence and slower adoption. Providing targeted support and materials can enhance digital readiness and build confidence among both clinicians and patients.

Building Institutional Trust and Security

Trust indicators, such as a national cybersecurity commitment and system performance, are prominent factors in shaping user perception. Healthcare managers must strengthen data-driven planning and prioritize financial accuracy to ensure sustainable drug availability and service continuity. Transparency regarding how data is used, stored, and deleted is critical to overcoming the "lack of transparency" that slows adoption in primary care.

Strategic Resource Allocation and Funding

Rural medical centers often face financial pressure and a lack of analytic resources, limiting their ability to localize or train their own AI models.⁵ Managers should utilize advanced and prospective payments provided under value-

based care initiatives to fund IT infrastructure upgrades. Performance-based contracting can also help ensure that vendors are held accountable by tying payments to measurable outcomes.⁶

Policy Recommendations and Regulatory Frameworks

- **Standardized Interoperability:** Policies must mandate international standards for the exchange of healthcare and financial information (such as HL7 FHIR) to ensure seamless delivery across different providers.
- **Broadband as a Priority:** Expanding affordable broadband coverage and education is essential to ensure access to telemedicine and digital payment services in rural areas.
- **Reimbursement Reform:** Billing, reimbursement, and licensing policies must be "friendly" to virtual care usage and consistent across states and insurance programs.
- **Equity-Driven Infrastructure:** Policy frameworks should focus on building equity-driven data infrastructure that integrates social determinants of health (SDOH) screening into clinical workflows.
- **Dynamic Grouping Mechanisms:** For payment reforms, expert committees should be established to regularly review and adjust disease groupings (like DIP or DRG) to optimize the rationality of clinical groupings.

Future Frontiers: AI and Blockchain

Blockchain and Smart Contracts

Blockchain smart contracts are process-oriented disruptive technologies that can successfully replace traditional business processes. They have improved patient outcomes and increased efficiency by enhancing the management of medical sensors in telehealth and providing remote access to quality professionals while reducing travel costs. Despite these benefits, patients may still perceive them as risky, necessitating further research into building trust in blockchain-based systems.

Artificial Intelligence in Rural Settings

Common rural AI use cases include ambient scribes to document appointments and billing automation within EHRs. AI models can also target resource allocation and distribution in underserved areas. However, the "data sparsity" of rural sites means that applying AI models from urban academic centers alone may not provide sustainable or equitable access, highlighting a need for rural-specific validation studies^[5].

Conclusions

The adoption of digital payment systems in rural healthcare is a multi-faceted management challenge that sits at the intersection of finance, technology, and social equity. While the drivers—ranging from financial inclusion and cost mitigation to enhanced transparency—are powerful, the path is obstructed by persistent barriers in infrastructure, literacy, and trust. The evidence from global case studies demonstrates that integrated digital health platforms can significantly improve system efficiency and patient outcomes when they are built on trusted backbones and integrated with national health priorities.

For rural healthcare managers, the strategic priority must shift from technology acquisition to workflow and community integration. This requires a leadership style that

values co-design, prioritizes human-centered training, and recognizes the critical role of institutional trust. Policymakers, in turn, must provide the regulatory and infrastructural support necessary to bridge the urban-rural digital divide. Ultimately, the success of these innovations will be measured by their ability to provide equitable, sustainable, and high-quality care to the world's most vulnerable populations, ensuring that geography is no longer a barrier to health.

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