Review Article

Impact of Digital Health Interventions on Medication Adherence in Chronic Diseases: A Review in the Indian Context

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ABSTRACT

India faces a rising burden of chronic diseases, making medication adherence crucial for better health outcomes. Digital health interventions (DHIs) – such as mobile apps, SMS reminders, and telemedicine – offer promising approaches to support adherence, aligning with national initiatives like the Ayushman Bharat Digital Mission (ABDM). This review examined studies in the Indian context evaluating DHIs for chronic disease medication adherence. The included literature indicates that mobile tools and telehealth can enhance patient engagement and adherence but also reveals persistent challenges. Key themes identified include improved adherence through smartphone and SMS-based tools, which are contrasted with barriers such as limited digital literacy, a fragmented digital health landscape, and ethical concerns (including privacy and equity). The findings underscore the need for integrated policy efforts and practice guidelines to scale effective DHIs and address these challenges, informing better adherence and chronic disease outcomes.

Keywords: Digital health, mHealth, medication adherence, chronic diseases, India.

INTRODUCTION

India is witnessing a sharp and concerning rise in non-communicable diseases (NCDs), which now account for nearly two-thirds of all deaths nationally. Chronic conditions such as type 2 diabetes, hypertension, cardiovascular diseases (CVDs), and chronic respiratory disorders not only result in significant morbidity and mortality but also impose a dual clinical and economic burden on individuals and the healthcare system. According to the World Health Organisation, NCDs are responsible for approximately 74% of global deaths, with low- and middle-income countries like India facing a disproportionately high share[1]. The India: Health of the Nation's States report noted that the contribution of NCDs to the total disease burden in India increased from 30% in 1990 to over 55% by 2016[2]. In the Indian context, the burden of chronic diseases... has risen sharply, accounting for nearly 65% of total deaths in recent years[2].

A critical aspect of chronic disease management is medication adherence, defined as the extent to which patients take medications as prescribed. Non-adherence—whether due to skipping doses, failing to refill prescriptions, or discontinuing treatment prematurely—compromises therapeutic outcomes, elevates the risk of complications, and drives up healthcare costs. Indian studies report that only one-third to half of patients with diabetes or hypertension consistently adhere to medication regimens[3,4]. Contributing factors include limited access to care, low health literacy, socioeconomic constraints, and fragmented healthcare delivery[7,21].

In response, Digital Health Interventions (DHIs)... have emerged as scalable tools for enhancing medication adherence. The advent of India's digital transformation, powered by the Ayushman Bharat Digital Mission (ABDM), has further accelerated the potential for technology-enabled chronic care through national digital health registries, ABHA-linked prescriptions, and Unified Health Interfaces[6].

Emerging studies suggest that DHIs can improve adherence rates and self-management behaviour across both rural and urban Indian settings. Interventions such as SMS alerts, reminder apps, and community health worker integration have shown significant improvements in medication compliance, particularly for diabetes and hypertension patients[8,10]. However, the digital divide, low digital literacy, lack of evaluation frameworks, and ethical concerns about privacy and equity continue to pose substantial challenges to scale and sustainability[7,21].

However, existing reviews have either generalised across LMICs (Low- and Middle-Income Countries) or lacked systematic appraisal within the Indian digital health landscape.[33,8] To address this gap, we conducted a review of peer-reviewed literature evaluating the impact of digital health interventions on medication adherence among patients with chronic diseases in India. This review seeks to synthesize current peer-reviewed evidence, evaluate the types of interventions employed, and identify gaps and best practices that can guide clinical decision-making and policy reforms. It evaluates the types of DHIs employed, assesses their effectiveness, and identifies the barriers and facilitators of implementation. Furthermore, it explores alignment with national policies like ABDM to inform clinical strategies and digital health policymaking.

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India's Digital Health Journey

India's journey toward digital health transformation has evolved rapidly over the last two decades. It began with isolated SMS-based reminders and localized telemedicine pilots in the early 2000s. Over time, the growth of mobile penetration, Aadhaar-linked authentication, and cloud-based platforms enabled more structured digital interventions for public health[6,19].

A major inflection point came during the COVID-19 pandemic, which catalysed national adoption of teleconsultation (e.g., via eSanjeevani) and digital prescriptions. Recognizing the need for integrated care, the Ayushman Bharat Digital Mission (ABDM) was launched in 2021 by the National Health Authority (NHA) to establish a federated digital health infrastructure across India [6,20]. This includes core tools such as:

- **ABHA (Ayushman Bharat Health Account)** – a unique 14-digit digital ID enabling lifelong continuity of care
- **Healthcare Professionals Registry (HPR)** and **Health Facility Registry (HFR)** – comprehensive directories of verified practitioners and institutions
- **Personal Health Records (PHR)** – citizen-owned digital health data accessible via smartphones or online portals

Built with open APIs and privacy-preserving architecture, ABDM supports seamless interoperability between government, private, and public–private platforms and AI-driven alerts for adherence monitoring[6]. As of 2025, over 500 million ABHA IDs have been issued, and 80,000+ health facilities have been integrated into the system, along with growing adoption of Digi Doctor for e-prescriptions and digital referrals[23–25].

States such as Kerala, Tamil Nadu, and Maharashtra have adopted and localised these tools to monitor chronic disease care through mobile apps, digital refills, and adherence tracking via community health workers. India has also leveraged open-source platforms (e.g., DHIS2: *District Health Information Software 2*, OpenMRS: *Open Medical Record System)* to support disease registries and monitoring dashboards, TB (tuberculosis)surveillance[17,25].

This rapidly evolving ecosystem provides a robust infrastructure for implementing Digital Health Interventions (DHIs) in chronic disease management, particularly for improving medication adherence, which remains a major challenge in India's non-communicable disease (NCD) care continuum.[19,36]

METHODS

This review adopts a narrative synthesis approach. Articles were sourced from PubMed, Scopus, DOAJ, ScienceDirect, Google Scholar, and Indian government portals. Studies published in English between January 2019 and July 2025 were considered. Search terms included combinations like "digital health," "mHealth," "medication adherence," "chronic diseases," and "India."

Out of 183 retrieved articles, 48 were shortlisted after screening titles, abstracts, and full texts. Studies were categorised thematically into five digital intervention domains: mHealth, SMS reminders, telemedicine, smart monitoring tools, and national programs, such as ABDM. This review included studies conducted in or focused on the Indian context, specifically those evaluating digital interventions—such as mobile apps, SMS reminders, or telehealth—aimed at improving medication adherence in chronic diseases. Peer-reviewed articles, trials, policy papers, and reports were considered. Studies were excluded if they lacked Indian relevance, did not address adherence or digital components, or focused solely on acute care or infectious diseases. Editorials, opinion pieces, and letters to the editor were also excluded.

Data from the selected studies were extracted based on study type, setting, target population, disease focus, digital health modality (e.g., SMS, app, teleconsultation), and reported impact on medication adherence, including key outcomes and barriers. A thematic synthesis approach grouped the findings into five categories: mobile health applications, SMS/reminder systems, telemedicine, smart monitoring tools, and national digital health programs. This method enabled a structured analysis despite the diversity of study designs and technologies.

Thematic Evidence on Digital Health Interventions and Medication Adherence in India

1. Mobile Health Applications (mHealth) and Adherence Support

Mobile apps have become valuable tools for managing chronic diseases, offering reminders, educational resources, and tracking features. Studies report improved adherence among users, particularly those managing type 2 diabetes and hypertension[27,11]. However, low eHealth literacy among older adults, especially in rural India, remains a significant barrier[7].

2. SMS-Based Reminders and Communication Interventions

SMS interventions are cost-effective and scalable, with evidence from Kerala showing improved adherence to cardiovascular medications when SMS was paired with community health worker support[34]. Personalized and vernacular messages improved engagement, but issues like infrastructure gaps, message fatigue, and lack of interactivity hinder sustainability.

3. Telemedicine and Virtual Consultations

Telemedicine usage surged during the COVID-19 pandemic, with platforms like eSanjeevani enhancing care continuity and adherence in underserved areas[8]. Patients reported improved access and ease of prescription refills. However, fragmented platforms and digital exclusion, particularly in tribal and rural communities, limit the full potential.

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4. Digital Adherence Monitoring Tools and Smart Devices

Smart devices such as pillboxes, glucometers, and BP monitors allow real-time monitoring and provider alerts. One study highlighted that integrating these tools with behavioral nudges improved adherence among patients with diabetes and hypertension[10]. Yet, cost, device maintenance, and poor interoperability reduce scalability.

The above findings are summarised in Figure 1 and findings like Summary of Included Studies on Digital Health Interventions and Medication Adherence in India(Table 1), "Regional Adoption of DHIs Supporting Medication Adherence in Chronic Disease Management"(Table 1) are summarised in these tables and discussed in later sections.

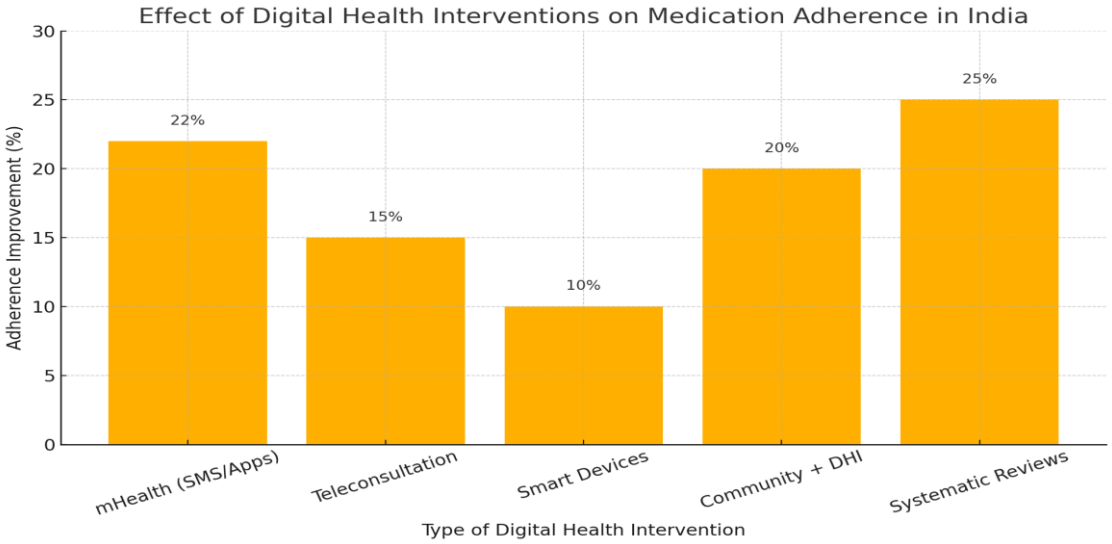

Figure 1: Bar chart illustrating the Effect of Digital Health Interventions on Medication Adherence in India.

Table 1: Summary of Included Studies on Digital Health Interventions and Medication Adherence in India

Study (Author, Year)	Intervention Type	Disease Focus	Adherence Measurement	Reported Impact
Sahoo et al., 2022	mHealth Apps	Type 2 Diabetes	MMAS-8	18–22% improvement in adherence
Joha et al., 2025	mHealth Apps	Type 2 Diabetes	MMAS-8	Similar adherence improvement
Amin et al., 2025	mHealth Apps	Chronic Diseases	Adherence Score	Higher scores in users vs non-users
Huda et al., 2025	Smart Devices + mHealth	Diabetes, Hypertension	Behavioral metrics	10–12% improvement
Patel et al., 2025	SMS Reminder Apps	Diabetes	App feedback	Improved compliance
Jose et al., 2025	Adherence Tool Development	NCDs	Digital scale validation	Tool proposed
Rasekaba et al., 2022	Digital Literacy Assessment	Older adults (rural)	Survey	Low eHealth literacy
Menon et al., 2024	SMS + CHW Protocol	Cardiovascular	Planned RCT	Scalable trial protocol
Narayan et al., 2024	ABDM Policy Analysis	Chronic Disease	Framework synthesis	Platform readiness
Jain, 2023	Ethical Review	N/A	Legal critique	Gaps in consent & accountability
Pal et al., 2023	Systematic Review	Multiple NCDs	Meta-analysis	Pooled 63% adherence
Joshi et al., 2023	Systematic Review	Chronic Diseases	Meta-analysis	10–25% improvement
Verma et al., 2025	mHealth Tools	COPD	App adherence tracking	Better compliance
Asif & Gaur, 2025	Telemedicine	General	Remote care engagement	Increased continuity
Kumaragurubaran et al., 2024	Teleconsultation App	Hypertension	Follow-up adherence	Positive outcome
Santra et al., 2024	Scoping Review	Chronic Disease	Qualitative summary	Highlighted digital gaps
Bairwa et al., 2022	Review	General NCDs	Review synthesis	Mixed results
Backes et al., 2021	TB mHealth App	Tuberculosis	App logs	Improved reminder-based adherence

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Hassan & Davies, 2024	eHealth Overview	COVID era	Observational	Boosted digital uptake
Rana et al., 2023	EHR Integration	Chronic Care	Policy analysis	Reduced fragmentation
Zarei et al., 2024	KAP Checklist	N/A	Tool creation	Checklist proposed
Gupta et al., 2023	Survey	NCDs	Survey response	Positive attitude, low practice
Mahapatro et al., 2024	Program Evaluation	NHPs	Utilization	Regional impact noted
Kumar et al., 2021	Pilot DHI Study	Diabetes	Pre-post data	Preliminary increase in adherence
Yadav et al., 2022	Cross-Sectional Survey	Hypertension	MMAS-8	44% consistent adherence

Table 2: Regional Adoption of DHIs Supporting Medication Adherence in Chronic Disease Management

State/ Region	Digital Intervention (Type)	Sector	How It Affected Medication Adherence	Measured Outcomes / Adherence Metrics
Tamil Nadu	*"Digisahayam" Assisted Telemedicine* (Telemedicine platform with EHR and decision support)	Public (Pilot)	**Indirect:** Nurse-assisted teleconsultations improved follow-up for diabetes and hypertension, bridging access gaps in rural clinics. Digital records and clinical decision support ensured patients received consistent care and follow-ups.	Significant improvement in chronic markers over 9 months: average fasting blood sugar reduced by ~33 mg/dL in diabetes patients, and systolic/diastolic BP decreased by ~9.6/5.5 mmHg in hypertensives ($p<0.0001$). New diagnoses were made for many patients (43% of diabetics; 75% of hypertensives), indicating better screening and initiation of therapy[44].
Punjab, Kerala, MP, Maharashtra, Telangana	*India Hypertension Control Initiative (IHCI)* (Digital patient tracking system & tele-follow ups for hypertension)	Public (Government + Partners)	**Indirect:** Implemented a digital registry and follow-up system in public clinics. Regular tracking of patients' BP readings and automated reminders for visits ensured medication pick-ups and continued treatment. Reliable drug supply and standardized protocols under IHCI further supported adherence.	Among ~570,000 patients enrolled, only 11% had no follow-up visit in the past year (indicating high retention/adherence). Clinic-level blood pressure control rates reached ~43% on average by early 2020. The proportion of hypertensive patients under control in the population tripled (from ~1.4% to 5.0%) after IHCI's implementation, demonstrating improved long-term adherence and outcomes[45,46].
New Delhi (Pan-India)	*BeatO Diabetes Care Program* (Mobile app with connected glucometer, tele-coaching)	Private	**Direct:** The app provides real-time blood glucose monitoring, medication reminders, and on-demand expert coaching. These features encourage patients to take medications on time, adjust lifestyle, and promptly address high readings, directly boosting adherence and self-management.	A 2023 clinical study (721 participants) showed a **mean HbA1c reduction of 2.16%** in just 3 months of using the BeatO digital program (from baseline ~8.5% down to ~6.3%, $p<0.0001$). Users also saw significant drops in fasting glucose (~38 mg/dL) and post-prandial glucose (~37 mg/dL), along with modest weight loss. These improvements reflect better medication adherence and glycemic control through the app's intervention[46].
Multi-site (29 centers across India)	*Accu-Chek "mySugr" App + Glucose Meter* (Mobile self-management app linked with Bluetooth glucometer)	Private (Public-Private study)	**Direct:** Integrated digital logbook and reminder system. The mySugr app encourages frequent blood sugar monitoring and provides feedback, which motivates patients to adhere to insulin/oral medications and lifestyle advice. The gamified tracking and alerts indirectly reinforce daily medication routines.	In a 2025 real-world study with 111 diabetes patients across India, **mean HbA1c dropped from 8.8% to 7.5%** after 3 months of app usage (≈1.3% absolute reduction, $p<0.0001$). Patients who monitored glucose ≥6 times per week achieved larger HbA1c improvements (−1.5%) than those monitoring less frequently (−1.0%), indicating that the app's frequent reminders and data tracking correlated with better adherence and glycemic outcomes[47].

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DISCUSSION

This narrative review synthesizes recent Indian evidence on the role of digital health interventions (DHIs) in improving medication adherence among patients with chronic diseases. The findings highlight that tools such as mobile health (mHealth) apps, SMS-based reminders, teleconsultations, and national digital platforms like ABDM show considerable promise in addressing the longstanding issue of poor treatment compliance.(Figure-1)

India's escalating burden of non-communicable diseases (NCDs)—notably diabetes and hypertension—has outpaced traditional healthcare delivery, especially in rural and low-resource regions. In this setting, DHIs offer scalable, cost-effective solutions that support continuity of care and patient self-management. Studies by Huda et al. and Patel et al. confirm that mobile apps and SMS reminders significantly improve adherence by delivering structured prompts and ongoing education[10,27]. (Table 1)

However, the effectiveness of these technologies is highly context-dependent. Socioeconomic status, digital literacy, and user engagement significantly influence adoption and sustained use. Rasekaba et al. reported that elderly populations in rural India struggle with basic digital navigation required for mHealth and teleconsultation platforms[7]. Additionally, Jose et al. emphasized the need for culturally appropriate and linguistically adapted adherence measurement tools for digital environments[35].(Table 1)

Crucially, digital tools work best when complemented by human support systems. For instance, Menon et al.'s trial combining SMS reminders with community health worker (CHW) engagement demonstrated superior adherence outcomes compared to standalone interventions[34]. Similarly, the success of large-scale initiatives like ABDM hinges on seamless platform interoperability, privacy safeguards, and public trust[13,21].(Table 1)

Despite their potential, gaps remain. There is a need for: More randomized controlled trials (RCTs) and longitudinal studies to assess the clinical impact of DHIs, and Economic evaluations to assess scalability in low-resource settings. Ethical frameworks that ensure safe and equitable deployment, especially among vulnerable populations.

Ultimately, the future of DHIs in India rests not only on technological advancements but on inclusive design, supportive policies, and a digitally prepared health system.

Challenges and Implementation Barriers

Despite the growing adoption of digital health interventions (DHIs) in India, several challenges hinder their equitable implementation. These include technological limitations, regulatory gaps, and social inequities.

1. Digital Literacy and Access

The digital divide between urban and rural India remains a major obstacle. Although smartphone penetration is rising, access to devices, reliable internet, and digital literacy remains low, especially among older adults and marginalized populations[19]. A cross-sectional study reported that low education and income levels significantly affect digital readiness and health engagement[7]. Without targeted digital inclusion strategies, DHIs risk widening existing healthcare disparities. (Table 2)

2. Fragmentation and Standardization

India's digital health space is highly fragmented, with multiple platforms operating in silos. The absence of uniform data formats and interoperability hinders scaling and integration. A 2023 report emphasized the urgent need for national standards to ensure data portability and system certification across sectors[15]. Without harmonisation, patient continuity and provider confidence may be compromised. (Table 2)

3. Legal and Ethical Concerns

India lacks a comprehensive legal framework for digital health. Issues such as patient consent, data privacy, liability in automated alerts, and ethical use of sensitive data are inadequately addressed. Experts have raised concerns about autonomy and accountability in the absence of a national health data protection law[21]. Studies by Jain and Sood also highlight the importance of consent and ethical safeguards in data-driven interventions[16,17].

Role of ABDM in Medication Adherence

The Ayushman Bharat Digital Mission (ABDM) is India's central strategy to digitize health infrastructure. With over 680 million ABHA IDs and 3 billion digital health records issued[2], ABDM provides the digital backbone for adherence-based interventions. Its features include:

- E-prescription-linked reminders
- Refill tracking systems
- Patient dashboards for chronic disease milestones
- Alerts for missed doses or adverse events
- API (Application Programming Interfaces)integration with mHealth apps[6]

ABDM's sandbox environment also supports innovation by allowing startups to pilot adherence technologies securely. However, to maximise impact, digital literacy and provider training must be prioritized. State-level evidence from Kerala and Maharashtra shows that combining ABDM with CHW support and mHealth platforms can significantly improve chronic disease outcomes[3].

If leveraged appropriately, ABDM offers a national platform for deploying scalable and secure adherence tools across India's chronic care ecosystem. Despite the growing adoption and demonstrated potential of digital health interventions (DHIs) in improving medication adherence in India, several structural and systemic challenges hinder their widespread and equitable implementation. These barriers span technological, social, regulatory, and

However, effective utilisation of ABDM in adherence enhancement remains contingent on improving digital

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literacy, provider sensitisation, and interoperability between private and public healthcare facilities. Evidence from states like Kerala and Maharashtra suggests that combining ABDM infrastructure with community health workers (CHWs) and mHealth platforms can significantly boost chronic disease management outcomes[3].

This comprehensive infrastructure provides a national platform for implementing scalable digital health interventions targeting chronic disease management and medication adherence.

CONCLUSION

Digital health interventions (DHIs), particularly mobile health (mHealth) apps, AI-enabled platforms, and teleconsultation services, have shown measurable effectiveness in improving medication adherence among patients with chronic conditions in India[1–5]. This review of studies conducted post-2019 highlights adherence improvements of 10% to 25% across diseases such as diabetes, hypertension, COPD, and cardiovascular disorders[2–7].

India's digital health evolution has progressed from early SMS-based interventions to robust national platforms like the Ayushman Bharat Digital Mission (ABDM), eSanjeevani, and CDAC's EHR systems[11–14,23–25]. With built-in interoperability through ABHA, PHR, HPR, and HFR, and adoption at scale (over 500 million health IDs and 80,000 facilities), ABDM provides a strong foundation for AI-based alerts, e-prescription monitoring, and app-based engagement.

The pandemic catalysed this transition from fragmented digital pilots to an integrated, patient-centric ecosystem[8,11–14]. This presents a unique opportunity to embed adherence tools directly into routine clinical workflows and national programs.

However, key challenges persist. These include low digital literacy, lack of standardized adherence metrics, limited access in rural settings[7,15]and unresolved ethical issues around data privacy, consent, and algorithmic transparency[16–19]. Strengthening policy safeguards and enforcing regulatory oversight is critical to ensuring public trust and ethical deployment.

To maximize impact, a multi-pronged strategy is essential—emphasising user-centred design, ASHA **(Accredited Social Health Activist**) training, interoperability standards, and rigorous health technology assessments[20,21]. Scaling these interventions through India's expanding digital infrastructure could markedly enhance adherence and chronic disease outcomes while reducing long-term public health burden[13,22].

Priority future actions should include:

- Promoting interoperable, open-source DHI tools[26]
- Integrating AI(Artificial Intelligence)/ML(Machine Learning)for patient-level adherence monitoring[27]
- Embedding adherence tracking within primary care and ABDM workflows
- Strengthening the digital capacity of community health workers[21]

With the right blend of innovation, equity, and policy alignment, DHIs have the potential to transform chronic disease care and establish India as a global leader in digital health delivery.

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