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Review Article

Strengthening Primary Healthcare through Digital Health Services: Opportunities and Challenges in Urban India

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Abstract: Urban India is witnessing a rapid rise in non-communicable diseases, population density, and migration-related health vulnerabilities, placing unprecedented pressure on primary healthcare systems. Digital health services—ranging from telemedicine platforms like eSanjeevani and Ayushman Bharat Digital Mission (ABDM) tools to mHealth applications and AI-supported screening—have emerged as promising avenues to strengthen primary care delivery in cities. This review synthesises existing evidence on the opportunities these technologies offer for improving access, continuity of care, and efficiency in urban primary health centres (UPHCs), Mohalla Clinics, Basti Dawakhanas and similar models. It also examines persistent challenges including fragmented digital infrastructure, uneven interoperability, digital literacy gaps among providers and patients, data privacy concerns, and weak integration with existing referral systems. Drawing on published studies, government reports and implementation experiences, the paper highlights that while digital tools have expanded reach and reduced some access barriers, their impact remains constrained by system-level bottlenecks. Observations point to partial successes in assisted telemedicine and community health worker-supported models, yet sustainability and equity remain incomplete. The review concludes with future directions emphasising interoperable architecture, capacity building, hybrid care models, and stronger policy alignment to realise the full potential of digital health in urban primary care.

Keywords: Digital health, Primary healthcare, Urban India, Telemedicine, eSanjeevani, Ayushman Bharat Digital Mission, Health equity, Non-communicable diseases

1. Introduction

Primary healthcare forms the foundation of any effective health system. In India, the Alma-Ata vision of "Health for All" has guided successive policies, yet urban primary care has historically received less attention than its rural counterpart. Rapid urbanisation, the growth of informal settlements, and the rising burden of hypertension, diabetes, and other non-communicable diseases have exposed serious gaps in service delivery. Many urban residents, particularly those in low-income neighbourhoods, continue to bypass under-resourced primary facilities and crowd tertiary hospitals.

Digital health services have been positioned as a practical response to these pressures. Platforms such as eSanjeevani, the Ayushman Bharat Digital Mission (ABDM) with its unique health IDs (ABHA), electronic health records, and various mHealth applications aim to improve access, continuity, and efficiency. In urban settings, these tools interact with a diverse ecosystem that includes government UPHCs, municipal clinics (Mohalla Clinics in Delhi, Basti Dawakhanas in Hyderabad, Aapla Dawakhana in Mumbai), private providers, and community health workers.

This review examines how digital health services are currently being used to strengthen primary healthcare in urban India. It explores the opportunities they create, the challenges that limit their effectiveness, and the practical lessons emerging from recent implementations. The discussion is grounded in published literature, programme evaluations, and observed patterns rather than theoretical speculation.

2. Literature Review

The literature on digital health in Indian primary care has grown substantially since the COVID-19 pandemic accelerated telemedicine adoption. Studies range from scoping reviews of interventions for vulnerable populations to evaluations of specific platforms and urban clinic models. The following synthesis organises the evidence thematically and presents key studies in tabular form for clarity.

2.1 Scope and Nature of Digital Interventions

A scoping review examining digital health interventions for improving access to primary care among vulnerable groups in India identified seven distinct technological innovations. The most common were virtual tele-health systems and mHealth applications running on Android smartphones or tablets. These tools were tested mainly for maternal and child health, hypertension awareness, and general primary care outreach in both urban slums and rural pockets. The review concluded that digital interventions show promise when embedded within existing health systems and supported by frontline workers, but stressed the need for inclusive design and rigorous evaluation.

Another body of work focuses on assisted telemedicine models. The Digisahayam initiative, implemented in urban and rural areas of Tamil Nadu, combined electronic health records, point-of-care diagnostics, and clinical decision support. Over 2.4 years it served more than 11,000 patients, diagnosed many new cases of diabetes and hypertension, and demonstrated measurable reductions in blood sugar and blood pressure among retained patients. The model relied on trained facilitators rather than requiring patients to navigate technology independently, addressing literacy and device barriers.

2.2 Platform-Level Evidence: eSanjeevani and ABDM

eSanjeevani, India's national telemedicine service, has recorded hundreds of millions of consultations. Studies and programme reviews note its value in reducing travel and waiting times, particularly for specialist access. However, multiple analyses highlight operational shortcomings: inappropriate referrals, sparse clinical notes, long wait times for specialists, network failures, and limited continuity of care. Provider-side challenges include inconsistent doctor availability, inadequate training of community health officers, and insufficient integration with local medicine and diagnostic supply chains.

The Ayushman Bharat Digital Mission provides the architectural backbone through

unique health IDs, consent-based data sharing, and interoperable records. Viewpoint papers emphasise its potential for continuum of care in primary settings, yet ground-level reports repeatedly cite patchy infrastructure, limited digital literacy among health workers, and resistance to workflow changes as major constraints.

2.3 Urban Primary Care Models and Digital Integration

Critical appraisals of urban primary healthcare models (Mohalla Clinics, Basti Dawakhanas, Aapla Dawakhana, Namma Clinics, and others) reveal uneven digitalisation. Telangana's Basti Dawakhanas show relatively stronger linkage with digital platforms and eSanjeevani, while many Delhi Mohalla Clinics have introduced e-health cards with limited functionality. Most facilities still rely on manual registers or fragmented tools. Common gaps include absence of functional electronic medical records, poor diagnostic data capture, and weak referral linkages.

Community health worker-led, technology-enabled programmes targeting diabetes and hypertension among the urban poor have demonstrated feasibility in large metropolitan settings. Retention in the programme was strongly associated with better clinical outcomes, underscoring the importance of sustained engagement rather than one-time screening.

Table 1: Selected Studies on Digital Health Interventions in Indian Primary Care

Study / Source	Focus Area	Setting	Key Findings	Limitations Noted
Scoping review on DHIs for primary care access (PLOS Global Public Health, 2024)	Digital tools for vulnerable populations	Multiple Indian states (urban & rural)	Virtual tele-health and mHealth apps most common; positive for access when supported by workers	Small number of studies; limited rigorous outcome data
Digisahayam assisted telemedicine (BMC Primary Care, 2024)	Assisted telemedicine with EHR & diagnostics	Urban & rural Tamil Nadu	11,000+ patients; significant reductions in FBS & BP; high new diagnosis rates	Scaling challenges due to language & cultural diversity; ABDM non-compliance
Urban PHC models appraisal (IJCMPH, 2025)	Mohalla Clinics, Basti Dawakhanas, etc.	Delhi, Hyderabad, Mumbai, Karnataka, Rajasthan	Digitalisation uneven; some partial eSanjeevani links; infrastructure & HR gaps	Limited scalability; weak standardisation
CHW + technology for diabetes/hypertension (BMJ Open, 2021)	Community health worker-led NCD management	Large Indian metropolitan city	Feasible screening & management; outcomes better with retention	High drop-out; need for public system integration to reduce OOP costs
System-level barriers	Perspectives of	Jharkhand &	High ratings for ease of	Focused on

for CHOs using telemedicine (SN Comprehensive Clinical Medicine, 2025)	Community Health Officers	Tripura	use; barriers: doctor availability, wait times, stock-outs, network	rural-leaning states; urban applicability needs further study

Table 2: Opportunities and Challenges Identified across Literature

Dimension	Opportunities Highlighted	Challenges Highlighted
Access & Reach	Reduced travel & waiting; specialist access via telemedicine; community outreach in slums	Digital divide (literacy, devices, connectivity); preference for in-person care among some groups
Continuity of Care	ABHA IDs & interoperable records; follow-up tracking	Fragmented portals; lack of re-referral mechanisms; incomplete records
Efficiency & Quality	Clinical decision support; AI screening; standardised workflows	Inappropriate referrals; sparse clinical notes; medicine & investigation stock-outs
Equity	Potential to reach urban poor via assisted models	Benefits concentrated among digitally literate; gender & age disparities
System Integration	Alignment with Ayushman Bharat & NUHM	Siloed applications; weak governance; insufficient training & incentives

The literature consistently shows that technology alone does not solve primary care weaknesses. Success depends on human support, reliable infrastructure, supply chain readiness, and deliberate efforts to include the most marginalised urban residents.

2.4 Detailed Review of Key Empirical Studies

Several empirical studies provide concrete evidence on how digital health interventions function in Indian primary care settings, particularly with relevance to urban contexts. These studies move beyond descriptive accounts and offer measurable outcomes, implementation insights, and identified barriers.

One of the more rigorously documented assisted telemedicine models is the Digisahayam programme evaluated by Soni et al. (2024). Implemented across urban and rural sites in Tamil Nadu over 2.4 years, the model integrated electronic health records, point-of-care diagnostics, and clinical decision support under facilitated teleconsultation. A total of 11,388 patients (mean age 45 years, 59.3% female) accessed services, resulting in 26,998 consultations and 15,437 laboratory investigations. Among patients reporting chronic conditions, diabetes (61%) and hypertension (45%) were predominant. Notably, 43% of diabetes cases and 75.3% of hypertension cases were newly diagnosed through the programme. At nine-month follow-up, patients with diabetes showed a mean reduction of 33.0 mg/dL in fasting blood sugar (95% CI: −42.4 to −23.7, $p < 0.001$), while those with hypertension recorded reductions

of 9.6 mmHg in systolic and 5.5 mmHg in diastolic blood pressure (both $p < 0.0001$). The study concluded that facilitated (rather than purely patient-driven) telemedicine improved both access and clinical outcomes, though the platform's non-compliance with Ayushman Bharat Digital Mission standards limited broader interoperability [2].

A large-scale community health worker (CHW)-led intervention targeting the urban poor was examined by Jindal et al. (2021) in a major Indian metropolitan city. Using a technology-enabled private-sector model, CHWs conducted screening and monthly management visits for diabetes and hypertension, supported by a tablet-based application. The retrospective cohort analysis demonstrated that retention in the programme was strongly associated with clinical improvement. Adjusted mean reductions in fasting blood glucose ranged from −14.0 mg/dL to −27.9 mg/dL depending on retention duration. Systolic blood pressure reductions ranged from −2.7 mmHg to −7.1 mmHg, and diastolic reductions from −1.7 mmHg to −4.2 mmHg. While the model proved feasible for large-scale screening and long-term management, the authors noted high attrition and recommended closer integration with the public health system to reduce out-of-pocket expenditure and improve sustainability [4].

Platform-level performance of eSanjeevani has been scrutinised in multiple recent analyses. A mixed-methods study by researchers examining Community Health Officers (CHOs) in Jharkhand and Tripura (2025) found that CHOs rated the telemedicine platform highly for learnability (mean 4.2/5) and ease of use (mean 3.95/5). Overall performance was scored at 3.91. Qualitative data, however, revealed persistent system-level barriers: inconsistent specialist availability, prolonged wait times, medicine stock-outs, and poor network connectivity. Despite these constraints, CHOs valued the reduction in patient travel and improved access to qualified physicians. The authors emphasised that embedding telemedicine within broader health system strengthening—reliable doctor availability, robust supply chains, and continuous capacity building—was essential for sustained impact [5].

Implementation fidelity of multiple digital health interventions at the primary care level was assessed in a cross-sectional study conducted in Chandigarh (2025). Nine digital tools were evaluated, including eVIN, RCH portal, HMIS, HWC portal, CPHC-NCD, FP-LMIS, eSanjeevani, IDSP-IHIP, and CoWIN. eVIN and RCH portals showed relatively strong implementation (70–90% scores), while eSanjeevani scored in the moderate range (51–70%). Several other portals (HMIS, HWC, CPHC-NCD, FP-LMIS) performed poorly (25–50%). Help-desk and feedback features were almost unused by frontline workers (0–3.8% utilisation). The findings highlight that even when platforms exist, actual usage and data quality remain uneven, particularly for tools requiring sustained data entry beyond vertical programme reporting [14].

A systematic review by researchers examining mobile health (mHealth) interventions for hypertension and diabetes control in India (2025) synthesised evidence across multiple trials. mHealth tools, particularly SMS-based education and structured digital platforms, were associated with significant improvements in blood pressure, HbA1c, and fasting blood glucose compared with control groups. Treatment adherence and patient satisfaction also improved. One earlier cluster randomised trial cited in the review (Anchala et al., 2015) demonstrated that a clinical decision support system reduced systolic blood pressure by an average of 6.59 mmHg relative to conventional chart-based care in primary health centres. Collectively, these findings support the clinical utility of well-designed digital tools, while underscoring the need for sustained engagement strategies [12].

Urban primary care models themselves have been critically appraised. A 2025 review of evolving service delivery models—including Delhi's Mohalla Clinics, Hyderabad's Basti Dawakhanas, Mumbai's Aapla Dawakhana, Karnataka's Namma Clinics, and Rajasthan's Janta Clinics—found that digital integration remains highly uneven. Basti Dawakhanas demonstrated comparatively stronger linkage

with digital platforms and partial eSanjeevani connectivity, whereas most other models continued to rely on manual registers or fragmented tools. Common deficiencies included absence of functional electronic medical records, limited diagnostic data capture, and weak referral linkages. The authors recommended a harmonised urban primary healthcare strategy anchored in Indian Public Health Standards, dedicated human resource policies, and systematic digital health integration [3].

Taken together, these studies indicate that digital health interventions can deliver measurable gains in access, diagnosis, and intermediate clinical outcomes when supported by human facilitation, adequate supply chains, and sustained patient engagement. At the same time, they consistently reveal gaps in interoperability, specialist availability, data quality, and equity of reach—particularly for the urban poor and digitally less literate populations. The evidence base therefore supports cautious optimism tempered by the recognition that technology functions best as an enabler within a strengthened primary care system rather than as a standalone solution.

3. Observation

From the available evidence and programme reports, several practical patterns stand out in urban India.

First, assisted models outperform pure patient-facing digital tools. When community health workers or clinic staff handle the technology and facilitate the consultation, uptake and clinical outcomes improve, especially among older adults and those with limited literacy. Pure app-based solutions struggle with the same populations.

Table 3: Detailed Review of Key Empirical Studies on Digital Health in Indian Primary Care

Study / Authors (Year)	Focus / Intervention	Setting	Key Findings & Outcomes	Limitations / Notes
Soni et al. (2024) – Digisahayam assisted telemedicine	Assisted telemedicine with EHR, point-of-care diagnostics & clinical decision support	Urban & rural Tamil Nadu	11,388 patients; 26,998 consultations; 15,437 lab tests. 43% new diabetes & 75.3% new hypertension diagnoses. FBS ↓ 33.0 mg/dL; SBP ↓ 9.6 mmHg; DBP ↓ 5.5 mmHg at 9 months ($p < 0.001$).	Platform not ABDM-compliant; scaling challenges due to language & cultural diversity.
Jindal et al. (2021) – CHW-led technology model	Community Health Worker-led screening & monthly management of diabetes & hypertension using tablet app	Large Indian metropolitan city (urban poor)	Retention linked to better outcomes. FBS reduction −14.0 to −27.9 mg/dL; SBP −2.7 to −7.1 mmHg; DBP −1.7 to −4.2 mmHg (adjusted).	High attrition; recommended public-system integration to reduce OOP costs.
CHO telemedicine study (2025) – Jharkhand &	Perspectives of Community Health Officers using assisted	Jharkhand & Tripura (primary care)	Learnability 4.2/5; ease of use 3.95/5; overall performance 3.91/5. Valued reduced travel	Barriers: inconsistent doctor availability, long wait times, medicine stock-outs,

Tripura	telemedicine platform		& specialist access.	poor network.
Chandigarh DHI implementation study (2025)	Implementation status of 9 digital health interventions (eVIN, RCH, HMIS, eSanjeevani, CPHC-NCD, etc.)	Primary health care level, Chandigarh	eVIN & RCH: 70–90% implementation. eSanjeevani: 51–70%. HMIS, HWC, CPHC-NCD, FP-LMIS: 25–50%. Help-desk use 0–3.8%.	Uneven usage and data quality despite platform availability.
mHealth systematic review for HTN & DM (2025)	Mobile health interventions (SMS education, digital platforms, CDSS) for hypertension & diabetes control	Multiple Indian primary care settings	Significant improvements in BP, HbA1c & FBG vs controls. Better adherence & satisfaction. Anchala et al. (2015) CDSS: SBP ↓ 6.59 mmHg.	Need for sustained engagement strategies beyond short-term interventions.
Urban PHC models appraisal (IJCMPH, 2025)	Critical appraisal of Mohalla Clinics, Basti Dawakhanas, Aapla Dawakhana, Namma Clinics, Janta Clinics	Delhi, Hyderabad, Mumbai, Karnataka, Rajasthan	Digitalisation uneven. Basti Dawakhanas stronger digital linkage & partial eSanjeevani use. Most models still use manual registers.	Gaps: functional EMR, diagnostic data capture, referral linkages, HR norms, scalability.
Scoping review – DHIs for vulnerable populations (PLOS Global Public Health, 2024)	Digital health interventions improving access to primary care among vulnerable groups	Multiple Indian states (urban slums & rural)	7 technological innovations identified. Virtual tele-health systems & Android mHealth apps most common. Positive when supported by frontline workers.	Limited number of rigorous outcome studies; need for inclusive design & evaluation.

Note: Citations correspond to the reference list in the main review paper. FBS = Fasting Blood Sugar; SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; CDSS = Clinical Decision Support System; ABDM = Ayushman Bharat Digital Mission; OOP = Out-of-Pocket.

Second, digitalisation remains superficial in many urban primary facilities. Even where e-health cards or portals exist, functional electronic medical records, diagnostic integration, and seamless referral tracking are rare. Manual parallel systems continue, defeating the purpose of digitisation.

Third, specialist availability and medicine supply emerge as recurring bottlenecks. Teleconsultation platforms can generate

prescriptions, but patients often cannot obtain the recommended investigations or drugs at the primary level, forcing them back into the same access barriers the technology was meant to overcome.

Fourth, urban settings present distinct advantages and risks compared with rural areas. Higher smartphone penetration and denser specialist networks exist, yet informal settlements suffer from unreliable electricity, overcrowding of facilities, and high population mobility that disrupts longitudinal records. Smart-city health initiatives have improved services for some groups while leaving others behind when infrastructure and governance remain uneven.

Finally, provider motivation and workload matter. Community health officers and doctors frequently report additional administrative burden without commensurate incentives or technical support, leading to incomplete data entry and reluctance to fully engage with platforms.

These observations suggest that digital health is currently acting more as an add-on than as a transformative redesign of urban primary care.

4. Results and Discussion

The collective evidence indicates that digital health services have expanded the reach of primary care consultations and improved certain intermediate outcomes (new diagnoses, short-term risk factor control) in selected urban and peri-urban programmes. Platforms such as eSanjeevani have demonstrated scale, while assisted models like Digisahayam have shown clinical impact among retained patients. Urban clinic innovations that incorporate even partial digital tools report better visibility and some reduction in patient travel.

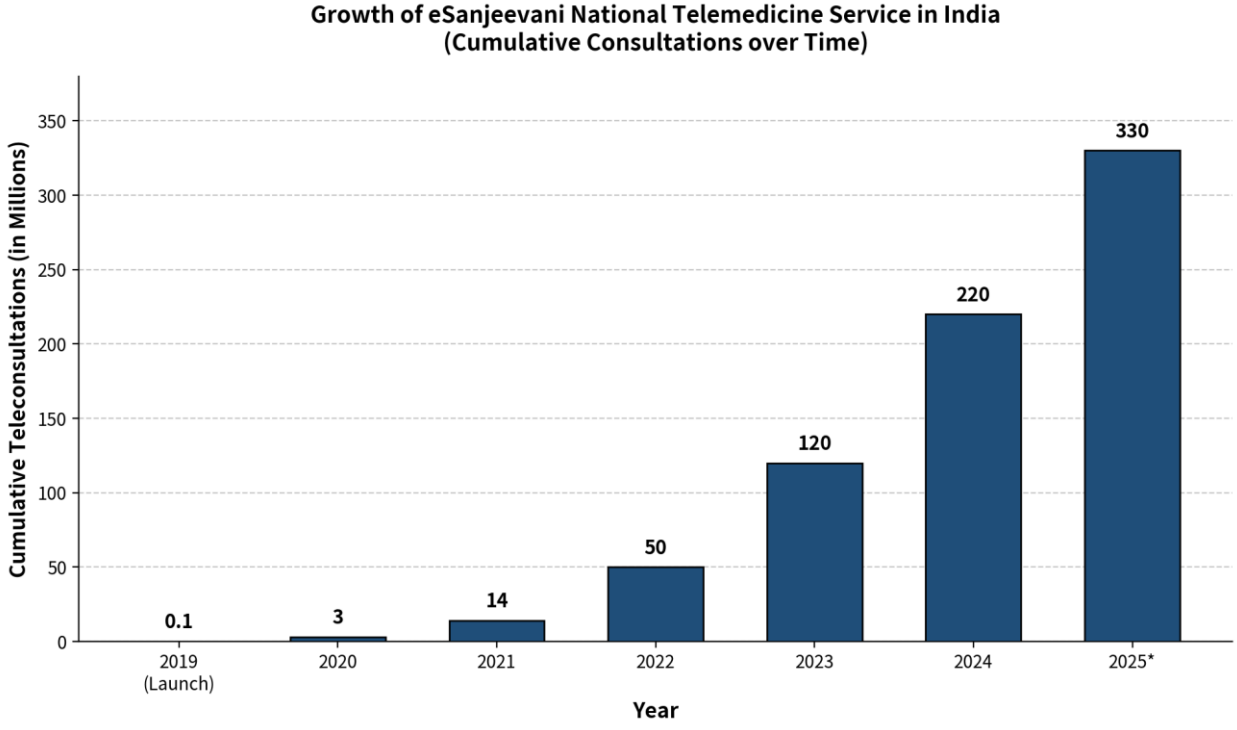

Figure 1: Growth trajectory of eSanjeevani, India's national telemedicine service, showing cumulative teleconsultations (in millions) from its launch in 2019 to 2025.

However, the results also reveal limited systemic transformation. Interoperability remains weak; multiple vertical portals (RCH, NCD, Nikshay, etc.) continue to operate in silos at the facility level. Continuity of care is compromised by the absence of reliable follow-up mechanisms and incomplete records. Equity gains are partial—digitally

literate, younger, and better-connected residents benefit more readily, while the urban poor in informal settlements face compounded barriers of device ownership, data costs, language, and trust.

Discussion of these findings points to a central tension: technology can amplify existing system strengths and weaknesses. Where urban primary care facilities already have reasonable staffing, medicine supply, and governance, digital tools enhance efficiency. Where these fundamentals are missing, technology exposes and sometimes exacerbates the gaps. The literature therefore converges on the need for "digital health + health system strengthening" rather than digital health as a standalone solution.

Policy frameworks (National Digital Health Blueprint, ABDM, National Urban Health Mission) provide necessary direction, yet implementation capacity at the municipal and facility level varies widely. Successful examples tend to feature strong local ownership, continuous training, and deliberate design for low-literacy users.

5. Future Scope

Several directions emerge for strengthening the contribution of digital health to urban primary care.

Interoperable architecture must move from policy documents to facility-level reality. A unified primary care information system that links ABHA, electronic medical records, diagnostics, pharmacy, and referral pathways is essential. Open standards and modular design would allow states and cities to adapt while remaining nationally coherent.

Hybrid care models deserve systematic testing. Combining in-person primary care with facilitated teleconsultation, remote monitoring for chronic conditions, and AI-supported screening (as recently piloted in some municipal centres) can balance accessibility with clinical quality.

Capacity building requires sustained investment rather than one-time training. Digital literacy programmes for both providers and community members, coupled with ongoing technical support and realistic workload adjustments, will determine long-term adoption.

Equity-focused design should become standard. Offline functionality, regional language interfaces, voice-based navigation, and community facilitator roles can reduce exclusion. Public-private partnerships that embed digital tools within trusted community structures (as seen in some recent CSR-supported slum programmes) offer useful templates.

Finally, robust evaluation frameworks are needed. Future research should move beyond consultation counts to measure clinical outcomes, continuity, patient experience, cost-effectiveness, and equity impacts across different urban contexts—metros, tier-2 cities, and informal settlements.

6. Conclusion

Digital health services offer genuine opportunities to strengthen primary healthcare in urban India by improving access, supporting chronic disease management, and enabling better data use. Platforms such as eSanjeevani and the broader ABDM ecosystem, together with assisted telemedicine and mHealth tools, have already demonstrated scale and selective clinical benefits. Yet the challenges of fragmented infrastructure, incomplete integration, digital divides, and weak system readiness continue to limit impact.

The evidence reviewed here suggests that technology succeeds when it is deliberately embedded within a strengthened primary care system—adequate human resources, reliable supply chains, clear referral pathways, and inclusive design. Without these foundations, digital tools risk becoming another layer of complexity rather than a solution. A pragmatic, equity-oriented, and system-aware approach is required if digital health is to help urban primary care fulfil its role as the first and most continuous point of contact for India's growing city populations.

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