JOURNAL OF CLINICAL AND BIOMEDICAL SCIENCES

ORIGINAL ARTICLE

OPEN ACCESS

Received: 12-07-2025
Accepted: 04-10-2025
Published: 31-03-2026

Citation: Khritish S. Health Informatics, Community, and Home Care in India: An Investigative Study. 2026; 16(1):34-39. https://doi.org/10.58739/jcbs/v16i1.25.219

* **Corresponding author.**
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Funding: None

Competing Interests: None

Published By Sri Devaraj Urs Academy of Higher Education, Kolar, Karnataka

ISSN
Print: 2231-4180
Electronic: 2319-2453

Health Informatics, Community, and Home Care in India: An Investigative Study

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Abstract

Background: Health informatics, leveraging technology to manage and analyze health data, is transforming healthcare delivery in India, particularly in community and home care settings. With a vast population and diverse geography, India faces challenges in healthcare access, making digital tools like telemedicine and mobile health (mHealth) applications vital for enhancing care beyond traditional facilities. **Objective:** This study aims to explore the current state, perceived benefits, and challenges of implementing health informatics in community and home care across India, focusing on adoption and effectiveness. **Method:** A cross-sectional survey was conducted in Pune district, Maharashtra, from January to March 2025, involving 385 participants (192 healthcare providers and 193 patients/caregivers). Structured questionnaires assessed awareness, usage, benefits, and barriers to digital health tools, including telemedicine, mHealth apps, and electronic health records (EHRs). **Results:** Awareness was high (85% of providers, 72% of patients/caregivers), with telemedicine used by 68% of providers and 55% of patients/caregivers. Benefits included improved accessibility (80% rural patients), enhanced communication (70% providers), and better health management (60% patients). However, challenges like unreliable internet (65% rural areas), low digital literacy (45% older adults), and data privacy concerns (40%) hindered adoption. **Conclusion:** Health informatics significantly enhances community and home care in India, yet its potential remains constrained by infrastructural and literacy barriers. Overcoming these challenges through improved connectivity, user-friendly designs, and robust data security is essential for equitable and effective healthcare delivery.

Keywords: Health informatics, Community care, Home care, Digital health, India

1 Introduction

The landscape of healthcare in India has experienced a transformative shift in recent decades, driven by advancements in technology and a growing recognition of the importance of accessible and efficient care. Health informatics, defined as the interdisciplinary field that uses information technology to organize and analyze health data to improve healthcare outcomes, has emerged as a crucial catalyst in this evolution[2]. Concurrently, the imperative to extend healthcare services beyond traditional hospital settings into community and home-based environments has gained significant traction, particularly in a country like India with its vast geographical diversity and burgeoning population.

Community care in India often involves primary healthcare centers, health and wellness centers, and the extensive network of Accredited Social Health Activists (ASHAs) who serve as a critical link between communities and the formal health system. Home care, on the other hand, encompasses a range of medical and supportive services delivered to patients in their residences, catering to the elderly, chronically ill, or those recovering from acute conditions[10]. The integration of health informatics within these spheres holds immense potential to bridge existing gaps in healthcare delivery,

enhance patient outcomes, and improve the efficiency of resource allocation.

Despite considerable progress, India's healthcare system still grapples with challenges such as an unequal distribution of healthcare infrastructure, a shortage of qualified medical professionals, and significant out-of-pocket expenditure for healthcare services, particularly in rural areas[8]. Digital health solutions, including telemedicine, mobile health (mHealth) applications, and electronic health records (EHRs), offered promising avenues to address these disparities by enhancing accessibility, improving care coordination, and empowering individuals with health information[1].

This research paper investigated the current state, perceived benefits, and challenges associated with the implementation of health informatics in community and home care settings across India. The study aimed to provide insights into how digital interventions were being utilized and to identify key factors influencing their adoption and effectiveness.

2 Literature Review

The pervasive impact of digital technologies on healthcare delivery in India has been a subject of increasing academic scrutiny. Research consistently highlighted the potential of health informatics to address geographical barriers and enhance access to care, particularly in rural and underserved areas. Telemedicine platforms, such as the government-backed eSanjeevani, played a pivotal role in facilitating remote consultations, significantly reducing the need for patients to travel long distances for medical advice, thereby improving accessibility and reducing costs[7, 8]. The platform's rapid development and widespread adoption, especially during the COVID-19 pandemic, underscored its transformative potential for healthcare service delivery across the nation[8].

The integration of Electronic Health Records (EHRs) was recognized as fundamental to improving care coordination and minimizing medical errors by providing healthcare providers with comprehensive access to a patient's medical history[1]. While the adoption of EHRs in India was not yet mainstream, governmental efforts, such as the establishment of the "Electronic Health Record Standards for India" committee, indicated a concerted push towards wider utilization of digitized medical reporting and record sharing[2]. Initiatives like the Ayushman Bharat Digital Mission (ABDM) further aimed to create a nationwide digital health ecosystem, promoting unique health IDs, professional registries, and interoperable health interfaces to streamline data exchange and improve healthcare delivery[7].

Mobile health (mHealth) interventions, encompassing applications for health education, preventive care, medication reminders, and remote monitoring, demonstrated significant promise in empowering individuals and supporting community health workers. Studies indicated that mHealth applications had a positive impact on maternal and child health services, leading to improved knowledge among mothers regarding preterm home care and enhancing the coverage and quality of services in difficult-to-reach areas[5, 9]. These applications facilitated real-time data collection and communication, enabling ASHAs and primary healthcare staff to conduct more effective home visits and manage chronic diseases more efficiently[3, 5].

Despite the evident benefits, the implementation of health informatics in Indian community and home care settings faced several persistent challenges. Limited digital literacy, particularly among older adults and those in rural areas, posed a significant barrier to the effective adoption of digital tools[1, 8]. Furthermore, unreliable internet connectivity and inconsistent electricity supply in remote regions hindered the full utilization of telemedicine and other digital health interventions[1]. From the healthcare professional's perspective, concerns regarding data security, medico-legal implications, and the need for adequate training in using digital platforms were also highlighted[4].

Previous systematic reviews underscored the dual impact of digital health interventions, demonstrating improvements in health outcomes such as decreased disease-specific markers, reduced symptom severity, and increased patient satisfaction, alongside significant cost savings for patients[10]. However, the existing literature also revealed a need for tailored approaches that respected local cultures and addressed specific infrastructural and literacy challenges to ensure sustainable and equitable adoption of these technologies across India[8]. The National Health Systems Resource Centre (NHSRC) emphasized the critical need for interoperability among information systems and the effective use of collected data for monitoring, evaluation, and policy-making to optimize health informatics in the Indian context[6].

3 Methodology

3.1 Research Design

This study adopted a descriptive cross-sectional survey design to investigate the perceptions, adoption, and impact of health informatics in community and home care settings in a selected district of India. A quantitative approach was primarily employed to gather data on the prevalence of digital health tool usage, perceived benefits, encountered challenges, and factors influencing adoption among healthcare providers and beneficiaries.

3.2 Instruments and Tools Used

The primary instrument for data collection was a structured, self-administered questionnaire. The questionnaire comprised both closed-ended (Likert scale, multiple-choice) and open-

ended questions to capture both quantitative metrics and qualitative insights.

Key sections of the questionnaire included:

1. **Demographic Information:** Age, gender, education level, occupation (e.g., ASHA, nurse, patient, family caregiver), monthly income (for patients/caregivers), years of experience in healthcare (for providers), and residential area (urban/rural).
2. **Access to and Usage of Digital Devices:** Ownership of smartphones, internet connectivity (type and reliability), and frequency of digital device usage for health-related purposes.
3. **Awareness and Perception of Health Informatics Tools:** Questions assessing familiarity with telemedicine, mHealth apps, EHRs, and remote monitoring devices. Likert scales (e.g., 1=Strongly Disagree to 5=Strongly Agree) were used to gauge perceptions of ease of use, usefulness, and trust in these technologies.
4. **Utilization of Health Informatics in Community/Home Care:** Specific questions on how frequently participants used telemedicine for consultations, mHealth apps for health education or reminders, or remote monitoring for chronic disease management.
5. **Perceived Benefits:** Questions on improved accessibility, reduced travel time/cost, enhanced communication with healthcare providers, better health management, and increased knowledge.
6. **Challenges Encountered:** Questions related to internet connectivity issues, lack of digital literacy, language barriers, data privacy concerns, technical glitches, and insufficient training.
7. **Impact on Health Outcomes (Perceived):** Questions on whether health informatics tools contributed to better disease management, timely interventions, and overall improved well-being.
8. **Suggestions for Improvement:** Open-ended questions soliciting recommendations for enhancing the effectiveness and adoption of health informatics.

The questionnaire was initially developed in English and then translated into local languages (e.g., Hindi, Marathi) by a professional translator, followed by back-translation to ensure linguistic equivalence and conceptual accuracy.

3.3 Location and Duration

The study was conducted in the Pune district of Maharashtra, India. This location was chosen due to its mix of urban and rural areas, offering a representative cross-section of the target population. Data collection spanned a period of three months, from January to March 2025.

3.4 Variables

1. Independent Variables:

- **Demographic Factors:** Age, education, income, residential area.
- **Technological Access:** Smartphone ownership, internet availability and reliability.
- **Digital Literacy:** Self-reported comfort and proficiency in using digital devices and applications.
- **Training Received:** Whether the participant had received formal training on using health informatics tools.

2. Dependent Variables:

- **Adoption Rate:** Frequency and consistency of using health informatics tools.
- **Perceived Usefulness:** Extent to which participants believed health informatics tools improved healthcare processes and outcomes.
- **Perceived Ease of Use:** Extent to which participants found health informatics tools easy to operate.
- **Patient Satisfaction:** Satisfaction with healthcare services delivered via digital platforms.
- **Self-Efficacy in Health Management:** Participants' confidence in managing their own health using digital tools.
- **Challenges Experienced:** Number and severity of technical, literacy, or access-related issues.

3.5 Sampling and Sample Technique Used

A multi-stage sampling technique was employed.

1. **Stage 1 (Purposive Sampling):** From Pune district, two urban zones and two rural blocks were purposively selected to ensure representation of diverse geographical settings.
2. **Stage 2 (Stratified Random Sampling):** Within the selected urban zones and rural blocks, primary healthcare centers (PHCs), health and wellness centers (HWCs), and prominent home care service providers were identified. From these centers/providers, a list of healthcare workers (ASHAs, nurses) and patients/caregivers who had utilized or were eligible to utilize community/home care services was obtained.

3. **Stage 3 (Systematic Random Sampling):** A systematic random sampling approach was then applied to select the final participants. For healthcare workers, every 'k'th individual from the list was selected. For patients/caregivers, systematic sampling was done from patient registers or appointment lists, ensuring a diverse representation across various conditions relevant to home care.

The target sample size was 400 participants (200 healthcare providers and 200 patients/caregivers). The actual sample achieved was 385 (192 healthcare providers and 193 patients/caregivers), yielding a response rate of 96.25%.

3.6 Reliability and Validity Calculations

1. Reliability: The internal consistency of the questionnaire's scales (e.g., perceived usefulness, perceived ease of use, satisfaction) was assessed using Cronbach's Alpha. A pilot study was conducted on a subsample of 40 participants (20 healthcare providers, 20 patients/caregivers) who were not part of the main study. The Cronbach's Alpha values for the key scales ranged from 0.78 to 0.92, indicating good to excellent internal consistency.

2. Validity:

- **Content Validity:** The questionnaire was reviewed by a panel of five experts in health informatics, public health, and healthcare delivery in India. Their feedback on relevance, clarity, and comprehensiveness was incorporated into the final version of the instrument.
- **Face Validity:** The questionnaire was administered to a small group of target audience members during the pilot phase to ensure that the questions were understandable and appropriately worded.
- **Construct Validity:** This was assessed post-data collection through exploratory factor analysis to confirm that the underlying theoretical constructs (e.g., perceived usefulness, ease of use) were adequately measured by the respective items.

3.7 Pilot Testing Results

The pilot study, conducted with 40 participants, revealed several insights. Participants generally understood the questions, but minor ambiguities in a few statements were identified and subsequently rephrased for clarity. It was observed that some participants in rural areas required assistance with reading or understanding certain technical terms, necessitating the deployment of trained research assistants for in-person administration. The estimated time for completing the questionnaire was around 15-20 minutes, which was deemed acceptable. No significant issues with question flow or response options were noted. The data collected during the pilot was excluded from the main study analysis.

3.8 Exclusion and Inclusion Criteria

1. Inclusion Criteria:

- **Healthcare Providers:** Actively working in community health centers or home care services in Pune district for at least six months; willingness to participate and provide informed consent.
- **Patients/Caregivers:** Receiving or having received community/home care services in Pune district within the last 12 months; aged 18 years or above; willing to participate and provide informed consent.

2. Exclusion Criteria:

- Individuals unwilling to provide informed consent.
- Individuals with severe cognitive impairments that precluded them from understanding the questionnaire.
- Healthcare providers or patients/caregivers not directly involved with community or home care services.

3.9 Procedure for Exact Research Procedure with Duration

1. Phase 1: Planning and Ethical Approval (October - December 2024)

- Defined research objectives and questions.
- Developed the initial draft of the questionnaire.
- Identified potential study locations and sought preliminary permissions.
- Submitted the research proposal and questionnaire to the Institutional Ethics Committee (IEC) for approval.
- Obtained IEC approval.

2. Phase 2: Instrument Refinement and Pilot Testing (December 2024)

- Translated the questionnaire into local languages and performed back-translation.
- Conducted expert review for content validity.
- Conducted pilot testing with 40 participants (20 healthcare providers, 20 patients/caregivers) to assess clarity, flow, and timing.
- Revised the questionnaire based on pilot feedback and expert recommendations.
- Trained research assistants on data collection protocols, ethical considerations, and questionnaire administration techniques, especially for assisting participants with low literacy.

3. Phase 3: Data Collection (January - March 2025)

- Approached selected primary healthcare centers, health and wellness centers, and home care providers in Pune district.
- Obtained administrative permissions from relevant authorities for access to premises and participant lists.
- Research assistants visited the selected sites.
- Potential participants were informed about the study's purpose, confidentiality, and voluntary nature.
- Informed consent was obtained from all participants prior to their participation.
- Questionnaires were administered:
    1. For literate participants, self-administration was preferred.
    2. For participants with low literacy or those preferring assistance, research assistants read out questions and recorded responses, ensuring no bias.
- Data was collected consistently across all sites to minimize variability.
- Weekly progress meetings were held with research assistants to address any field challenges and ensure data quality.

4. Phase 4: Data Entry and Analysis (April - May 2025)

- Collected questionnaires were thoroughly checked for completeness and consistency.
- Data was entered into statistical software (e.g., SPSS version 28.0) by trained data entry operators. Double-entry was utilized for a subset of data to check for accuracy.
- Data cleaning procedures were performed to identify and correct any errors or inconsistencies.
- Descriptive statistics (e.g., frequencies, percentages, means, standard deviations) were used to summarize participant demographics and the prevalence of digital health tool usage.
- Inferential statistics (e.g., Chi-square tests, independent t-tests, ANOVA) were employed to analyze associations between independent and dependent variables.
- Correlation analysis was conducted to examine relationships between perceived usefulness, ease of use, and adoption rates.
- Qualitative responses from open-ended questions were subjected to thematic analysis to identify recurring themes and insights.

5. Phase 5: Report Writing (June 2025)

- Interpretation of statistical analysis results.
- Integration of quantitative and qualitative findings.
- Drafting of the research paper, including Introduction, Literature Review, Methodology, Results and Findings, Discussion, and Conclusion sections.
- Final review and editing before submission.

4 Results and Findings

The study surveyed 385 participants in Pune, Maharashtra: 192 healthcare providers (65% ASHAs/community health workers, 35% nurses/allied health professionals) and 193 patients/caregivers (58% rural, 42% urban). Mean ages were 48.5 years (SD = 15.2) for patients/caregivers and 36.7 years (SD = 9.8) for providers. Education varied, with 35% of rural patients having primary education or less versus 10% in urban areas.

Awareness and Adoption: Most participants knew of digital health tools (85% providers, 72% patients/caregivers), with smartphone ownership at 92% (providers) and 78% (patients/caregivers). Only 55% of rural respondents had reliable high-speed internet, compared to 88% urban (χ^2 = 34.1, $p < 0.001$). Telemedicine (e.g., eSanjeevani) was used by 68% of providers (mean = 4.2 consultations/week, SD = 2.1) and 55% of patients/caregivers (mean satisfaction = 4.1/5, SD = 0.7). mHealth apps were adopted by 60% of providers and 45% of patients/caregivers, with higher use among ages 18-40 (60%) than over 60 (25%) (χ^2 = 28.5, $p < 0.001$). EHR use was low (30% of providers), due to interoperability and interface issues.

Perceived Benefits: Usefulness scores averaged 4.3 (SD = 0.6) for providers and 3.9 (SD = 0.8) for patients/caregivers (t-test, $p < 0.01$).

1. **Accessibility**: 80% of rural patients/caregivers saved 3-5 hours and INR 200-500 per visit via telemedicine; 75% of providers reported 25% more outreach.
2. **Communication**: 70% of providers and 65% of patients/caregivers noted better follow-up communication.
3. **Health Management**: 60% of patients/caregivers improved chronic condition management (15% higher adherence); 68% of providers saw 10% fewer urgent visits.
4. **Knowledge**: 55% of patients/caregivers and 70% of ASHAs reported better health understanding.

Challenges:

1. **Digital Literacy**: 45% of patients/caregivers, especially over 60 (70%), struggled with interfaces (mean ease score = 2.5/5).

2. **Internet**: 65% of rural participants faced unreliable connectivity, affecting 30% of telemedicine calls and 40% of online access.
3. **Language**: 30% of rural patients cited issues with non-localized content.
4. **Privacy**: 40% of patients/caregivers worried about data security (mean trust = 3.0/5).
5. **Cost**: 60% of low-income participants (income < INR 15,000/month) cited device costs, 45% data costs.
6. **Integration**: 72% of providers noted tool fragmentation, adding 1.5 hours weekly for 40%.

Health Outcomes: 62% of patients felt telemedicine aided early diagnosis; 50% with chronic conditions reported better adherence and 35% fewer exacerbations. Providers (60%) observed 10-15% higher compliance.

5 Discussion

The study aligns with prior research on health informatics in India, showing promise and challenges[7, 8]. High adoption of telemedicine and mHealth improved accessibility and communication, supporting findings on reducing geographical barriers[1, 10]. Patients/caregivers and providers valued reduced travel and better management, consistent with mHealth benefits[5, 9]. Younger patients' higher app use (60% vs. 25% in older adults) suggests age-targeted literacy needs.

Barriers like unreliable internet (65% rural), digital literacy gaps, and low EHR use (30%) despite initiatives like Ayushman Bharat Digital Mission[2] highlight infrastructure issues[1, 8]. Tool fragmentation and privacy concerns (40% of patients) underscore needs for integration and trust-building. While perceived benefits like improved follow-ups and fewer urgent visits suggest potential, the cross-sectional design and self-reported data limit causality claims. Future longitudinal studies with clinical metrics (e.g., hospitalization rates) are needed. The findings stress user-centric, culturally apt solutions and robust infrastructure for equitable health informatics in Indian community care.

6 Conclusion

This study in Pune, India, highlights the potential of health informatics to enhance community and home care by improving accessibility, communication, and health management, with 85% of healthcare providers and 72% of patients using tools like telemedicine and mHealth apps. Key benefits include reduced travel time/costs (80% of rural patients saved 3-5 hours, INR 200-500) and better chronic disease management (60% of patients). However, challenges such as limited digital literacy (45% of patients), unreliable internet (65% rural), language barriers (30%), and data privacy concerns (40%) hinder adoption. Recommendations include improving digital literacy, internet infrastructure, user-friendly designs, and data security. Future research should evaluate long-term outcomes to ensure equitable healthcare delivery.

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