ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov109

Digital Health Literacy and Healthcare Access Among Rural and Underserved Communities in India

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Publication Date: 2026/11/12

Abstract: Digital health has become an important component of healthcare delivery in India, particularly for extending services to rural and underserved populations. However, the availability of digital health platforms does not automatically guarantee equitable access. Digital health literacy, internet connectivity, affordability, language, disability, privacy concerns, social support and confidence in using technology influence whether individuals can effectively benefit from digital healthcare services. This review examines the relationship between digital health literacy and healthcare access among rural and underserved communities in India and discusses the potential contribution of community health nursing. Published literature and major policy and programme documents concerning digital health, telemedicine, digital health literacy, rural healthcare access and community based digital services were reviewed. The evidence indicates that digital technologies can reduce geographical barriers, facilitate remote consultations, support continuity of care and improve access to health information. However, persistent digital inequalities, limited awareness, inadequate infrastructure, low digital literacy and concerns regarding privacy and trust may restrict equitable utilization. Indian initiatives such as the Ayushman Bharat Digital Mission and eSanjeevani demonstrate the potential of digital platforms to strengthen primary healthcare and connect underserved populations with health professionals. Community health nurses and other frontline health workers can act as important intermediaries by providing digital health education, assisting patients with digital services, promoting safe use of online health information and supporting continuity between digital and face to face care. Digital health equity therefore requires an integrated approach combining infrastructure, digital literacy, accessible technology, community participation, health workforce training, privacy protection and responsive public policy.

Keywords: *Access; Community Health Nursing; Digital Divide; Digital Health; Health Literacy; India; Rural Health; Telemedicine.*

How to Cite: Sriram E.; Vasanthy S. (2026) Digital Health Literacy and Healthcare Access Among Rural and Underserved Communities in India. *International Journal of Innovative Science and Research Technology*, 11(11), 94-101. https://doi.org/10.38124/ijisrt/26nov109

I. INTRODUCTION

Digital transformation is increasingly influencing the organization and delivery of healthcare. Digital health includes the use of information and communication technologies for health information, clinical care, health promotion, surveillance, health education, communication and health system management. The World Health Organization recognizes that digital technologies can support health systems when they are people centred, equitable, secure, sustainable and appropriately integrated into existing health systems [1].

The importance of digital health has increased considerably in India. The country has developed a broad digital health ecosystem involving electronic health information, telemedicine, digital health identification, health facility and healthcare professional registries, mobile health services and digital public infrastructure. The National Digital Health Blueprint provided an early framework for developing an integrated digital health ecosystem with emphasis on interoperability, personal health records, privacy, consent management and accessibility [2]. The Ayushman Bharat Digital Mission subsequently sought to establish an interoperable digital health ecosystem connecting

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov109

citizens, healthcare professionals, health facilities and digital health services [3].

Digital health has particular relevance for rural and underserved communities. Rural populations may experience geographical barriers, shortages of specialists, transportation difficulties, financial constraints and limited availability of healthcare services. Telemedicine and other digital interventions can potentially reduce some of these barriers by connecting patients and peripheral health facilities with healthcare professionals located elsewhere. The Government of India has developed eSanjeevani as a national telemedicine service to support provider assisted and patient to provider consultations [4].

However, digitalization does not automatically produce health equity. Access to a smartphone or internet connection is only one component of meaningful digital health participation. Individuals must also be able to locate, understand, evaluate and appropriately use digital health information and services. The concept of eHealth literacy was described as the ability to seek, find, understand and evaluate electronic health information and apply the knowledge obtained to address health problems [5]. Digital health literacy extends this concept within the broader digital environment.

The World Health Organization has identified access to information and communication technologies, equipment, broadband and the internet as important digital determinants of health [1]. Consequently, individuals who have limited digital skills or poor access to connectivity may experience a new form of inequality when health services increasingly move into digital platforms.

Evidence from India illustrates this concern. A study among ageing adults in rural and urban Telangana found that only a minority of participants demonstrated good digital health literacy, indicating the importance of strengthening both digital and health literacy [6]. Similarly, a community based study in rural Karnataka found very low awareness of eSanjeevani OPD despite considerable willingness among participants to use teleconsultation when appropriately informed [7].

The issue is therefore not simply whether digital healthcare services exist. The more important question is whether rural and underserved populations can access, understand, trust and effectively use these services.

This review examines the relationship between digital health literacy and healthcare access among rural and underserved communities in India. It also considers the barriers affecting digital health utilization, the opportunities created by Indian digital health programmes and the role of community health nursing in promoting digital health equity.

II. MATERIALS AND METHODS

➢ *Review Approach*

This article was developed as a narrative review of published literature and major policy and programme documents concerning digital health literacy, digital healthcare access, telemedicine, rural healthcare and community based digital health services in India.

The review did not involve primary data collection, human participants, questionnaires or intervention implementation. Therefore, no original participant level data were generated for this article.

➢ *Sources of Information*

Relevant literature was identified from PubMed indexed publications and publicly available documents from authoritative organizations and government institutions. Major sources included the World Health Organization, Ministry of Health and Family Welfare, National Health Authority, Government of India, Telecom Regulatory Authority of India and peer reviewed scientific literature.

The literature was examined under the following broad concepts:

- Digital health and healthcare access.
- Digital health literacy and eHealth literacy.
- Rural and underserved populations.
- Telemedicine and eSanjeevani.
- Ayushman Bharat Digital Mission.
- Digital divide and connectivity.
- Community health workers and community health nursing.
- Privacy, security and trust in digital health.

➢ *Analytical Approach*

The identified evidence was organized thematically rather than statistically pooled. The synthesis focused on the relationship between digital health infrastructure, digital literacy and equitable healthcare utilization.

Particular attention was given to evidence from India and to interventions relevant to primary healthcare and community settings. Findings from individual studies were not generalized beyond their study populations.

III. RESULTS

➢ *Digital Health as an Opportunity for Healthcare Access*

The reviewed evidence indicates that digital health can contribute to improved access by reducing geographical barriers and facilitating communication between patients, frontline health workers and healthcare professionals.

The Indian digital health ecosystem has developed around the concept of interoperability and connected healthcare. The National Digital Health Blueprint proposed an ecosystem based on digital infrastructure, health information exchange, personal health records, privacy and

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov109

consent management [2]. The Ayushman Bharat Digital Mission further developed this direction by creating building blocks such as the Ayushman Bharat Health Account, Health Facility Registry and Healthcare Professionals Registry [3].

These developments can support continuity of care when digital systems are appropriately integrated into health services. A patient may potentially access health information, receive teleconsultation, maintain digital health records and interact with different levels of the health system without being physically present at every point of care.

However, technology should be considered an enabling mechanism rather than a substitute for the health system itself.

➢ *Digital Health Literacy as a Determinant of Meaningful Access*

Digital health literacy represents an important determinant of whether people can benefit from digital healthcare.

Norman and Skinner described eHealth literacy as a combination of different literacy skills that allow individuals to seek, understand and evaluate health information obtained through electronic sources [5]. In contemporary healthcare, these skills may include the ability to use smartphones, navigate health applications, communicate through digital platforms, interpret electronic health information, identify reliable sources and protect personal information.

The importance of digital health literacy is particularly evident among populations with limited educational opportunities, older adults and individuals with limited experience using digital technologies.

A comparative study involving ageing adults in Telangana found that only 20.4 percent of participants had good digital health literacy. The study did not identify a statistically significant difference between its rural and urban groups, demonstrating that digital health literacy can be limited across settings and is influenced by multiple factors rather than geography alone [6].

Digital health literacy should therefore be viewed as a multidimensional public health capability rather than merely a technological skill.

➢ *The Rural Digital Divide*

The digital divide remains an important challenge to digital healthcare equity.

Connectivity depends on telecommunications infrastructure, electricity, device availability, network quality and affordability. TRAI data demonstrate substantial differences between rural and urban internet tele-density, indicating continuing inequalities in digital connectivity [8].

Even where mobile connectivity exists, the quality of the connection may not be sufficient for video consultation or digital diagnostic applications. Individuals may also share mobile phones within households, have limited data availability or rely on basic devices.

The digital divide can therefore operate at several levels:

- Availability of infrastructure.
- Availability of appropriate devices.
- Affordability of devices and data.
- Quality and reliability of connectivity.
- Digital skills.
- Language and accessibility.
- Confidence and trust.
- Ability to use digital health services independently.

Digital health programmes that address only infrastructure may consequently leave behind populations who require additional support.

➢ *Telemedicine and eSanjeevani*

Telemedicine is one of the most visible applications of digital health in India.

The Government of India introduced telemedicine practice guidelines in 2020 that established principles concerning patient identification, consent, appropriate technology, clinical evaluation, documentation, privacy and professional responsibility [9].

eSanjeevani provides an important example of large scale government supported telemedicine. The service operates through provider assisted and patient to provider models. In the provider assisted model, frontline health workers can facilitate connections between patients and doctors or specialists located at higher levels of the health system [4].

Government reporting indicates substantial expansion of eSanjeevani. The Ministry of Health and Family Welfare reported that the platform had served more than 330 million patients by the end of December 2024, with a large network of health facilities, hubs and healthcare professionals participating in the programme [10].

Independent analysis of programme data also demonstrates extensive utilization. Sood and colleagues reported more than 163 million consultations between national rollout in November 2019 and September 2023, with the provider assisted eSanjeevani AB-HWC model accounting for more than 93 percent of reported usage during the study period [11].

These findings demonstrate the scale that government supported digital health services can achieve.

However, scale should not be interpreted as equivalent to equitable access. Utilization may vary according to awareness, digital skills, connectivity, availability of trained personnel and local health system capacity.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov109

➢ *Awareness and Willingness to Use Telemedicine*

Awareness is an important intermediate factor between service availability and actual utilization.

A community based study in rural Karnataka found that awareness of teleconsultation was very low, although a substantial proportion of participants expressed willingness to use eSanjeevani OPD after receiving appropriate information [7]. The finding demonstrates an important policy issue: a service may be technically available while remaining functionally inaccessible to the population because people do not know about it or do not understand how to use it.

Community based awareness programmes can therefore play an important role in increasing the effective reach of digital health initiatives.

➢ *Barriers Affecting Digital Healthcare Utilization*

The reviewed literature identifies several categories of barriers.

- Infrastructure barriers: Poor network connectivity, inadequate electricity, insufficient devices and limited availability of technical infrastructure can prevent successful digital consultations.
- Digital literacy barriers: Individuals may not know how to download applications, register for services, upload information, participate in video consultations or interpret electronic health information.
- Health literacy barriers: Digital skills alone do not guarantee the ability to understand health information. Individuals may encounter complex medical terminology, conflicting online information or misleading health claims.
- Language barriers: Digital health platforms may not always provide information in locally preferred languages or in formats appropriate for people with limited literacy.
- Financial barriers: Smartphone ownership, internet data, transport to assisted telemedicine centres and device maintenance may create indirect costs.
- Sociocultural barriers: Gender, age, disability, social norms, family decision making and trust in technology may influence utilization.
- Privacy and security concerns: Digital health requires appropriate protection of personal and health information. The Digital Personal Data Protection Act 2023 provides a legislative framework concerning processing of digital personal data and recognition of individual rights regarding personal data [12].
- Clinical limitations: Telemedicine cannot replace all forms of face to face assessment. Physical examination, emergency care, diagnostic procedures and certain procedures require in-person healthcare.

A systematic review of telemedicine in India identified infrastructural, sociocultural, regulatory and financial factors as important influences on implementation [13]. Another scoping review highlighted inadequate funding, resistance to change and implementation barriers while identifying policy support, infrastructure investment and collaboration as important facilitators [14].

➢ *Digital Health and Persons with Disabilities*

Digital health has potential to improve access for people with disabilities by reducing the need for physical travel. However, inaccessible digital platforms can also create new barriers.

A scoping review of telehealth in India involving people with disabilities identified the potential of telehealth to promote affordable and inclusive healthcare while highlighting the risk that digital inequality and inadequate health literacy could reproduce existing inequities [15].

Accessibility therefore needs to be incorporated into digital health design from the beginning. Digital platforms should consider screen readers, captioning, audio support, simple navigation, appropriate font sizes and other accessibility requirements.

➢ *Role of Community Health Nursing*

Community health nurses can play an important role in translating digital health infrastructure into meaningful community level healthcare.

The community health nurse frequently operates at the interface between households, community resources and formal healthcare services. This position provides opportunities to support digital health adoption.

Key roles include:

- Digital health education: Teaching individuals how to access reliable digital health services.
- Telemedicine facilitation: Assisting patients in connecting with doctors and specialists.
- Health information evaluation: Helping individuals distinguish reliable health information from misinformation.
- Digital registration support: Supporting eligible individuals with digital health service registration.
- Privacy education: Teaching patients not to unnecessarily disclose personal health information.
- Continuity of care: Linking digital consultation recommendations with local follow up.
- Vulnerable population support: Assisting older adults, people with disabilities and individuals with limited literacy.
- Community awareness: Conducting health education sessions concerning available digital health services.
- Feedback collection: Identifying technical and service barriers experienced by community members.
- Referral support: Ensuring that patients requiring physical examination or higher-level care are appropriately referred.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov109

The role of the community health nurse should therefore extend beyond operating digital equipment. It should include health education, patient advocacy, communication, digital navigation and continuity of care.

➢ *Digital Competency of the Health Workforce*

Digital transformation also requires investment in healthcare worker competencies.

Healthcare workers need sufficient knowledge to use digital platforms, protect patient information, communicate through telehealth systems, recognize limitations of remote assessment and appropriately integrate digital information into clinical care.

WHO has emphasized the importance of digital health competencies among health workers and identified competency frameworks as an important component of digital health system development [16].

For nursing education, digital health competencies can be incorporated into undergraduate and postgraduate curricula. Students can be introduced to telehealth communication, electronic documentation, digital patient education, privacy, cybersecurity awareness, online health information appraisal and digital referral systems.

➢ *Summary of Major Barriers and Potential Responses*

Table 1 Major Barriers and Potential Responses for Digital Health Equity

Major barrier	Potential effect	Suggested response
Poor connectivity	Interrupted or unavailable teleconsultation	Strengthen rural connectivity and offline capable systems
Limited device access	Inability to independently use digital services	Assisted digital access through health facilities and community workers
Low digital literacy	Difficulty navigating platforms	Community based digital health education
Low health literacy	Misinterpretation of digital information	Simplified health communication and patient education
Language barriers	Reduced comprehension	Local language and multilingual content
Disability related barriers	Difficulty using platforms	Universal accessibility standards
Privacy concerns	Reduced trust and utilization	Strong privacy protection and patient education
Limited workforce training	Ineffective digital service delivery	Digital competency training
Limited awareness	Underutilization of available services	Community awareness campaigns
Clinical limitations of telemedicine	Delayed physical assessment	Clear referral and escalation pathways

IV. DISCUSSION

The central finding of this review is that digital healthcare access should not be understood solely in terms of technological availability. Meaningful access requires the interaction of infrastructure, affordability, digital literacy, health literacy, accessibility, trust and appropriate health system support.

India has made substantial progress in establishing national digital health infrastructure. The National Digital Health Blueprint created a framework for an integrated ecosystem, while ABDM has continued the development of interoperable digital health infrastructure [2,3]. eSanjeevani has demonstrated that telemedicine can be implemented at very large scale across diverse geographical settings [10,11].

However, the existence of infrastructure does not eliminate inequalities. A person who does not have a suitable smartphone, reliable internet connection or adequate digital literacy may remain excluded from services that are technically available.

This creates an important distinction between digital availability and digital accessibility.

Digital availability refers to whether a service exists. Digital accessibility refers to whether individuals can realistically use that service. Digital equity goes one step further by asking whether different population groups receive a fair opportunity to benefit from digital healthcare.

➢ *Digital Health Literacy as a Public Health Intervention*

Digital health literacy should be incorporated into routine health promotion.

Traditional health education often focuses on disease prevention, nutrition, hygiene, maternal health, child health and treatment adherence. In an increasingly digital healthcare environment, communities also require skills to identify trustworthy information, use digital health services and protect personal information.

Community health nurses can incorporate digital health literacy into existing health education activities.

For example, during community visits, nurses can explain how to identify official healthcare websites, how to use government telemedicine services and how to recognize misleading health claims circulating through social media.

This approach is particularly relevant because misinformation can spread rapidly through digital networks. Digital health literacy should therefore include not only technical ability but also critical evaluation.

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➢ *From Digital Divide to Digital Inclusion*

The policy objective should move from simply increasing connectivity to creating digital inclusion.

Digital inclusion requires:

- Affordable connectivity.
- Reliable infrastructure.
- Appropriate devices.
- Accessible digital platforms.
- Local language content.
- Digital education.
- Assisted access.
- Privacy protection.
- Community participation.

The rural digital divide remains significant, as reflected in telecommunications data [8]. Therefore, digital health planning should be linked with broader digital infrastructure development.

➢ *Assisted Digital Healthcare*

One of the most promising approaches for underserved populations is assisted digital healthcare.

The eSanjeevani provider assisted model demonstrates how frontline healthcare workers can facilitate digital connections between patients and distant healthcare professionals [4,10]. This model is important because it recognizes that digital health does not necessarily have to be completely self-service.

For older adults, people with disabilities, individuals with low literacy and people without smartphones, an assisted model may be more equitable than a purely app based model.

Community health centres, Ayushman Arogya Mandirs and other primary healthcare facilities can therefore function as digital access points.

➢ *The Importance of Continuity of Care*

Telemedicine should not be viewed as an isolated consultation.

A patient may receive advice through teleconsultation but still require local examination, laboratory investigations, medication collection, follow up or referral.

Therefore, digital health systems should include clear pathways connecting:

Community → Primary healthcare → Teleconsultation → Specialist care → Follow up → Community

Poorly integrated digital services can create fragmentation. Reviews of telemedicine in India have identified concerns relating to referral pathways, training, technology and continuity of care [13,14].

Community health nurses can contribute to closing this gap by following patients after digital consultations and ensuring that recommendations are understood and implemented.

➢ *Privacy and Trust*

Healthcare information is highly sensitive. Digital health expansion therefore requires strong privacy and security practices.

The Digital Personal Data Protection Act 2023 establishes a legal framework concerning digital personal data [12]. At the service level, patients should also receive understandable information about what data are collected, why they are collected and how they may be used.

Trust is particularly important among communities that may already experience barriers to formal healthcare.

Digital health programmes should therefore emphasize transparency, informed participation and respectful communication.

➢ *Digital Health and Public Policy*

Digital health is not only a technological issue. It is also a public policy issue.

Policies need to coordinate health, telecommunications, education, disability inclusion, data protection and social welfare.

A successful digital health policy should ask:

- Who has access?
- Who is excluded?
- What prevents utilization?
- Are services accessible to people with disabilities?
- Are local languages supported?
- Are health workers adequately trained?
- Are privacy safeguards understood?
- Are digital services integrated with physical healthcare?
- Is the intervention sustainable?
- Does digitalization actually improve health outcomes?

These questions shift the discussion from technology adoption to health equity.

V. RECOMMENDATIONS

Based on the reviewed evidence, the following recommendations are proposed.

➢ *Strengthen Rural Digital Infrastructure*

Expansion of reliable internet connectivity and electricity should remain a priority for rural and remote healthcare areas.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26nov109

- *Introduce Community Based Digital Health Literacy Programmes*

Digital health education should be integrated into existing community health activities. Training should use simple language, demonstrations and locally appropriate examples.

- *Strengthen the Role of Community Health Nurses*

Community health nurses should receive structured training in telehealth, digital health platforms, digital communication, privacy, online misinformation and digital patient education.

- *Promote Assisted Digital Access*

Healthcare facilities should provide assistance to individuals who cannot independently access digital services.

- *Develop Multilingual Platforms*

Digital health content should be available in regional and local languages with simple explanations.

- *Improve Accessibility for Persons with Disabilities*

Digital health services should follow accessibility principles and provide appropriate audio, visual and navigation support.

- *Strengthen Referral and Follow Up Mechanisms*

Teleconsultation platforms should be connected to clear pathways for physical examination, investigation, referral and follow up.

- *Protect Privacy and Security*

Digital health programmes should implement strong security measures and provide understandable privacy information to patients.

- *Incorporate Digital Health Into Nursing Education*

Undergraduate nursing curricula should provide competency based education on telehealth, digital health literacy, electronic health records, patient privacy and digital communication.

- *Conduct Community Level Research*

Future studies should examine digital health literacy among different population groups, including older adults, women, people with disabilities, tribal populations, economically disadvantaged households and geographically isolated communities.

VI. CONCLUSION

Digital health has the potential to strengthen healthcare access in rural and underserved communities in India. National initiatives such as the Ayushman Bharat Digital Mission and eSanjeevani demonstrate the country's increasing capacity to use digital technologies to connect patients, healthcare workers and health systems.

Nevertheless, digital health infrastructure alone cannot guarantee health equity. Individuals require reliable connectivity, appropriate devices, digital skills, health literacy, accessible services, trustworthy information and protection of personal data.

The evidence reviewed in this article indicates that digital health literacy should be considered an important component of modern public health practice. Community health nurses can play a particularly important role by helping individuals navigate digital health services, providing digital health education, facilitating teleconsultation and maintaining continuity between digital and face to face care.

The future of digital health equity in India therefore depends on a combination of technology and human support. Digital systems should not replace community based healthcare. Instead, they should strengthen it. A people centred approach that combines digital infrastructure, trained health workers, community participation, accessibility, privacy and appropriate public policy can help ensure that digital transformation contributes to more equitable healthcare access.

ACKNOWLEDGMENT

The authors acknowledge the contribution of publicly available scientific literature and official policy documents that informed this review.

- *Conflict of Interest*

The authors declare that there is no conflict of interest associated with this manuscript.

- *Funding*

No external funding was received for this review.

- *Ethical Consideration*

This article is a narrative review based on published literature and publicly available policy documents. No human participants, personal data or primary participant level information were involved. Therefore, institutional ethical approval was not required for this review.

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