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Original Research Article

Impact of Digital Health Literacy on Preventive Care Uptake in Rural Populations

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Abstract

Background: Digital Health Literacy (DHL) is the ability to deal with health relevant digital information and information options with the aim of promoting and maintaining health and wellbeing of oneself and one's environment. Preventive healthcare is critical for reducing disease burden, yet rural populations in India continue to face barriers to accessing and utilizing preventive services. Digital health literacy the ability to seek, understand, and use digital platforms for health-related purposes has the potential to bridge these gaps. However, limited evidence exists on how digital health literacy directly influences preventive care uptake in rural settings.

Methods: Around100 rural participants participated in a cross-sectional study from January to June 2024. Collection methods included medical records, systematic digital usage surveys, and community health intervention records**.** The level of digital health literacy among participants was categorised using the Digital Health Literacy Instrument (DHLI). Based on DHLI scoring guidelines, participants were classified into low, medium, and high digital health literacy groups according to their total score distribution**.** Low, medium, or high digital health literacy was the independent variable. Dependent variables included immunisations, prenatal checkups, screening, and health camp attendance. Descriptive statistics described participant demographics, and chi-square tests and logistic regression investigated digital literacy and preventative care.

Results: Out of 100 participants, 36% had poor digital health literacy, 44% medium, and 20% high. High and low digital literacy significantly affected immunisation (90%), prenatal visits (82% vs. 43%), and screenings (70% vs. 28%). The study found a significant association ($p < 0.05$) between digital health literacy and preventative healthcare use.

Conclusion: Digital health literacy plays a pivotal role in improving preventive care uptake in rural Varanasi. Policy measures focused on digital training, infrastructure development, and localized awareness campaigns could substantially enhance preventive healthcare outcomes in similar rural settings across India.

Keywords: Digital Health Literacy, Preventive Care, Rural Health, Varanasi, Cross-Sectional Study.

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Introduction

A key prerequisite for successful digital transformation of healthcare delivery system is a well-developed digital health literacy (DHL) among the population. DHL is the ability to deal with health relevant digital information and information options with the aim of promoting and maintaining health and well-being of oneself and one's environment. Preventive healthcare is a foundation of public health policy worldwide, emphasising early diagnosis, rapid action, and successful disease treatment [1]. Preventive healthcare is crucial in India due to the rising frequency of Non-Communicable Diseases (NCDs), maternity and child health issues, and the rural majority of the population [2]. Rural India, where two-thirds to one-half of the population lives, lacks personnel and material means to offer effective medical care [3]. Prevention measures include prenatal care, cancer screenings, immunisations, lifestyle changes, and health camps can reduce death and morbidity. These prophylactic measures are still underutilised in rural areas. Rural

communities use less preventative care than cities [4]. Structural disparities make democratic healthcare challenging, resulting in underutilisation. Digital health literacy allows consumers to access, understand, and use government health portals, wearable health devices, telemedicine services, and mobile health apps to make health decisions [5]. The country's fast-growing digital infrastructure is giving rural Indians access to cell phones, mobile internet, and digital services [6]. The Indian government's flagship programs, Ayushman Bharat Digital Mission and Digital India, have laid the basis for digital healthcare delivery [7]. In preventive care, digital health literacy enhances awareness of the necessity of preventative actions and improves access to existing healthcare services [8]. Technology can assist rural communities prevent disease using digital health awareness campaigns, prenatal teleconsultations, and mobile immunisation schedule reminders.

Even while rural populations have many opportunities to use digital health literacy, they face challenges [9]. Economically disadvantaged people confront infrastructure issues such limited digital device availability, poor mobile network coverage, and low internet usage [10]. Lower education, especially among women key decision-makers in household health-seeking behaviour exacerbates the digital divide between rural and urban India [11]. Due to a lack of digital platform knowledge and confidence, rural people still rely on family doctors, community leaders, and local practitioners for health information [12]. Language and cultural barriers can make digital health technology use difficult. Thus, digital health literacy has only slightly improved rural preventative healthcare. Rural Varanasi has serious public health challenges despite its spiritual and cultural significance. Health indicators, including neonatal and maternal mortality and immunisation coverage are low in Uttar Pradesh than in other Indian states. Despite several government and non-governmental initiatives to improve health outcomes in rural Varanasi, preventive therapy acceptance is variable. Varanasi is a good area to research how digital health literacy affects preventative care due to its growing number of digital projects and cell phones.

Few studies have integrated the two perspectives, but several have examined digital solutions in health promotion or preventive healthcare barriers. Most of the available research provides valuable insights; however, it cannot primarily track changes over time or assess the actual uptake of preventive therapies. Cross-sectional studies show genuine behaviour and outcomes, not self-reported attitudes. Medical information, digital usage statistics, and health camp participation records can be used to create these records. This strategy can help us to determine if people of remote locations of Varanasi use preventative health services more.

Objectives

1. To assess the level of digital health literacy among rural participants.
2. To evaluate the relationship among digital health literacy and uptake of preventive care.

Materials and Methods

Study Design & Study Period: This research was conducted as a cross-sectional study to evaluate the relationship between digital health literacy and preventive care uptake among rural populations in Varanasi, India. The study covered the period from January 2024 to July 2024. The level of digital health literacy among participants was categorised using the Digital Health Literacy Instrument (DHLI). This standardised tool assesses skills across multiple domains such as accessing, understanding, appraising, and applying digital health information. Based on DHLI scoring guidelines, participants were classified into low, medium, and high digital health literacy groups according to their total score distribution. Data collection and analysis focused on preventive care uptake and digital engagement within this seven-month timeframe.

Sample Size and Sampling Method: A total of 100 participants were included in the study. Participants were selected through purposive sampling from local health centers and community outreach programs to ensure representation of individuals who had utilized healthcare services during the study period.

Inclusion Criteria: Adults aged 18 years and above residing in rural Varanasi, having at least one recorded healthcare interaction between January and July 2024, and willing to provide informed consent for data collection.

Exclusion Criteria: Individuals with severe cognitive impairments preventing recall of digital usage, those unwilling to share personal health data, and participants residing in urban or peri-urban areas of Varanasi.

Data Sources: The data set included medical records, digital usage surveys, and community health initiative preventative health intervention data.

Medical records provided preventative care uptake data, whereas structured surveys examined internet accessibility, digital platform comfort, and device use. Health intervention records were cross-checked for accuracy. These data cover immunisation drives and health camps.

Variables Collected

Independent Variable: Level of digital health literacy, categorized into low, medium, and high based on participants' ability to access, understand, and utilize digital health resources.

Dependent Variables: Preventive care uptake, measured through indicators such as completion of immunization schedules, attendance at maternal check-ups, participation in screening programs, and attendance at government-organized health camps.

Data Analysis: The data was analysed using descriptive and inferential statistics. Demographics, digital literacy, and preventative care usage were summarised using summary data. Digital health literacy and categorical preventive care use were studied using chi-square testing. Logistic regression models were used to estimate correlation magnitude and direction after controlling for gender, age, and socioeconomic position. A p-value below 0.05 indicated statistical significance.

Results

Demographics: The study included 100 rural Varanasi residents. According to the demographic profile, 62% of participants were 25–45, 24% were 45 and older, and 14% were 18–24. Males (46%), females (54%). Some 16% had never attended school, 42% had finished elementary school, and 30% had graduated high school or higher. After controlling for household income and occupation, 56% were low-income, 34% middle-income, and 10% high-income.

Table 1: Demographic profile of participants

Variable	Category	n (%)
Age group (years)	18–24	14 (14)
	25–45	62 (62)
	>45	24 (24)
Gender	Male	46 (46)
	Female	54 (54)
Education level	No formal schooling	28 (28)
	Primary–Secondary	42 (42)
	Higher secondary or above	30 (30)
Socioeconomic status	Low-income	56 (56)
	Middle-income	34 (34)
	High-income	10 (10)

Digital Health Literacy Distribution: According to the analysis, 36% of individuals had poor digital health literacy, 44% medium, and 20% high. Participants with middle-to-high socioeconomic class and higher education had higher digital health literacy.

Preventive Care Uptake Rates: Services used preventive care differently. Only 72% of research participants had their required prenatal checkups, and 65% did not receive a vaccination. 48% of the sample had blood pressure and diabetes examinations, and 52% attended a government health camp. Median to high digital health literacy was consistently associated with higher uptake.

Association between Digital Health Literacy and Preventive Care Uptake: Chi-square testing revealed a strong correlation between digital health literacy and preventative treatment utilisation ($p < 0.05$).

Participants with high digital literacy (90% vaccination completion, 82% antenatal visit attendance, and 70% screening participation) had higher uptake rates than those with low literacy (55% vaccination, 43% antenatal visits, and 28% screens).

Logistic regression indicated that digital literacy strongly predicted preventative care utilisation after controlling for demographic characteristics like age, gender, and socioeconomic status.

Table 2: Digital health literacy levels and preventive care uptake

Preventive Care Indicator	Low Literacy (n=36)	Medium Literacy (n=44)	High Literacy (n=20)
Vaccination completed (%)	55	75	90
Antenatal visits (as per norms) (%)	43	68	82
Screening participation (%)	28	52	70
Attendance at health camps (%)	39	57	80

Overall, the results indicate that higher digital health literacy is strongly associated with better preventive healthcare uptake in rural Varanasi. Participants with medium-to-high digital literacy

consistently demonstrated higher engagement with vaccination, antenatal visits, screenings, and health camps, suggesting that digital empowerment plays a pivotal role in influencing preventive health-seeking behaviour.

Discussion

This study examined if digital health literacy and preventative care were linked in rural Varanasi, India. The findings suggest that digital health experts are more likely to use preventive healthcare services including flu shots, prenatal appointments, screenings, and free government health camps. These results emphasise the role of digital empowerment in influencing health-seeking habits and suggest that improving digital health literacy could improve rural preventative healthcare delivery.

Different levels of digital health literacy seek preventative care at different rates. Digitally perception people were 90% more likely to follow their immunisation schedules than those who couldn't (55%). Similar trends were seen in screening (70% vs. 28%) and prenatal visits (82% vs. 43%). This supports the idea that digital health literacy promotes preventative care knowledge and access. Literate people are more likely to understand and act on digital health communications, monitor their healthcare needs via mobile apps, and take preventative measures when advised. In contrast, persons without digital health literacy rely on traditional sources of information, which may be unreliable or impossible to obtain, reducing adoption.

Comparison with Previous Literature: The study's findings support domestic and international literature on digital health literacy for healthcare use. A rural Maharashtra, India, study found that mobile health messages increased prenatal care and vaccination rates for women and their children. Health screening and camp participants in Karnataka were also more digitally involved. Research in Southeast Asia and sub-Saharan Africa shows a strong link between digital literacy and improved preventive healthcare, especially in low-resource settings.

A Ugandan study indicated that mobile health reminders increased rural vaccination coverage by 20%. In Indonesia, digital tool training boosted prenatal care awareness and attendance. These findings, which are similar across locales, show that digital health literacy enables preventative healthcare. According to the study's high association, digital literacy is especially crucial in rural India, where poor infrastructure, a lack of staff, and cultural norms make preventative care difficult.

Table 3: Comparison of present study with existing literature

Study	Study Type	Sample Size & Setting	Key Findings
Present Study	Cross-Sectional observational	100 rural participants, Varanasi	High digital literacy strongly associated with better preventive care uptake (vaccination 90% vs. 55%; antenatal 82% vs. 43%).
Study 1 [13]	Cross-sectional survey	250 rural women, Maharashtra	Mobile-based health reminders increased immunization compliance and antenatal visits by ~20%.
Study 2 [14]	Mixed-methods (survey + interviews)	180 rural households, Karnataka	Higher digital engagement linked to more frequent participation in health camps and NCD screenings.
Study 3 [15]	Prospective cohort	300 mothers in rural districts	SMS reminders significantly improved child immunization coverage (85% vs. 65% in control).

Varanasi offers unique insights into rural India's digital health literacy. Despite its historical and cultural significance, rural Varanasi has lower health indicators than the rest of the country.

This study demonstrated limited preventive care uptake initially, consistent with this pattern. In this context, social class and education closely correspond with digital health literacy. The connection between literacy and health outcomes was strongest among those with moderate to high incomes and schooling. This makes digital health literacy a crucial part of rural education and economic security initiatives. The report also highlights Varanasi-specific gender dynamics. Despite being slightly more numerous and having lower computer literacy than men, women still have most of the authority in maternal health and child immunisation decisions. Gender inequality in digital access presents a difficulty and an opportunity.

Implications for Health Policy and Digital Interventions: The study's conclusions affect India's public health policy and practice. Rural populations must be included in programs like the Ayushman Bharat Digital Mission to create a digital health ecosystem immediately. Women and other marginalised groups should lead digital competency policies.

Mobile health apps in local languages, community-based digital literacy programs, and simplified preventive health reminder platforms are feasible answers. By using online messaging and in-person counselling, community health workers like ASHA and Anganwadi workers may close the gap. Sponsoring smartphones or internet plans for low-income families is another approach to get them online. By adding digital health literacy to preventative healthcare programs, lawmakers can improve treatment outcomes.

Limitations of the Study: The results are interesting, but there are several drawbacks. Only 100 people were sampled, therefore the results cannot be generalised. A larger sample size would enable demographic subgroup investigations and boost statistical power. Cross-sectional designs risk memory bias and poor documentation due to their reliance on pre-existing data and participant-reported surveys. This study examined rural Varanasi, therefore its findings may not apply to other rural Indian regions with different cultures or surroundings. The study has some limitations, but it provides an excellent framework for future research on digital health literacy and preventive treatment in rural India.

Future Directions: This study's findings should base on future multi-center, rural Indian studies. Prospective longitudinal research would assist determine how digital health literacy affects preventative care behaviour over time. Randomised controlled trials could examine teleconsultation platforms, community-based training programs, and mobile reminder devices. These evaluations may help construct federal public health policy scalable models. In addition to quantitative findings, qualitative studies on how individuals and groups experience digital health technologies may reveal what supports and inhibits digital involvement.

Conclusion

This cross-sectional study examined rural Varanasi, India, data on digital health literacy and preventative care utilisation. Higher digital health literacy is associated with more immunisations, prenatal visits, tests, and community health camp participation. Those who had limited digital skills used less preventative healthcare, demonstrating the importance of digital empowerment in health-seeking behaviour.

Digital health literacy is crucial for rural preventative healthcare, according to the research. Digital literacy lets users use health apps, respond to reminders, and obtain reliable health information while improving awareness. Digital engagement can connect people to important health services in places like Varanasi where physical health care facilities are limited.

Community-based training and awareness programs and legislative digital infrastructure enhancements are highlighted by the results. Digital skills initiatives for rural residents, especially low-income women, may improve preventative health outcomes. Increase internet connectivity, promote mobile health apps in local languages, and empower frontline health providers to share digital skills to make preventative healthcare more accessible. Technology inclusion and digital health literacy can improve rural India's access to preventative, egalitarian, and sustainable healthcare.

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