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Original Research Article

DIGITAL HEALTH LITERACY AND ASSOCIATED FACTORS AMONG ADULTS IN A RURAL COMMUNITY OF NORTH KERALA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Digital health literacy (DHL) determines how effectively people can use India's expanding digital health services, yet despite Kerala's high general literacy, community-level evidence on DHL among rural adults is limited. This study assessed DHL using the Digital Health Literacy Instrument (DHLI) 2.0 and examined the sociodemographic factors associated DHL among adults aged 30 years and above in a rural community of Kozhikode, Kerala.

Materials and Methods: A community-based cross-sectional study was conducted from June to July 2026 in the rural field practice area of Malabar Medical College Hospital and Research Centre. Adult smartphone users were recruited by convenience sampling through house-to-house visits, and 232 participants were interviewed using a pre-tested questionnaire and the DHLI 2.0. Overall scores (1–4 scale) were categorised as poor, moderate or good using the 25th and 75th percentiles. Associations were tested using the chi-square or Fisher's exact test ($p < 0.05$).

Results: The mean age was 51 ± 15.75 years and 55.6% were female. The mean overall DHLI score was 2.66 ± 0.93; operational and navigation skills scored highest and generating content lowest. DHL was poor in 24%, moderate in 51% and good in 25%. Although 64.2% were aware of at least one digital health service, only 37.5% had used one. DHL was significantly associated with age, education, occupation, socio-economic status and morbidity ($p < 0.001$). Good DHL was seen in 62.5% of those aged 30–39 years and 68.5% of graduates, but in none of those aged 60 years or above or with primary education or less.

Conclusion: DHL among rural adults was moderate, with only one in four having good DHL. Older, less-educated, economically disadvantaged adults and those with multiple morbidities were most affected. Community-based programmes strengthening critical appraisal skills and use of public digital health services are needed to prioritise these groups.

Keywords: Digital health literacy, DHLI 2.0, rural population, Kerala, cross-sectional study

INTRODUCTION

Digital health literacy (DHL) refers to the ability of individuals to access, understand, evaluate and use health information and digital health technologies to make appropriate health-related decisions. It lies at the intersection of health literacy and digital literacy. Health literacy encompasses the ability to access, understand, appraise and use health information and services, while digital literacy involves the ability to use digital technologies effectively to access, manage, evaluate and communicate information.[1,2] In the context of electronic health information, eHealth literacy has been described as the ability to

seek, find, understand and appraise health information from electronic sources and apply the knowledge gained to address health problems.[3]

The rapid expansion of digital technologies has transformed the way individuals obtain health information and interact with healthcare systems. Smartphones, health-related applications, telemedicine, online health information resources and digital health records have created opportunities for individuals to participate more actively in their healthcare. The COVID-19 pandemic further accelerated the adoption of digital platforms for healthcare delivery, communication and access to essential services. However, access to digital technologies alone does not ensure their effective use. Differences in digital skills, the ability to judge the reliability of online information, navigation difficulties and concerns regarding privacy and security may contribute to unequal benefits from digital health technologies.[4]

These issues are particularly relevant in India, where digital health services are expanding rapidly. National initiatives such as the Ayushman Bharat Digital Mission (ABDM), Ayushman Bharat Health Account (ABHA), eSanjeevani telemedicine services and other technology-enabled health services have increased opportunities for individuals to access healthcare and health information through digital platforms. At the same time, effective use of these services requires users to possess adequate digital health skills.

Kerala provides an important setting in which to examine digital health literacy. The state has a high level of general literacy and widespread access to digital technologies. However, high general literacy and digital access do not necessarily translate into the ability to effectively search for, evaluate and use digital health information. This distinction is particularly important among adults who increasingly interact with digital healthcare services for themselves and their families.

Digital health literacy may also vary across population groups according to age, education, socioeconomic characteristics and patterns of internet use.[5] The assessment of DHL among adults aged 30 years and above is therefore relevant because this population increasingly encounters digital health services while also functioning as caregivers and healthcare decision-makers within families. Understanding their level of DHL and the factors associated with it can help identify groups that may require additional support to use digital health services effectively.

Several instruments have been developed to measure digital or eHealth literacy, including the eHealth Literacy Scale (eHEALS) and other multidimensional instruments.[3,6] The Digital Health Literacy Instrument (DHLI) was developed to assess practical skills involved in accessing, evaluating and using online health information. The updated DHLI 2.0 incorporates changes in the digital health environment, including widespread smartphone use and competencies related to digital security. It comprises 24 items across eight domains: operational skills, navigation skills, information searching, evaluating reliability, determining relevance, generating content, using security measures and protecting privacy.[7]

Despite the increasing digitalization of healthcare services in Kerala, community-level evidence regarding digital health literacy among adults in rural settings remains limited. Assessing DHL at the community level can provide useful information for designing digital health education and interventions and for ensuring that expanding digital health services are accessible and usable by different sections of the population.

Therefore, the present study was conducted to assess digital health literacy using the DHLI 2.0 and to examine the socio-demographic factors associated with digital health literacy among adults aged 30 years and above in a rural community of Kozhikode, Kerala.

MATERIALS AND METHODS

Study Design and Setting: A community-based cross-sectional study was conducted from May to June 2026 in the rural field practice area of Malabar Medical College Hospital and Research Centre, Kozhikode, Kerala. The study population comprised adults aged 30 years and above residing in the field practice area.

Study Population and Eligibility Criteria: Adults aged 30 years and above who had resided in the study area for more than six months, used a smartphone at least once a week, and were willing to provide informed consent were eligible for participation. Individuals who were unable to comprehend or respond to the study questionnaire were excluded.

Sample Size and Sampling: The sample size was calculated using the formula for estimating a mean, with a standard normal deviate of 1.96, a standard deviation of 7.29, and an absolute precision of 1. The standard deviation was obtained from a previous community-based study of eHealth literacy conducted in Kerala.[8] The initial calculated sample size was 205. After allowing for a 10% non-response rate, the minimum required sample size was 225.

Participants were recruited using convenience sampling from the rural field practice area of Malabar Medical College Hospital and Research Centre, Kozhikode. Investigators conducted house-to-house visits during the study period and approached adults who met the eligibility criteria. When more than one eligible adult was present in a household, one participant was selected by lottery. The selected participant was then screened for eligibility and interviewed after obtaining written informed consent. Recruitment continued until the required sample size was achieved. A total of 232 participants were enrolled and included in the analysis.

Data Collection: Data were collected through house-to-house visits using a pre-tested, semi-structured, interviewer-administered questionnaire. The purpose of the study was explained to the participants and written informed consent was obtained before data collection. The questionnaire collected information on socio-demographic characteristics, morbidity, use of internet-based health information, awareness and utilization of digital health services, and digital health literacy.

Assessment of Digital Health Literacy: Digital health literacy (DHL) was assessed using the 24-item Digital Health Literacy Instrument 2.0 (DHLI 2.0).7 The instrument assesses eight domains: operational skills, navigation skills, information searching, evaluating reliability, determining relevance, generating content, using security measures, and protecting privacy. Each item is rated on a four-point response scale, with responses coded so that higher scores indicate higher levels of digital health literacy.[7]

The instrument includes three conditional items (6a–6c) under the domain of protecting privacy. These items are administered only to participants who have previously posted a message on a public forum or social media.[7] Therefore, not all participants are expected to respond to all 24 items. The overall DHLI score is calculated as the mean of the completed item scores and can be calculated when at least 16 of the 24 items have been completed. Domain scores are calculated as the mean of the items within the respective domain when all items in that domain are completed.[7]

For the present study, the overall DHLI score was primarily considered as a continuous score. For comparative analysis, participants were categorised into three groups based on the distribution of scores in the study population. The 25th and 75th percentiles were used as cut-points, with scores below the 25th percentile classified as poor DHL, scores between the 25th and 75th percentiles classified as moderate DHL, and scores above the 75th percentile classified as good DHLI. These categories were derived from the study population and were not pre-defined cut-offs of the DHLI 2.0 instrument.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 27. Quantitative variables were summarised using mean and standard deviation or median and interquartile range, as appropriate. Categorical variables were summarised using frequencies and percentages. Associations between DHL categories and categorical variables were assessed using the chi-square test or Fisher's exact test, as appropriate; education was analysed in five merged categories because of small cell counts. A two-sided p value <0.05 was considered statistically significant.

Ethical Considerations: Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was obtained from all participants before data collection. Confidentiality and anonymity of participant information were maintained throughout the study.

RESULTS

Socio-demographic Characteristics and Morbidity Status: A total of 232 participants were included in the study. The mean age was 51 ± 15.75 years, with the largest proportion belonging to the 50–59-year age group 73 (31.5%). Females constituted 129 (55.6%) participants and males 103 (44.4%). Muslims accounted for 124 (53.4%) and Hindus for 108 (46.6%) participants. Secondary education was the most common educational level 56 (24.1%), while homemakers constituted the largest occupational group 92(39.7%). Most participants were married 217 (93.5%) and belonged to nuclear families 161 (69.4%). Nearly half belonged to socioeconomic Class V 113 (48.7%).

Regarding morbidity, 144 (62.1%) participants had no morbidity, 57 (24.6%) had a single morbidity and 31 (13.4%) had multiple morbidities. Hypertension was the most commonly reported morbidity 60 (25.9%), followed by diabetes mellitus 53 (22.8%) and dyslipidaemia 17 (7.3%). Multiple responses were permitted for individual morbidities. Further details on the socio-demographic and morbidity characteristics of the participants are presented in [Table 1].

Table 1: Socio-demographic and morbidity characteristics of study participants (N = 232)

Variable	Category	n (%)
Age (years)	30–39	32 (13.8)
	40–49	71 (30.6)
	50–59	73 (31.5)
	≥60	56 (24.1)
Gender	Female	129 (55.6)
	Male	103 (44.4)
Religion	Hindu	108 (46.6)
	Muslim	124 (53.4)
	Christian	0 (0.0)
Education	Illiterate	1 (0.4)
	Pre-primary	4 (1.7)
	Primary	25 (10.8)
	Upper primary	44 (19.0)
	Secondary	56 (24.1)

	Senior secondary	48 (20.7)
	Undergraduate	40 (17.2)
	Postgraduate	9 (3.9)
	MPhil	5 (2.2)
Occupation	Professional	16 (6.9)
	White-collar job	14 (6.0)
	Skilled worker	25 (10.8)
	Semiskilled worker	39 (16.8)
	Unskilled worker	14 (6.0)
	Homemaker	92 (39.7)
	Student	1 (0.4)
	Unemployed	31 (13.4)
Marital status	Unmarried	6 (2.6)
	Married	217 (93.5)
	Widowed/widower/separated	9 (3.9)
Type of family	Nuclear	161 (69.4)
	Joint	26 (11.2)
	Three-generation	45 (19.4)
Socioeconomic status	Class I	28 (12.1)
	Class II	34 (14.7)
	Class III	23 (9.9)
	Class IV	34 (14.7)
	Class V	113 (48.7)
Morbidity status*	No morbidity	144 (62.1)
	Single morbidity	57 (24.6)
	Multiple morbidities	31 (13.4)

*Multiple responses were permitted for individual morbidity conditions.

Among the platforms used to search for health information, YouTube was the most commonly reported 149 (64.2%), followed by Google 92 (39.7%), WhatsApp 73 (31.5%), ChatGPT 31 (13.4%), and Gemini 11(4.7%). Overall, 58 (25.0%) participants reported that they had not used any online platform to search for health information. Multiple responses were permitted.

Awareness and Utilisation of Digital Health Services: Among the 232 participants, 149 (64.2%) were aware of at least one digital health service, while 87(37.5%) had utilised at least one such service. Among individual services, awareness was highest for Aarogya Setu 118 (50.9%), followed by KASP 104 (44.8%), whereas CoWIN had the lowest awareness 41(17.7%). Aarogya Setu was also the most commonly utilised service 52 (22.4%), followed by KASP 49 (21.1%). Tele-MANAS and eSanjeevani were the least utilised services, with 3 (1.3%) participants each. Detailed service-specific awareness and utilisation are presented in [Table 2].

Table 2: Awareness and utilisation of different digital health services among study participants (N=232) (*Multiple responses were permitted)

Digital health service	Aware, n (%)	Utilised, n (%)
Aarogya Setu	118 (50.9)	52 (22.4)
KASP	104 (44.8)	49 (21.1)
ABHA	81 (34.9)	16 (6.9)
Online hospital appointments	80 (34.5)	36 (15.5)
eSanjeevani	42 (18.1)	3 (1.3)
Tele-MANAS	42 (18.1)	3 (1.3)
CoWIN	41 (17.7)	17 (7.3)

Digital Health Literacy Instrument Scores: The mean overall digital health literacy score was 2.66 ± 0.93, with a median of 2.67 (IQR 1.52) on a 1–4 scale. Operational and navigation skills had the highest mean scores, while generating content had the lowest. The three items assessing protecting privacy were excluded from the analysis because none of the participants met the eligibility criterion for these items. The overall DHLI score was therefore calculated from the remaining 21 items and expressed on a 1–4 scale. Detailed domain-wise scores are presented in [Table 3].

Table 3: Descriptive Statistics of Digital Health Literacy Domains

Domain	Mean ± SD	Median (IQR)
Operational skills	2.74 ± 1.10	3.00 (2.20)
Navigation skills	2.77 ± 0.97	3.00 (1.67)
Information searching	2.57 ± 1.07	3.00 (1.33)
Evaluating reliability	2.40 ± 0.97	2.33 (1.33)
Determining relevance	2.40 ± 0.93	2.33 (1.33)
Generating content	2.20 ± 1.03	2.00 (2.00)
Using security measures	2.45 ± 1.10	2.50 (2.00)
Protecting privacy*	—	—
Overall DHLI score*	2.66 ± 0.93	2.67 (1.52)

Note: Protecting privacy was not reported. The overall DHLI score is marked with an asterisk as in the original data. SD = standard deviation; IQR = interquartile range.

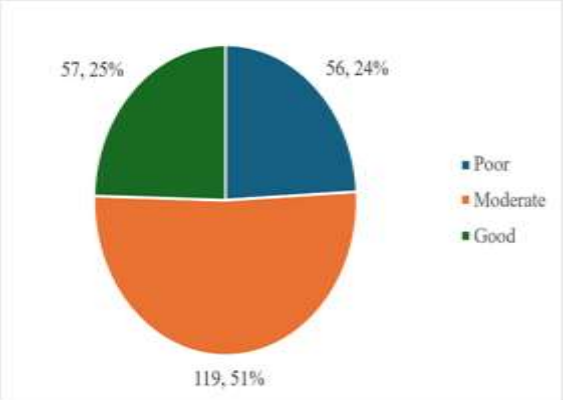


Figure 1: Distribution of Study Participants Based on Digital Health Literacy Level (N=232)

Digital Health Literacy Categories: The distribution of digital health literacy scores was examined using quartiles. The first quartile (Q1) was 39 and the third quartile (Q3) was 71. Based on these percentile cut-offs, participants with scores <39 were categorised as having poor digital health literacy, scores of 39–71 as moderate, and scores >71 as good digital health literacy. Accordingly, 56 (24%) participants had poor, 119 (51%) had moderate, and 57 (25%) had good digital health literacy [Figure 1].

Association of Digital Health Literacy with Socio-demographic Characteristics and Morbidity: Digital health literacy showed statistically significant associations with age group, education, occupation, socio-economic status and morbidity status ($p < 0.001$). Participants aged 30–39 years had the highest proportion of good digital health literacy 62.5% , whereas none of the participants aged ≥60 years had good digital health literacy and 57.1% had poor digital health literacy. Good digital health literacy increased markedly with higher educational attainment, with 37 (68.5%) of those with graduate-level education or above and none of those with primary education or below having good digital health literacy. Professionals had the highest proportion of good digital health literacy among occupational groups (87.5%). Participants belonging to socio-economic status Class I had the highest proportion of good digital health literacy (82.1%). Participants with no morbidity had a higher proportion of good digital health literacy (29.9%), while those with multiple morbidities had the highest proportion of poor digital health literacy (58.1%). Gender, religion, marital status, type of family and total family size were not significantly associated with digital health literacy ($p > 0.05$) [Table 4]

Table 4. Association between Digital Health Literacy and Socio-demographic Characteristics and Morbidity (N=232)

Variable	Category	Poor n (%)	Moderate n (%)	Good n (%)	Total	χ^2 / Fisher's Exact	p-value
Age group	30–39	0 (0)	12 (37.5)	20 (62.5)	32	78.531	<0.001
	40–49	6 (8.5)	42 (59.2)	23 (32.4)	71		
	50–59	18 (24.7)	41 (56.2)	14 (19.2)	73		
	≥60	32 (57.1)	24 (42.9)	0 (0)	56		
Gender	Female	31 (24.0)	72 (55.8)	26 (20.2)	129	3.463	0.177
	Male	25 (24.3)	47 (45.6)	31 (30.1)	103		
Religion	Hindu	23 (21.3)	52 (48.1)	33 (30.6)	108	4.013	0.134
	Muslim	33 (26.6)	67 (54.0)	24 (19.4)	124		
Education	≤ Primary	20 (66.7)	10 (33.3)	0 (0)	30	114.611	<0.001
	Upper primary	18 (40.9)	22 (50)	4 (9.1)	44		
	Secondary	12 (21.4)	39 (69.6)	5 (8.9)	56		
	Senior secondary	6 (12.5)	31 (64.6)	11 (22.9)	48		
	Graduate and above	0 (0)	17 (31.5)	37 (68.5)	54		
Occupation	Professional	0 (0)	2 (12.5)	14 (87.5)	16	62.627	<0.001
	White-collar job	0 (0)	7 (50)	7 (50)	14		
	Skilled worker	4 (16)	13 (52)	8 (32)	25		
	Semi-skilled worker	7 (17.9)	25 (64.1)	7 (17.9)	39		
	Unskilled worker	7 (50)	5 (35.7)	2 (14.3)	14		
	Homemaker	30 (32.6)	47 (51.1)	15 (16.3)	92		
	Student	0 (0)	0 (0)	1 (100)	1		
	Unemployed	8 (25.8)	20 (64.5)	3 (9.7)	31		
Marital status	Unmarried	1 (16.7)	2 (33.3)	3 (50.0)	6	5.925	0.205
	Married	51 (23.5)	112 (51.6)	54 (24.9)	217		
	Widow/Widower/Separated	4 (44.4)	5 (55.6)	0 (0)	9		
Socio-economic status	Class 1	1 (3.6)	4 (14.3)	23 (82.1)	28	63.213	<0.001
	Class 2	10 (29.4)	15 (44.1)	9 (26.5)	34		
	Class 3	4 (17.4)	17 (73.9)	2 (8.7)	23		
	Class 4	11 (32.4)	17 (50)	6 (17.6)	34		
	Class 5	30 (26.5)	66 (58.4)	17 (15.0)	113		
Morbidity	No morbidity	24 (16.7)	77 (53.5)	43 (29.9)	144	25.785	<0.001
	Single morbidity	14 (24.6)	32 (56.1)	11 (19.3)	57		
	Multiple morbidity	18 (58.1)	10 (32.3)	3 (9.7)	31		

DISCUSSION

This study found moderate digital health literacy (DHL) among rural adults in Kozhikode (mean 2.66 on a 1–4 scale), with one-quarter having good DHL. Operational and navigation skills were highest, whereas evaluating reliability, determining relevance and generating content were lowest. Participants were thus more comfortable operating devices than appraising or creating health information, a pattern consistent with Diviani et al,[9] who reported that low health literacy impairs the evaluation of online information. A previous Kerala study by Surendran et al.[8] likewise found that electronic health literacy varied by sociodemographic group despite high general literacy.

Age showed the steepest gradient: 62.5% of those aged 30–39 years had good DHL, compared with none of those aged 60 years or above, over half of whom had poor DHL. Lower eHealth literacy among older adults has been reported by Tennant et al.[10] and Estacio et al,.[11] and may reflect less digital exposure, sensory and cognitive barriers, and reliance on family members for digital tasks. DHL also rose steadily with education, with good DHL in 68.5% of those with graduate-level education or above but none of those with primary education or less, consistent with Neter and Brainin,[5] Estacio et al,[11] and Xesfingi and Vozikis.[12] Despite Kerala's near-universal basic literacy, good DHL was largely confined to the highly educated, indicating that general literacy does not ensure the critical skills needed for digital health. Professionals (87.5%) and socio economic Class I participants (82.1%) had the highest DHL, while homemakers and unskilled workers fared worse, in line with van Deursen and van Dijk,[13] and Mackert et al,[14] who showed that socio-economic position shapes digital skills and the benefits gained from technology. Gender, religion, marital status and family type were not associated with DHL, suggesting that generational, educational and economic factors outweigh cultural or household characteristics. Participants with multiple morbidities had the highest proportion of poor DHL (58.1%), implying that those with the greatest health needs are least equipped to use digital services, as Berkman et al,[15] linked low health literacy to poorer outcomes. This association is probably confounded by age, which was not adjusted for.

Most participants used YouTube (64.2%) and WhatsApp (31.5%) for health information, platforms of variable quality, as reviewed by Madathil et al,[16] and 13.4% already used ChatGPT, which makes appraisal skills especially important. Awareness of digital health services (64.2%) exceeded use (37.5%); ABHA was known to 34.9% but used by 6.9%, and eSanjeevani and Tele-MANAS were each used by only 1.3%. The WHO global strategy,[4] stresses that digital health tools must be accessible and usable by all to avoid widening inequalities. Since interventions can improve eHealth skills in older adults, as reviewed by Watkins and Xie,[17] community programmes through NCD clinics, ASHA workers and Kudumbashree groups should target older, less-educated and chronically ill adults, emphasising critical appraisal and use of public digital services. Further multivariable studies using larger, probability-based samples are needed to confirm these associations.

CONCLUSION

Digital health literacy among adults in the rural community of Kozhikode was moderate, with better skills in operating and navigating digital platforms than in evaluating and creating online health information. Age, education, occupation, socioeconomic status and morbidity were significantly associated with digital health literacy. Older adults, those with lower educational levels, economically disadvantaged groups and individuals with multiple morbidities were more likely to have poor digital health literacy. Community-based programmes should focus on improving digital health literacy among these vulnerable groups. Practical training on identifying reliable online health information and using digital health services safely and effectively should be promoted through primary healthcare facilities and community outreach activities.

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