Associations of Health and Digital Health Literacy with Health-Related Quality of Life: A Cross-Sectional Study in Greece and Cyprus

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Background and Objective: Health literacy and digital health literacy reflect on an individual's ability to access, understand, and use health information and digital tools. Both have been associated with self-efficacy and improved health outcomes. The main aim of this study is to investigate the relationship between health literacy and digital health literacy with health-related quality of life. In addition, the study aims to identify the factors contributing to health and digital health literacy.

Materials and Methods: A cross-sectional online survey was conducted between December 2024 and January 2025. The questionnaire included socio-demographic data, the HLS-EU-Q16, the electronic Health Literacy Scale (eHEALS), while the SF-12 was applied to assess physical and mental health-related quality of life. Descriptive statistics and inferential analysis were applied, including multiple linear and logistic regressions.

Results: The sample included 557 adults, aged 18 years or above (mean age: 31.4 years; 76.5% female). Most participants had an adequate level of health literacy (64.8%), while the average digital health literacy score was 27.92 (sd=7.15). A significant positive correlation between health literacy and digital health literacy was found ($r = 0.487$, $p<0.001$). Health literacy was positively associated with educational level and income. Digital health literacy was also associated with higher educational attainment. Health literacy, but not digital health literacy, was significantly associated with better physical and mental health-related quality of life ($b = 0.64$ and $b = 0.84$, respectively; $p<0.001$).

Conclusions: Among adults in Greece and Cyprus, health literacy was generally adequate and positively associated with higher education and income. Digital health literacy correlated with health literacy and education but was not independently related to health-related quality of life. Higher health literacy consistently predicted better physical and mental health-related quality of life, underscoring health literacy as a key, modifiable correlate. These findings support prioritizing health literacy building strategies to advance equity and self-management.

Keywords: Health Literacy, Digital Health Literacy, Health-Related Quality of Life, Public Health

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Introduction

Background

In recent years, a concept that has become increasingly important in the field of public health is health literacy. Health literacy (HL) is defined as the cognitive and social skills that determine individuals' motivation and ability to access, understand, use, and apply health information in ways that promote and maintain good health (1). Health literacy is divided into three types: communicative literacy, critical literacy, and functional literacy. Communicative literacy refers to an individual's cognitive, grammatical, and social abilities to participate in everyday activities. Critical literacy focuses on higher-level skills for evaluating information with the aim of applying it correctly (2). Functional health literacy refers to basic skills in reading and writing that are necessary to function effectively in everyday health contexts, such as understanding medication labels or following appointment schedules (3).

Health literacy operationalizes empowerment and is therefore foundational to public health practice and outcomes (3). As Dr. Rima Rudd notes, low health literacy is not merely an individual deficit but a social risk that undermines public health at scale. Consequently, effective health promotion should explicitly build health literacy—through plain-language communication, numeracy and navigation supports, and digital health literacy—so that information and interventions translate into equitable, actionable, and sustainable health gains (4).

An extension of health literacy is digital health literacy (DHL), which is a relatively newer concept than health literacy. Digital health literacy refers to an individual's ability to access, understand, and engage with digital health materials or technologies in order to contribute to their quality of life (5). Both health literacy and digital health literacy are influenced by socioeconomic factors. The factors that influence health literacy and are associated with low levels of health literacy are educational attainment, income, and occupation (6). Age, educational attainment, and social status are the main factors associated with reduced levels of digital health literacy (7). Both health literacy and digital health literacy are considered important determinants of health and have been associated with self-efficacy and improved health outcomes (8).

Problem Statement

Public health planning in Greece and Cyprus lacks population-based evidence on health literacy and digital health literacy. Without these data, it is difficult to target communication, digital inclusion, and prevention initiatives and to anticipate their effects on health-related quality of life (HRQoL). Rigorous, population-level assessment of health literacy, digital health literacy, and their relationships with HRQoL is therefore needed.

Literature Review

An important question that concerns us in this particular study is how health literacy and digital health literacy affect health in relation to people's quality of life. Studies in international literature have investigated this research question. One such study was conducted by Gibney et al. Their research sought to investigate the association between health status, health

behavior, and healthcare utilization with health literacy in the Irish population. A characteristic feature of this study is that the lower and middle social classes are associated with poorer health status and long-term health conditions, in contrast to the higher social classes, which had a higher level of health literacy and better health status (7).

In Japan, Yokoyama et al. examined health literacy in relation to the lifestyle and health status of students. The results showed that students with higher scores on the HSL-EU-Q47 questionnaire also had higher scores on the SF-36 questionnaire, which assesses health status (9). Berete et al. investigated the mediation of HL between socioeconomic status and health-related conditions. It was found that HL is positively related to physical activity and nutrition, while inadequate levels of HL are related to poor mental health. Furthermore, HL appeared to have a significant mediating relationship between income and mental health status10.

The study by Persell et al showed that participants with low health literacy reported limited physical activity and poorer initial physical condition compared to individuals with higher health literacy levels. However, mental health did not appear to be directly related to health literacy, leading to the conclusion that the relationship between health literacy and health varies depending on the outcomes under consideration (10). More recent research, such as the one conducted by Svendsen et al. found a strong correlation between health literacy and health status, reporting that higher levels of health literacy are associated with better health and, conversely, lower levels of health literacy with poorer health. In addition, a correlation was found between health literacy and health behavior, with a characteristic example being that individuals with low levels of health literacy have an increased risk of developing obesity compared to individuals with higher levels of health literacy (11).

A recent study conducted among the Egyptian population aimed to examine health literacy and antibiotic use. A sample of 500 participants showed that individuals with low levels of health literacy lacked knowledge about the proper use of antibiotics and also took antibiotics without a prescription. This study highlighted the need to design programs to avoid side effects and risks such as the development of microbial resistance (12).

In the systematic review by Xie et al. on digital health literacy and health outcomes among older adults, a positive relationship between health and digital health literacy was found. More specifically, a positive relationship between digital health literacy and self-care, self-efficacy, and psychological well-being was observed (13). Similar results were found in the study by Arias Lopez et al. who found that 24.5% of 53 studies associated digital health literacy with health outcomes. Health promotion ranked first, specifically health-related behaviors such as stress management, social support, and self-actualization (14).

The research by Milanti et al. which has also been analyzed in terms of the factors of psychological well-being, has provided useful results regarding the relationship between digital health literacy and health. A relation between mental health and digital health literacy was found. In particular, higher levels of digital health literacy were associated with better psychological well-being, self-actualization, better self-management, and factors that

contribute to health, such as diet and sleep. Digital health literacy was also linked to the social dimension of health, with individuals with higher levels of digital health literacy exhibiting better social interactions (15).

A recently published study by Jiao et al. examined the long-term relationship between digital health literacy and healthy lifestyles among older adults in China. It was found that older adults with higher digital health skills exhibited significantly better health-promoting behaviors over time. A positive attitude toward digital health tools appeared to reinforce this relationship. The effect was particularly pronounced in individuals with chronic conditions, indicating the value of enhancing digital literacy to improve their health (16).

Nutbeam, through further research examines the relationship between eHealth and healthy lifestyles in older adults in China through a three-part longitudinal study. He concludes that higher digital health literacy contributes to improved healthy lifestyle habits, especially in individuals with chronic conditions. A positive attitude toward eHealth significantly mediates this relationship, while the need for tailored interventions for people with chronic conditions is critical. The study also emphasizes the importance of providing educational programs tailored to older adults on digital platforms to enhance literacy and access to health (3).

Health literacy has emerged as a key policy area in Europe, with the World Health Organization promoting systematic measurement and monitoring through the M-POHL network and the pan-European HLS19 survey (17). At the same time, programs such as IDEAHL (Horizon Europe) and EU4Health 2021–2027 emphasize the importance of digital literacy and citizen empowerment, making health literacy a strategic priority (18-19). At the national level, Greece has incorporated the promotion of health literacy into its Patient Quality and Safety Strategy 2025–203020, while in Cyprus, research interest is developing that focuses on parents and health professionals (20-21). However, despite these initiatives, implementation remains fragmented and evidence of policy effectiveness is limited. There is therefore a need for further empirical research, both comparative at European level and targeted at national specificities, in order to develop evidence-based interventions and fill existing knowledge gaps.

Research gap

Essentially, the simultaneous measurement of health literacy and digital health literacy aims to provide an overall picture of HL at a time when health systems are being digitized. It is therefore important to study the two concepts, identify populations that are lagging behind, and provide new data for the formulation of targeted policies in both countries aimed at improving HRQoL, in line with European standards.

Research objectives

The specific objectives of this study are:

1. Estimate population levels of Health Literacy and Digital Health Literacy among adults in Greece and Cyprus using validated instruments.

2. Identify sociodemographic correlates of Health Literacy and Digital Health Literacy.

3. Quantify the independent and joint associations of Health Literacy and Digital Health Literacy with Health-Related Quality of Life.

Materials and Methods

A cross-sectional study was conducted from December 2024 to January 2025 among the general adult population of Greece and Cyprus. Eligible participants were adults (≥18 years), residents of Cyprus or Greece, who were using digital media. A convenience sample was derived from the dissemination of the questionnaire on various social media platforms.

The questionnaire was written in Greek and in an electronic form, appropriately formatted by Microsoft Forms. Participation was anonymous. The survey platform restricted participation to one completed submission per browser session/device. All items were single-response and mandatory. Participants provided electronic informed consent and confirmed age ≥18 years before proceeding. We audited data for completeness and internal consistency and excluded incomplete or inconsistent records.

For the purposes of the survey, we created a single electronic questionnaire consisting of four parts. The first part contained eight questions about demographic and socioeconomic data such as age, gender, income, family status, professional status, educational level, current place of residence (urban center or countryside) and permanent residence. The second part of the questionnaire contained the HLS-EU-Q16 questionnaire (22). This questionnaire measures the levels of health literacy. To meet the requirements of our study, we used the Greek version of the questionnaire, which has been translated and standardized into Greek by Michou & Costarelli (23). It includes 16 self-report questions. The questions use a Likert scale from 1 to 4, with 1 = very difficult and 4 = very easy. The answers "very difficult" and "difficult" are coded as 0, while the answers "easy" and "very easy" are coded as 1. The maximum score is 16. A score of 0-8 corresponds to an inadequate level, 9-12 to a problematic level, and 13-16 to an adequate level. The Greek HLS-EU-Q16 showed evidence of construct validity (three-factor structure—"Health Care," "Disease Prevention," "Health Promotion"—with eigenvalues >1) and strong reliability in the Greek population, with excellent internal consistency for the total scale (Cronbach's α=0.884), acceptable subscale Cronbach's α (0.790, 0.710, 0.800), and good 15-day test–retest stability (Spearman r=0.628, p<0.01).

The third part includes the eHEALS questionnaire for measuring Digital Health Literacy (24). This questionnaire was used in Greek, based on the translation and weighting carried out by researchers Kritsotakis et al (25). The eight questions are on a Likert scale of 1 to 5 with a maximum score of 40 and a minimum of 8. The Greek version of eHEALS demonstrated excellent internal consistency (Cronbach's α=0.93), indicating strong reliability in the Greek population. The fourth and final part of the questionnaire was the SF-12, which has been translated and calibrated by Kontodimopoulos et al. This questionnaire has 12 self-report questions, either on a Likert scale or in the form of "yes" or "no" answers and yields two summary indices: the Physical Component Summary (PCS-12) and the Mental Component

Summary (MCS-12). This 12-item instrument includes Likert-type and yes/no items. The Greek SF-12 demonstrates strong construct and concurrent validity (including expected convergence with EQ-5D) and good sensitivity (26).

The statistical analysis was performed using the SPSS statistical package. Measures of central tendency and dispersion were used for continuous variables and frequency and percentages for categorical variables. ANOVA, chi-square, and t-tests were used for bivariable analysis while multiple linear and logistic regression were used for multivariable analysis. To identify predictors of health literacy, we fitted both multiple linear and multiple logistic regression models. Health literacy was modeled on its native continuous scale using multiple linear regression to preserve information, maximize statistical power, and yield directly interpretable effect estimates (β coefficients as adjusted mean differences per unit change in each predictor), thereby avoiding information loss from arbitrary cut-points. For comparability with prior literature, we also dichotomized health literacy into “adequate” vs “inadequate” according to commonly used criteria and applied multiple logistic regression to estimate adjusted odds ratios; using both parameterizations enabled an assessment of robustness to outcome scaling. Predictors of digital health literacy were examined using multiple linear regression. All models adjusted for the same covariates: gender, age, educational level, family status, employment status, and monthly income. Finally, associations of health literacy and digital health literacy with health-related quality of life (HRQoL) were evaluated using simple (unadjusted) and multiple (adjusted) linear regression, with HRQoL as the dependent variable and HL/DHL as the primary exposures; the multivariable models included the covariates listed above. We examined linearity, multicollinearity (variance inflation factors) and residual diagnostics for multiple linear regression, and assessed discrimination/calibration for multiple logistic regression.

This study was conducted in accordance with the Declaration of Helsinki; the study protocol and informed-consent procedures were assessed and approved by the Cyprus National Bioethics Committee (ΕΕΒΚ ΕΠ 2024.01.383), and written informed consent was obtained from all participants.

Result

The final sample size was 557 participants, after applying the inclusion criteria mentioned above. Starting with the description of the results, the average age was 31.36 years (sd=12.14). Women outnumbered men, accounting for 76.5% of the sample, while men accounted for only 23.5%. Regarding permanent residence, the vast majority of participants reported that they were residents of Greece, accounting for 97.8% compared to 2.2% of Cypriot participants. 56.6% reported that they lived in an urban center, while 43.4% stated that they lived in the countryside.

After grouping the variable of marital status, three categories emerged with their respective percentages, which are: unmarried with a percentage of 62.7%, divorced/separated/widowed: 4.1%, and married/in a civil partnership 33.2%. Employment

status was categorized into two groups. The first group consisted of the unemployed, those who were not working, and retirees, while the second group consisted of part-time or full-time employees, with corresponding percentages of 29.6% and 70.4%.

Four categories emerged in terms of educational level. The first category consisted of participants up to secondary education. The second consisted of participants who had Post-Secondary Vocational Education. The third category consisted of graduates of higher education institutions and the fourth of holders of master's and doctoral degrees. The percentages for each category were in order: 33%, 10.1%, 40.6% and 16.3%. Monthly income (gross income) in euro was grouped into three categories: 1) <€1,000, 2) €1,000 – €1,500, 3) > €1,500. The percentages attributed to each category are 61.8%, 25.9% and 12.4%.

Our sample had an adequate HL level (64.85%) with a mean value of 13.18 (sd=2.91). The score for DHL was calculated at 27.92 (sd=7.15) **(Table 1).** In the bivariable analysis for the HL and DHL variables, we used Pearson's correlation coefficient. The correlation coefficient was r=0.487 (p=0.00), demonstrating a moderately strong positive association between the two variables.

For HL, multiple linear regression models identified educational level and monthly income as statistically significant factors. Participants in the "MSc/PhD holders" category and those with a monthly income of " >1,500 euros" had higher HL scores (b= 0.83; 95% CI: 0.03 – 1.63; p=0.043, b=0.85; 95% CI: 0.01 – 1.68; p=0.047 respectively). DHL was associated with higher educational levels. Specifically, university graduates and MSc/PhD holders had the highest DHL scores (b=2.41; 95% CI: 0.93 - 3.90; p=0.001 and b=4.72; 95% CI: 2.77 - 6.70; p=0.000 for each category) **(Table 2).**

With regard to HRQoL, the simple linear regression models identified HL and DHL as statistically significant factors of HRQoL. When the two variables were included simultaneously in the multiple regression model and adjusted for confounding factors (age, gender, educational level, income), only the relationship between HL and HRQoL remained (PCS: b=0.64; 95% CI:0.31 - 0.978 when HL was treated as continuous variable and b= 3.41; 95%: 1.48 - 5.35 when HL was treated as categorical variable, MCS: b=0.84; 95% CI: 0.53 - 1.15 as continuous variable and b=3.41; 95% CI: 1.48 - 5.35 as categorical variable). It is important to note that HL remained a statistically significant factor for HRQoL, if we included it in the model as a categorical variable with three levels (inadequate, problematic and adequate) **(Table 3).**

Table 1. Descriptive statistics for demographic data and Health Literacy and Digital Health Literacy scores

Variables		Frequency (%)
Educational level	Up to secondary education	184 (33%)
	Post-Secondary Vocational Education	56 (10.1%)
	University graduates	226 (40.6%)
	MSc/PhD holders	91 (16.3%)
Family status	Unmarried	349 (62.7%)

	Divorced, separated, widowed	23 (4.1%)
	Married / in a civil partnership	185 (33.2%)
Professional status	Unemployed, Not working, Retired.	165 (29.6%)
	Part-time – full-time employment.	392 (70.4%)
Monthly income(in euros)	<1,000	344 (61.8%)
	1,000 – 1,500	144 (25.9%)
	>1,500	69 (12.4%)
Gender	Male	131 (23.5%)
	Female	426 (76.5%)
Permanent residence	Greece	545 (97,8%)
	Cyprus	12 (2,2%)
Resident	Urban center	315 (56.6%)
	Countryside	242 (43.4%)
		Mean (SD)
Age (in years)	-	31.36 (12.14)
		Frequency (%)
Health Literacy	Inadequate	43 (7.7%)
	Problematic	153 (27.5%)
	Adequate	361 (64.8%)
		Mean (SD)
Health Literacy Scale	-	13.8 (2.91)
Digital Health Literacy Scale	-	27.92 (7.15)

Table 2. Predictors of Health Literacy (HL) and Digital Health Literacy (DHL)

Variables	Health Literacy Levels (categorical)				Health Literacy Score (continuous)				Digital Health Literacy			
	Frequency of adequate (%)	p-value*	OR (95% CI)	Reg.p-value‡	Mean (SD)	p-value	β (95% CI)	Reg. p-value±	Mean (SD)	P-value	β(95% CI)	Reg. p-value±
Gender												
Male	81 (61.8%)	0.41	Ref.		12.82 (3.25)	0.10¶	Ref.		27.59 (7.57)	0.54¶	Ref.	
Female	280 (65.7%)		0.76 (0.49 - 1.19)	0.22	13.29 (2.79)		0.58 (-0.01 - 1.16)	0.05	28.02 (7.02)		0.02 (-1.42 - 1.46)	0.97
Resident												
Countryside	153 (63.2%)	0.49	Ref.		13.02 (2.93)	0.23¶	Ref.		27.47 (7.08)	0.19¶	Ref.	
Urban center	208 (66%)		0.95 (0.66 - 1.37)	0.77	13.31 (2.88)		0.18 (-0.31 - 0.67)	0.48	28.27 (7.19)		0.58 (-0.64 - 1.77)	0.33
Permanent residence												
Greece	1 (8.3%)	0.49	Ref.		13.16 (2.93)	0.03¶	Ref.		27.91 (7.11)	0.87¶	Ref.	
Cyprus	11 (91.7%)		0.18 (0.02 - 1.43)	0.10	14.17 (1.40)		0.82 (-0.83 - 2.47)	0.32	28.25 (8.89)		5,58 (-3.92 - 4.21)	0.92
Educational level												
Up to secondary education	105 (57.1%)	0.04	Ref.		12.52 (3.13)	0.00§	Ref.		26.05 (7.02)	0.00§	Ref.	
Post-Secondary Vocational Education	37 (66.1%)		0.65 (0.33 - 1.26)	0.20	13.57 (2.87)		1.04 (0.15 - 1.94)	**0.02**	26.96 (7.96)		1.01(-1.18 - 3.22)	0.36
University graduates	153 (67.7%)		0.66 (0.42 - 1.04)	0.07	13.40 (2.69)		0.70 (0.10 - 1.30)	**0.02**	28.49 (6.72)		2.41 (0.93 - 3.90)	**0.00**
MSc/PhD	66 (72.5%)		0.61 (0.33 - 1.13)	0.11	13.75 (2.78)		0.83 (0.03 - 1.63)	**0.04**	30.88 (6.80)		4.72 (2.77 - 6.70)	**0.00**
Family status												
Unmarried	218 (62.5%)	0.04	Ref.		13.04 (2.80)	0.13§	Ref.		27.50 (7.19)	0.07§	Ref.	
Divorced, separated, widowed	20 (87%)		0.33 (0.09 - 1.21)	0.09	14.52 (2.64)		0.91 (-0.40 - 2.22)	0.17	28.65 (5.10)		0.64 (-2.46 - 3.99)	0.67
Married, in a civil partnership	123 (66.5%)		1.08 (0.64 - 1.84)	0.76	13.29 (3.09)		-0.21 (-0.90 - 0.48)	0.55	28.63 (7.26)		0.46 (-1.13 - 2.27)	0.49
Professional status												
Unemployed, Not working, Retired.	107 (64.8%)	0.99	Ref.		12.99 (2.87)	0.30	Ref.		27.32(6.95)	0.20¶	Ref.	
Part-time, full-time employment.	254 (64.8%)		1.51 (0.98 - 2.35)	0.06	13.27 (2.92)		-0.39 (-0.97 - 0.20)	0.19	28.17(7.22)		-0.55 (-1.98 - 0.89)	0.44
Monthly income (in euros)												
<1.000	203 (59%)	0.00	Ref.		12.78 (2.98)	0.00§	Ref.		27.32 (7.04)	0.01§	Ref.	
1.000-1.500	108 (75%)		2.04 (1.26 - 3.33)	**0.00**	13.90 (2.51)		1.01 (0.39 - 1.63)	**0.00**	29.22 (6.98)		0.90 (-0.60 - 2.46)	0.24
>1.500	50 (72.5%)		1.78 (0.92 - 3.44)	**0.08**	13.68 (2.97)		0.85 (0.01 - 1.68)	**0.04**	28.20 (7.73)		-0.49 (-2.50 - 1.62)	0.63
Variable	**Mean age of sufficient (SD)**	**P-value**	**OR (95%)**	**Reg p-value**	**Simple regression coefficient(95%CI)**	**p-value**	**Mult.Reg.coefficient (95% CI)**		**Simple regression coefficient(95% CI)**	**Reg. p-value**	**Mult.Reg.coefficient (95% CI)**	**Reg. p-value**

Age	32.07 (12.35)	0.05	1.01 (0.98 - 1.03)	0.62	0.02 (0 - 0.04)	0.02	0.01 (-0.02 - 0.04)	0.52	0.04 (-0.01 - 0.09)	0.10	-0.001 (23.51 - 28.37)	0.83

* Chi-square test

‡ Multiple logistic regression

¶ Independent samples t-test

§ Analysis of Variance test (ANOVA)

± Multiple linear regression

Table 3. Association of Health Literacy Score (HL) and Digital Health Literacy (DHL) with the Physical and Mental health component of SF-12

Variable	Simple regression coefficient (95%CI)	p-value	Multivariable Regression Coefficient(95% CI)	Regression p-value
Physical Component Summary (PCS)				
Health Literacy Scale	0.65 (0.36 - 0.93)	0.00	0.64 (0.31 - 0.97)	**0.00**
Digital Health Literacy Scale	0,16 (0.04 - 0.27)	0.00	0.03 (-0.10 - 0.16)	0.65
Mental Component Summary (MCS)				
Health Literacy Scale	0.94 0.94 (0.66 - 1.22)	0.00	0.84 (0.53 - 1.15)	**0.00**
Digital Health Literacy Scale	0.21 (0.09 - 0.32)	0.00	0.01 (-0.12 - 0.14)	0.90
Physical Component Summary (PCS)				
Level_1_ Inadequate level	-3.96 (-5.44 - -2.01)	0.00	Ref.	
Level_2_Adequate level	3.96 (2.01 - 5.44)		3.41 (1.48 - 5.35)	**0.00**
Digital Health Literacy Scale	0.16 (0.04 - 0.27)	0.00	0.05 (-0.08 - 0,18)	0.42
Mental Component Summary (MCS)				
Level_1_ Inadequate level	-0.19 (-5.67 - -2.25)	0.00	Ref.	
Level_2_Adequate level	0.19 (2.25 - 5.67)		2.74 (0.87 - 4.61)	**0.00**
Digital Health Literacy Scale	0.21 (0.09 - 0.32)	0.00	0.09 (-0,04 - 0,22)	0.16

Discussion

Using validated instruments (HLS-EU-Q16, eHEALS, SF-12), we surveyed 557 adults and found that 64.8% had adequate health literacy (mean13.18, sd=12.14), the mean digital health literacy score was 27.9, and health literacy and digital health literacy were moderately correlated ($r=0.487$; $p<0.001$). Higher health literacy was observed among participants with postgraduate education and higher income, whereas higher digital health literacy was associated with higher educational attainment. In adjusted analyses, health literacy, but not digital health literacy, was independently associated with higher PCS-12 and MCS-12 scores and these associations held when health literacy was modelled either continuously or across three categorical levels. Together, these results suggest that general health literacy is more proximally linked to perceived physical and mental health status than self-reported digital health literacy as captured by eHEALS, despite their moderate correlation.

The factors found in our study to influence health literacy include educational level and monthly income. This finding is confirmed by the research conducted by Xesfingi and Vozikis (2016), which identified age, monthly income, and social class as factors influencing health literacy (27). Similarly, research by Soresen et al. (2015) on health literacy in European countries (including Greece) showed strong statistical significance results, with income being one of the factors contributing to health literacy. To interpret this relationship, one can infer that low income and economic deprivation are reflected in the lack of health literacy and poorer health (28).

The research by Van Der Heide et al. (2013) adds to the confirmation of education as a factor contributing to health literacy, emphasizing that health literacy is particularly important in individuals with low educational levels due to their reports of poorer health compared to individuals with higher educational levels (29). Moreover, research by Garcia-Codina et al. (2019) reports that individuals with lower educational levels are almost 2.08 times more likely to have low levels of health literacy than individuals with higher educational levels. Similarly, it reports that individuals with a low socioeconomic level are 2.11 times more likely to have low health literacy than those with a high socioeconomic level (30).

With respect to digital health literacy, the multiple linear regression model highlighted educational level as a predictor, with particular statistical emphasis on the categories of university graduates and holders of master's and doctoral degrees. This result indicates that digital health literacy is a skill that appeals to people with a higher level of education and computer skills. This factor has been confirmed by Xesfingi and Vozikis (2016)27. The same results were found in the study by Estrella et al. (2023), who investigated the socioeconomic factors that influence digital health literacy. Among their findings, they identified a strong correlation between educational level and digital health literacy (31).

Health literacy and digital health literacy showed a moderately strong positive correlation. This result is supported by various studies, one of which is that of the WHO (2025), emphasizing that with the increase of digital health literacy and the creation of appropriate health information networks, citizens will have access to valid and reliable information that

will contribute to increasing their health literacy (1). Another study reinforces the hypothesis of the correlation between the two variables mentioned above, arguing that individuals with higher health literacy tend to have higher digital health literacy. Delving deeper into the positive relationship between them, it can be interpreted as follows: digital health literacy enables the search and processing of information through the use of digital tools. Health literacy allows individuals to understand, process, and apply (by definition) the information obtained from digital media. This creates a partial substitution between the two variables, while researchers emphasize the complexity of this relationship (32).

Although health literacy and digital health literacy were correlated, only health literacy showed an independent association with health-related quality of life. In multivariable models, higher health literacy consistently predicted better SF-12 Physical Component Summary (PCS-12) and Mental Component Summary (MCS-12) scores. The study by Naimi et al., which involved adults with hypertension, came to the same conclusions. It appeared that health-related quality of life had a positive relationship with health literacy. Another similar study in cancer patients concluded that health literacy is a contributing factor in health-related quality of life. It should be noted that in this study, as in ours, health literacy was used in both forms, i.e., as a continuous variable (using its score) and as a categorical variable (using health literacy levels). In commenting on their results, the researchers report that patients with low health literacy had low health-related quality of life scores (33). Further research on HRQoL, such as that conducted by Stellefson et al. (2019) (34) and Van Der Heide et al. (2013) (29), reaches the same conclusion, highlighting the statistically significant relationship between the two variables. Specifically, patients with low levels of health literacy are associated with severe COPD, poor health, and low levels of self-care (35). This result is interpreted by considering the overall effect of health literacy on treatment compliance and the strengthening of self-management, as emphasized by Soresen et al. Additionally, self-management contributes to the normalization of symptoms, anxiety, and reduced hospitalization, which ultimately leads to a better quality of life related to health (28).

One possible explanation for the lack of correlation between digital health literacy and HRQoL is that adopting a healthy lifestyle does not necessarily lead to improved digital health literacy, i.e., better evaluation of information from digital media. A typical example is provided by Li et al. (2022) who explained that students spend a lot of time on digital media, but this does not mean that they can adequately evaluate the information they receive from digital media in terms of its reliability and validity (36).

Zrubka et al. (2023) explain that eHEALs (a questionnaire on digital health literacy) is not a direct predictor of health-related quality of life. Secondly, this questionnaire refers to the personal assessment of respondents' ability to filter health information from digital media and not to the actual assessment of health information (37). Furthermore, the nature of the eHEALs questionnaire (self-report questionnaire) leads to an overestimation of abilities in relation to digital health literacy (24).

Despite its valuable insights, this study has several limitations. First, the number of participants from the general adult population of Cyprus is small, which underpowers country-specific analyses and limits the generalizability to Cyprus. Therefore, we avoid reporting Cyprus-specific estimates. Gender imbalance is one more limitation. Moreover, participants had to have access to digital devices such as computers, tablets, and mobile phones, as well as access to the respective platforms where the questionnaire was shared (such as Instagram and Facebook). This excluded individuals who did not have access to the above and may not be fully representative of the entire Greek and Cypriot population. The questionnaire belonged to the category of self-reporting, or as it is widely known, "self-report." The risk with this type of questionnaire is social desirability bias, where participants answer based on what is "socially acceptable," especially for questions about physical and mental health. There is also the possibility that participants may interpret a question differently than they should, thus giving a different answer than they would have given with the explanation of the question.

Future research should investigate the co-evaluation of health literacy and digital health literacy with the adoption of healthy daily activities such as healthy eating, preventive examinations (blood tests), and, more generally, the correlation with a lifestyle that promotes and protects people's health. Furthermore, it is vital to further investigate the relationship between the two variables health literacy and digital health literacy in order to clarify the complex relationship that governs them. Health literacy and digital health literacy are interrelated yet non-identical constructs with distinct pathways to outcomes. Digital health literacy is not simply a combination of health literacy and digital literacy, but it encompasses broader functional, communicative, critical, and translational skills that are contingent on task, technology, and context (8). In our study, health literacy and digital health literacy were moderately correlated, but only health literacy retained an independent association with HRQoL after adjustment, indicating overlapping but different pathways to health-related quality of life.

Health literacy is crucial for the implementation and execution of the three principles of Public Health: prevention, promotion, and protection of the population's health. It is therefore imperative to design programs aimed at strengthening health literacy, especially among people with low educational and socioeconomic status. This policy safeguards the health of the population and reduces health inequalities. The goal of health literacy and digital health literacy (as an extension of health literacy) is personal empowerment to adopt healthy lifestyles, utilize and evaluate health information and sources, and apply them. The above goal empowers people's abilities with regard to health information. The aim is for individuals to self-manage their health through the implementation of policies related to the empowerment of health literacy.

The findings of the study highlight the factors that require attention when formulating policies and interventions. For digital health literacy, lower educational levels need to be strengthened so that they can participate in digital health systems. Similarly, for health

literacy, low-income and low-education groups need special attention in policy-making. This can be achieved through education, such as workshops and community campaigns (universities, villages, workplaces) aimed at informing and educating the public on issues related to health management and digital health. Furthermore, the creation of user-friendly applications will facilitate access for people who are not so familiar with technology, as will the development of appropriately designed material (e.g., videos, brochures in simple language and, if necessary, in the local dialect) that will inform the reader about healthy lifestyles, the use of health-related applications, and general health promotion issues.

Conclusions

This bi-national study highlights health literacy as a salient and potentially modifiable correlate of better health-related quality of life, with socioeconomic patterning that points to equity-focused targets (e.g., individuals with lower education and income). Public health practice should incorporate health literacy strategies, such as the creation of appropriate audiovisual material accessible to all, workshops and campaigns in the community, at work, and in educational institutions to inform and educate citizens, and the active participation of patients in decision-making, the use of self-management tools (health diaries) and a range of other interventions to stimulate health literacy. Future research should employ representative sampling in both countries and longitudinal designs to clarify causal pathways and inform scalable interventions aimed at improving HRQoL and reducing health inequalities.

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