BMC Public Health

RESEARCH

Open Access

Exploring health literacy and demographic determinants among village health volunteers in the post-COVID-19 era: a web-based cross-sectional study

Kitsarawut Khuancharee[1*], Chawin Suwanchatchai[1] and Unchalee Ngampiw[2]

Abstract

Background Health literacy (HL) is essential for individuals to effectively navigate health information and make informed decisions. Village Health Volunteers (VHVs) in rural Thailand are crucial in delivering health education and services, yet little is known about their HL levels, particularly following the COVID-19 pandemic. Understanding the HL of VHVs is crucial for enhancing health communication and the effectiveness of public health initiatives. This study aims to evaluate the HL levels of VHVs and explore the association between demographic factors and HL levels following the COVID-19 outbreaks.

Methods A web-based, cross-sectional, descriptive-analytic study was conducted with 840 adults (aged 18–85 years) in Nakhon Nayok, Thailand, using random cluster sampling. HL levels were assessed using a validated HL questionnaire. A multiple logistic regression model was employed to identify demographic factors associated with HL levels.

Results The findings revealed that 0.4% of VHVs had inadequate HL, 4.8% had marginal HL, 65.5% demonstrated adequate HL, and 29.4% exhibited excellent HL. Multivariate logistic regression analysis identified several factors significantly associated with adequate HL. A positive attitude (AOR = 3.44; 95% CI: 1.37–3.57; $p = 0.012$), high levels of motivation (AOR = 4.56; 95% CI: 1.70–6.73; $p < 0.001$), and more than 10 years of experience as a VHVs (AOR = 3.63; 95% CI: 1.29–10.19; $p = 0.014$) were positively associated with adequate HL. In contrast, a monthly household income exceeding 9,000 THB was negatively related to adequate HL (AOR = 0.38; 95% CI: 0.15–0.93; $p = 0.034$).

Conclusion The current results indicate that the majority of VHVs demonstrated adequate HL followed by excellent HL. Positive attitudes, high motivation, and over 10 years of experience were key factors linked to better HL. To enhance HL levels, educational interventions should target VHVs with neutral attitudes, low motivation, and less than 10 years of experience.

Keywords Health literacy, Demography, COVID-19, Community health workers, Village health volunteers

*Correspondence:
Kitsarawut Khuancharee
kitsarawut@g.swu.ac.th
[1]Department of Preventive and Community Medicine, Faculty of Medicine, Srinakharinwirot University, Nakhon Nayok, Thailand
[2]Nakhon Nayok Provincial Public Health Office, Nakhon Nayok, Thailand

Introduction

Health literacy (HL) is defined as the capacity to access, understand, and apply health-related information to make informed decisions about one's health [1]. It is a critical determinant of health outcomes and plays a central role in advancing health equity [2]. HL is considered one of the most important factors for improving public health across various dimensions [2]. It serves as a key indicator of an individual's ability to navigate health systems, make informed decisions, and effectively manage their well-being. Previous studies have consistently shown that HL is strongly linked to preventive and health-promoting behaviors [3–6]. In contrast, low HL is associated with suboptimal health behaviors and inadequate disease self-management, including poor adherence to weight control, smoking cessation, and cancer screening guidelines [7]. Individuals with low HL are also more likely to experience delayed diagnoses, receive late-stage treatments, and have poorer health outcomes [8].

Despite its importance, many individuals face challenges in understanding or acting upon health information due to limited HL [9]. International studies have highlighted the widespread prevalence of low HL across diverse populations globally [10–15]. In Thailand, a national study revealed that more than half of the population (59%) demonstrated limited HL, with older adults and the general Thai adult population exhibiting higher levels of inadequate HL compared to younger individuals [16, 17]. Younger individuals typically exhibit better HL, owing to their greater access to digital health information and comfort in navigating online health resources [18–20]. HL is especially vital in disease prevention and control [21], as individuals with limited HL may struggle to comprehend health communication materials, thereby decreasing their likelihood of participating in preventive health screenings or effectively managing chronic conditions.

A particularly important group in Thailand's public health system is the Village Health Volunteers (VHVs). These community-based workers serve as a vital link between formal healthcare providers and the population, especially in rural and underserved areas [22–24]. Their responsibilities include conducting household health surveys, managing health promotion initiatives, participating in disease prevention campaigns, and delivering health education through home visits and community outreach activities [25, 26]. For VHVs to successfully fulfill these roles and influence health behaviors in their communities, a high level of HL is essential. HL enables VHVs to interpret and convey health information accurately, support behavior change, and respond appropriately to community health needs.

Several studies conducted prior to the COVID-19 pandemic reported that most VHVs in Thailand had high HL levels [27–31]. However, some studies presented contrasting findings, with evidence suggesting that certain VHVs had only moderate or inadequate HL [32, 33]. These differences may be attributed to variations in geographic location, training quality, or personal characteristics such as age and education. This inconsistency in the literature highlights the need for further investigation, particularly in the context of evolving public health demands.

The COVID-19 pandemic significantly altered the landscape of public health and reshaped the roles of VHVs. During the pandemic, VHVs were called upon to take on additional responsibilities—such as contact tracing, public health education, facilitating access to COVID-19 testing and vaccination, and monitoring quarantine compliance—which demanded enhanced HL and adaptability to rapidly changing protocols. These expanded roles increased their exposure to complex health information and required more active engagement with both digital tools and government health campaigns. A recent study by Saisanan Na Ayudhaya et al. [34] demonstrated that VHVs in Southern Thailand played a key role in promoting preventive behaviors during the pandemic, further emphasizing the importance of HL in enabling effective responses to emerging health threats.

Despite these developments, limited research has assessed the HL levels of VHVs in the post-pandemic context or examined how demographic and psychosocial factors may influence HL after such a public health crisis. Understanding the current state of HL among VHVs is essential for identifying training needs and ensuring that these frontline workers remain well-equipped to support their communities. Therefore, this study aims to assess general HL levels and examine their relationship with demographic factors among literate VHVs in Nakhon Nayok Province, Thailand. Identifying such associations can inform targeted strategies by policymakers, educators, and health authorities to enhance HL, strengthen the capacity of VHVs, and ultimately improve health outcomes at the community level.

Materials and methods

Study design and study population

A web-based cross-sectional survey was conducted to evaluate HL levels among VHVs and explore associated demographic factors. Study participants included VHVs selected from rural and urban communities in Nakhon Nayok Province, Thailand. The inclusion criteria for participation in the study included being a registered VHV in the Primary Health Care Division's information system and have internet access to complete the web-based survey. Additionally, active VHVs with experience both before and after the COVID-19 outbreaks were included. Exclusion criteria included individuals with physical or

mental disabilities, mental disorders, vision or hearing impairments, those undergoing surgical treatment or hospitalization, and participants who provided incomplete responses to the questionnaire. The sample size was calculated using the formula for an infinite population proportion. Based on a similar previous study that reported a 2.9% prevalence of inadequate HL among VHVs before the COVID-19 outbreaks [32], and accounting for a 40% nonresponse rate, the estimated sample size was determined to be 860 participants. A random cluster sampling method was used to recruit participants. VHVs were recruited through social media platforms, email invitations, and community health networks. A web-based questionnaire link was distributed to the core group of VHVs via their Line and email accounts.

Data collection

A web-based, self-administered questionnaire was used to collect data from VHVs. The first section included 10 items on sociodemographic characteristics, such as age, gender, education, occupation, marital status, income, health status, BMI, years of VHV experience, and personal skills. Attitude and motivation were assessed using researcher-developed scales, informed by literature review and expert input. Content validity was confirmed by three experts (CVI: 0.89 for attitude; 0.80 for motivation), and both scales showed good internal consistency (Cronbach's alpha: 0.94 for attitude; 0.77 for motivation). The attitude scale consisted of nine items, which assessed participants' attitudes towards various aspects of their role as VHVs, with responses ranging from 1 (strongly disagree) to 4 (strongly agree). Total attitude scores for each participant were calculated and categorized into three levels: positive attitude (3.50–5.00), neutral attitude (2.50–3.49), and negative attitude (1.00–2.49). Motivation for the role of VHVs was assessed using a self-reported questionnaire containing seven items, with values ranging from 1 (strongly disagree) to 5 (strongly agree). Overall motivation scores were calculated for each participant and categorized into three levels: high (3.50-5.00), moderate (2.50–3.49), and low (1.00-2.49) motivation in their role as VHVs.

The HL questionnaire, developed by the principal investigator (Khuancharee K.), was informed by established HL frameworks and adapted to the VHV context. It consists of 26 items across five domains: access, cognitive, self-management, media literacy, and decision-making. Content validity was assessed by experts (CVI = 0.85), and the tool showed good internal consistency (Cronbach's alpha = 0.86). Responses were recorded on a 5-point Likert scale, ranging from "always" to "not at all." The final score was calculated by converting the scores of the five HL subscales into a standardized score between 0 and 100. According to the scoring guidelines, a score between 0 and 50 indicates inadequate HL, 51 to 60 represents marginal HL, 61 to 84 signifies adequate HL, and 85 to 100 reflects excellent HL.

After data collection, the completed questionnaires were reviewed for completeness and entered into Google Forms to reduce errors. The data was automatically transferred to an online Google Sheet, which was then downloaded and imported into STATA 16 for cleaning, coding, and analysis. To minimize recall bias, participants were asked to recall events from the past three months before data collection. Additionally, to reduce social desirability bias and encourage truthful responses, the questionnaire was designed to be anonymous. Data collection via an online self-administered questionnaire may have introduced selection bias, potentially excluding VHVs with limited access to digital devices or low digital literacy. This limitation may have resulted in overrepresentation of participants who are more digitally literate, which should be considered when interpreting the findings.

Data analysis

Descriptive statistics were used to summarize the demographic characteristics and HL levels of VHVs. Fisher's exact test was used to analyze the differences in the proportions of high HL levels. To assess the relationships between demographic factors and HL levels while controlling for potential confounders (age, sex, and educational attainment), a multivariate logistic regression model was used. Variables with p-values < 0.20 in univariate analyses were considered for inclusion in the multivariate model. Multicollinearity was assessed using variance inflation factors (VIF), and variables with high collinearity (VIF > 10) were excluded. The final model incorporated demographic and psychosocial factors that were both relevant and non-collinear. Model discrimination was evaluated using the area under the receiver operating characteristic (ROC) curve (AUC), with an AUC ≥ 0.70 indicating acceptable discrimination. Model calibration was assessed via the Hosmer–Lemeshow goodness-of-fit test. In addition, potential effect modification was examined through interaction analysis by including product terms between key psychosocial variables and demographic factors (e.g. motivation × work experience). All analyses were conducted using STATA version 16.0, and statistical significance was determined using two-sided p-values < 0.05.

Results

A total of 840 VHVs participated in the web-based cross-sectional study, with a response rate of 98%. The majority of participants were female, middle-aged, and reported monthly incomes below 9,000 THB. Most had completed only primary or lower secondary education and were engaged in agriculture or wage-based occupations.

Approximately half reported having at least one underlying chronic condition, and a substantial proportion were classified as overweight or obese. Over half of the VHVs had more than 10 years of work experience. Although digital literacy levels were generally low, most participants demonstrated high motivation and held a neutral attitude toward their volunteer role (Table 1).

Table 1 Demographic characteristics of VHVs (*N* = 840)

Demographics	*N*	%
Age (year)		
- 18–59	541	64.40
- 60+	299	35.60
Gender		
- Female	741	88.21
- Male	99	11.79
Educational background		
- Primary/middle school	518	61.67
- Senior high school/Vocational certificate	175	20.83
- Diploma/High vocational certificate	99	11.79
- Undergraduate degree	48	5.71
Main occupation		
- Employee	349	41.55
- Agriculture	230	27.38
- Housekeeper	174	20.71
- Unemployed	51	6.07
- Government employee	29	3.45
- Company employee	3	0.36
Marital status		
- Marriage	559	66.55
- Divorce/Separate/Widow	153	18.21
- Single	128	15.24
Monthly income (THB), Median (IQR)	5000	(3000–9000)
History of disease		
- No	421	50.12
- Yes	419	49.88
Body mass index (kg/m^2)	25.82	4.69
- < 18.5	24	2.86
- 18.5-22.99	220	26.19
- 23.00-24.99	159	18.93
- 25.00-29.99	299	35.60
- 30.00+	138	16.43
Years of experience in VHV		
- < 5	135	16.07
- 5–10	239	28.45
- 10+	466	55.48
Skills and Abilities		
- Active listening skills	764	90.95
- Proficient oral communication	732	87.14
- Strong reading comprehension	756	90.11
- Effective written communication	709	84.51
- Computer/smartphone literate	419	49.94
Total attitude scores, Mean (SD)	3.43	(0.44)
Total motivation scores, Mean (SD)	4.23	(0.54)

SD Standard deviation

Most participants (65.5%) demonstrated adequate overall HL, with a mean total HL score of 80.23 (SD = 10.70). Subscale scores indicated generally favorable levels, with the highest mean scores observed in the Access (82.98 ± 11.74) and Cognitive (81.13 ± 11.97) domains. The lowest mean score was reported in the Self-management domain (76.93 ± 12.31), although it remained within the adequate range. Notably, over 59% of VHVs achieved adequate HL across all five domains. The highest proportion of participants with excellent HL was found in the Access domain (34.5%), followed by Cognitive (27.6%) and Decision-making (26.5%). In contrast, only a small proportion of VHVs exhibited marginal or inadequate HL, most commonly in the Self-management (12.9% marginal) and Decision-making (0.7% inadequate) domains (Fig. 1).

A greater proportion of VHVs with a positive attitude, high motivation, and more than 10 years of experience achieved adequate-to-excellent overall HL scores. Additionally, significant differences were found between HL levels and factors such as attitude, motivation, and years of experience. However, no statistically significant associations were identified between HL levels and variables such as age, gender, education, employment status, marital status, monthly income, body mass index, or disease history (Table 2).

Table 3 presents the associations between demographic characteristics and adequate HL among VHV participants (*N* = 840), using both crude odds ratios (COR) and adjusted odds ratios (AOR). The multivariate logistic regression model adjusted for age, sex, and educational attainment and demonstrated excellent discriminatory power, with an area under the receiver operating characteristic (ROC) curve (AUC) of 0.93. After adjustment, several factors were significantly associated with adequate HL. Participants with a monthly income exceeding 9,000 THB were significantly less likely to have adequate HL (AOR = 0.38; 95% CI: 0.15–0.93). In contrast, VHVs with more than 10 years of experience were significantly more likely to report adequate HL (AOR = 3.63; 95% CI: 1.29–10.19). Psychosocial factors also showed strong positive associations. VHVs with a positive attitude toward their volunteer role had significantly higher odds of possessing adequate HL (AOR = 3.44; 95% CI: 1.37–3.57). Similarly, high levels of motivation were associated with markedly increased odds of adequate HL (AOR = 4.56; 95% CI: 1.70–6.73).

Interaction analysis revealed a potential negative interaction between high motivation and work experience exceeding five years (OR = 0.13; 95% CI: 0.01–1.31), suggesting a possible attenuation of the positive association between motivation and HL in more experienced VHVs, although this did not reach statistical significance. Other variables—including body mass index, presence

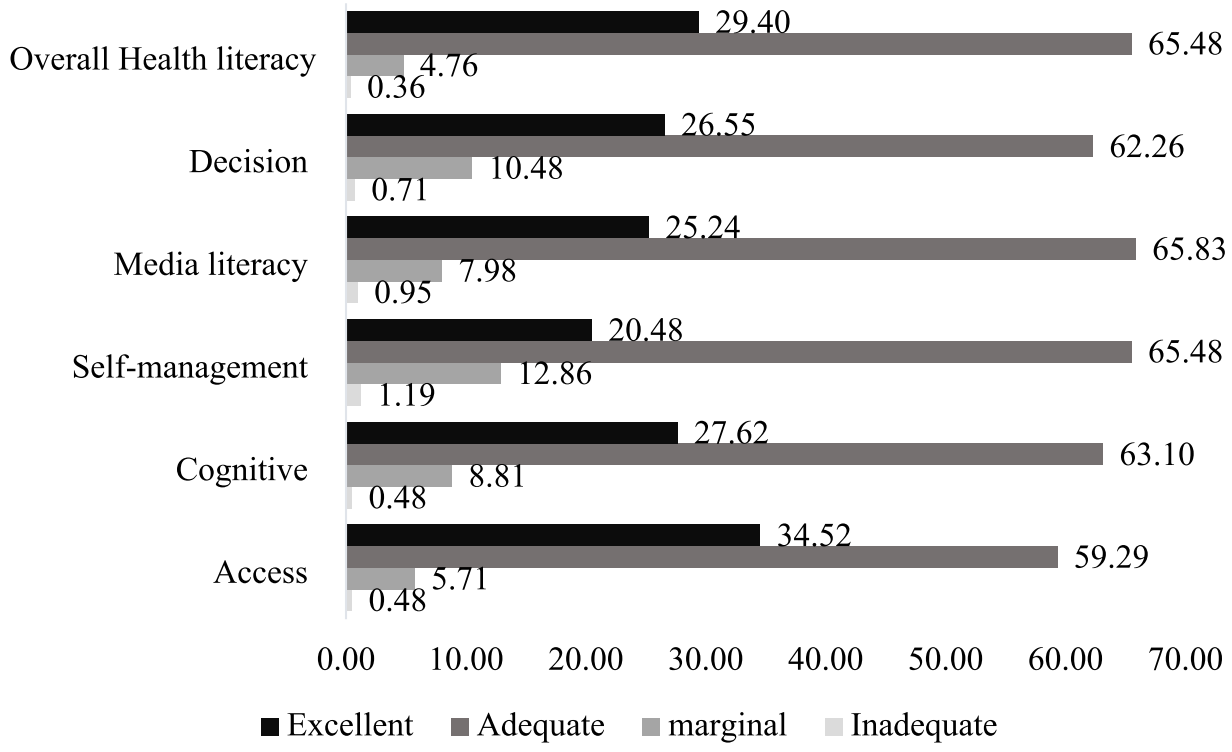

Fig. 1 Health literacy level in VHV participants ($N = 840$)

of chronic illness, communication ability, and digital literacy—were not significantly associated with HL in the fully adjusted model.

Discussion

HL plays a key role in promoting health and well-being within communities worldwide. This study found that 65.5% of VHVs demonstrated adequate HL, with 29.4% achieving excellent HL, while only a small minority had marginal or inadequate HL. Instead of highlighting low HL, the high and excellent HL observed in this study indicate that a substantial proportion of VHVs possess strong abilities to access, understand, evaluate, and apply health information effectively. These higher levels of HL suggest that VHVs are well-prepared to perform health-promoting roles within their communities [1, 10, 22–24, 35, 36]. Policymakers recognize the importance of promoting, as it enables individuals to make informed health decisions and improves healthcare service quality [2]. VHVs are integral in advancing community health, serving as vital links between healthcare providers and community members, particularly in both rural and urban settings [22–24]. This study aims to evaluate HL levels among VHVs and examine the relationship between demographic factors and HL following the COVID-19 pandemic.

Our findings showed that HL among VHVs was largely favorable, with 65.5% classified as having adequate HL and 29.4% as having excellent HL. Only a small proportion had marginal (4.8%) or inadequate (0.4%) HL. These results align with a study conducted prior to the pandemic that reported high HL levels among VHVs [27–31], although others found that certain VHVs had limited HL [32, 33]. The COVID-19 pandemic likely played a transformative role in reinforcing the importance of HL among VHVs. During the crisis, VHVs were mobilized to support national and local health campaigns, including contact tracing, health education, and vaccine promotion. For example, Saisanan Na Ayudhaya et al. [34] reported that VHVs in Southern Thailand demonstrated strong preventive behaviors and engagement in COVID-19-related health communication, which was associated with increased HL. Such findings suggest that crisis-driven public health roles may lead to improved HL through real-world learning and increased exposure to health information.

Our study also found that positive attitudes and high levels of motivation have been consistently linked to adequate HL levels among VHVs. A positive attitude towards learning and healthcare engagement fosters an environment conducive to acquiring and comprehending health-related information effectively. Individuals with positive attitudes are more inclined to proactively seek health

Table 2 Levels of HL according to the demographic characteristics ($N=840$)

Demographic characteristics	Level of HL, *n* (%)				*P*-value
	Inadequate	marginal	Adequate	Excellent	
Age (year)					
- 18–59	2(66.67)	23(57.50)	348(63.27)	168(68.02)	0.409
- 60+	1(33.33)	17(42.50)	202(36.73)	79(31.98)	
Gender					
- Female	3(100)	34(85)	485(88.18)	219(88.66)	0.823
- Male	0	6(15)	65(11.82)	28(11.34)	
Educational background					
- Primary/ middle school	3(100)	28(70)	327(59.45)	162(65.59)	0.197
- Senior high school	0	7(17.50)	127(23.09)	40(16.19)	
- Diploma/ Undergraduate	0	5(12.50)	96(17.45)	45(18.22)	
Main occupation					
- Employee	0	15(37.50)	219(39.82)	115(46.56)	0.843
- Agriculture	2(66.67)	11(27.50)	156(28.36)	61(24.70)	
- Housekeeper	1(33.33)	10(25)	114(20.73)	49(19.84)	
- Unemployed	0	1(2.50)	37(6.73)	13(5.26)	
- Government employee	0	3(7.50)	20(3.64)	6(2.43)	
- Company employee	0	0	2(0.36)	1(0.40)	
Marital status					
- Marriage	3(100)	27(67.50)	361(65.64)	168(68.02)	0.881
- Divorce/ Separate/Widow	0	6(15)	100(18.18)	47(19.03)	
- Single	0	7(17.50)	89(16.18)	32(12.96)	
Monthly income (THB)					
- < 9000	1(33.33)	24(60)	397(72.18)	176(71.26)	0.160
- 9000+	2(66.67)	16(40)	153(27.82)	71(28.74)	
History of disease					
- No	2(66.67)	22(55)	290(52.73)	113(45.75)	0.248
- Yes	1(33.33)	18(45)	260(47.27)	134(54.25)	
Body mass index (kg/m^2)					
- < 18.5	0	2(5)	18(3.27)	4(1.62)	0.533
- 18.5-22.99	1(33.33)	8(20)	141(25.64)	70(28.34)	
- 23.00+	2(66.67)	30(75)	391(71.09)	173(70.04)	
Years of experience in VHV					
- < 5	3(100)	12(30)	88(16)	35(14.17)	0.038
- 5–10	0	10(25)	144(26.18)	85(34.41)	
- 10+	0	18(45)	318(57.82)	127(51.42)	
Attitude					
- Negative Attitude	1(33.33)	0	0	1(0.40)	0.001
- Neutral attitude	1(33.33)	38(95)	399(72.55)	40(16.19)	
- Positive attitude	1(33.33)	2(5)	151(27.45)	206(83.40)	
Motivation					0.001
- Moderate	2(66.67)	29(72.50)	36(6.55)	2(0.81)	
- High	1(33.33)	11(27.50)	514(93.45)	245(99.19)	

Table 3 Association between demographic characteristics and adequate HL ($N=840$)

Demographic characteristics	COR	AOR	95%CI	*P*-value
Incomes over 9,000 THB per month	0.54	0.38	0.15–0.93	0.034
Having a history of disease	1.23	0.86	0.37–1.98	0.727
Body mass index (kg/m^2)				
- < 18.5	0.47	0.67	0.21–2.13	0.496
- 23.00+	0.75	1.41	0.31–6.36	0.655
Years of experience in VHV				
- 5–10	2.23	2.54	0.77–8.39	0.075
- 10+	2.07	3.63	1.29–10.19	0.014
Positive attitude	3.52	3.44	1.37–3.57	0.012
High level of motivation	5.59	4.56	1.70–6.73	< 0.001
Skills and Abilities				
- Active listening skills	0.61	0.47	0.13–1.73	0.256
- Proficient oral communication	0.48	1.27	0.38–4.31	0.698
- Strong reading comprehension	0.25	0.86	0.20–3.67	0.836
- Effective written communication	0.25	0.42	0.12–1.41	0.159
- Computer/smartphone literate	0.42	0.57	0.22–1.43	0.232

The *p*-value was presented after adjustment for age, sex, and education. The area under the ROC curve was calculated to be 0.9300

information, participate in health-promoting activities, and engage in open communication with healthcare providers [35, 36]. This proactive approach to health management contributes significantly to higher HL levels, as demonstrated in various studies examining the association between attitudes and HL [37]. Moreover, high levels of motivation play a crucial role in sustaining efforts to improve HL. Motivated individuals demonstrate a willingness to overcome barriers and persist in their efforts to understand complex health concepts. Motivation drives individuals to engage in continuous learning, which is essential for acquiring and maintaining adequate HL levels. Studies revealed that individuals with high levels of motivation are more likely to engage in health education initiatives, follow treatment protocols, and adopt healthier lifestyle choices, all of which play a significant role in improving HL [38, 39]. Therefore, interventions aimed at improving HL should consider strategies to foster positive attitudes and motivation among individuals, thereby enhancing their overall health outcomes and well-being.

Additionally, VHVs with over 10 years of experience have been identified as significant determinants of adequate HL due to their prolonged exposure and engagement in community health promotion activities. The experienced VHVs possess greater confidence in their roles, which positively influences their ability to convey health information accurately and advocate for preventive measures. Experience in the field allows VHVs to develop a deeper understanding of health-related issues, effective communication strategies, and the ability to tailor health information to the specific needs of their communities [26, 40]. These findings support prior evidence

that experience enhances the depth and retention of health knowledge among community-based workers [41–43]. Therefore, recognizing the invaluable contribution of experienced VHVs in promoting HL within their communities is essential for the development and implementation of effective healthcare interventions. Interestingly, an exploratory interaction analysis suggested a negative interaction effect between motivation and experience—implying that when both variables are high, their combined impact on HL may be less than additive. Although this interaction did not reach statistical significance, it may suggest diminishing returns and warrants further exploration in future studies.

One of the more unexpected findings was the inverse association between household income and HL. Contrary to most literature, which reports a positive association between income and HL, our results indicate that VHVs with higher household income were less likely to have adequate HL. Several context-specific explanations may account for this. VHVs from higher-income households may have competing responsibilities that limit their involvement in health promotion activities or public health training. They may rely more heavily on formal health services rather than actively engaging in community-based learning. Moreover, as observed in a previous study [36], higher-income individuals may face different HL challenges—such as navigating complex healthcare systems, interpreting specialized medical information, or managing chronic diseases in more technologically advanced contexts. These findings suggest that socioeconomic factors influence HL in nuanced ways, particularly in the context of volunteer-based community health work.

The current study has several limitations. Firstly, the findings are based on a sample from only one province in Thailand, limiting their generalizability to other regions or populations. It is important to note that regional variations in healthcare infrastructure, digital literacy, and VHV training programs may affect HL levels differently across Thailand. Thus, caution is warranted when extrapolating these results to other provinces, especially those with differing urban-rural compositions and socioeconomic conditions. Secondly, the use of a self-administered online questionnaire introduces the potential for biases, including social desirability and recall biases, which may have influenced participant responses. Social desirability bias could have led to overreporting of positive attitudes and HL competencies, while recall bias might have affected the accuracy of self-reported data on experience and motivation. These biases may have resulted in a slight overestimation of HL levels. Additionally, while this study focused on general HL, further research is needed to examine specific aspects such as food and nutrition literacy. Considering the important role of food and nutrition literacy in preventing chronic diseases and promoting well-being, future research should investigate these dimensions to develop targeted educational interventions for VHVs. Longitudinal studies are also recommended to track changes in HL over time and to explore the potential causal relationships between demographic factors and HL outcomes among VHVs.

Conclusion

In conclusion, the current results indicate that the majority of VHVs demonstrated adequate HL followed by excellent HL. Positive attitude, high motivation, and more than 10 years of experience were associated with adequate HL, while higher household income was associated with lower HL scores. Future studies with larger populations, longitudinal designs, and mixed-methods approaches are recommended to confirm these findings, explore causal pathways, and develop targeted strategies to enhance HL among VHVs.

Acknowledgements
The authors express sincere gratitude to all participants who voluntarily dedicated their valuable time to the study.

Authors' contributions
Khuancharee K. conceived the research idea, Khuancharee K. and Suwanchatchai C. designed the study, and Ngampiw U. enrolled study participants. Khuancharee K. analyzed the data, and all authors contributed to writing the original draft of the manuscript. All authors have agreed on the manuscript's results and conclusions.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability
The data supporting the findings of this study are not publicly available due to sensitivity and participant privacy but can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Srinakharinwirot University (SWUEC-672523). Informed Consent was obtained from all subjects. All VHVs participated voluntarily following an official invitation, with data confidentiality strictly maintained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 19 January 2025 / Accepted: 30 December 2025
Published online: 08 January 2026

References

1. Freedman DA, Bess KD, Tucker HA, Boyd DL, Tuchman AM, Wallston KA. Public health literacy defined. Am J Prev Med. 2009;36(5):446–51.

2. Marmot M, Friel S, Bell R, Houweling TA, Taylor S. Closing the gap in a generation: health equity through action on the social determinants of health. Lancet. 2008;372(9650):1661–9.
3. Fleary SA, Paasche-Orlow MK, Joseph P, Freund KM. The relationship between health Literacy, cancer prevention Beliefs, and cancer prevention behaviors. J Cancer Educ. 2019;34(5):958–65.
4. Fernandez DM, Larson JL, Zikmund-Fisher BJ. Associations between health literacy and preventive health behaviors among older adults: findings from the health and retirement study. BMC Public Health. 2016;16:596.
5. Friis K, Vind BD, Simmons RK, Maindal HT. The relationship between health literacy and health behaviour in people with diabetes: A Danish Population-Based study. J Diabetes Res. 2016;2016:7823130.
6. Chahardah-Cherik SM, Gheibizadeh MP, Jahani SP, Cheraghian BP. The relationship between health literacy and health promoting behaviors in patients with type 2 diabetes. Int J Community Based Nurs Midwifery. 2018;6(1):65–75.
7. Weiss SM, Smith-Simone SY. Consumer and health literacy: the need to better design tobacco-cessation product packaging, labels, and inserts. Am J Prev Med. 2010;38(3 Suppl):S403–413.
8. Aljassim N, Ostini R. Health literacy in rural and urban populations: A systematic review. Patient Educ Couns. 2020;103(10):2142–54.
9. Fleary SA, Ettienne R. Social disparities in health literacy in the united States. Health Lit Res Pract. 2019;3(1):e47–52.
10. Sørensen K, Pelikan JM, Röthlin F, Ganahl K, Slonska Z, Doyle G, Fullam J, Kondilis B, Agrafiotis D, Uiters E, et al. Health literacy in europe: comparative results of the European health literacy survey (HLS-EU). Eur J Public Health. 2015;25(6):1053–8.
11. Berens EM, Vogt D, Messer M, Hurrelmann K, Schaeffer D. Health literacy among different age groups in germany: results of a cross-sectional survey. BMC Public Health. 2016;16(1):1151.
12. Jeong SH, Kim HK. Health literacy and barriers to health information seeking: A nationwide survey in South Korea. Patient Educ Couns. 2016;99(11):1880–7.
13. Mahmoodi H, Dalvand S, Gheshlagh RG, Kurdi A. A systematic review and meta-analysis of health literacy in the Iranian population: findings and implications. Shiraz E-Medical J. 2019;20(4):e81115.
14. Coughlin SS, Vernon M, Hatzigeorgiou C, George V. Health literacy, social determinants of Health, and disease prevention and control. J Environ Health Sci. 2020;6(1).
15. Magnani JW, Mujahid MS, Aronow HD, Cené CW, Dickson VV, Havranek E, Morgenstern LB, Paasche-Orlow MK, Pollak A, Willey JZ. Health literacy and cardiovascular disease: fundamental relevance to primary and secondary prevention: A scientific statement from the American heart association. Circulation. 2018;138(2):e48–74.
16. Intarakamhang U, Khammungkul J, Boocha P. General health literacy scale for Thais and comparison between age groups. Heliyon. 2022;8(5):e09462.
17. Jasiyajirawattana S, Burtdee P, Napasai P. Health literacy and its related factors among Thai population in Eastern (Health region 6) Thailand. Thail J Health Promotion Environ Health. 2022;45(2):25–38.
18. Moreno MA, Ralston JD, Grossman DC. Adolescent access to online health services: perils and promise. J Adolesc Health. 2009;44(3):244–51.
19. Jain AV, Bickham D. Adolescent health literacy and the internet: challenges and opportunities. Curr Opin Pediatr. 2014;26(4):435–9.
20. Okoniewski AE, Lee YJ, Rodriguez M, Schnall R, Low AF. Health information seeking behaviors of ethnically diverse adolescents. J Immigr Minor Health. 2014;16(4):652–60.
21. Halverson J, Martinez-Donate A, Trentham-Dietz A, Walsh MC, Strickland JS, Palta M, Smith PD, Cleary J. Health literacy and urbanicity among cancer patients. J Rural Health. 2013;29(4):392–402.
22. Kauffman KS, Myers DH. The changing role of village health volunteers in Northeast thailand: an ethnographic field study. Int J Nurs Stud. 1997;34(4):249–55.
23. Chanpanit P, Wongmanee W, Judabood N. Strengthening the community: role of village health volunteers. J Royal Thai Army Nurses. 2023;24(3):23–30.
24. Woldie M, Feyissa GT, Admasu B, Hassen K, Mitchell K, Mayhew S, McKee M, Balabanova D. Community health volunteers could help improve access to and use of essential health services by communities in lmics: an umbrella review. Health Policy Plann. 2018;33(10):1128–43.
25. Singweratham N, Nawsuwan K, Suriya N, Oupra R, Lillahkul N. Factors perceived by village health volunteers to implement the strategies of the COVID-19 control centre in Thailand. Health Promot J Austr. 2023.
26. Kaweenuttayanon N, Pattanarattanamolee R, Sorncha N, Nakahara S. Community surveillance of COVID-19 by village health volunteers, Thailand. Bull World Health Organ. 2021;99(5):393–7.
27. Lorlowhakarn S, Narintharuksa P. Health literacy health behavior and quality of life of Phuket village health volunteers. J Health Sci. 2021;30:414–22.
28. Boonmun T. Factors affecting the health literacy of village health volunteers (VHV), Sukhothai Province. Naresuan University. 2021.
29. Mueangchang W, Jantarach N, Srisookkum T. Health literacy and behavioral model of Dhammanamai among village health volunteers in the Northern Thailand. J Public Health Dev. 2022;20:108–20.
30. Ngasaengsai P, Sornsriyon P, Pattrabenjapol S. A Sase study of health literacy among village health volunteers. Isan J Pharm Sci. 2014;9:82–7.
31. Buachum B. Health literacy and health behavior of village health volunteers (VHVs) in Pa Ngiu Sub-district health, Wiang Pa Pao District, Chiang Rai Province. J Department Health Service Support. 2020;16(3):49–58.
32. Tachavijitjaru C, Srisupornkornkul A, Changtej S. Selected factors related with the health literacy of village health volunteer. J Royal Thai Army Nurses. 2018;19:320–32.
33. Raethong A. Health literacy and health Behaviour, 3Aor 2Sor, for the village health volunteers (VHVs): case study of Hintok Sub-district, Ronphibun District, Nakhon Si Thammarat Province. Department Health Service Support J. 2019;15(3):62–70.
34. Ayudhaya SN, Thanapop W, Wongrith C, Loonlawong P, Laor S, Fajriyah P. Health literacy and preventive behaviors towards COVID-19 among village health volunteers and residents in urban and rural areas of upper Southern Thailand. Soc Sci. 2023;12(7):377.
35. Paasche-Orlow MK, Wolf MS. The causal pathways linking health literacy to health outcomes. Am J Health Behav. 2007;31(Suppl 1):S19–26.
36. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. Ann Intern Med. 2011;155(2):97–107.
37. Smith SG, Curtis LM, Wardle J, von Wagner C, Wolf MS. Skill set or Mind set? Associations between health literacy, patient activation and health. PLoS ONE. 2013;8(9):e74373.
38. Xu X, Leung A, Chau P. Health Literacy, Self-Efficacy, and associated factors among patients with diabetes. HLRP: Health Lit Res Pract. 2018;2:e67–77.
39. Buchmann M, Jordan S, Loer A-KM, Finger JD, Domanska OM. Motivational readiness for physical activity and health literacy: results of a cross-sectional survey of the adult population in Germany. BMC Public Health. 2023;23(1):331.
40. Sornmai W, Silawan T, Chamroonsawasdi K, Saengsawang P, Hanchenlak C. Role of village health volunteers in prevention and control of coronavirus disease 2019, Mueang District, Nakhon ratchasima Province. Public Health Policy Laws J. 2023;9(2):309–22.
41. Srisarakham P, Amnatsatsue K, Kerdmongkol P, Leerapan P. Development of a capacity Building program for village health volunteers to support Self-Management in a high risk population for diabetes in a rural community in Northeast Thailand. Asian/Pacific Island Nurs J. 2016;1:46–54.
42. Karuhadej P, Popijan M, Danpradit P. Effectiveness of increase health volunteer ability program in basic care for the dependent elderly in the communities, Nakhon pathom Province, Thailand. J Health Res. 2019;33.
43. Yaresheemi S, Elangovan AR, Jangam K, Doraiswamy P, Sharma MK, Chandra PS. Outcome of capacity Building in mental health for well-being volunteers. Front Psychiatry. 2023;14:1205344.

Publisher's note