ORIGINAL ARTICLE

Digital Health Literacy Among Elderly Dayak in Southern Sarawak: A Cross-sectional Study

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ABSTRACT

Introduction: Digital health literacy (DHL) is often perceived as low among the elderly, yet the specific status among Sarawak's elderly Dayak remains uncertain. Investigating DHL levels in the digital era has the potential to yield significant benefits for improving their health. **Materials and methods:** A cross-sectional study was conducted from March to June 2023 via an interviewer-assisted survey. The study employed a multistage sampling approach to recruit elderly Dayak individuals from Kuching, Samarahan, and Serian. The data were analysed using the Statistical Package for Social Sciences (SPSS) version 27. **Results:** A total of 275 elderly Dayak individuals were selected, with an average age of 68.0 (SD 6.61) years, ranging from 60 to 92 years. The mean digital health literacy score was 23.36 (SD 9.79). Factors significantly associated with high DHL levels were self-reported disability (AOR 24.54, 95% CI 4.06, 148.33), staying nearer to health facilities (AOR 2.83, 95% CI 1.21, 6.62), increased daily Internet usage time (AOR 1.62, 95% CI 1.19, 2.23), and perceived ease of using the Internet (AOR 3.92, 95% CI 1.16, 13.20). On the other hand, a moderate to higher frequency of receiving passive guidance from family members (AOR 0.09, 95% CI 0.01, 0.80) and self-reported difficulties preventing device usage (AOR 0.63, 95% CI 0.49, 0.80) were associated with low DHL. **Conclusion:** This study highlights the prevalence of digital device usage and internet engagement among the participants, with a substantial proportion demonstrating low DHL.
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INTRODUCTION

In Malaysia, elderly is defined as individuals aged 60 years and above (1). Malaysia was estimated to has about 11.1% of its population aged 60 years and older in 2022, and the ratio had been increasing continuously throughout the years (2). Not only Malaysia, most countries in the world are going to deal with population growth and an ageing population (3). According to the NHMS 2018, looking into elderly health by the Institute of Health System Research, the prevalence of non-communicable diseases (NCDs) had been on the rise, and those aged 50 years and older were found to be the majority (4). At the same time, they were also found to be the main users of health care (5). Current existing traditional health care system might not be enough to cater the need of the special group (6, 7).

On one hand, the convergence of technology and health care delivery would be inevitable. As digital technology develops rapidly and becomes more accessible than ever, digital technology could be used to help older adults to improve their health (8, 9). On the other hand, older adults would need to acquire new skill to use the technology in their favour (10, 11).

Digital health literacy (DHL) or also called as eHealth literacy is defined as the ability to seek, find, understand, analyse, and appraise health information from digital sources and apply the knowledge gained to address or solve a health problem, a more specific definition, in term of the method of getting the health information (12). Nowadays, the public can find a huge amount of health information online about their medical conditions or treatments, yet older adults are still lagging as compared to younger adults in the adoption of technology.

Malaysian Communications and Multimedia Commission's (MCMC) survey on Internet users in 2020 showed a decline in non-Internet users from 12.6% in 2018 to 11.3% in 2020; more than one third of the non-Internet users were still 50 years old and above (13). A study done in 23 Elderly Activity Centres in Malaysia in 2017 showed that 32.3% of the 799 people who took part had used the Internet before and that 86.4% of the elderly used the Internet to find health information (14).

The rapid advancement of technology, especially in the medical field had created a divide between those who

could effectively utilise digital health tools and those who could not (10, 11, 15, 16, 17, 18). A particular concern was the level of DHL among the elderly population, especially within the context of Sarawak, Malaysia. The demographic transition, including the increasing prevalence of NCDs among the aging population, necessitates a closer look at this issue, particularly focusing on the Dayak community, the predominant indigenous population in Sarawak.

The World Health Organization (3) underlined that the elderly were more susceptible to diseases and require a comprehensive understanding of technology to manage their health. Several sociodemographic factors affect the elderly's ability to access and utilise digital health tools, including income, education, marital status, and overall health literacy (17, 18). However, such a relation was not well established in Malaysia, particularly in Sarawak.

Davis's Technology Acceptance Model (TAM) provided the basic theoretical framework explaining the positive association of user's perceived usefulness and perceived usability regarding technology usage toward user's attitude, which later will influence the intention and actual use of the technology (19). Perceived usefulness refers to the belief that using a particular technology will enhance performance or life quality. In the context of DHL among the elderly, this could mean better health management or improved communication with health care providers. Perceived ease of use, on the other hand, involves the belief that the technology will be free of effort. Among the elderly, particularly the Dayak community, ease of use can be a crucial factor, as cognitive decline or physical limitations may affect interaction with digital health platforms. The TAM posits that these perceptions influence attitudes, leading to the intention to use the technology, and finally, actual system use. Later, Arcury and others proposed combining the Lawton's person-environmental interaction model with TAM to explain the interaction between the dynamic physical, social environments, and the person's behaviour for elderly (20, 21).

Therefore, the significance of this research lies in examining the complex associations between various factors and DHL within Sarawak's specific context, particularly concerning the vulnerable Dayak community. A deeper understanding of these relationships will inform the formulation of more precise policies and implementation strategies, towards enhancing health care delivery, meeting the escalating public health demands, such as the increasing burden of NCDs.

MATERIALS AND METHODS

Sample collection

This research was a cross-sectional study design. Kuching, Samarahan and Serian division in Sarawak were included in the study. The sample size was calculated using Finite Population formulation based on 95% Confidence Interval (CI) with a margin of error of 1, and a reference variance of 57.76, based on the standard deviation of eHEALS score reported (22). Population size of elderly Dayak in Southern Sarawak is estimated to be 49,609 (2). Therefore, the number of samples calculated was 221 from the total population of the elderly Dayak in the selected divisions. Taking into the account 25% of attrition rate and rounding up, the final sample size for this study was 280 people. The sampling was conducted proportionally based on the ratio of the elderly Dayak population in each division, with the ratio determined to be roughly 6:2:1. The data among elderly Dayak in Southern Sarawak were collected from February 2023 to June 2023.

Inclusion and exclusion criteria

Elderly Dayak aged 60 and above residing in the Kuching, Samarahan, and Serian divisions of Malaysia were included in this study. Exclusion criteria comprised individuals with severe cognitive impairment and those with acute medical conditions requiring immediate attention. Our study was conducted in English and Malay to facilitate effective communication with participants. Consequently, individuals who were unable to communicate in both of these languages were excluded to ensure consistency of the languages used and to minimise misinterpretation.

Data collection procedure

Before conducting the interview, all participants were briefed regarding purpose of the study using the participant information sheet followed by obtaining the informed consents. The participants were required to answer the entire question via the face-to face interview by the researcher or research assistants. Local interpreters who are fluent in Iban and or Bidayuh language were hired to assist during the interview session when necessary.

Data collection instrument

The questionnaire in this study consisted of five parts presented in both English and Malay language. Namely, Part A (Socio-demographic Characteristics), Part B (Environmental Characteristics), Part C (Device Characteristics), Part D (Characteristics of Internet Use), and Part E (eHealth Literacy Score).

eHealth Literacy Scale (eHEALS)

This English and Malay version of eHEALS was adopted from Norman and Skinner and Wong et al. respectively (22, 23). A globally used tool to assess the level of DHL, to assess the following six competencies or skills: traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy, which are intensively dependent on and interdependent upon one another. It consists of eight questions, each question can be answered on a 5-point Likert scale,

with a total score ranging from 8 to 40, a higher score indicates higher DHL. A recent study in Malaysia using eHEALS in English, Malay and Chinese language reported Cronbach alpha of 0.961, 0.970, and 0.983 (22). The high internal consistency indicating it can be used for local population and older adults.

Pilot/pre-test

A pilot study was carried out with a total of 30 eligible participants for both English and Malay versions of the questionnaire. The individuals chosen for the pilot study were not included in the main study and represented the subjects in the principal sample. Following the initial testing of the questionnaire during the pilot phase, Cronbach's alpha was used to evaluate the internal consistency reliability of Questionnaire Part E. A Cronbach's alpha value of 0.94 was attained, denoting a substantial level of internal coherence. This result confirmed that the questionnaire was appropriately designed for use within the elderly Dayak population.

Data analysis

All statistical analysis were done using the SPSS version 27. Descriptive information such as frequency and percentage for qualitative (categorical) variables, mean and standard deviation for quantitative (continuous) variables were generated. Subsequently for analysis purpose, DHL was classified into two distinct groups utilising the mean eHEALS score of 23.36 as a threshold. Specifically, high DHL was delineated as an eHEALS score of ≥23.36, whereas low DHL was identified by a score of <23.36.

The Chi-square test for independence, independent samples t-test and Mann-Whitney U test were employed for univariate analyses. Variables demonstrating p-values below 0.25 in the univariate analyses were included as potential factors in the multiple logistic regression model. The primary objective of this model was to identify the predictors of elevated DHL. The results were subsequently presented in terms of adjusted odds ratios, along with 95% confidence intervals. All determinations of statistical significance were based on a threshold of 0.05.

Ethical Clearance

We obtained approval from the Medical Ethics Committee, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, registered under UNIMAS/TNC(PI)09-65/02 (16).

RESULTS

Demographic characteristics of the elderly Dayak

A total of 275 elderly Dayak individuals were recruited out of the proposed 280, with an average age of 68.0 years. Most participants were Bidayuh, female, married, and living with family members. Majority of participants lived within 5km of health facilities and had access to transportation for reaching them. The primary sources of health information for elderly Dayak in southern Sarawak were health facilities or personnel, followed by consultation with family and friends. Only a small percentage reported not having any specific source of health information. The other details on sociodemographic characteristics are presented in Table I.

Table I: Descriptive statistics for sociodemographic characteristics (N=275)

Variables	Mean (SD)	*n*	%
Age (years)[a]	68.03 (6.61)[a]		
Gender			
Male		133	48.4%
Female		142	51.6%
Ethnic			
Bidayuh		248	90.2%
Iban		27	9.8%
Education			
Never went to school/Primary school		140	50.9%
Secondary school/College or university		135	49.1%
Employment status			
Government/Private/Self-employed		75	27.3%
Unemployed/Retired/Housewife		200	72.7%
Marital status			
Single/divorced/separated/widowed		81	29.5%
Married		194	70.5%
Living arrangement			
Live with spouse only		34	12.4%
Live with children/grandchildren/relative		63	22.9%
Live with spouse/children/grandchildren/relative		157	57.1%
Live alone		21	7.6%

CONTINUE

Table I: Descriptive statistics for sociodemographic characteristics (N=275). (CONT.)

Variables	Mean (SD)	*n*	%
Household size	4.69 (2.38)[b]		
Household income group (n=237)[†]			
No income		10	4.2%
<RM3720		169	71.3%
RM3720-RM8649		52	21.9%
>=RM8650		6	2.5%
Household income per capita (n=237)[†]	652.34 (635.84)[c]		
Self-perceived health status			
Poor/Fair		150	54.5%
Good		125	45.5%
Self-perceived health knowledge			
Poor/Fair		156	56.7%
Good		119	43.3%
Health concerns			
Not concerned/Fair		59	21.5%
Generally concerned		216	78.5%
History of visited a doctor in the past one year			
Yes		222	80.7%
No/Unsure		53	19.3%
Chronic disease			
Yes		188	68.4%
No/Unsure		87	31.6%
Number of comorbid per participant	1.32 (1.22)[d]		
Disability			
Yes		57	20.7%
No		218	79.3%
Long term medication use			
Yes		171	62.2%
No/Unsure		104	37.8%
Nearest health facilities			
Less than 5km		178	64.7%
5km and above		97	35.3%
Transportation availability to health facilities			
Yes		254	92.4%
No/Unsure		21	7.6%
Source of health information			
From health facility/personnel		198	72.0%
From family and friends		188	68.4%
From social media		77	28.0%
From newspaper/magazine/book		46	16.7%
Through Internet		40	14.5%
From traditional medicine worker		21	7.6%
Other source of health information		1	0.4%
No source of health information		10	3.6%
Sources of health information per participants	2.00 (1.16)[e]		

[†]Missing value excluded (n=237)
[a]Min, Max =60,93; [b]Min, Max=1,11; [c]Min, Max=0,3571.43; [d]Min, Max=0,5; [e]Min, Max=0,5

Device characteristics of the elderly Dayak

Majority of participants owned or used an average of 2.42 (SD 1.72) digital devices, with smartphones being the most prevalent at 69.1%, followed by television or radio at 60%, and smart television at 34.5%. Notably, most participants reported low stress frequency associated with using digital devices in the past month. (Table II)

Table II: Descriptive statistics for device characteristics (N=275)

	Mean (SD)	*n*	%
Currently using digital device			
Yes		249	90.5%
No		26	9.5%
Currently owning digital device			
Yes		229	83.3%
No		46	16.7%
Type of digital device owning/ using			
Smartphone		190	69.1%
TV/Radio		165	60.0%
Smart TV		95	34.5%
Laptop		39	14.2%
Conventional mobile phone		29	10.5%
Personal computer		18	6.5%
Tablet		10	3.6%
Smart watch		9	3.3%
Not owning/using		26	9.5%
Number of digital devices per participant owning/using (n=249)[†]	2.42 (1.72)[a]		
Experiencing stress in using digital device for the past one month			
Low frequency		240	87.3%
Moderate to high frequency		35	12.7%

[†]Non digital device owing/using participants were excluded (n=249)
[a]Min, Max=0,9

Characteristics of Internet use among the elderly Dayak

In this study, 64.7% of elderly Dayak self-reported active Internet usage, with an average duration of 7.96 years and 1.97 hours per day. Notably, 43.6% indicated low frequency, less than once per month. The majority used the Internet at home by 64.4%, followed by 51.3% using the mobile broadband.

Primary Internet objectives were 53.5% for social activities, 41.4% for accessing news, and 36.4% for entertainment. Only 27.3% used it for health information, with 74.2% demonstrating low frequency. Most participants, 74.2% rarely sought family help for navigating online health information, and 76.0% received low-frequency passive guidance when navigating for online health information.

The Internet was found to be useful by 60.7% of participants, while 45.1% considered it easy to use, and 87.6% perceived low risk. However, 68% were uncertain or found it unreliable for information. Participants not using the Internet cited reasons like being "too old to learn" and a "lack of confidence or skill". Other challenges included "visual problems", "lack of Internet connection", and "lack of interest". Additional reasons included "language problems," "lack of guidance," and "lack of a digital device". (Table III)

Table III: Descriptive statistics for characteristic of Internet use (N=275)

Variables	Mean (SD)	*n*	%
Internet usage			
Yes		178	64.7%
No		97	35.3%
Duration of using Internet (years)[†]	7.96 (6.42)[a]		
Time spent per day (hours)[†]	1.97 (1.85)[b]		
Frequency of Internet usage			
Low frequency		120	43.6%
Moderate to high frequency		155	56.4%
Place of accessing Internet			
Home		177	64.4%
Workplace		27	9.8%
Commercial area		20	7.3%
Another person's house		11	4.0%
Type of Internet network			
Mobile broadband		141	51.3%
Fixed/home broadband		90	32.7%
Hotspot tethering		15	5.5%
Unsure or not using		102	37.1%
Purpose of Internet usage			
Social activities		147	53.5%
Access to current news		113	41.1%
Film/Music/TV shows		100	36.4%
Access to health information		75	27.3%
Work		31	11.3%
Online shopping		20	7.3%
Online banking		19	6.9%
Online games		9	3.3%
Online health information frequency			
Low frequency		192	69.8%
Moderate to high frequency		83	30.2%
Frequency of asking for help actively			
Low frequency		204	74.2%
Moderate to high frequency		71	25.8%
Frequency of receiving guidance passively			
Low frequency		209	76.0%
Moderate to high frequency		66	24.0%
Perceived usefulness of using Internet			
Not useful at all/Not useful/Unsure		108	39.3%
Very useful/Useful		167	60.7%
Perceived ease of using Internet			
Very difficult/Difficult/Unsure		151	54.9%
Very easy/Easy		124	45.1%
Perceived risk of using Internet			
Very low risk/Low risk/Unsure		241	87.6%
Very high risk/High risk		34	12.4%
Perceived reliability of Internet			
Very unreliable/Unreliable/Unsure		187	68.0%
Very Reliable/Reliable		88	32.0%
Reasons for not using or difficulties faced when using digital devices/Internet			
Too old to learn		125	45.5%
Lack of confidence/skill		109	39.6%

CONTINUE

Table III: Descriptive statistics for characteristic of Internet use (N=275). (CONT.)

Variables	Mean (SD)	*n*	%
Reasons for not using or difficulties faced when using digital devices/Internet			
Visual problem		98	35.6%
Lack of Internet connection		94	34.2%
Lack of interest		84	30.5%
Lack of guidance		79	28.7%
Language problem		68	24.7%
Difficulty concentrating		34	12.4%
Not enough time		34	12.4%
Lack of digital device		33	12.0%
Unsteady hands		29	10.5%
Total difficulties preventing usage of devices	2.86 (2.10)[c]		

[†]Non-Internet users were excluded (n=178)
[a]Min, Max=0.17,30.00; [b]Min, Max=0.17,8.00; [c]Min, Max=0.00,9.00

eHealth Literacy Scale (eHEALS) Score

The mean eHEALS score was 23.36 (SD 9.79) with the range of 8 to 40. Overall, the average score for each of the eight items ranged from 2.84 to 3.00, with the highest score recorded in Item 1 with an average score of 3.00 (SD 1.27) and the lowest score in Item 6 with an average score of 2.84 (SD 1.28). (Figure 1)

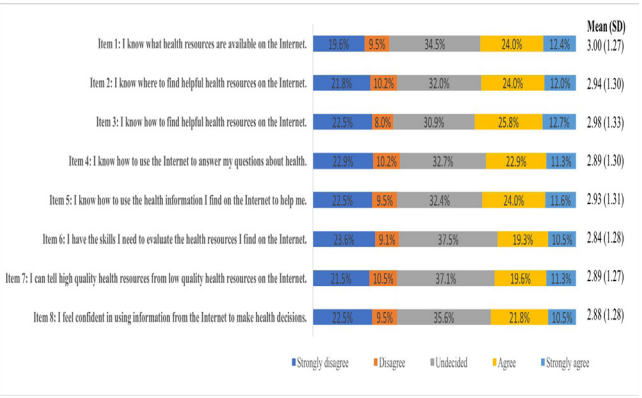

Figure 1: Extent of agreement and mean scores of eHEALS items. This figure is a bar chart that displays responses to eight statements about digital health literacy. Each item is represented by a bar that is segmented to show the proportion of responses in each of the five categories. The bars are colour-coded as follows: Dark blue: Strongly disagree; Orange: Disagree; Grey: Undecided; Yellow: Agree; Light blue: Strongly agree.

Factors affecting digital health literacy: Logistic Regression Analysis

Digital health literacy (low vs high, dichotomous) was used as the dependent variable. All factors with p<0.25 based on the univariate analysis were further analysed using binary logistic regression to determine the main predicting factors of digital health literacy. (Table IV)

Table IV: Multivariable logistic regression of the predictors of high digital health literacy.

	B	Exp(B)	95% CI	
			Lower	Upper
Disability				
No (RC)		1	-	-
Yes	3.200***	24.535	4.058	148.326
Nearest health facilities				
Less than 5km (RC)		1	-	-
5km and above	-1.040*	0.353	0.151	0.826
Time spent per day (hours)	0.485**	1.624	1.186	2.226
Frequency of receiving guidance passively				
Low frequency (RC)		1	-	-
Moderate to high frequency	-2.387*	0.092	0.011	0.802
Perceived ease of using Internet				
Not difficult/Difficult/ Unsure (RC)		1	-	-
Very easy/Easy	1.365*	3.915	1.161	13.202
Perceived ease of using Internet				
Not difficult/Difficult/ Unsure (RC)		1	-	-
Very easy/Easy	1.365*	3.915	1.161	13.202
Total difficulties preventing usage of devices	-0.469***	0.625	0.489	0.800
Constant		-3.089	0.046	
Model Chi-square (df)		124.675 (31)***		
n		275		
Hosmer and Lemeshow Test		*p*=0.631		

*$p<0.05$, **$p<0.01$, ***$p<0.001$
Dependent variable= digital health literacy (low vs high)

The findings demonstrated that the combined effects of the predictors were responsible for a considerable proportion of the variability in success. The Omnibus Tests of Model Coefficients yielded a statistically significant result (p<0.001), indicating a substantial enhancement in fit compared to the null model. Consequently, the current model is deemed to exhibit a favourable fit. In terms of the Hosmer and Lemeshow test, the insignificance value (p=0.631) suggests that the model sufficiently accommodates the data, signifying a lack of disparity between the observed and predicted outcomes of the model. This was supported by the statistically significant likelihood ratio $\chi^2(31) = 124.675$, p<0.001. The joint impact of both the Cox and Snell R square is 40.9%, as well as the Nagelkerke R square, indicated that approximately 55.7% of the variance in high digital literacy could be attributed to the overall set of predictors. In general, the accuracy rate reached

a commendable 81.4%. The model demonstrates robust sensitivity, as it accurately predicted 85.1% of individuals with either low or high DHL as having high DHL based on the model's predictions.

DISCUSSION

Technology is often considered a valuable tool for helping elderly maintain their health, independence, safety, and social connections (3). The study participants exhibited a mean eHEALS score of 23.36 (SD 9.79), indicating a lower level of proficiency in comparison to the more recent discoveries (22). Nevertheless, these outcomes were in alignment with existing research, reflecting a trend where older adults tend to demonstrate lower scores on the eHEALS assessment (17, 24).

The findings illuminated the DHL landscape among the elderly Dayak, and to the best of our knowledge, this study marked the first examination of elderly Dayak in Sarawak. Although the prevalence of digital device usage and ownership were notably high, suggesting widespread access to technology, the observed low level of DHL unveiled a disparity in their proficiency in effectively utilising these resources for health-related purposes. As supported by most researchers, it was found that the elderly usually did not obtain health-related information via the Internet (25).

The strong association observed between self-reported disability and high DHL could be explained by the fact that disabled individuals often encounter physical limitations that might hinder access to conventional sources of health information and health care services. Similar finding was also reported by other researchers (10, 26). As a result, they might tend to adapt by turning to digital platforms as an alternative means, fostering a deeper familiarity and adeptness in utilising digital devices for health-related purposes. Over the time, these could lead to a higher familiarity and proficiency in using digital devices for health-related purposes. Hence, higher DHL. However, the severity of the disability was not further investigated in this study to show the full picture of the association.

In the current global context, over 46% of those classified as elderly were faced with disabilities, equating to over 250 million elderly individuals grappling with moderate to severe disability, as reported by the United Nations. Meanwhile, in Malaysia, a recent national survey disclosed a disability prevalence of 41.0% (27). Given the prevailing international trends in ageing populations, coupled with an increased susceptibility to disability among the elderly, the prevalence of disabilities is projected to continue an upward trajectory, including in Sarawak.

Contrasting these figures, our study revealed a disability prevalence of only 20.7% among the elderly Dayak, a figure that is notably lower when compared to both the United Nations' data and the national survey. The reasons behind this discrepancy remained unclear but might be attributable to phenomena such as the healthy worker effect and potential selection bias inherent in our study design. This might imply that individuals with pre-existing disabilities might be less likely to engage in the study, which could result in their underrepresentation in our study sample.

This study showed a tendency towards a relatively younger age group within the elderly population, a trend that aligned with observations in the national population pyramid. Such a skew towards the younger elderly might have implications for understanding the DHL in this community, and further research might explore how this demographic characteristic interacts with other factors in the context of health care and technology utilisation. However, in this study, it was found that there was no significant association between age and DHL among elderly Dayak ($p>0.05$), which aligned with other researcher (17, 28). This stood in contrast to the observations made by another group of researchers, and where their studies revealed an inverse relationship between age and both Internet usage and DHL (10, 29). This disparity in findings specific to Sarawak could potentially be attributed to the fact that the elderly Dayak involved in the study were not actively using digital health resources or platforms. This limited involvement with digital health-related activities might account for the absence of a significant association between age and DHL.

Conversely, internet usage has exhibited a steady rise over the previous decade. Interestingly, even with this upward trajectory, the older population remains predominant among those who do not use the Internet (13). Specific older adults have faced challenges in keeping up with the swift emergence and advancement of the Internet, leading to some experiencing exclusion from its benefits. Nonetheless, there is a positive outlook as the pervasive Internet penetration over time should gradually diminish age-related obstacles to technology adoption.

Furthermore, in this study, DHL did not exhibit significant associations with ethnicity, education level, employment status, marital status, living arrangement, household size, household income per capita, self-perceived health status or knowledge, individual's health concern, and individual's medical condition. Diverse findings have emerged from different studies on these aspects. A stronger socioeconomic status, encompassing factors such as income, education, and health-seeking behaviour, which commonly linked with improved access to health resources, which in turn facilitates greater accessibility to digital health solutions

associated with better DHL (10, 22, 24, 29).

Elderly Dayak residing in closer proximity to health facilities demonstrated a heightened likelihood to possess high DHL (AOR 2.83, 95% CI 1.21, 6.62). This could be attributed to the increased accessibility to health care information and services. Individuals living nearer to health facilities may find themselves more inclined to explore digital resources for health information due to the convenience of accessing professional guidance and medical knowledge online. This ease of access may motivate them to actively engage with digital platforms, thereby contributing to the development of their digital health literacy skills. In addition, the enhanced infrastructure often associated with proximity to health facilities, including better Internet connectivity, can play a pivotal role. Enhanced technological infrastructure can also encourage elderly individuals to access health information online, contributing to improved DHL (30).

Device ownership did not display any notable association with DHL. The findings in our study were consistent with the earlier observation that elderly Dayak were not optimally utilising digital health resources. Concurrently, it is pertinent to note that a mere 12.7% reported encountering moderate to high levels of stress while using digital devices in the past month. This potentially implies a low frequency of actual digital device usage among this demographic.

In this study, it was also found that among the elderly Dayak, those who devoted more time to daily Internet usage were 1.6 times more likely to have a high level of DHL (AOR 1.62, 95% CI 1.19, 2.23), a result that corresponds with the findings reported by Liu and others (29). This might suggest that consistent exposure and interaction with online resources contribute to the development of DHL skills over time. Engaging with digital platforms daily likely enhances their familiarity and comfort in navigating digital health information. However, the mean time spent per day among those with high DHL was 2.19 (1.90) hours and 1.30 (SD 1.53) hours among those with low DHL, which were both considered as mild users and lower as compared to finding reported by Malaysian Communications and Multimedia Commission (13). It is worth noting that the daily time spent on the Internet is influenced by factors such as affordability, availability, and accessibility, which could limit the extent of engagement for certain individuals (16, 17, 18).

Additionally, the perception of Internet usage as easy or very easy yielded a substantial likelihood increase of 3.9 times for possessing high DHL (AOR 3.92, 95% CI 1.16, 13.20). This finding underscores the importance of perceived ease in shaping an individual's willingness to engage with digital platforms, even in the elderly. Those who find Internet usage intuitive and straightforward are more likely to explore health-related content online, consequently fostering higher DHL. The perception of ease encourages a positive attitude toward technology adoption, fostering a greater willingness to navigate digital spaces for health information and resources. Ensuring that digital platforms are easy to use aligns with the preferences and needs of elderly Dayak, ultimately promoting their utilisation of online health resources. In contrast, the self-perceived usefulness, reliability, and risk of using the Internet which did not display any significant associations, contradicts the results reported by Liu and others (29). In their study, older adults often tend to be passive recipients rather than active communicators of health information and older adults demonstrated weak application ability, suggesting challenges in effectively translating Internet health knowledge into actionable health management strategies which related to the self-perception on the ease of use, usefulness, reliability, and risk of using the Internet.

Elderly Dayak who reported a lower frequency of receiving passive guidance from family members exhibited a remarkable 10.9-fold increase in the likelihood of having high DHL (AOR 0.09, 95% CI 0.01, 0.80). This observation might reflect a scenario where individuals who independently explore and navigate digital platforms tend to develop stronger DHL skills. Reduced reliance on passive guidance from family members might encourage them to actively seek health information online, contributing to their proficiency. By embracing self-learning, they are likely to build the confidence and competence needed to effectively use digital platforms for health-related purposes. While passive guidance can indeed offer valuable support, particularly for digital newcomers, by facilitating positive initial experiences, our study's conflicting results indicate the need for further investigation into the observed differences in passive guidance effectiveness.

Subsequently, those elderly Dayak who encountered fewer self-reported difficulties preventing usage of digital devices had a 1.6 times greater likelihood of possessing high DHL (AOR 0.63, 95% CI 0.49, 0.80). Among the reasons cited by elderly Dayak for not using or encountering challenges with Internet usage were factors such as aging, lack of confidence, visual impairments, inadequate Internet connectivity, lack of interest, limited guidance, language barriers, and difficulties in concentration. These multifaceted challenges collectively underscore the complexity of digital engagement among elderly populations which was also reported in other studies (10).

Limitation of the study

The focus of the study was limited to the southern area of Sarawak, resulting in generalisability of findings to population and regions with similar characteristics only. Furthermore, the study's cross-sectional design, coupled with a clustering effect, restricts the broader

generalisation. While the study revealed associations, establishing causality within this framework remains uncertain. Potential biases associated with self-reporting and recall were also part of the limitation. The use of eHEALS as a measure of DHL in this study presents a potential limitation. Being a self-perceived scale, eHEALS relies on participants' subjective assessments of their own DHL. This approach may introduce bias, as individuals may either overestimate or underestimate their actual abilities in DHL. Further research, including diverse samples, objective measures, and longitudinal studies, is essential for a nuanced understanding.

CONCLUSION

In conclusion, this study illuminates the relatively low levels of DHL observed among elderly Dayak in Southern Sarawak. The identification of various independent variables that influence DHL provides valuable insights into this intricate matter. Given the imminent challenges posed by the aging population in Sarawak, it becomes imperative to equip elderly individuals with the skills and knowledge necessary to navigate the digital landscape in the context of health care.

By recognising the associated factors, tailored interventions can be designed to enhance DHL, enabling a more effective and targeted approach. Such interventions hold the potential to not only promote health and well-being but also to reduce morbidity and mortality rates, ultimately leading to an improved quality of life for the elderly population in Sarawak.

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