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# Factors associated with eHealth literacy focusing on digital literacy components: A cross-sectional study of middle-aged adults in South Korea

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## Abstract

**Background:** Digital technology has dramatically changed the world in which we live, and the ability to access and understand information through these new technologies is becoming increasingly important. eHealth literacy is closely related to digital literacy, and some concepts may overlap to a certain extent. Identifying personal and digital-related factors related to eHealth literacy levels in middle-aged adults would be useful for planning tailored interventions and health promotion strategies.

**Objective:** We aimed to identify the differences in digital literacy and eHealth literacy levels according to demographic features, and to elucidate the factors associated with eHealth literacy in the middle-aged population.

**Methods:** We conducted a cross-sectional, observational study from 4th to 8th February 2021. A total of 320 South Korean participants aged 40–64 years were recruited and completed an online questionnaire, where demographic features, chronic disease status, frequency of Internet use, digital skills, digital competence, and eHealth literacy were measured. eHealth literacy was measured with the eHEALS. We used multiple regression analysis to elucidate the factors associated with eHealth literacy.

**Results:** Multiple regression analysis revealed that digital competence was the highest contributor to an individual's eHealth literacy ($\beta = 0.330$, $P < 0.001$), while digital skills was not significantly associated with eHealth literacy ($\beta = 0.086$, $P = 0.267$). In addition, eHealth literacy was positively associated with increasing age ($\beta = 0.258$, $P < 0.001$), female gender ($\beta = -0.118$, $P = 0.022$), and higher education levels ($\beta = 0.114$, $P = 0.041$), while marital state, chronic disease, and frequency of internet use were not significantly associated with eHealth literacy.

**Conclusions:** Our study provides valuable information on digital literacy and eHealth literacy in middle-aged adults and may be used to guide tailored interventions for improving eHealth literacy. Future studies should consider the differences in digital literacy levels across generations when assessing eHealth literacy or planning digital health interventions.

## Keywords

eHealth literacy, digital literacy, digital skills, digital competence, middle-aged adults

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## Introduction

Digital technology has dramatically changed the world in which we live. Currently, 96% of people between 50 and 64 years use the Internet, and 83% have their own smartphones in the USA.[1] In South Korea, 91.9% of the total population use the Internet, 93.1% have their own

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smartphones, and 91.5% use the Internet on their mobile devices.[2] In this context, the ability to access and understand information through these new technologies is becoming increasingly important. For example, information and communications technology (ICT) has enabled patients to easily acquire disease-related knowledge or health-related information online, rather than from health personnel on outpatient visits.[3] Using mobile devices to search for health-related information is becoming a major trend,[4] and social media has become a potential channel for transmitting health-related information and knowledge to the masses.[5,6]

Following this trend, the ability to properly understand and interpret health-related information on the Internet is becoming an important factor, which is called eHealth literacy.[7] eHealth literacy is defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem."[7] eHealth literacy was found to be related to an individuals' sociodemographic characteristics (age,[8–15] gender,[16,17] education level,[9–12] etc.), health-related factors (chronic diseases,[9,10] depression,[8] perceived health status,[11] etc.), and digital-related factors (frequency of ICT use,[8,10,18] computer skills,[12] number of ICT devices,[11] etc.). Additionally, interventions to increase eHealth literacy may improve computer/web skills,[19–21] self-efficacy,[21–23] disease knowledge,[24] and health-related behavior/decision making.[19–22] As health-related information acquired from the Internet is related to health-related behavioral changes,[25,26] promoting eHealth literacy may help improve an individual's health status.

The term eHealth literacy was first introduced in 2006 which originally consisted of six components: traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy.[7] However, the digital-related components, such as media literacy or computer literacy, have not been thoroughly evaluated in digital health interventions.[27] Additionally, the eHealth literacy scale (eHEALS),[28] which is the most frequently used instrument to assess eHealth literacy[27,29] and digital literacy,[30] has not been regarded as a tool that fully covers all aspects of digital health technologies.[29] Given that technology plays a dominant role in digital health interventions,[27,31] it is important to consider the factors associated with eHealth literacy from a technological standpoint.

The concept of digital literacy was introduced about two decades ago,[32] and has generally evolved from a concept solely focused on technical use toward a more comprehensive idea, including cognitive, critical, and responsible perspectives.[33] Although the concept has been widely implicated, it has been described quite poorly in many scientific research papers.[33–35] The terms "digital literacy" and "digital competence" are used interchangeably,[33–35] and although "digital literacy" has been used more often and over a longer period of time, most publications actually do not refer to any previous documents.[33] Conversely, "digital competence" is mostly referred to the DigComp framework published by the European Union.[30,35] In this study, we define digital literacy with the definition proposed in the Digital Literacy Global Framework (DLGF) by UNESCO, because it integrates various governmental and non-governmental frameworks, including DigComp.[36] Here, digital literacy is defined as "the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship" that "includes competences that are variously referred to as computer literacy, ICT literacy, information literacy, and media literacy."[36] When compared to DigComp, the DLGF additionally includes an "operation of digital devices" area. In this viewpoint, digital literacy can be roughly divided into basic technical skills and the engagement in practices with these digital tools.[34,35,37] The latter concept includes components such as information management, communication, collaboration, content creation, ethics, safety, problem solving, and so on, which is termed "digital competence."[36,38,39] We follow this view and divide digital literacy into "digital skills" and "digital competence."

By definition, digital literacy is closely associated with eHealth literacy. However, most studies that examine the relationship between digital literacy and eHealth literacy have either measured digital literacy from a limited scope, such as frequency of ICT use[8,10,18] or use of social media for health information,[11] or failed to evaluate the exact concept of eHealth literacy.[31] Therefore, clarification and detailed examination of such similar concepts are required. Here, we hypothesized that individuals with higher levels of digital literacy components will show higher levels of eHealth literacy (H1), and posed the question: which component of digital literacy is more significantly associated with eHealth literacy? (RQ1)

Age is a critical factor associated with digital literacy[40,41] and eHealth literacy levels.[8–15] In this study, we focused on the middle-aged population. 40.3% of South Korea's current population are middle-aged[42] and are now entering the older adult phase of life, which may greatly reshape the demographic composition in the future due to the spike in birth rates after the Korean war.[43] The middle-aged are unique in that most of them are currently developing health disorders themselves, have additional responsibilities of looking after their aging parents, and have to care for their children, which leads to a greater interest in searching for health-related information.[44,45] Additionally, they show higher education levels and have better economic status compared to older adults, which makes them more adaptive to new cultures and social changes,[46] including advances in technology.[47] Here, we introduce the following research question: which demographic and digital-related factors are significantly associated with eHealth literacy in middle-aged adults? (RQ2)

In this study, we aim to (1) identify the differences in digital skills, digital competence, and eHealth literacy

levels according to demographic features, and (2) elucidate which demographic factors and digital literacy components are associated with eHealth literacy in the middle-aged population in South Korea.

## Methods

### Study population

We conducted a cross-sectional, observational study From February 4th to 8th 2021. Middle-aged adults from South Korea aged 40 to 64 years were recruited online by a professional agency (Macromill Embrain, Seoul, Korea), where 1.3 million online participants are available, which maintains a demographic distribution based on census data from the National Statistical Office. First, a weblink or notice was sent to the target audience via email or mobile application. On the starting page, all participants were informed about the purpose of the study via online documentation, which was available for download if needed. Participants voluntarily moved onto the survey by clicking the start button, which was considered equivalent to informed consent. Next, the participants were asked to respond to an online questionnaire. The online survey system did not allow the participants to move on to the next question if an answer was absent or inaccurate, which prevented the collection of incomplete or inaccurate data. The participants were free to drop out at any point of the survey. All personal identifying information was removed from the collected data. This study was approved by the Institutional Review Board of the Seoul National University (No. 2102/002-002).

The minimum sample size was calculated using the G*power 3 program. Considering an intermediate effect size of 0.15, significance level of 0.05, power of 0.95 and number of independent variables of 8, at least 160 samples were needed for proper analysis.[48]

A total of 547 participants initially accessed the survey. Of those 547, two were not eligible based on age, 39 dropped out before completing the survey, and 144 were eliminated due to oversampling. Samples were collected using the proportionate quota sampling method for age and gender, where participants aged between 40 and 49, 50 and 59, and 60 and 64 were set at a 2:2:1 ratio, and men and women were set at a 1:1 ratio. Of the selected 362 people, 42 were excluded due to poor data quality, such as extremely short response time or the same responses for all questions. As a result, 320 cases were included in the final analysis. The response rate was 88.4%.

### Measurements

*Demographic features.* The demographic features including age, gender, educational level, marital status, chronic diseases, and frequency of Internet use were assessed. Chronic disease status was assessed by asking respondents whether they had any chronic diseases or not. Frequency of Internet use was assessed by asking respondents how many days they used the Internet in the past month (range: 0–31 days). For categorization, we considered 30 or 31 days of use as "daily use," and the remainder as "intermittent use."

*Digital literacy (digital skills and digital competence).* Digital-related factors were measured with questions extracted from a national survey on the digital divide in South Korea (see Supplemental Information).[49] Each item was rated on a 4-point Likert scale, with scores ranging from ([1 = strongly disagree] to [4 = strongly agree]). According to the 2019 report,[49] the measures were highly reliable for both digital skills (Cronbach's alpha = 0.956) and digital competence (Cronbach's alpha = 0.911).

*Digital skills* were evaluated with seven items designed to seek information pertaining to basic skills for using digital devices, especially mobile phones. Some examples are as follows: "I am comfortable with adjusting the settings of display/volume/security/alarm on mobile devices"; "I am comfortable with sending files/photos from my mobile devices to others." Total scores ranged from 7 to 28, where higher scores represent higher digital skill levels. Internal consistency of the measure was high in this study (Cronbach's alpha = 0.928).

*Digital competence* was measured with four items on the ability or attitude towards use of digital devices for different purposes such as communication, collaboration, safety, and ethics. Each item was measured with the following questions: "I am comfortable with communicating and collaborating with others to solve problems or accomplish tasks on the Internet"; "I am comfortable with actively sharing my opinions on political/social issues or participating in various activities such as discussions, donations, or volunteering for public issues on the Internet"; "I am comfortable with protecting myself and others from the various risks of using the Internet, such as personal information leakage"; "I am able to use the Internet responsibly by avoiding illegal media use or infringing on the rights of others, and also understand and accept different opinions from others." Total scores ranged from 4 to 16, where higher scores represent higher digital competence levels. Internal consistency of the measure was high in this study (Cronbach's alpha = 0.877).

*eHealth literacy.* eHealth literacy was measured with eHEALS, which was developed by Norman and Skinner[28] and adapted in Korean by Chang et al.[50] The scale consists of eight items measuring an individual's perceived skills and comfortability with eHealth. Some examples of items are: "I know what health resources are available on the Internet"; and "I know where to find helpful health resources on the Internet." The responses were rated on a 5-point Likert scale with scores ranging

from ([1 = strongly disagree] to [5 = strongly agree]). Total scores ranged from 8 to 40, where higher scores represent higher eHealth literacy levels. Internal consistency of the measure was high in this study (Cronbach's alpha = 0.926).

### Statistical analysis

Data were analyzed using the SPSS (version 22.0; IBM Corp.) software. Differences between groups were analyzed using either Student's *t*-test or one-way ANOVA, and *P* values <0.05 were considered statistically significant. Post-hoc analyses were performed using Scheffe's method. Bivariate analyses were conducted using Pearson's correlation coefficients to observe correlations between the measured variables. We performed multiple regression analysis to find the extent to which demographic features and digital-related factors contributed to eHealth literacy. Multicollinearity effects were measured using VIF values, where values lower than 10 were considered insignificant.

**Table 1.** Demographic features of the study sample ($N = 320$).

| Variables | Categories | *N* | % | Mean ± SD |
|---|---|---|---|---|
| Age (years) | 40–49 | 124 | 38.8 | 51.33 ± 7.24 |
| | 50–59 | 129 | 40.3 | |
| | 60–64 | 67 | 20.9 | |
| Gender | Male | 157 | 49.1 | |
| | Female | 163 | 50.9 | |
| Educational level | High school | 74 | 23.1 | |
| | College | 211 | 66.0 | |
| | Graduate school | 35 | 10.9 | |
| Marital state | Single | 40 | 12.5 | |
| | Married | 256 | 80.0 | |
| | Divorced | 21 | 6.6 | |
| | Widowed | 2 | 0.6 | |
| | Other | 1 | 0.3 | |
| Chronic diseases | Yes | 112 | 35 | |
| | No | 208 | 65 | |
| Frequency of internet use | Intermittent use | 53 | 16.6 | 27.78 ± 6.49 |
| | Daily use | 267 | 83.4 | |

## Results

### Demographic features

Table 1 shows the demographic features of the study participants. The mean age was 51.33 years, and participants were similarly distributed across age and gender. All participants received high school education, while 76.9% received advanced education. The majority of participants had experience of being married, and 35% reported to have had at least one chronic disease. Most of the participants used the Internet on a daily basis (mean of number of days per month = 27.78 days).

### Comparison of measured variables according to demographic features

Descriptive statistics of the measured variables according to demographic features are illustrated in Table 2. People in their 40s showed higher levels of digital skills and digital competence, but lower levels of eHealth literacy as compared to those in their 60s. Digital competence was higher in men than in women, while no significant difference was found between digital skills of men and women. Participants with basic education showed lower level digital skills, digital competence, and eHealth literacy as compared to those who received advanced education. Those who were single showed lower eHealth literacy than those who had a spouse. People with chronic diseases had higher levels of eHealth literacy as compared to healthy individuals. Finally, people who used the Internet daily showed advanced digital skills than intermittent users.

### Bivariate relationships between measured variables

Bivariate relationships between subcomponents of digital literacy and eHealth literacy are depicted in Table 3. The results indicated strong positive correlations between digital skills and digital competence, digital skills and eHealth literacy, and digital competence and eHealth literacy.

### Factors associated with eHealth literacy among middle-aged adults

The results of the multiple regression analysis are presented in Table 4. Age, frequency of internet use, digital skills, and digital competence were included as continuous variables, while gender, educational level, marital state, and chronic disease state were converted into dummy variables.

**Table 2.** Comparison of measured variables according to demographic features.

| | | Digital literacy | | | | | |
|---|---|---|---|---|---|---|---|
| | | Digital skills | | Digital competence | | e-Health literacy | |
| Variables | Categories | Mean ± SD | *P* | Mean ± SD | *P* | Mean ± SD | *P* |
| Age (years) | 40–49 | 23.79 ± 3.70 | | 12.61 ± 2.18 | | 26.31 ± 5.36 | |
| | 50–59 | 22.43 ± 3.64 | <0.001 | 11.83 ± 2.40 | 0.003 | 27.35 ± 4.99 | 0.023 |
| | 60–64 | 21.55 ± 3.94 | | 11.55 ± 2.30 | | 28.45 ± 5.26 | |
| Gender | Male | 23.17 ± 3.73 | | 12.42 ± 2.18 | | 27.00 ± 5.39 | |
| | Female | 22.39 ± 3.87 | 0.070 | 11.74 ± 2.42 | 0.009 | 27.34 ± 5.11 | 0.559 |
| Education level | High school | 21.32 ± 3.90 | | 10.58 ± 2.26 | | 25.64 ± 5.77 | |
| | Advanced[a] | 23.21 ± 3.69 | <0.001 | 12.52 ± 2.16 | <0.001 | 27.64 ± 4.99 | 0.004 |
| Marital state | Single | 22.38 ± 3.32 | | 11.63 ± 1.76 | | 25.20 ± 4.79 | |
| | Other[b] | 22.83 ± 3.88 | 0.483 | 12.14 ± 2.40 | 0.106 | 27.46 ± 5.25 | 0.011 |
| Chronic diseases | Yes | 22.32 ± 3.43 | | 11.89 ± 2.31 | | 28.14 ± 4.71 | |
| | No | 23.01 ± 4.00 | 0.105 | 12.17 ± 2.33 | 0.306 | 26.65 ± 5.45 | 0.015 |
| Frequency of internet use | Intermittent | 21.23 ± 4.00 | | 11.50 ± 2.29 | | 27.44 ± 5.61 | . |
| | Daily | 23.04 ± 3.72 | 0.002 | 12.18 ± 2.33 | 0.064 | 27.13 ± 5.18 | 0.707 |

[a]College education or above.
[b]Includes married, divorced, widowed, and separated.

eHealth literacy was positively associated with increasing age, female gender, higher education levels, and higher digital competence. Digital skills were not significantly associated with eHealth literacy. According to VIF values, multicollinearity effects were considered insignificant.

Regarding our hypothesis and research questions, H1 was partially supported, as digital competence, but not digital skills, was positively associated with eHealth literacy, where RQ1 is also answered. RQ2 is answered, as age, gender, and educational level were positively associated with eHealth literacy in middle-aged adults. All questions are further discussed in the following section.

## Discussion

### *Principal findings*

In this study, we observed demographic and digital-related factors associated with eHealth literacy in the middle-aged population. Results of multiple regression analysis revealed that individuals with higher eHealth literacy were older, female, possessed higher educational qualifications, and had higher digital competence levels as compared to those with lower eHealth literacy. Marital state, chronic disease status, frequency of Internet use, and digital skills were not significantly associated with eHealth literacy levels.

The most interesting finding in this study was that digital competence was the highest contributor to an individual's eHealth literacy, while digital skills were not significantly associated with eHealth literacy. This is in line with a previous study reporting that information literacy was positively associated with eHealth literacy.[12] However, computer literacy[12] or frequency of ICT use[8,10,18] was also positively associated with eHealth literacy,[12] which partially disagrees with our results. The contradictory results may be due to differences in the study population, as all of the reports mentioned above evaluate the general adult population. National surveys indicate that rates of Internet use and owning digital devices sharply decrease

**Table 3.** Bivariate relationships between digital skills, digital competence, and eHealth literacy.

| | Mean ± SD | Min | Max | Digital skills | Digital competence | eHealth literacy |
|---|---|---|---|---|---|---|
| Digital skills | 22.77 ± 3.82 | 9 | 28 | 1 | | |
| Digital competence | 12.08 ± 2.33 | 5 | 16 | 0.751[a] | 1 | |
| eHealth literacy | 27.18 ± 5.24 | 8 | 40 | 0.275[a] | 0.366[a] | 1 |

[a] $P < 0.001$.

in older adults,[2,49] and previous studies showed that older adults are less likely to use digital technologies to access health information compared to middle-aged adults.[51] Accordingly, the inclusion of older adults in the study population may affect the relationship between digital literacy and eHealth literacy. In addition, middle-aged adults have an increased need for health information and services, and they rarely face technical problems when searching for and acquiring such information online.[45] Therefore, in order to develop eHealth literacy in the middle-aged population, merely improving basic skills on how to handle digital devices or increasing the frequency of Internet use may not be the right approach. Instead, working on what to do with these skills, such as communicating with others or using the media more safely and appropriately would actually be more effective. In short, interventions should focus on the "what," rather than the "how."

Several studies conducted earlier have supported this notion. A study on cancer survivors reported that patients increased their eHealth literacy by exchanging information through online health communities.[16] Such positive associations with eHealth literacy is considered to be a result of their online interactions with others as a form of social support. Additionally, digital privacy protection skills were found to be key elements in critically evaluating the credibility and security of online health information.[52] Currently, most interventional studies aiming to increase eHealth literacy levels have targeted older adults and applied skill-based interventions, such as providing training for searching health information online.[19,21,22,53,54] In addition, only a few studies have included content related to privacy or security in the intervention design.[19,21,22] The results of our study suggest that different approaches should be adopted for middle-aged adults, with a focus on digital competence measures, such as teaching them how to enhance collaboration through the web or discussing privacy and ethical issues pertaining to the use of the Internet. Another example could be teaching how to navigate through misinformation, given that incorrect health information has shown a profound impact on health-related decision making throughout the COVID-19 pandemic.[55]

Our results showed that age was positively correlated to eHealth literacy. Previous studies have reported that younger people have higher eHealth literacy levels in various age groups, such as adults aged over 50,[11] over 18 years of age[10,13] or between 20 and 65 years of age.[9] These conflicting results may be explained by the different characteristics between age groups, as all reports mentioned above include two or more different generations. Since only a few studies focus on a single generation,[21,56] further research is needed to explore the relationship between age and eHealth literacy in specific age groups. Additionally, as most studies seeking to enhance eHealth literacy have focused on older adults, where digital literacy levels are low, future studies should consider the differences in digital literacy levels across generations when assessing eHealth literacy or planning digital health interventions.

The positive correlation between age and eHealth literacy in middle-aged adults may be partially explained by the difference in digital skills. In this study, digital skill levels were lower with increasing age, while previous studies have reported that people with higher digital skills show less trust in online information,[57] and the level of trust is strongly correlated to online health information seeking behavior,[58] which in turn is positively associated with health literacy levels.[59]

The results of this study also revealed that women have higher eHealth literacy levels than men and the finding is in conformity with the finding of a previous study on cancer survivors.[16] Although many studies have reported no significant relationships between gender and eHealth literacy,[10–12] women search the Internet for health-related information more frequently than men.[11,44,60] In addition, women seek health information not only for their own health but also for the health of their family members.[61] Considering that the frequency of searching for health-related information is positively associated with health literacy,[59] women may show higher eHealth literacy levels than men.

In our study, people with higher education levels showed higher eHealth literacy levels, which is consistent with previous studies.[9–12] People with higher education are more likely to use the Internet for productive purposes, such as searching health-related information, purchasing products, and online banking,[62–64] which may result in increased ability and confidence in seeking and understanding health-related information through use of the Internet.

The *t*-test results from our study indicated that people suffering from at least one chronic disease showed higher

**Table 4.** Factors associated with eHealth literacy among middle-aged adults.

| Variable | $\beta$ | 95% CI[a] | $t$ | $P$ | VIF[b] |
|---|---|---|---|---|---|
| (constant) | | (−0.565, 12.092) | 1.792 | 0.074 | |
| Age | 0.258 | (0.105, 0.269) | 4.468 | <0.001 | 1.355 |
| Gender (Male = 1) | −0.118 | (−2.297, −0.180) | −2.303 | 0.022 | 1.071 |
| Education level (Advanced = 1) | 0.114 | (0.059, 2.773) | 2.054 | 0.041 | 1.253 |
| Marital state (Single = 1) | −0.049 | (−2.387, 0.827) | −0.955 | 0.340 | 1.081 |
| Chronic disease (Yes = 1) | 0.074 | (−0.365, 1.979) | 1.355 | 0.176 | 1.196 |
| Frequency of internet use | −0.022 | (−0.100, 0.064) | −0.428 | 0.669 | 1.075 |
| Digital literacy–Digital skills | 0.086 | (−0.091, 0.328) | 1.112 | 0.267 | 2.435 |
| Digital literacy–Digital competence | 0.330 | (0.390, 1.092) | 4.153 | <0.001 | 2.559 |
| $F = 11.845$ ($P < 0.001$), $R^2 = 0.234$, Adjusted $R^2 = 0.214$, Durbin-Watson = 1.938 | | | | | |

[a]CI, confidence interval.
[b]VIF, variance inflation factor.

eHealth literacy levels as compared to healthy individuals, although regression analysis showed that chronic disease status did not predict eHealth literacy. Disease-related factors have been examined and analyzed in various ways in related studies, which may have led to contradictory results. For example, Neter et al.'s comparative study found a higher frequency of chronic disease occurrences in people with lower eHealth literacy levels,[10] and Guo et al.'s study reported negative correlations between duration of diabetes and eHealth literacy by bivariate analyses.[9] On the other hand, Tennant et al.'s study reported that perceived health status had a positive effect on eHealth literacy from the results of multiple regression analysis, which contradicts the above stated finding.[11] Therefore, it is not clear whether chronic disease status is associated with eHealth literacy, and the effects of perceived health status and disease duration should also be considered in order to investigate an individual's health more comprehensively.

## Limitations

This study has several limitations. First, digital literacy is a very broad concept that includes more than the two areas investigated in our study, which may not have been fully investigated. For instance, the DigComp framework divides digital competence into five areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving,[36,39] which examine the concept more comprehensively. Therefore, a more detailed questionnaire evaluating the detailed aspects of digital literacy and using them to elucidate the specific factors associated to eHealth literacy may be beneficial in further studies.

Second, since the survey questionnaire was administered online, there is a possibility that the questions might have been misunderstood by the respondents, leading to unintended responses. Additionally, bias toward higher digital literacy levels may have been present, because individuals who are comfortable with using mobile applications would have had better access to the questionnaire. Therefore, use of multiple data collection methods, such as telephone-based interviews or in-person meetings, would provide a better picture of the subject.

Third, the study population showed relatively high educational levels, as all participants had at least a high school diploma. Although the education rates of South Koreans are relatively high due to cultural reasons and educational policies, where 88.7% of adults aged 25 to 64 have finished high school,[65] our sample may have shown higher levels of digital skills, digital competence, and eHealth literacy compared to the general population. Therefore, further studies should consider a study sample with more diversity, including digital and educational minorities, to yield results which can be generalized.

Finally, we assessed the frequency of Internet usage by the number of days per month, although most respondents used the Internet on a daily basis. Therefore, determining the frequency of use with hours per day, or both, might be more appropriate in future studies, as the use of digital devices is continuously increasing.

## Conclusions

This study evaluated the factors associated with eHealth literacy in the middle-aged population, focusing on the specific subcomponents of digital literacy. Middle-aged adults who were older, were female, had received an advanced education, and had higher digital competence levels showed higher eHealth literacy levels. Middle-aged individuals not only have considerable interest in health-related information but are also open to the use of digital devices and media, for which investigating the link between digital-related factors and eHealth literacy, like our study, holds substantial value. Our study provides unique and valuable information on digital literacy and eHealth literacy in middle-aged adults, and may be used to guide tailored interventions for improving eHealth literacy.

**Contributorship:** J. Lee conceptualized the study, collected and analyzed the data, and wrote the manuscript. S.H. Tak supervised the study and provided insights into the study design.

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