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Original Article

# Effects of social support and self-efficacy on eHealth literacy in Korean women undergoing breast cancer treatment: A secondary analysis

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## ARTICLE INFO

## ABSTRACT

*Objective:* Patients with breast cancer need to seek out and understand relevant health information to make informed decisions about long-term and complicated illnesses. With the increased use of interventions using online health information, research on eHealth literacy should be expanded. However, existing studies on the factors affecting eHealth literacy in patients with breast cancer are currently lacking. This study, therefore, conducts a secondary analysis of a previous study that surveyed the quality of life of patients with breast cancer. The primary study found a significant correlation between eHealth literacy, social support, and self-efficacy. In this secondary analysis study, we specifically examine eHealth literacy among patients with breast cancer undergoing treatment, and how patient demographic characteristics, breast cancer-specific self-efficacy, and social support contribute to their eHealth literacy.

*Methods:* A total of 143 women receiving outpatient treatment or were hospitalized for breast cancer at a cancer hospital in South Korea participated in the study from January to November 2022. The eHealth Literacy Scale (eHEALS), Multidimensional Social Support Scale, and Breast Cancer Survivors Scale were utilized in the analysis. The data were analyzed using a multiple regression analysis.

*Results:* Full-time employment ($\beta = 0.19$, $P = 0.006$), a monthly family income of over 4 million won (3600 USD) ($\beta = 0.14$, $P = 0.042$), completing a high school education ($\beta = 0.52$, $P < 0.001$), completing college level or higher education ($\beta = 0.54$, $P < 0.001$), age ($\beta = -0.23$, $P = 0.003$), and social support ($\beta = 0.21$, $P = 0.002$) were predictors of eHealth literacy, explaining 40.2% of the total variance ($F = 14.63$, $P < 0.001$).

*Conclusions:* Social support was identified as a new factor influencing eHealth literacy among patients with breast cancer undergoing treatment. Therefore, nursing interventions to strengthen social support should be developed to improve eHealth literacy.

## Introduction

Patients with cancer should have an adequate level of health literacy for understanding health-related information to facilitate medical decision-making and successful self-care.[1] Health literacy affects the quality of life of breast cancer survivors, particularly explaining 18.8% of variance in the mental domain of the quality of life.[2] Higher health literacy among patients with breast cancer was found to be associated with higher physical activity, patient involvement in decision-making about testing for the risk of breast cancer recurrence, and knowledge of chemotherapy, while lower health literacy was associated with greater fear of progression, psychological support needs, and cancer-related difficulties.[3] Patients with an adequate level of health literacy tend to

be more actively involved in their healthcare. More actively searching for useful resources and communicating more effectively with healthcare providers can increase patients' self-efficacy in disease management and positively impact their quality of life.[1,3] Cancer care coordination can significantly affect the quality of life among patients with breast cancer and lower health literacy.[4] Therefore, oncology nurses must empower patients to understand health-related information in order to enable them to make more informed medical decisions.

With the widespread use of the Internet and smartphones today, patients with breast cancer have increased opportunities to obtain online information on cancer-related health management, cancer symptom management strategies, and treatment feedback on cancer treatment complications. Through web or mobile apps, they are also able to interact

more with other patients.[5] As efforts to identify accurate and reliable online and digital health information have increased during the COVID-19 pandemic,[6] interest is growing around the role of eHealth literacy in finding, processing, evaluating pertinent information for improving self-management behavior in patients with chronic illness,[7] and increasing quality of life in cancer patients.[8]

Health information provided by healthcare providers during face-to-face meetings may sometimes be insufficient,[9] leading patients to seek information from social networks and self-help groups.[10] Alternatively, they can participate in eHealth interventions (eg, websites and apps) as an effective strategy for improving quality of life, distress, self-efficacy, and fatigue.[11] To obtain, understand, and determine the accuracy of online information through eHealth interventions, patients should have an appropriate level of eHealth literacy.

eHealth literacy is required to understand online health information and strengthen health behaviors.[12] Patients undergoing breast cancer treatment should be able to understand the explanations of healthcare providers, select appropriate treatment methods, and develop self-care skills to effectively manage the side effects of chemotherapy. To improve eHealth literacy for patients with breast cancer, the predictors of eHealth literacy must be identified before it is applied in nursing interventional strategies. Higher education and family income level, younger age at diagnosis, and lower fear of cancer recurrence were reported to predict health literacy in patients with breast cancer[13]; health literacy was found to be positively correlated with patients' education and family income level, but negatively correlated with their age at surgery, age at diagnosis, comorbidity, and symptoms. Predisposing factors, such as age, gender, and education level, were also found to influence cancer patients' eHealth literacy.[14] The enabling factors of eHealth literacy for patients with cancer were found to involve the frequency of searching for online health information, access to mobile devices and electronic resources, and emotional support behavior.[14] Health literacy and eHealth literacy are similar in that they are both influenced by personal determinants related to demographic factors such as age, race, gender, education level, and income level.[1,15] However, the difference between the predictors of health literacy and eHealth literacy is that technological determinants such as access devices and the type and number of technologies used to access health information are factors that influence eHealth literacy.[15] As an active coping strategy, seeking health information was reported to be associated with breast cancer patients' self-efficacy for understanding medical information.[16] In older adults[17] and older adults with chronic diseases,[7] eHealth literacy and self-efficacy was found to be significantly positively correlated. Various studies have also shown a significant relationship between social support and eHealth literacy among patients with chronic illnesses; a study conducted with patients hospitalized with cancer[18] and another with older adults with chronic diseases[7] both revealed a significant positive correlation between social support and eHealth literacy.

Existing studies have focused mainly on predictors of health literacy rather than those of eHealth literacy, in various types of cancer survivors,[2] patients with diabetes,[19] or the general population.[20] Only one study has examined eHealth literacy in patients with various types of cancer.[14] Moreover, evidence on whether social support and breast cancer-specific self-efficacy determine eHealth literacy in patients with breast cancer is lacking. While significant correlations have been reported between eHealth literacy, demographic characteristics, social support, and self-efficacy in a survey investigating the quality of life of patients with breast cancer, eHealth literacy was not identified as a significant independent variable of quality of life.[21] Based on a literature review, this study hypothesized that social support and breast cancer-specific self-efficacy affect eHealth literacy in patients with breast cancer. The current study aimed to identify the factors influencing eHealth literacy in breast cancer patients undergoing treatment. Specifically, this study sought to (1) investigate the correlation between patient demographic characteristics, social support, breast cancer-specific self-efficacy, and eHealth literacy; (2) compare the level of eHealth literacy according to differences in patient demographic characteristics; (3) investigate the factors affecting eHealth literacy in breast cancer patients

undergoing treatment. This study is a secondary data analysis of a previous survey that examined the quality of life of patients with breast cancer. The primary study was a descriptive, cross-sectional study that used self-administered survey data.[21]

## Methods

### Study design and participants

This study analyzed the primary study's self-administered survey data on the quality of life of patients with breast cancer. Using convenience sampling, the primary study sampled women in South Korea who were hospitalized and undergoing treatment one month after breast cancer diagnosis. The inclusion criteria for participants in the primary study were (1) aged 18–65 years old, (2) has undergone chemotherapy or surgery and chemotherapy, and (3) is able to use the Internet through a mobile device or personal computer. The exclusion criteria were patients who received radiation or hormone therapy alone.

To estimate the appropriate sample size, effect sizes were calculated using the squared multiple correlations of a previous study on predictors of health literacy. The required sample size was calculated at 129 to detect the effect size of 0.16,[13] 15 independent variables, alpha level of 0.05, and power of 0.8 using G-power 3.1.9.4. Considering the dropout rate of 10%, the sample size of 143 participants surveyed in the primary study was appropriate, showing an actual power of 0.85. Mahalanobis distance was evaluated using a chi-squared test, with degrees of freedom equal to the number of variables using the criterion for multivariate outliers at $P < 0.001$.[22] There was no multivariate outlier, and data from 143 participants were analyzed.

### Measures

#### Demographic characteristics

Variables representing the demographic characteristics were developed based on previous literature and included age, education level, employment status, family monthly income, marital status, religion, participation in self-help group activities for patients with breast cancer, and Internet usage time for health information search. Disease-related variables included duration since diagnosis of breast cancer, cancer metastasis, history of radiation therapy, history of hormonal treatment, and morbidity index adjusted for age; they were measured using the Age-adjusted Charlson Comorbidity Index (ACCI). ACCI was calculated by reflecting the severity of 19 diseases and participants' age of 50 years or older and was used to predict the prognosis of cancer patients.[23]

#### eHealth literacy

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."[24] To measure eHealth Literacy, the Korean version of the eHealth Literacy Scale (eHEALS) developed by Norman and Skinner (2006) was used.[25] The eHEALS is a self-reported scale that measures individual perceptions of six core skills: traditional literacy, health literacy, information literacy, scientific literacy, medial literacy, and computer literacy. This scale provides a general estimate of eHealth-related skills used to inform clinical decision-making and health promotion planning with individuals or a specific population. The eHEALS is a unidimensional scale with eight items and is evaluated on a 5-point Likert scale; a higher average score indicates higher eHealth literacy. Cronbach's α was 0.88 at the time of the scale's development.

#### Social support

This study used the Korean version of the Multidimensional Scale of Perceived Social Support to measure social support.[26] The

Multidimensional Scale of Perceived Social Support consists of 12 items in three domains: family support, friend support, and medical staff support. It is evaluated on a 5-point Likert scale; the higher the average score, the higher the degree of perceived social support. Cronbach's α was 0.85 at the time of tool development.

### Breast cancer-specific self-efficacy

This study used the Breast Cancer Survivors Scale developed to measure breast cancer-specific self-efficacy in patients with breast cancer.[27] This scale measures the perceived ability to manage symptoms and quality-of-life problems resulting from the diagnosis and treatment of breast cancer. The Breast Cancer Survivors Scale is a unidimensional scale with 14 items and is evaluated on a 5-point Likert scale. The total score ranges from 5 to 70, with a higher total score indicating higher self-efficacy. Cronbach's α was 0.93 at the time of the scale's development.

### Data collection

This study utilized secondary data analysis. The primary survey was distributed to participants after the study was explained. Informed consent was obtained from all individual participants included in the study. In the primary survey, disease-related characteristics were collected from electronic medical charts and other variables were collected using a paper-and-pencil questionnaire. Data were collected from January to December 2022 during the primary survey.

### Data analysis

Data were analyzed using IBM SPSS Statistics for Windows version 27.0. Descriptive statistics were used to measure the mean and frequency of demographic characteristics, level of social support, breast cancer-specific self-efficacy, and eHealth literacy. Independent *t*-test and one-way analysis of variance were used to compare the level of eHealth literacy according to differences in demographic characteristics. Pearson's correlation coefficients were utilized to investigate the correlations between demographic characteristics, social support, breast cancer-specific self-efficacy, and eHealth literacy. Multiple regression analysis was conducted to determine the predictors of eHealth literacy.

The basic assumptions of the regression model, including linearity, no multicollinearity, multivariate normality, independence of the residuals, and homoscedasticity, were examined.[22] The Mahalanobis distance for the multivariate outlier test was confirmed. Statistical significance was set at $P < 0.05$.

### Results

#### Demographic characteristics and level of social support, breast cancer-specific self-efficacy, and eHealth literacy

Table 1 shows the demographic characteristics. The mean age was 49.48 years. Those educated to the high school level and those educated to the college level or higher accounted for 52.4% ($n = 75$) and 40.6% ($n = 58$) of the participants, respectively. The majority of the patients were unemployed (75.5%, $n = 108$), married (75.5%, $n = 108$), and religious (65.7%, $n = 94$). Nearly half reported a monthly family income between 2 and 4 million won (1801–3600 USD) (49.7%, $n = 71$). Some patients participated in self-help group activities for patients with breast cancer (30.8%, $n = 44$). Internet usage time for health information search was 2.3 h per week.

The mean length of time since breast cancer diagnosis was 29.72 months. Stage II was the most common diagnosis (42.0%, $n = 60$). Metastasis at the time of investigation was observed in 29.4% ($n = 42$) of the patients. In addition to surgical treatment and chemotherapy, most patients (73.4%, $n = 105$) received radiation and/or hormone therapy, while 31 (21.7%) patients only underwent chemotherapy. The mean

comorbidity index measured by ACCI was $2.5 \pm 3.0$. The mean of eHealth literacy was $3.4 \pm 0.9$, social support was $3.5 \pm 0.7$, and self-efficacy was $45.9 \pm 8.1$. Cronbach's alpha for eHealth literacy, social support, and breast cancer-specific self-efficacy was 0.96, 0.90, and 0.89, respectively, in this study, which were appropriate levels.

#### Comparisons of the level of eHealth literacy according to differences in patient demographic characteristics

eHealth literacy was statistically significantly greater in those educated to the college level or higher than those educated to the primary, middle, or high school level ($F = 22.45$, $P < 0.001$). It was also statistically significantly greater in participants with full-time employment than in those with part-time or no employment ($F = 8.86$, $P < 0.001$). eHealth literacy was statistically significantly greater in patients with a monthly income of 4 million won (3600 USD) or more than those with a monthly income less than 2 million won (1801 USD) and those earning between 2 and 4 million won (1801–3600 USD) ($F = 10.11$, $P < 0.001$). Patients who participated in self-help groups had a statistically significantly greater eHealth literacy than those who did not ($t = -3.43$, $P = 0.001$). eHealth literacy was also statistically significantly greater among patients without cancer metastasis than in those with metastasis ($t = 2.67$, $P = 0.008$). There was no difference in eHealth literacy according to breast cancer stage at diagnosis or type of cancer treatment regimen (Table 1).

#### Correlation among eHealth literacy and other variables

In the correlation analysis, eHealth literacy showed a positive correlation with social support ($r = 0.336$, $P < 0.001$) and breast cancer-specific self-efficacy ($r = 0.317$, $P < 0.001$). In addition, eHealth literacy was showed a statistically significantly negative correlation with age ($r = -0.409$, $P < 0.001$), breast cancer duration ($r = -0.208$, $P < 0.05$), and ACCI ($r = -0.353$, $P < 0.001$), but a significantly positive correlation with Internet usage time for health information search ($r = 0.239$, $P < 0.01$) (Table 2).

#### Factors influencing eHealth literacy

As this study aimed to investigate the factors affecting eHealth literacy, assumptions for multiple regression analysis must be explored. The normality, linearity, and equal variance for regression analysis were verified through the examination of residual scatterplots between predicted dependent variable scores and prediction errors.[22] The standardized residual values ranged from $-2.08$ to $2.59$, which were within $\pm 3$. The Durbin–Watson statistic was 1.993. Dots following the diagonal line in the P–P plot were examined. To test multicollinearity, the variance inflation factor was lower than 10 and tolerance was higher than 0.1.

Full-time employment ($\beta = 0.19$, $P = 0.006$), a monthly family income of over 4 million won (3600 USD) ($\beta = 0.14$, $P = 0.042$), completing a high school education ($\beta = 0.52$, $P < 0.001$), completing college level or higher education ($\beta = 0.54$, $P < 0.001$), age ($\beta = -0.23$, $P = 0.003$), and social support ($\beta = 0.21$, $P = 0.002$) were predictors of eHealth literacy. Seven variables explained 40.2% of the total variance in eHealth literacy ($F = 14.63$, $P < 0.001$) (Table 3).

### Discussion

In the present study, eHealth literacy showed a negative correlation with age, and there were differences according to education level and family monthly income. Younger age, higher level of education, and higher level of family income were identified as factors influencing eHealth literacy. Vandraas et al[17] similarly found that younger age at diagnosis influenced eHealth literacy levels. In another study, the low level of health literacy in patients with breast cancer increased from 15% in the 45-54 year old group to 26.4% in the 65-74 year old group and

**Table 1**

Comparisons of the level of eHealth literacy according to differences in patient demographic characteristics ($N = 143$).

| Variables | n (%) | Mean ± SD | t or F (p) |
|---|---|---|---|
| Age (years) | | 49.48±8.51 | |
| Education level | | | |
|   Primary or middle school [a] | 10 (7.0) | 1.95±0.88 | 22.45 |
|   High school [b] | 75 (52.4) | 3.31±0.76 | (< 0.001) |
|   Educated to college level or higher [§;c] | 58 (40.6) | 3.68±0.74 | a < b, c***, b < c* |
| Employment status | | | |
|   Part-time employment [a] | 10 (7.0) | 3.05±0.92 | 8.86 |
|   Unemployed or housewife [b] | 108 (75.5) | 3.25±0.85 | (< 0.001) |
|   Full-time employment [c] | 25 (17.5) | 3.99±0.64 | a < c*, b < c *** |
| Family monthly income | | | |
|   ≤ 2 million won (1800 USD) [a] | 27 (18.9) | 2.93±0.93 | 10.11 |
|   2–4 million won (1801–3600 USD) [b] | 71 (49.7) | 3.27±0.88 | ( <0.001) |
|   > 4 million won (3600 USD) [c] | 45 (31.5) | 3.78±0.63 | a < c***, b < c** |
| Marital status | | | |
|   Non-married | 16 (11.2) | 3.36±0.91 | 0.21 |
|   Married | 108 (75.5) | 3.39±0.85 | (0.808) |
|   Widow or divorced | 19 (13.3) | 3.24±0.96 | |
| Having religion | | | |
|   No | 49 (34.3) | 3.45±0.85 | 0.90 |
|   Yes | 94 (65.7) | 3.32±0.88 | (0.371) |
| Self-help group activity | | | |
|   No | 99 (69.2) | 3.20±0.88 | −3.43 |
|   Yes | 44 (30.8) | 3.72±0.73 | (0.001) |
| Internet usage time (hours per week) | | 2.32±3.32 | |
| Length of time since breast cancer diagnosis (months) | | 29.72±42.21 | |
| Metastasis at the time of investigation | | | |
|   No | 101 (70.6) | 3.49±0.85 | 2.67 |
|   Yes | 42 (29.4) | 3.07±0.85 | (0.008) |
| Cancer stage at diagnosis | | | |
|   0 | 3 (2.1) | 3.33±0.85 | 0.62 |
|   I | 22 (15.4) | 3.43±0.83 | (0.650) |
|   II | 60 (42.0) | 3.44±0.95 | |
|   III | 31 (21.7) | 3.37±0.86 | |
|   IV | 27 (18.9) | 3.13±0.75 | |
| Cancer treatment regimen | | | |
|   CTX + RT and/or HT | 7 (4.9) | 2.89±0.94 | 0.92 |
|   CTX only | 31 (21.7) | 3.35±1.00 | (0.472) |
|   CTX + OP + RT + HT | 42 (29.4) | 3.51±0.75 | |
|   CTX + OP + RT | 27 (18.9) | 3.20±0.86 | |
|   CTX + OP | 27 (18.9) | 3.37±0.76 | |
|   CTX + OP + HT | 9 (6.3) | 3.57±1.18 | |
| Age-adjusted Charlson Comorbidity Index | | 2.50±3.03 | |

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

CTX, chemotherapy; OP, operation; RT, radiation therapy; HT, hormone therapy.

[a, b, c] groups for post hoc tests.

[§] College, university or graduate school.

**Table 2**

Correlations among eHealth literacy and other variables ($N = 143$).

| Variables | eHealth literacy | Social support | Self-efficacy | Age | Length of time since breast cancer diagnosis | ACCI | Internet usage time |
|---|---|---|---|---|---|---|---|
| eHealth literacy | 1 | | | | | | |
| Social support | 0.336*** | 1 | | | | | |
| Self-efficacy | 0.317*** | 0.482*** | 1 | | | | |
| Age | −0.409*** | −0.178* | −0.137 | 1 | | | |
| Length of time since breast cancer diagnosis | −0.208* | −0.008 | −0.108 | 0.167* | 1 | | |
| ACCI | −0.353*** | −0.241** | −0.164 | 0.429*** | 0.606*** | 1 | |
| Internet usage time | 0.239** | −0.015 | 0.083 | −0.078 | −0.084 | −0.138 | 1 |

*$P < 0.05$, **$P < 0.01$, *** $P < 0.001$.

ACCI, Age-adjusted Charlson Comorbidity Index.

46% in the 75–93 year old group.[28] This increase can be explained by the impaired cognitive ability of older adult patients with cancer.[1] Moreover, older patients do not use mobile devices and the Internet to search for information as much as younger patients.[29] It is important to note, however, that age alone may not be an adequate predictor of health literacy, as both older or younger age has been found to be associated with

**Table 3**
Multiple regression analysis of factors influencing eHealth literacy ($N = 143$).

| Variables | B | β | t | P |
|---|---|---|---|---|
| Constant | 2.54 | | 4.338 | < 0.001 |
| Full-time employment status[a] | 0.43 | 0.19 | 2.770 | **0.006** |
| Family monthly income over 4 million won (3600 USD)[b] | 0.27 | 0.14 | 2.050 | **0.042** |
| High school education[c] | 0.90 | 0.52 | 3.749 | **< 0.001** |
| Educated to college level or higher[c] | 0.95 | 0.54 | 3.373 | **< 0.001** |
| Age | −0.02 | −0.23 | −3.012 | **0.003** |
| Internet usage time per week | 0.03 | 0.13 | 1.971 | 0.051 |
| Social support | 0.25 | 0.21 | 3.114 | **0.002** |
| Adjusted $R^2$ | 0.402 | | | |
| F (p) | **14.629 (< 0.001)** | | | |

**Bold**: significant variables.
[a] Reference: unemployed or housewife.
[b] Reference: ≤ 2 million won (1800 USD).
[c] Reference primary or middle school.

higher levels of health literacy in other studies. Other confounding factors associated with age should, therefore, be considered.[1]

The association between health literacy and education level was also confirmed in a meta-analysis.[1] In another study that examined patients with cancer, education level was shown to have an effect on eHealth literacy.[14] Education level may be a reasonable predictor of health literacy with respect to the skills needed to obtain and understand the necessary medical information and to assess its quality. It is known that the level of health literacy differs depending on income level. Adults living below the poverty level had a significantly lower health literacy score than higher income adults.[1] Low-income rural communities where residents do not have high-speed Internet connections or computers also continue to be at a major disadvantage due to low health literacy.[1] However, considering the smartphone usage rate in South Korea,[30] the effect of family monthly income on higher eHealth literacy is speculated to be more closely related to education level and employment status rather than Internet access.

This study found a significant positive correlation between eHealth literacy and Internet usage time ($r = 0.24$, $P < 0.01$), which supports that access to online health information is an antecedent factor for eHealth literacy.[14] While our study observed a weak negative correlation between length of time since breast cancer diagnosis and eHealth literacy, the former was not an influencing factor on eHealth literacy. In a previous study[20] of patients with cancer, no difference was observed in the level of eHealth literacy according to the post-diagnosis period. Similarly, another study found no difference in the number of years of the patient having cancer between groups with adequate and inadequate health literacy level.[31] With increasing concerns about the accessibility of unverified, incorrect, and non-personalized health information on the Internet,[1] patients' confidence in assessing the quality of health information and their reliance on Internet health information for decision-making may decrease even as the duration of illness increases. Future research is thus needed to examine whether patients no longer rely on universal or superficial knowledge from the Internet and instead seek better quality personalized information, such as interactions with healthcare providers, as disease duration increases over time.

This study revealed a negative correlation between ACCI and eHealth literacy. eHealth literacy was lower in patients with than without cancer metastases. This finding supports that reported in previous studies, wherein comorbidities in breast cancer patients were found to be negatively correlated with health literacy,[13] and cancer patients with one comorbidity had higher levels of eHealth literacy than those with two comorbidities.[18] It is shown that patients with high subjective health status search for health information to maintain their current health level, and consequently maintain high eHealth literacy.[32]

While breast cancer-specific self-efficacy, that is, the perceived ability to manage breast cancer symptoms and quality-of-life problems showed a significant positive correlation with eHealth literacy in this study, it was not identified as a factor affecting eHealth literacy. In patients with chronic diseases, such as diabetes, claudication, and cancer, health literacy and self-efficacy were shown to have a significant relationship. In diabetic patients, health literacy showed a positive correlation with self-efficacy.[19] Intermittent claudication patients with high health literacy showed higher self-efficacy than those with low health literacy.[33] A systematic review found that patients with breast cancer and high self-efficacy for coping were more likely to seek and understand medical information.[16] A study of cancer patients found that low rectal cancer screening self-efficacy was associated with low health literacy; however, other studies found no correlation between rectal cancer screening self-efficacy and health literacy nor between self-efficacy and health literacy in bone marrow transplant patients.[34] Self-efficacy is defined as an individual's perception of their ability to complete a given task, which determines their view of their ability to overcome obstacles.[35] Accordingly, self-efficacy can mediate the relationship between individuals' perceptions of the usefulness of online information and eHealth literacy.[17] In the present study, the influence of demographic factors on eHealth literacy was greater than that of breast cancer-specific self-efficacy. In future studies on eHealth literacy and self-efficacy, awareness of the usefulness and utilization of online information should be investigated together.

The level of eHealth literacy was high among patients participating in self-help group activities; however, unlike social support, it was not a factor influencing eHealth literacy. These results are consistent with those of a previous study targeting hospitalized cancer patients[18] and diabetic patients,[19] which also identified social support as a factor related to health literacy.[19] In the present study, the correlation coefficient between eHealth literacy and social support was 0.34, which was higher than that obtained in a previous study conducted with older adults (0.15)[36] and that in a study on older adults with chronic diseases (0.21).[7] The correlation coefficients between eHealth literacy and the sub-dimension of social support were significant at values of 0.33 for the family dimension and 0.41 for the friend dimension in this study. These results are also in line with those of a previous study, which reported that living with a family member was a factor related to health literacy among breast cancer patients.[13] However, the correlation coefficient with the medical staff dimension of social support was 0.04, which shows no statistical significance in our study. The lack of correlation between social support by medical staff and health literacy was also found in a study of cancer patients in Korea.[9] These findings may be related to the Korean medical system, which inevitably shortens the time required for direct care, such as counseling services from healthcare providers because medical expenses are low and patients are concentrated in tertiary hospitals.[37] In the United States, email communication between patients and healthcare providers was found to positively impact the effectiveness of care,[1] suggesting the need for partnership with healthcare providers and the provision of supportive resources by oncology nurses as a strategy for improving eHealth literacy in patients with breast cancer.

The significance of this study is to identify demographic characteristics as a factor influencing eHealth literacy, providing participants with ideas to prioritize when planning interventions to improve eHealth literacy. Breast cancer survivors with low socioeconomic status have nursing needs, including health literacy.[38] Efforts are needed to improve eHealth literacy among low-income, less educated, and unemployed patients. In addition, given that social support was identified as an influencing factor in this study, eHealth literacy interventions should include strategies to enhance social support in breast cancer patients undergoing treatment. In particular, patients with low eHealth literacy should be given priority when it comes to receiving social support. A study by Kobayashi et al showed that social support could more strongly improve the quality of life in the low health literacy than the high health literacy group.[39]

In terms of healthcare policy, a strategy to improve the efficiency of the healthcare system is recommended. A previous study observed that

the presence of a care coordinator was associated with 17.1% higher perceived care coordination scores among women with low health literacy compared to those without a care coordinator.[28] When synthesizing the effect of social support on eHealth literacy in the current and previous studies, it is necessary to first identify the eHealth literacy level of patients with breast cancer and implement nursing interventions including social support for the patients with low eHealth literacy.

*Limitations*

This study has several limitations. First, as it only targeted patients with breast cancer undergoing outpatient or inpatient treatment at a single hospital in Korea, the results should be interpreted with caution in terms of their generalizability. Since social support according to the healthcare system environment differs per country, the results should be interpreted in consideration of the interaction of confounding variables on social support. Second, this study had to use secondary data; therefore, antecedents such as the utilization and usefulness of online health information for eHealth literacy were excluded.

## Conclusions

Full-time employment status, higher family monthly income, higher education level, and greater social support were significant predictors of eHealth literacy, accounting for 40.2% of the total variance. Social support was newly identified as a factor influencing eHealth literacy among patients undergoing breast cancer treatment. The eHealth literacy level of patients undergoing breast cancer treatment should be assessed and nursing interventions to improve eHealth literacy should be developed for the low-level eHealth literacy group. Policy and institutional level strategies to strengthen social support must also be developed in the interventions to improve eHealth literacy.

## CRediT author statement

All authors contributed to the study conception and design. Bang-Eun Lee: Conceptualization, Methodology, Investigation, Data Curation. Ju-Yeon Uhm: Conceptualization, Methodology, Software, Writing – Original and Revised draft preparation, Supervision. Myonung Soo Kim: Methodology, Software, Validation, Writing – Revised draft preparation. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

## Declaration of competing interest

The authors declare no conflict of interest.

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This study received no external funding.

## Ethics statement

This study was conducted after Institutional Review Board (IRB) approval independent of the primary study (Pukyong National University IRB No. 1041386-202302-HR-16-02). The primary study was approved by the IRB of the Dongnam Institute of Radiological & Medical Sciences (IRB No. D-2201-001-002). Informed consent was obtained from all individual participants included in the study.

## Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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