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ORIGINAL RESEARCH

# Assessing eHealth Literacy and Identifying Factors Influencing Its Adoption Among Cancer Inpatients: A Cross-Sectional Study in Guangdong Population

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**Purpose:** The purpose of this study was to investigate the current state of eHealth literacy among cancer patients in a grade A tertiary hospital in Guangzhou, Guangdong Province, and to identify the factors that influence it, in order to provide a basis for improving the eHealth literacy of cancer patients.

**Patients and Methods:** From September to November 2021, a convenience sampling method was employed to survey cancer patients in the oncology department of a grade A tertiary hospital in Guangzhou, using a self-administered general information questionnaire and the eHealth literacy scale (eHEALS). A total of 130 questionnaires were distributed, and 117 valid questionnaires were returned.

**Results:** The mean total score of eHealth literacy among cancer patients was 21.32±8.35. Multiple linear regression analysis revealed that the frequency of searching for health information and education level were significant factors influencing eHealth literacy (p<0.05). Specifically, the education level (junior high school vs primary school or below) was found to have a significant association with eHealth literacy (beta=0.26, p=0.039).

**Conclusion:** The results of this study suggest that the eHealth literacy of cancer patients is relatively low, with low scores on the dimensions of judgment and decision-making ability. The government and relevant regulatory authorities should focus on strengthening the reliability of online health information and implementing targeted e-interventions to enhance the eHealth literacy of cancer patients.

**Keywords:** health literacy, neoplasms, information seeking behavior, eHEALS

## Introduction

In December 2020, the 47th Statistical Report on the Development Status of the Internet in China, released by the China Internet Information Center (CNNIC), revealed that the number of Internet users in China had reached 989 million, with an Internet penetration rate of 70.4%.[1] Among these users, the number of individuals utilizing online medical resources has been rapidly increasing. Cancer patients, specifically, are a group that has a high demand for information regarding their condition.[2,3] In recent years, the number of patients who rely on the Internet as their primary source of information has been increasing, and is projected to continue to grow in the future. Studies have shown that cancer patients often access health information from multiple sources, including their primary care physician and the Internet, but cancer survivors at the end of treatment tend to prefer using the Internet as their primary source of information.[4] The Internet is thus an important resource for cancer patients throughout their illness. Following the outbreak of COVID-19, misinformation has flooded the online world,[5,6] putting enormous pressure on cancer patients, one of the most vulnerable populations, to be informed. Cancer

patients not only have to navigate the complex information landscape but also distinguish between credible and unreliable sources of information. In addition, the need for online information for cancer patients is likely to be even more acute during a pandemic, as cancer patients are at higher risk of serious illness and death due to their compromised immune systems and other underlying health conditions.[7–9]

eHealth literacy, as defined by Norman in 2006, refers to an individual's comprehensive ability to locate, evaluate, integrate, and apply health information obtained from electronic sources to solve health problems. Studies have shown that eHealth literacy is a reliable indicator of the impact of information technology on individual health interventions.[10] Enhancing eHealth literacy among patients with chronic diseases can be beneficial in promoting and maintaining healthy behaviors.[11,12] In China, studies on eHealth literacy have primarily focused on the student population[13–16] and the elderly,[17–19] with fewer studies conducted on cancer patients.[20,21] Recent research shows that cancer patients' information preferences vary according to the stage and type of cancer they are diagnosed with.[22] Therefore, this study aims to investigate the current state of eHealth literacy and its influencing factors among cancer patients in Guangzhou. The purpose of this research is to provide a practical foundation for improving eHealth literacy and quality of life for cancer patients, improving medical outcomes, and developing specific interventions.

## Materials and Methods
### Study Design
This study was conducted from September to November 2021, using a convenience sampling method to survey inpatients in the oncology department of a 3A tertiary care hospital in Guangzhou, Guangdong Province, China. Inclusion criteria for cancer patients were: (1) age $\geq$ 18 years; (2) pathological diagnosis of end-stage malignancy; and (3) informed consent and voluntary participation in the survey. Exclusion criteria for participants were: (1) mental cognitive impairment and inability to communicate normally; (2) severe illness and physical weakness that prevented them from participating in the survey.

### Procedures
The purpose of the survey was explained to patients and informed consent was obtained. Questionnaires were distributed for self-completion, with investigators providing one-on-one assistance to patients who were unable to complete the questionnaires due to low education levels or visual impairment. The questionnaires were checked and collected on the spot. A total of 130 questionnaires were distributed and 117 were effectively returned, resulting in a valid return rate of 90%.

### Measures
The study is based on a cross-sectional design with self-administered questionnaire, which included the following aspects: (1) a self-administered general information questionnaire, designed by the researcher, which contained socio-demographic information such as patients' age, gender, income, education level, marital status, disease and medical consultation status, and internet health search behavior; and (2) the Norman's eHealth literacy scale (eHEALS), proposed and developed by Norman,[10] and Chineseized by Guo Shuaijun et al[23] The scale consists of 8 items and is scored out of 40, with higher scores indicating higher eHealth literacy. The scale is divided into three dimensions: an assessment of the application of online health information and services (questions 1, 2, 3, 4, and 5), an assessment of judgmental ability (questions 6 and 7), and an assessment of decision-making ability (question 8). The questions are scored on a five-point Likert scale, with "very poorly matched", "somewhat poorly matched", "unsure", and "somewhat matched". The scores for the eight questions were added together to give a total eHealth literacy score (Appendix 1).

### Statistical Methods
Data was analyzed using IBM SPSS Statistics 26. Demographic data of cancer patients are presented in absolute and relative numbers. The eHealth literacy scores and total scores of cancer patients were expressed as x±SD. The Student's *t*-test was used for comparison between two groups, and analysis of one way ANOVA was used between multiple groups. Multiple linear regression was used to analyze the factors influencing eHealth literacy. The significance level was set at $\alpha=0.05$.

# Results

## Demographic Data

A total of 117 cancer patients participated in the study, with 68 (58.1%) being male and 49 (41.9%) being female. The age range of participants was between 22 and 81 years, with an average age of 53 years. Education levels were as follows: 24 (20.5%) with primary school education or below, 70 (59.9%) with junior or senior high school education, and 23 (19.7%) with college or higher education. Regarding personal monthly income, 48 (41%) participants earned less than 1000 RMB, 24 (20.5%) earned between 1001 and 3000 RMB, 18 (15.4%) earned between 3001 and 5000 RMB, and 29 (24.8%) earned more than 5000 RMB. The frequency of searching for cancer-related health information was as follows: 15 (12.8%) "often", 44 (37.6%) "sometimes", 32 (27.6%) "rarely", and 26 (22.2%) "never" (Table 1).

## eHealth Literacy
### eHealth Literacy Scale Scores for Cancer Patients

The results of the eHealth literacy scale for cancer patients revealed a mean score of 21.32±8.35, with an average score for each item of 2.66±0.23. The mean score for the application of online health information and services, as assessed by questions

**Table 1** Descriptive Statistics of Cancer Patients

| Characteristic | Groups | Number | Percentage (%) |
|---|---|---|---|
| Gender | Male | 68 | 58.10 |
| | Female | 49 | 41.90 |
| Age | ≤44 years old | 28 | 23.90 |
| | 45–59 years old | 46 | 39.30 |
| | ≥60 years old | 43 | 36.80 |
| Marriage Status | In Marriage | 108 | 92.30 |
| | Others | 9 | 7.70 |
| Education Background | Primary school and below | 24 | 20.50 |
| | Junior High School | 45 | 38.50 |
| | Senior High School | 25 | 21.40 |
| | College/Undergraduate or above | 23 | 19.70 |
| Personal monthly income | ≤1000 RMB | 48 | 41.00 |
| | 1001–3000 RMB | 24 | 20.50 |
| | 3001–5000 RMB | 18 | 15.40 |
| | >5000 RMB | 27 | 23.10 |
| Household structure | Living alone | 5 | 4.27 |
| | Living with your spouse | 56 | 47.86 |
| | Living with 2 generations | 33 | 28.21 |
| | Living with grandchildren | 23 | 19.66 |
| Whether the family members have medical background | Yes | 29 | 24.80 |
| | No | 88 | 75.20 |
| Types of Cancer | Lung cancer | 29 | 24.79 |
| | Gastric cancer | 16 | 13.68 |
| | Colorectal cancer | 20 | 17.09 |
| | Breast cancer | 10 | 8.55 |
| | Others | 42 | 35.90 |
| Validation medical behavior | Never | 56 | 47.86 |
| | Occasionally | 51 | 43.59 |
| | Frequently | 10 | 8.55 |
| Frequency of searching health information | Never | 26 | 22.20 |
| | Seldom | 32 | 27.40 |
| | Sometimes | 44 | 37.60 |
| | Frequently | 15 | 12.80 |

1–5, was 14.86±5.25. The mean score for the judgmental ability, as assessed by questions 6 and 7, was 5.20±2.31. Additionally, the mean score for decision-making ability, as assessed by question 8, was 2.50±1.20 (Table 2).

## eHealth Literacy of Patients with Different Demographic Characteristics

An analysis of eHealth literacy scores among cancer patients revealed statistically significant differences (p<0.05) based on various patient characteristics including age group (p=0.020), personal monthly income (p=0.008), education background (p<0.001), validation medical behavior (p=0.021) and frequency of using the Internet to search for health information (p<0.001) as demonstrated in (Table 3).

## Multiple Linear Regression Analysis of Influencing Factors of eHealth Literacy Among Cancer Patients

The multiple linear regression analysis was conducted with eHealth literacy as the dependent variable, and incorporating the potential influencing factors as independent variables, as presented in Table 3. The results indicate that educational background (Junior High School compared to Primary school and below) and frequency of searching for health information were found to be statistically significant (p<0.05). The Variance Inflation Factor (VIF) values were all less than 3, indicating no severe multicollinearity. The adjusted coefficient of determination was 0.367, indicating that the independent variables explained 36.7% of the variance in the eHealth literacy scores among cancer patients in Guangzhou, China (Table 4).

**Table 2** eHealth Literacy for 117 Cancer Patients

| Item | Score | Dimension | Score |
|---|---|---|---|
| Q1: I know how to find helpful health resources on the Internet | 2.97±1.23 | Application | 14.86±5.25 |
| Q2: I know how to use the Internet to answer my health questions | 2.97±1.24 | | |
| Q3: I know what health resources are available on the Internet | 2.78±1.21 | | |
| Q4: I know where to find helpful health resources on the Internet | 2.63±1.19 | | |
| Q5: I know how to use the health information I find on the Internet to help me | 2.64±1.24 | | |
| Q6: I have the skills I need to evaluate the health resources I find on the Internet | 2.42±1.20 | Judgement | 5.20±2.31 |
| Q7: I can tell high quality from low quality health resources on the Internet | 2.41±1.20 | | |
| Q8: I feel confident in using information from the Internet to make health decisions | 2.50±1.20 | Decision-making | 2.50±1.20 |
| **Mean score** | 2.66±1.23 | | |
| **Total** | | | 21.32±8.35 |

**Table 3** Comparison of eHealth Literacy with Different Characteristics of Patients

| Variables | Groups | The Average Total Score of eHealth | F/t | *P* |
|---|---|---|---|---|
| Gender | | | t=1.616 | 0.109 |
| | Male | 22.37±8.32 | | |
| | Female | 19.86±8.26 | | |
| Age group | | | F=4.036 | 0.020* |
| | ≤44 years old | 24.93±8.50 | | |
| | 45–59 years old | 20.93±7.79 | | |
| | ≥60 years old | 19.37±8.27 | | |
| Marriage Status | | | t=1.682 | 0.095 |
| | In Marriage | 20.94±8.32 | | |
| | Others | 25.78±7.86 | | |
| Education Background | | | F=8.570 | <0.001* |
| | Primary school and below | 15.71±7.78 | | |
| | Junior High School | 21.44±7.45 | | |
| | Senior High School | 21.24±7.80 | | |
| | College/Undergraduate or above | 27.00±7.68 | | |

(*Continued*)

**Table 3** (Continued).

| Variables | Groups | The Average Total Score of eHealth | F/t | P |
|---|---|---|---|---|
| Personal monthly income | | | F=4.104 | 0.008* |
| | ≤1000 RMB | 20.10±7.99 | | |
| | 1001–3000 RMB | 17.92±7.05 | | |
| | 3001–5000 RMB | 23.78±7.48 | | |
| | >5000 RMB | 24.85±9.20 | | |
| Household structure | | | F=0.464 | 0.708 |
| | Living alone | 24.00±6.96 | | |
| | Living with your spouse | 20.65±8.15 | | |
| | Living with 2 generations | 22.24±8.44 | | |
| | Living with grandchildren | 21.30±9.20 | | |
| Whether the family members have medical background | | | t=0.430 | 0.668 |
| | Yes | 21.90±9.23 | | |
| | No | 21.13±8.09 | | |
| Types of Cancer | | | F=0.193 | 0.941 |
| | Lung cancer | 22.28±6.63 | | |
| | Gastric cancer | 20.13±8.65 | | |
| | Colorectal cancer | 21.55±8.43 | | |
| | Breast cancer | 21.40±5.84 | | |
| | Others | 20.98±9.90 | | |
| Validation medical behavior | | | F=3.980 | 0.021* |
| | Never | 19.11±8.72 | | |
| | Occasionally | 23.45±7.67 | | |
| | Frequently | 22.80±6.93 | | |
| Frequency of searching health information | | | F=18.081 | <0.001* |
| | Never | 14.00±7.048 | | |
| | Seldom | 19.78±7.81 | | |
| | Sometimes | 24.34±6.61 | | |
| | Frequently | 28.40±5.71 | | |

**Note**: *Indication of statistically significant independent variables.

**Table 4** Multiple Linear Regression of Factors Influencing eHealth Literacy of Patients

| Variables | Unstandardized Coefficients | | Standardized Coefficients | t | p |
|---|---|---|---|---|---|
| | β | SE | β | | |
| Constant term | 13.846 | 2.378 | – | 5.822 | <0.001* |
| Age group | | | | | |
| ≤44 years old | | | | | |
| 45–59 years old | −1.613 | 1.861 | −0.094 | −0.867 | 0.388 |
| ≥60 years old | −1.96 | 1.689 | −0.115 | −1.160 | 0.249 |
| Validation medical behavior | | | | | |
| Never | | | | | |
| Occasionally | −0.777 | 2.465 | −0.026 | −0.315 | 0.753 |
| Frequently | 1.068 | 1.407 | 0.064 | 0.759 | 0.449 |

(*Continued*)

**Table 4** (Continued).

| Variables | Unstandardized Coefficients | | Standardized Coefficients | t | *p* |
|---|---|---|---|---|---|
| | β | SE | β | | |
| Frequency of searching health information | | | | | |
| Never | | | | | |
| Seldom | 12.406 | 2.321 | 0.499 | 5.345 | <0.001* |
| Sometimes | 8.021 | 1.84 | 0.467 | 4.360 | <0.001* |
| Frequently | 5.212 | 1.829 | 0.279 | 2.851 | 0.005* |
| Personal monthly income | | | | | |
| ≤1000 RMB | | | | | |
| 1001–3000 RMB | 1.291 | 1.94 | 0.065 | 0.665 | 0.507 |
| 3001–5000 RMB | 0.944 | 1.97 | 0.041 | 0.479 | 0.633 |
| >5000 RMB | −3.124 | 1.769 | −0.152 | −1.766 | 0.080 |
| Education | | | | | |
| Primary school and below | | | | | |
| Junior High School | 5.43 | 2.604 | 0.26 | 2.086 | 0.039* |
| Senior High School | 2.443 | 2.173 | 0.12 | 1.124 | 0.263 |
| Undergraduate or above | 2.627 | 1.952 | 0.154 | 1.346 | 0.181 |

**Note**: *Indication of statistically significant independent variables.

# Discussion

## Principal Findings

The present study aimed to assess eHealth literacy among cancer patients and compare it with other populations. The results revealed that the average eHealth literacy score of cancer patients in this study (21.32±8.35) was lower than that of oncology patients studied by Lingling Zhang[20] and Dongqin Kang et al[21] whose average eHealth literacy scores were (23.24±3.92) and (24.21±9.07) respectively. Furthermore, the eHealth literacy of cancer patients was found to be poorer in comparison to the student population, as it scored lower than the average eHealth literacy score of high school students (28.58±7.00) studied by Guo Shuaijun et al[23] and the average eHealth literacy score of university students (30.40±6.01) studied by Li Shaojie et al.[15] Additionally, the mean score of (2.66±1.23) for each item of eHealth literacy among cancer patients in this study was lower than the findings of Hoogland et al[24] for older cancer patients (3.44±0.91), which suggests that the eHealth literacy of cancer patients in this study was at a lower level, consistent with large-scale studies on eHealth literacy of patients with other chronic diseases. In the context of the covid-19 epidemic, cancer patients' perceptions of eHealth literacy were even less confident. Furthermore, the mean scores for questions 6, 7 and 8 for cancer patients (2.42±1.20, 2.41±1.20 and 2.50±1.20) were lower than the mean scores for each item (2.66±0.23), indicating that patients' ability to evaluate eHealth information and make decisions was low. Although cancer patients demonstrated a more positive inclination towards seeking electronic information, they were found to have shortcomings in assessing the reliability of electronic information and applying electronic information resources to solve their problems. This finding is consistent with other Chinese studies[21,23] that have also reported these features. Previous studies have pointed out that patients' lack of confidence in electronic health information when making medical decisions is one of the reasons for their inability to evaluate the reliability of information.[25] The research also suggest that the heterogeneous cancer patients in this survey had a greater preference for symptom management, cancer knowledge queries and online doctor consultations.

The present study found that cancer patients have lower eHealth literacy compared to other populations, with an average eHealth literacy score of 21.32±8.35. This is consistent with previous studies, which have also found lower eHealth literacy among patients with chronic diseases. Furthermore, the results of linear regression analysis indicated that educational attainment is a significant predictor of eHealth literacy among cancer patients, particularly those with junior high school education. The study corresponded with the study of Milne et al[26] which has indicated that cancer patients high eHealth literacy correlated with the level of education received. This also aligns with previous research,[27,28] which has shown that

patients with lower levels of education have greater difficulties in comprehending and utilizing eHealth information. These findings suggest that targeted and personalized educational interventions are needed to improve eHealth literacy among cancer patients, particularly those with lower levels of education. This can be achieved through the development of online education platforms tailored to patients' different educational backgrounds. Additionally, healthcare providers should also prioritize providing clear and easily understandable information to these patients to help them make informed decisions about their health.

The frequency of utilizing the Internet to seek out health information significantly impacted cancer patients' eHealth literacy. Results from this study revealed that eHealth literacy scores of cancer patients were positively correlated with the frequency of using the Internet to search for health information, with patients who searched more frequently exhibiting higher eHealth literacy scores. Previous studies have also established a relationship between the frequency of using the Internet to seek out health information and eHealth literacy, as reported by Liu et al[17] and Melholt.[29] The more frequently a person searches for health information, the more confident they feel in doing so. One possible association may be found in self-efficacy.[30] The frequency of utilizing eHealth services also had a positive impact on cancer patients' ability to evaluate the credibility of health information.[31] To improve the eHealth literacy of cancer patients, authorities should work towards increasing the accessibility of eHealth resources, provide training on patients' online information-seeking skills, and encourage frequent search for eHealth information. In response to a greater need for information during the COVID-19 epidemic, cancer patients were more likely to follow recommendations and to search for online information more frequently. Additionally, research on the correlation between media health literacy and eHealth literacy is needed to gain a deeper understanding of the relationship between these two variables as studies have revealed a correlation between media-related variables and eHealth literacy.[21,32]

## Limitations

It is important to note that this study has some limitations. The sample size is relatively small and the survey period was short. Enlarging sample size and forming a study with multi-centre sample would be necessary for greater representativeness. Additionally, while the eHealth literacy scale used in this study is widely used in China and abroad and has relatively good reliability, some studies have suggested that there may be a discrepancy between individuals' perceived eHealth literacy and their actual ability to use cancer-related information online.[33–35] Furthermore, the advent of social media and the increased use of mobile web browsing has led to a shift in the context, since the eHEALS was first developed.[36] With the rise of the social media era (web2.0), eHEALS measures a relatively narrow scope of eHealth literacy.[37]

## Conclusion

In conclusion, the results of this study indicate that the overall eHealth literacy levels among the cancer patients surveyed were low, with a lack of judgment and decision-making skills. Further research is necessary to better understand the status and factors influencing eHealth literacy in cancer patients in order to implement appropriate educational measures and interventions while few studies have already conducted research on it.[38] It is essential for relevant authorities and platforms to regulate and ensure the quality of health information available on the internet, as there is currently a high volume of unreliable information. Medical professionals and experts should also take a proactive role in providing patients with accurate and authoritative eHealth information. Personalized and tailored electronic training and education can also be beneficial in enhancing eHealth literacy, with a particular focus on judgment and decision-making skills. Improving eHealth literacy can positively impact patient communication patterns, trust in the healthcare system, and shared decision-making in cancer care. This study also highlights the need for healthcare professionals to provide education and training on eHealth search skills during the active phase of a patient's disease and to provide accurate eHealth information resources tailored to the information needs of cancer patients throughout the course of their illness.

## Data Sharing Statement

In this study, raw data is unavailable due to privacy or ethical restrictions.

## Ethical Statement

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## Author Contributions

All authors have read and agreed to the published version of the manuscript. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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