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Perceived eHealth Literacy and Learning Experiences Among Japanese Undergraduate Nursing Students

A Cross-sectional Study

Junichi Tanaka, PhD, MPH, RN, Hiromi Kuroda, PhD, RN, Nana Igawa, RN, Takayoshi Sakurai, RN, Mayumi Ohnishi, PhD, MPH, RN

This study aimed to describe undergraduate nursing students' perceived eHealth literacy and learning experiences of eHealth literacy in Japan and to clarify the relationship between these factors. We conducted a self-administered online questionnaire survey using a convenience sample of 353 Japanese undergraduate nursing students selected from three universities. Participants completed the eHealth Literacy Scale and questionnaires on learning experiences of eHealth literacy and some demographic factors. Participants had moderate perceived eHealth (mean [SD], 24.52 [5.20]). More than half the participants responded that they had no learning experiences of health or science literacy. We observed a positive correlation between the total mean eHealth literacy and learning experiences scores. Undergraduate nursing students in Japan had slightly lower perceived eHealth literacy than nursing students in other countries, hospital nurses, and even patients. Of the 353 participants in this study, 69.4% did not know "where to find helpful health resources on the Internet," 80.2% of those lacked the skills "to evaluate health resources," and 68.9% could not "differentiate the quality of health resources on the Internet"; few of the participants perceived themselves as having any experience in learning the six domains of eHealth literacy. Very few reported learning about health (43.3%) and scientific (21.8%) literacy. The low perceived eHealth literacy among participants might reflect lack of knowledge and confidence in eHealth literacy as well as their own low level of health-promoting behaviors; this might influence the quality of health education of clients and their families. Nursing educators should address the lack of eHealth literacy among undergraduate nursing students.

KEY WORDS: eHealth literacy, Health information, Internet, Nursing education, Nursing students

A survey on communication usage trends conducted by the Ministry of Internal Affairs and Communications in 2016 showed that nearly 83.5% of the 40 297 sampled individuals in Japan use the Internet, more than 90% of whom were aged 13 to 59 years.[1] In other words, Internet use in Japan is widespread. The Internet has enabled the general population to have easy access to an enormous quantity of information in various fields. Health-related information is particularly sought after—surveys revealed that 72% of adult Internet users in the United States in 2013 and 71% of Internet users older than 15 years in Europe had at some point used the Internet to search for health-related information.[2,3] A similar proportion (approximately 70%) was found among Japanese adult Internet users.[4] The information sought often concerned specific diseases and health problems or was intended to inform decision-making on whether to see a physician and to prepare for and follow up on physicians' appointments.[2] Problematically, despite the widespread use of the Internet for health-related information, much of this information is unreliable or difficult to understand, particularly for individuals with low levels of health literacy.[5–7]

Norman and Skinner[8] introduced the concept of eHealth literacy, defining it as the ability to seek, find, understand, and appraise health information from electronic sources and apply such information to addressing or solving a health problem. On the other hand, based on the 1998 definition of the World Health Organization, health literacy represents the cognitive and social skills that determine individuals' motivation and ability to gain access to, understand, and use information in ways that promote and maintain good health.[9] Health literacy therefore concerns information sent from all types of sources such as television and magazines, whereas eHealth literacy refers only to information derived from the Internet. eHealth literacy contains six core domains: traditional, health, information, scientific, media, and computer literacy.[10] Traditional literacy relates to basic skills, such as reading, understanding written passages, and coherently speaking and writing in a

Author Affiliations: Nagasaki University Graduate School of Biomedical Sciences (Dr Tanaka and Dr Kuroda and Dr Ohnishi); and Nagasaki University Hospital (Ms Igawa); and Makita General Hospital (Mr Sakurai), Japan.

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Corresponding author: Junichi Tanaka, PhD, MPH, RN, Department of Clinical Nursing Sciences, Health Sciences, Nagasaki University Graduate School of Biomedical Sciences, 1-7-1 Sakamoto, Nagasaki 852-8520, Japan (jtanaka@nagasaki-u.ac.jp).

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given language.[11] According to the American Library Association, information literacy is defined as knowing "how knowledge is organized, how to find information, and how to use information in such a way that others can learn from them."[12] Scientific literacy is broadly conceived as an understanding of the nature, aims, methods, applications, limitations, and policies of creating knowledge in a systematic manner.[8] Media literacy refers to the ability to critically think about media content and "enables people to place information in a social and political context and to consider issues such as the market place, audience relations, and how media forms in themselves shape the message that gets conveyed."[8] Finally, computer literacy involves the ability to use computers to solve problems. According to Norman, "Computer literacy includes the ability to adapt new technologies and software and includes both absolute and relative access to eHealth resources."[8]

Because use of the Internet to seek out health-related information is increasing, it is increasingly important for nurses and nursing students to acquire and use eHealth literacy to educate clients and their families, who are users of such information. For the millennial generation of undergraduate students, the Internet is a preferred source of information.[13] However, the current level of perceived eHealth literacy among Japanese nursing students is unclear, making clarification necessary. It may also be necessary to clarify the perceptions of nurses and nursing students regarding the education they have received on eHealth literacy. Information literacy—one of the six core skills of eHealth literacy—has been incorporated as a learning objective in the "nursing education model core curriculum" announced by the Ministry of Education, Culture, Sports, Science and Technology in October 2017.[14] However, it can be inferred that not only nursing education but also "medical-health information" is not recognized as a part of the training content for medical and health professionals in Japan.

The purpose of this study was to describe undergraduate nursing students' perceptions of eHealth literacy and learning experiences of eHealth literacy in Japan. As a secondary purpose, we investigated the relationship between perceived eHealth literacy and perceived learning experiences among Japanese nursing students. To elucidate the current situation and these relationships, it is important to consider eHealth education for nursing students, who are expected to be nurses in the future.

METHODS

Design

A cross-sectional, descriptive design was used for this study.

Procedure

A convenience sample of nursing students was recruited from three universities located in Japan. The study participants were enrolled in a BSN program. Participants were informed about the nature of the study both orally and in writing from the researchers; subsequently, within a single week, participants accessed and completed self-administered online questionnaires (developed using SurveyMonkey; SurveyMonkey Inc, San Mateo, CA) through an embedded URL or QR code on the leaflet that we provided. We distributed the leaflets to 701 nursing students from September to October 2018. Returning completed online questionnaires was regarded as voluntary agreement to participate in the study.

Measurements

The questionnaires assessed demographic factors (eg, sex, academic level, type of admission), perceived eHealth literacy, and perceptions of learning experiences of eHealth literacy.

eHealth Literacy

The Japanese version of the eHealth Literacy Scale (J-eHEALS) was used to measure the perceived eHealth literacy among Japanese undergraduate nursing students.[4] The J-eHEALS contains eight items rated on a 5-point Likert scale (1, strongly disagree; 2, disagree; 3, unsure; 4, agree; 5, strongly agree). The total eHealth Literacy Scale (eHEALS) score, which ranged from 8 to 40 and reflected each participant's perceived eHealth literacy, was calculated by summing the item scores. The J-eHEALS was validated in a prior study by a confirmatory factor analysis (with fit indices as follows: goodness of fit index = 0.988, comparative fit index = 0.993, root mean square error of approximation = 0.056). It also demonstrated good internal consistency (Cronbach's α = .93) and test-retest reliability (r = 0.63, P < .01) in that study.[4] In this study, the Cronbach's α coefficient was .83. The original scale developed by Norman and Skinner[10] (eHEALS) also has been reported to have high reliability, with a Cronbach's α of .88.

Learning Experiences of eHealth Literacy

Participant perceptions of education toward eHealth literacy were measured by evaluating whether they had any prior experiences of learning in the six core domains of eHealth literacy (traditional, media, health, computer, scientific, and information literacy). Specifically, we asked the following questions: "Have you ever learned traditional literacy (ie, basic reading and numerical skills)?"; "Have you ever learned media literacy (ie, skills in evaluating retrieved information)?"; "Have you ever learned health literacy (ie, skills for evaluating health-related information)?"; "Have you ever learned computer literacy (ie, the ability to use computers or devices for Internet usage)?"; "Have you ever learned scientific literacy (ie, the skill to evaluate whether information has scientific backing)?"; and "Have you ever learned information literacy (ie, adequate information searching skill from various media)?"

Each item was answered using a binary scale (1, "yes"; 0, "no"). We calculated the learning experiences score from the items, which ranged from 0 to 6.

Statistical Analysis

We exported the data from the collected questionnaires into Microsoft Excel (Microsoft Office 2016; Microsoft Corporation, Redmond, WA). The data were then analyzed using Stata MP (Version 15.1; Stata Corp, College Station, TX). Pearson's correlation coefficients, *t* tests, and one-way analyses of variance were conducted to analyze the quantitative variables. The relationships were explored in more detail using multiple comparisons with Bonferroni corrections. We treated the eHealth score as the dependent variable, while sex, academic level, type of admission, university, and learning experience score were treated as independent variables. All tests were two-tailed, and the significance level was set at 5%.

Ethical Considerations

This research was approved by the Ethics Committee of Nagasaki University Graduate School of Biomedical Sciences (August 10, 2018; permission number: 18071205).

RESULTS

Participants' Characteristics With eHealth Literacy and Learning Experiences

Of the 701 participants to whom we administered questionnaires, 360 (51.4%) completed the survey. We discarded seven questionnaires with missing data, leaving a total of 353 for the final analysis (effective response rate, 50.4%).

Participants' characteristics, and differences in eHEALS and learning experience scores according to these characteristics, are shown in Table 1. The mean (SD) eHEALS score was 24.52 (5.20), while the mean (SD) learning experiences score was 3.17 (1.83) out of 6. Fourth year students had a significantly higher mean eHEALS score than did students from the other years ($F_{3,349} = 6.41$, $P = .0003$). Multiple comparisons using the Bonferroni correction revealed that the mean (SD) eHEALS score of participants who were fourth-year students was significantly higher (26.19 [5.41]) than were those of students in the first (23.58 [5.03], $P = .005$), second (23.91 [4.65], $P = .007$), and third years (23.51 [5.13], $P = .003$). Participants' eHEALS score did not differ according to sex, type of admission, or university.

As for learning experiences, participants who were fourth-year students had a higher mean score ($F_{3,349} = 5.62$, $P = .0009$). Bonferroni-corrected multiple comparisons revealed that the mean (SD) learning experience score was significantly higher among participants who were fourth-year students (3.64 [1.87]) than among participants in the second (2.71 [1.82], $P = .001$) and third years (2.87 [1.74], $P = .003$).

Participants' Response to Specific Items on the eHealth Literacy Scale

Table 2 shows participant responses to the individual eHEALS items. The items assessing skills to find helpful health resources, evaluate health resources, and differentiate high- and low-quality health resources had comparatively low mean scores when compared to the other eHEALS items.

Responses to Specific Items on the Scale of Learning Experiences Regarding eHealth Literacy

Table 3 shows the proportions of participants with learning experience for each domain of eHealth literacy, as well as how eHEALS scores differ according to their learning experiences. Remarkably, more than half of the participants had no experience with education in health or science literacy. Conversely, more than half of the participants had experience in acquiring traditional, media, computer, and information literacy. We observed significant differences in eHEALS scores according to whether participants had learning experience in traditional literacy ($t_{351} = -3.02$, $P = .003$), media literacy ($t_{351} = -8.06$, $P < .001$), health literacy ($t_{351} = -6.40$, $P < .001$), computer literacy ($t_{351} = -5.52$, $P < .001$), science literacy ($t_{351} = -4.41$, $P < .001$), and information literacy ($t_{351} = -5.74$, $P < .001$). We observed a positive correlation between mean eHEALS score and the total learning experiences score ($r = 0.44$, $P < .001$).

DISCUSSION

Participants had a mean perceived eHealth literacy score of 24.52 (on the eHEALS). This score was slightly lower than those found in two prior studies.[15,16] Tubaishat and Habiballah[15] reported that the self-perceived eHealth literacy of undergraduate nursing students from two universities in Jordan using the same measure (ie, the eHEALS) was 28.96 (or mean [SD], 3.62 [0.58], in the original study, which we converted to a comparable value). Korean undergraduate nursing students had a similarly high score (mean [SD], 27.06 [4.2]).[16] The mean score in our study was more similar to that of a study (also using the eHEALS) of military hospital patients in Iran (mean [SD], 25.35 [8.26]),[17] but lower than that of another study conducted in South Korea among hospital nurses (mean [SD], 28.21 [3.95]).[18] Of the single Japanese study on eHealth literacy, which targeted Japanese adults aged 20 to 59 years, the mean (SD) eHEALS score was 23.5 (6.5) and thus lower than in our study.[19] Taken together, the perceived eHealth literacy of Japanese undergraduate nursing students from three universities was lower compared to nursing students in other countries, hospital nurses, and even patients. The low perceived eHealth literacy among Japanese undergraduate nursing students might reflect lack of knowledge and confidence in eHealth literacy. A systematic curriculum is necessary to improve their perceived eHealth

Table 1. eHEALS and Learning Experience Scores According to Participants' Characteristics (N = 353)

Variables	*n*	%	eHEALS Score		*P*	Learning Experience Score		*P*
			Mean	SD		Mean	SD	
Sex								
Female	336	87.5	24.45	5.20		3.16	1.86	
Male	17	12.5	26.00	4.12	.231[a]	3.47	1.46	.495[a]
Year								
First	69	19.6	23.58	5.03		3.32	1.71	
Second	95	26.9	23.91	4.65		2.71	1.82	
Third	71	20.1	23.51	5.13		2.87	1.74	
Fourth	118	33.4	26.19	5.41	< .001[b]	3.64	1.87	< .001[b]
Type of admission								
Regular program	348	98.6	24.50	5.15		3.17	1.84	
RN to BSN	5	1.4	26.40	8.76	< .417[a]	3.60	1.67	< .601[a]
University								
A	74	21.0	24.36	5.51		2.74	1.89	
B	82	23.2	25.18	5.22		3.38	1.92	
C	197	55.8	24.31	5.08	< .424[b]	3.24	1.77	< .067[b]
All participants	353	100.0	24.52	5.20		3.17	1.83	

[a] *t* Test.
[b] Analysis of variance.

literacy, as they will use that knowledge and confidence in eHealth literacy for future client education.

Nakayama et al[20] conducted a survey comparing "health literacy"—not "eHealth literacy"—between Japan and Europe by using the European Health Literacy Survey Questionnaire[21] and its Japanese version (ie, measures of self-perceived health literacy). They found that the rate of difficulties in accessing, understanding, appraising, and applying information in tasks related to decision-making in healthcare, disease prevention, and health promotion in Japan was generally higher than that in eight European countries (Austria, Bulgaria, Germany, Greece, Ireland, the Netherlands, Poland, and Spain), and the mean (SD) general health literacy score was 33.8 (8.0) across these European countries and 25.3 (8.2) in Japan.[21] When the same instrument was administered to individuals from six different Asian countries,[22] the highest and lowest mean (SD) perceived health literacy scores were 34.4 (6.6) in Taiwan and 29.6 (9.1) in Vietnam, respectively; however,

Table 2. Participant Responses on the eHEALS (N = 353)

eHEALS Items	n (%)					
	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree	Mean (SD)
Knows what health resources are available on the Internet	15 (4.3)	93 (26.4)	87 (24.7)	148 (41.9)	10 (2.8)	3.13 (0.97)
Knows where to find helpful health resources on the Internet	22 (6.2)	125 (35.4)	98 (27.8)	103 (29.2)	5 (1.4)	2.84 (0.96)
Knows how to find helpful health resources on the Internet	12 (3.4)	95 (26.9)	84 (23.8)	153 (43.3)	9 (2.6)	3.15 (0.96)
Knows how to use the health information found on the Internet	9 (2.6)	70 (19.8)	80 (22.7)	174 (22.7)	20 (5.7)	3.36 (0.95)
Knows how to use the Internet to answer questions about health	6 (1.7)	66 (18.7)	95 (26.9)	174 (49.3)	12 (3.4)	3.34 (0.88)
Has the skills to evaluate health resources found on the Internet	33 (9.4)	133 (37.7)	117 (33.1)	63 (17.9)	7 (1.9)	2.65 (0.94)
Can tell high-quality health resources from low-quality health resources on the Internet	29 (8.2)	104 (29.5)	110 (31.2)	97 (27.5)	13 (3.7)	2.89 (1.02)
Feels confident in using information from the Internet to make health decisions	8 (2.3)	83 (23.5)	116 (32.9)	134 (38.0)	12 (3.4)	3.16 (0.90)

Table 3. eHealth Literacy Scores According to Learning Experiences (N = 353)

Variables	*n*	%	eHEALS Score		*P*
			Mean	*SD*	
Traditional literacy					
Yes	251	71.1	25.05	5.26	
No	102	28.9	23.23	4.80	.003[a]
Media literacy					
Yes	211	59.8	26.20	4.67	
No	142	40.2	22.02	4.95	< .001[a]
Health literacy					
Yes	153	43.3	26.44	5.03	
No	200	56.6	23.06	4.85	< .001[a]
Computer literacy					
Yes	212	60.6	25.72	5.10	
No	141	39.9	22.72	4.83	< .001[a]
Scientific literacy					
Yes	77	21.8	26.77	4.89	
No	276	78.2	23.89	5.12	< .001[a]
Information literacy					
Yes	216	61.2	25.74	4.75	
No	137	38.8	22.61	5.33	< .001[a]

[a] *t* Test.

both these were higher than the mean health literacy score in Japan. According to Nakayama et al,[20] a possible reason for the lower health literacy in Japan is that there are no reliable, easily understandable, neutral, and comprehensive Websites comparable to MedlinePlus (US National Library of Medicine) in Japan, causing Japanese people to use unreliable Web sites when searching the Internet for information about their symptoms or diseases. Furthermore, it is difficult for the general public to find and read Japanese research papers because there is no online database enabling free access to Japanese medical literature. Another reason is that modesty is a traditional characteristic of Japanese behavior. In a paper discussing cultural differences in responses to Likert scales for the 13-item Sense of Coherence scale, where participants were given a choice of four, five, or seven response options, Japanese people selected the midpoint of the scale more frequently than did Americans.[23] Thus, Japanese undergraduate nursing students might have selected lower answers on the eHEALS for a similar reason.

Participants who were fourth-year students had significantly higher total mean eHealth literacy scores than participants from any other year of study. A similar trend was found in previous studies.[15,16] Because research activities are conducted up to the fourth year, more seasoned students tend to have some experience in conducting systematic literature searches and reviews and creating research protocols and are in the process of writing their graduation thesis. As a result, fourth-year students might have had more opportunity (ie, more literacy) to search for health-related information systematically and to evaluate the quality and completeness of that information. Naturally, this would have resulted in higher eHEALS scores.

Many of the participants in this study did not know "where to find helpful health resources on the Internet." This suggests that Japanese academic societies should focus on creating a database similar to MedlinePlus that contains trustworthy health-related information. Moreover, we need to conduct further research to measure eHealth literacy among nursing faculty. Participants in this study also lacked the skill "to evaluate health resources" and "could not differentiate the quality of health resources." This lack of evaluation skills is consistent with the findings of previous studies in South Korea[16] and suggests that nursing educators should learn to recognize students who lack these skills. The low eHealth literacy might also reflect their own low level of health-promoting behaviors.[18]

As for participant perceptions of the learning experiences of eHealth literacy, we found that relatively few had any learning experiences of the six core domains of eHealth literacy, with especially few having experienced education in health literacy and scientific literacy. This finding may indicate that participants were simply not familiar with the definitions of each domain, even though we provided simple definitions of each. Alternatively, it might indicate that the Japanese nursing education system does not systematically provide students with adequate knowledge of eHealth literacy. We also observed a positive correlation between the overall mean eHealth literacy score and the learning experiences score, suggesting that learning experiences of the six domains of eHealth literacy can increase perceived eHealth literacy among undergraduate nursing students in Japan. Nursing educators should endeavor to recognize the lack of the six core domains of eHealth literacy among undergraduate nursing students and improve eHealth literacy education to ensure that the skills in these domains are acquired.

Limitations

All our data reflect participants' perceived eHealth literacy and learning experiences; thus, they might not reflect participants' actual eHealth literacy and learning experiences. This is the main limitation of our study; there is no further discussion in this article on their actual knowledge and learning experiences. Questionnaire surveys make it relatively possible to assess knowledge on memory levels of eHealth literary, but there are limitations when it comes to people's ability to appraise whether they have the information they require and whether it is appropriate. In the future, it is necessary to conduct research using a more objective eHealth literacy scale and actual learning experiences. Another limitation is that we did not investigate

past learning environments, the amount and quality of education on eHealth literacy, or the frequency of using the Internet. Furthermore, the timing of lectures differed across the universities involved in this study, which might have affected our results.

CONCLUSIONS

The perceived eHealth literacy of undergraduate nursing students in Japan was slightly lower compared to that of nursing students in other countries, hospital nurses, and even patients. Nursing students in their fourth year had significantly higher eHealth literacy than did students in other years. Of the 353 total undergraduate nursing students in this study, 69.4% did not know "where to find helpful health resources on the internet," 80.2% lacked the skills "to evaluate the health resources," and 68.9% could not "differentiate the quality of health resources on the internet"; few of the nursing students perceived themselves to have any experiences in the learning of the six domains of eHealth literacy. Very few reported having experiences regarding learning about health literacy (43.3%) and scientific literacy (21.8%). Finally, we found that learning experiences of the six domains of eHealth literacy are associated with higher perceived eHealth literacy. Therefore, nursing educators should aim to address the apparent lack of eHealth literacy among undergraduate nursing students.

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