**Reliability and Feasibility of the eHEALS in Thai Patients with Rheumatic and Autoimmune Diseases**

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**Abstract**

**Introduction**: Using health information requires digital literacy skill, an individual's ability to search, evaluate, and communicate information on various digital platforms. The eHealth Literacy Scale (eHEALS) is an 8-item measure developed to evaluate individual’s perceived skills at using health information technology. This study aimed to assess the reliability and feasibility of the Thai version of eHEALS.

**Method**: In this cross-sectional study, Thai patients with rheumatic and autoimmune diseases aged ≥18 years who were followed in the outpatient rheumatology clinics of Siriraj Hospital during September 2021 to January 2022 responded to the Thai version of eHEALS by themselves..

**Results**: Of 140 participants, 82% were women with a mean age (SD) of 45.17 (12.7) years and a mean duration of education (SD) of 14.18 (3.57) years. The Thai eHEALS had a high internal consistence with Cronbach's alpha coefficient of 0.85, and good test-retest reliability with ICC (95% CI) of 0.74 (0.65-0.81). According to Bland-Altman plots, the mean difference mean score (SD) for both tests was 0.13 (3.15), where the agreement limits at 95% of the CI of the mean difference ranged between -6.039 and 6.289 (p < 0.0001), also strengthen its reliability. The median time to complete the questionnaire (min-max) was 1 (0.75-14) minutes. Eighty-nine (89%) completed the questionnaires without missing an item. The median unanswered questions (min-max) were 2 (1-3).

**Conclusion**: The Thai version of eHEALS was reliable and feasible to evaluate the comfort and skill of Thai patients in using information technology for health.

**Keywords**: eHEALS, reliability, feasibility, digital health literacy, rheumatic disease, autoimmune disease

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**Introduction**

Health literacy is the ability or skill to access and understand health information or knowledge, including being able to act when receiving information or knowledge correctly.1 Health literacy requires many skills, including access to information, knowledge, understanding, media literacy, communication, decision making and self-management.2 Lack of health literacy results in increased use of emergency medical services and higher hospitalization rates.3 Furthermore, people who lack health literacy tend to administer drugs inappropriately due to inability to understand the instructions on drug labels and medical advice. Lack of health literacy results in poor health of the population. chronic disease deteriorating quality of life loss of medical expenses and died prematurely Therefore, knowledge of health is very important. Because these cognitive skills shape the motivation and ability of people to access, understand and use information to promote and maintain their own health.2

In the digital age, the Internet has become an essential part of human daily life for use in searching for information, news, including health information. Electronic health literacy requires several skills1 comprising traditional literacy,2 health literacy,3 information literacy,4 scientific literacy,5 media literacy,6 and computer literacy.4 Most also use the Internet and social networks to search for health information.5 In this digital era, the assessment of electronic health information literacy should be part of patient care so that healthcare providers can provide care and advice to patients appropriately according to the ability of each patient, including being able to advise patients to develop their knowledge of electronic health information. Consequently, patients can apply these skills correctly and appropriately leading to favorable outcomes.

The Electronic Health Literacy Scale or eHEALS5 is one of the several tools that can be used to assess digital health information literacy.6 The eHEALS was developed in Canada by Norman and Skinner4 to assess skills in retrieving, evaluating, making decisions, and communicating health information on digital media platforms. eHEALS consists of eight questions and responses were optional on a Likert scale 1-5. Its validity and reliability were evaluated.4, 7 It has been translated into several languages in Asia and Europe1, 5, 8-10, including Thai by the Office of the Department of Health 4.0 Driving Project for People's Health Awareness, Department of Health, Ministry of Public Health *(Supplement 1)*.11 However, its psychometric properties have not been evaluated. The objective of this study was to assess the reliability and feasibility of the Thai version of eHEALS in Thai patients with rheumatic and autoimmune diseases.

**Methods**

This prospective cross-sectional study was conducted in Siriraj Hospital outpatient rheumatology clinics during September 2021 to January 2022. We included individuals with rheumatic and autoimmune diseases, who were 18 years or older, competent in Thai and experienced in using electronic information media to obtain health information. Individuals who had a history of dementia, psychosis, schizophrenia, as well as individuals who were clearly vision impaired, which may have prevented them from completing the questionnaire by themselves, were excluded. The letter fluency test was used as a screening tool for dementia.12 All participants provided their informed consent prior to enrollment. The study protocol was approved by the Scientific Ethics Committee of Siriraj Institutional Review Board (SIRB) (COA No. Si616/2021). This study was carried out following the ethical principles outlined in the Declaration of Helsinki (1964) and all its subsequent provisions, and it adhered to the principles outlined in the International Conference on Harmonization (ICH) Tripartite Guideline for Good Clinical Practice (January 1997). Demographic and baseline characteristics, including age, sex, marital status, education level, place of residence, occupation, income, comorbidities and underlying rheumatic or autoimmune disease, were collected. Their internet usage was explored as followed, frequency of usage, duration per time, search category, mode and platform of internet access, and type of health information search, including sign and symptom, diagnosis, treatment, etc. Furthermore, functional status and quality of life related to health were assessed using the Thai version of the version of the Health Assessment Questionnaire (HAQ)13 and the Thai version of EQ-5D-5L,14 respectively.

For the psychometric evaluation of the Thai version of eHEALS, all participants were asked to complete the questionnaires themselves. eHEALS contains the following questions:

Q1: I know how to find helpful health resources on the Internet.

Q2: I know how to use the Internet to answer my health questions.

Q3: I know what health resources are available on the Internet.

Q4: I know where to find helpful health resources on the Internet.

Q5: I know how to use the health information I find on the Internet to help me.

Q6: I have the skills I need to evaluate the health resources that I find on the Internet.

Q7: I can tell high quality from low quality health resources on the Internet.

Q8: I feel confident using information on the Internet to make health decisions.

Each item in eHEALS uses a 5-point Likert scale to answer each question with response options ranging from 'strongly agree' to 'strongly disagree' (1-strongly disagree, 5-strongly agree). The total score was 8-40 points, with a higher score indicating greater literacy.5 The time to complete the questionnaire and the number of unanswered questions were collected. The investigators then asked the participants to answer the unanswered questions again to complete the questionnaires. For test-retest reliability, all participants were asked to complete Thai eHEALS again by themselves in the next two weeks and returned to the investigators by mail.

**Statistical analysis**

SPSS version 18.0 (SPSS Inc., Chicago, Illinois, USA) was used for data analysis. Qualitative variables, such as gender, the number of people who did not complete the questionnaire, and the number of unanswered questions were presented as frequency and percentage. Quantitative variables, such as age, time to complete the questionnaire, were presented with mean with standard deviation (SD) for normally distributed and median with minimum-maximum (min-max) for nonnormally distributed data. For reliability assessment, the internal consistency of eHEALS was evaluated using Cronbach’s alpha coefficients for the overall scale as well as for each element. An alpha of 0.7 or more was considered to be evidence of reliability.15 Stability of the measure was tested using a paired t-test analysis with eHEALS scores of the control group measured at baseline and 2 weeks. While the test-retest reliability was expressed as an intraclass correlation coefficient (ICC) with values less than 0.5, between 0.5 and 0.75, between 0.75 and 0.9, and greater than 0.90, indicating poor, moderate, good, and excellent reliability, respectively.16 Additionally, agreement between the two timepoint tests was evaluated using the Bland-Altman plot17, where the Y axis referred to the difference of the mean eHEALS score between the two timepoints and the X axis referred to the mean eHEALS of the two time points of each participant. For feasibility, the time to complete the questionnaire and the number of unanswered questions indicated its feasibility. A p-value of less than 0.05 was considered statistically significant. All reported p-values are two-sided.

**Sample size calculation**

The sample size was calculated based on the Cronbach alpha of the previous study on reliability by Dutch eHEALS in Norwegian rheumatic diseases, of 0.9318 by applying 20% precision and 20% dropout rate and the intraclass correlation coefficients reported in previous studies at 0.4-0.684, 18 with the width of the estimation interval (upper–lower) at 0.2, the standard value according to the Z table of 1.96, when the confidence level was established at 95%. Therefore, a total of 140 participants were required.

**Results**

**Baseline characteristics**

Of the 140 participants *(Table 1)*, 82.1 % (N = 115) were women with a mean age (SD) of 45.17 (12.69) years. Half of them were originally from Bangkok, followed by central regions of the country (38.6%). With regard to occupation, the government officer was the largest group, accounting for 28.6%, followed by private company employees (24.3%), unemployed respondents (14.3%), freelancers (10.7%), housewives (9.3%), students (7.9%), and farmers (1.4%). The mean level of education of the participants (SD) was 14.18 (3.57) years.

Regarding rheumatic diseases, autoimmune diseases, or vasculitis, the median duration of the disease (min-max) was 7.5 (0.5-35) years. The most common disease was rheumatoid arthritis (52.1%), followed by systemic lupus erythematosus (21.4%), ankylosing spondylosis (8.6%), psoriatic arthritis (7.1%), gouty arthritis (5%). spondylosis (1.4%), systemic sclerosis (1.4%), and undifferentiated arthritis (1.4%), while Sjögren’s syndrome, Still’s disease, osteoarthritis, fibromyalgia, Bechet’s disease, mixed connective tissue disease, juvenile rheumatoid arthritis, granulomatosis with polyangiitis and arteritis related to enthesitis were presented in 0.7%. Study participants exhibited mild functional impairment, as indicated by a median Thai Health Assessment Questionnaire (Thai-HAQ) score (min-max) of 0.13 (0-3). The quality of life related to health of the participants was high, with a median total score (min-max) of 0.96 (0.6-1) in EQ5D5L, and the perception of the participants was found to be excellent, with a median global health score (min-max) of 90 (35-100).

The majority of comorbidities identified among the study population consisted of hypertension (19.3%) and dyslipidemia (17.1%), followed by diabetes mellitus (7.9%), thyroid disease (3.6%), malignancy (3.6%), liver disease (2.9%), respiratory disease (2.9%), ischemic heart disease (2.1%), vitamin D deficiency (2.1%), renal disease (1.4%), allergic rhinitis (1.4%), deep vein thrombosis (1.4%), and valvular heart disease (1.4%). While other diseases account for 0.7% of underlying diseases, including panic disorder, atrial fibrillation, G6PD deficiency disease, anemia, and idiopathic thrombocytopenia *(Supplement 2)*.

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| Characteristics | N=140 |
| Age, year, mean (SD) | 45.17 (12.7) |
| Female, N (%) | 115 (82.1) |
| Married, N (%) | 76 (54.3) |
| Education, years, mean (SD) | 14.18 (3.57) |
| Disease duration, median (min-max) | 7.5 (0.5-35) |
| HAQ, median (min-max) | 0.13 (0-3) |
| EQ-5D-5L score, median (min-max) | 0.96 (0.6-1.0) |
| Mobility, median (min-max) | 1 (1-4) |
| Self-care, median (min-max) | 1 (1-3) |
| Daily activity, median (min-max) | 1 (1-4) |
| Pain/discomfort, median (min-max) | 2 (1-4) |
| Depression/anxiety, median (min-max) | 1 (1-4) |
| Global health, median (min-max) | 90 (35-100) |

**Table 1** Demographic andbaseline characteristics

HAQ, Health Assessment Questionnaire; Max, maximum; Min, minimum; N, number; SD, standard deviation

**Internet usage**

The mean frequency of Internet usage (SD) was 6.78 days (0.89), with a median session duration (min-max) of one hour (0.08-30). Almost all participants (99%) indicated that they mainly used the Internet to search for general information, followed by using the Internet for communication (87.9%), entertainment (77.7%), online shopping (45%), email (33.6%), work (11.4%), and other purposes (2.1%). Among the Internet platforms, the most frequently used were Line® (93.6%), Facebook® (84.3%), and Google® (77.9%). One-third of the respondents used YouTube® (35%), while Instagram® (31.4%) were other popular options. Additionally, participants reported using various social media platforms, including TikTok® (24.3%), Pantip®, a popular Thai language website and discussion forum (19.3%), Mhorprom®, an application launched by the Ministry of Public Health of Thailand to allow residents to access vaccination services (15%), Twitter®(15%), Siriraj connect®, an application developed by the Siriraj hospital to provide various health services (11.4%), Thai newspaper websites (2.9%), WeChat®(1.4%), Clubhouse®(1.4%) and others (6.4%).

**Internet usage for health**

The median frequency of electronic health (eHealth) communication among participants (min-max) was three days (1-7). More than half of them received eHealth communication through Internet platforms such as Line® (57.1%), Facebook® (53.6%) and Google® (50%). Additional platforms included YouTube®, Mhorprom®, Siriraj connect®, Pantip®, TikTok®, Instagram®, Email, Twitter®, Thai newspaper website (0.7%), and others (4.9%). Most of the eHealth information obtained by the participants was related to clinical updates and disease progression (85%), therapy (82.1%), as well as prevention and health promotion (82.1%).

**Reliability and agreement**

The mean eHEALS score (SD) was 32.47 (4.32). For reliability, Cronbach’s alpha showed good internal consistency with alpha of 0.85, while ICC (95%CI) showed good test-retest reliability of the total score and each item *(Table 2).* Furthermore, theBland-Altman graph showed high agreement of total mean scores *(Figure 1)* with the mean difference (95%CI) of 0.13 (-6.04 to 6.29), *p value* < 0.0001*)* and each element (*Table 3)* between 2 timepoint tests.

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| --- | --- | --- | --- | --- | --- |
| Question | Mean score | SD | Cronbach’s alpha | Cronbach’s alpha  if Item deleted | ICC [95% CI] |
| Q1 | 4.15 | 0.64 | 0.73 | 0.89 | 0.59 [0.46-0.69] |
| Q2 | 4.19 | 0.69 | 0.74 | 0.87 | 0.58 [0.45-0.69] |
| Q3 | 4.23 | 0.63 | 0.77 | 0.87 | 0.63 [0.51-0.73] |
| Q4 | 4.32 | 0.62 | 0.77 | 0.88 | 0.62 [0.50-0.72] |
| Q5 | 4.21 | 0.68 | 0.74 | 0.87 | 0.59 [0.45-0.69] |
| Q6 | 3.91 | 0.81 | 0.69 | 0.88 | 0.52 [0.38-0.64] |
| Q7 | 3.73 | 0.79 | 0.68 | 0.87 | 0.52 [0.37-0.63] |
| Q8 | 3.62 | 0.81 | 0.73 | 0.89 | 0.58 [0.45-0.69] |
| Total | 32.47 | 4.32 | 0.85 |  | 0.74 [0.64-0.81] |

**Table 2** Mean scores and reliability of eHEALS (N= 140)

CI, confidence interval; ICC, intraclass correlation; Q, question number; SD, standard deviation

**Table 3** Agreement between 2 timepoint tests for each eHEALS question of eHEALS (N= 140)

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| --- | --- | --- | --- | --- |
| Question | Difference score between 2 tests | SD | 95% CI | P Value |
| Q1 | -0.11 | 0.57 | -1.241.022 | < 0.0001 |
| Q2 | -0.07 | 0.63 | -1.305,1.171 | < 0.0001 |
| Q3 | 0.05 | 0.56 | -1.053,1.153 | < 0.0001 |
| Q4 | 0.12 | 0.55 | -0.967,1.200 | < 0.0001 |
| Q5 | 0.06 | 0.63 | -1.168,1.285 | < 0.0001 |
| Q6 | 0.03 | 0.76 | -1.447,1.513 | < 0.0001 |
| Q7 | -0.06 | 0.77 | -1.568,1.451 | < 0.0001 |
| Q8 | -0.01 | 0.70 | -1.388,1.372 | < 0.0001 |
| Total | 0.13 | 3.15 | -6.039, 6.289 | < 0.0001 |

CI, confidence interval; ICC, intraclass correlation; Q, question number; SD, standard deviation

Chart

Description automatically generated

**Figure 1** Bland-Altman plot of the agreement test-retest of eHEALS (N= 140)

**Feasibility**

A total of 125 (89.2%) participants completed the 1st eHEALS by themselves without an unanswered question. They took a short time to answer the questions with a median time to complete the questionnaire (min-max) of 1 (0.75-14) minutes. The median number of unanswered questions (min-max) was 2 items (1-3). Question 1 was the most unanswered question (7.1%), followed by question 2 (5%), question 6 (2.9%), question 7 (2.9%), while question 8 (2.1%) and 5 (0.7%) were the least unanswered question. The reasons for not answering these questions include "I do not understand the question" and "The choice for response was ambiguous."

For the second eHEALS, 120 participants (85.7%) returned the questionnaires. Of these, 118 (84.2%) participants completed the second eHEALS without an unanswered question. Only Question 2 was left unanswered by 2 participants (1.7%). They stated that 'I don't understand the question' and 'The questionnaire is not clear' as the reason for their reluctance to respond.

**Discussion**

This is the first study to evaluate the reliability and feasibility of the Thai version of eHEALS in patients with rheumatic and autoimmune diseases. The frequency and duration of daily Internet usage was similar to previous studies in Asia19, Africa, and Europe20, 21. Similarly to previous studies in a developed Asian nation5, more than half of participants (54.6%) used the Internet to find information, followed by social media services (34.2%) and games (6%); however, in a low-income country22, social media browsing was the most widely searched category on the Internet (81.2%). Line®, Facebook®, and Google® were the most widely used platforms that were different between countries due to their popularity and diversity.5 However, the frequency of the median electronic health information received was quite similar among studies (3 days per week). Depending on the status of rheumatic diseases, a common search for health information includes disease manifestation, treatment, and prevention. Compared to a study of African-Americans in North Florida, United States, who struggled with chronic diseases, these individuals usually search for health information regarding health and wellness (54%) and nutrition/diet (50%).23

For the total mean scores of these eHEALS, Thailand was also in the upper range compared to the study in the developing country24 and other research. The average scores were 23.4 in Japan19, 26.7 in a population in Switzerland25, 28.7, 29.2, and 30.5 among older people who were online in New Zealand, the United Kingdom, and the United States, respectively26, 29.5 and 30.3 among chronic patients in the United States27 and Australia28, respectively. Similar to other studies29, Question 8, "I feel confident in using information from the internet to make mental health decisions" obtained the lowest score. The mean score (SD) for this question was 3.34 (0.94), according to the difficult question by fit and outfit indices in a chronically ill Ethiopian adult of 20 years. Despite the fact that its highest education score was lower than that of another study24, in which more than half of the participants were physicians (56.28%) and fourth-year students (37.45%), which is at least fourteen years of highest education. Although research conducted on nonchronically ill Chinese adults30, most of whom were between the ages of 18 and 60, indicated that those with a higher socioeconomic position had a higher level of eHealth literacy and sought more web-based information for health. However, the score did not have a clear benchmark to measure its value because the health literacy tolls were an individual measurement.

Regarding reliability, the Thai version of eHEALS had good internal consistency and was comparable to other versions of eHEALS including Brazilian31 (Cronbach’s alpha = 0.76), Chinese9 (Cronbach’s alpha = 0.83), Ethiopian22 (Cronbach’s alpha = 0.94), Korean5 (r Cronbach alpha = 0.88), Indonesian32 (Cronbach’s alpha = 0.91), Italian25 (Cronbach’s alpha = 0.89), Iranian8 (Cronbach’s alpha = 0.88), Japanese19 (Cronbach’s alpha = 0.93), Polish20 (Cronbach’s alpha = 0.84), Serbian33 (Cronbach’s alpha = 0.85), Swedish34 (Cronbach’s alpha = 0.94), Turkish35 (Cronbach’s alpha = 0.78), Vietnamese24 (Cronbach’s alpha = 0.94) versions, while Norman and Skinner's first evaluation of eHEALS4 resulted in a Cronbach's alpha of 0.88, demonstrating equally outstanding reliability of the instrument. The test–retest reliability of eHEALS in this study was quite good (ICC = 0.74), which is in accordance with the ICC findings of earlier research in Japan (0.63)19.

For feasibility, the median time to complete eHEALS was similar to other studies36 ranging between 31 and 190.5 seconds and the response time did not influence the eHEALS scores. Almost all participants completed questionnaires themselves without missing an item. Question number 1 was the most unanswered on both the first and second test because they did not understand the question. However, the Cronbach alpha and the means score were not different from another question. It seems that the Thai translation may need to be adjusted to make more comprehensible.

Our population was patients with rheumatic and autoimmune diseases, which were noncommunicable diseases with long-term pain and disability37. The results of this study should be generalizable to other chronic noncommunicable diseases. Although the original version of eHEALS was studied in a young population with a mean age (SD) of 14.95 (1.24) years4, our study showed that eHEALS can be reliably used in a middle-aged to elderly population.

Some limitations should be considered in this study. Electronic health knowledge may be related to experience in Internet use, as shown in previous studies38, but these data were not available in this study. eHEALS assessed self-reported eHealth literacy, which was not the same as assessing an individual's eHealth knowledge. Self-reported eHealth literacy may be exaggerated or underestimated, depending on several factors, including self-perceived health and attitudes. As a result, more research was needed to investigate the relationship between subjective and objective knowledge about eHealth. Additionally, participants in this study were predominately from Bangkok Metropolitan Region, where they had relatively higher education and socioeconomic status, as compared to other regions in Thailand. This may limit its generalizability to other population with limited internet access or lower educational levels.

**Conclusion**

The Thai version of eHEALS was reliable and feasible to evaluate the comfort and skill of Thai patients to use information technology for health.

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

**Statistical analysis** The statistics were checked prior to submission by an expert statistician, Khemajira Karaketklang, B.Sc. (Nursing), MPH, e-mail:- oy.kemajira@gmail.com

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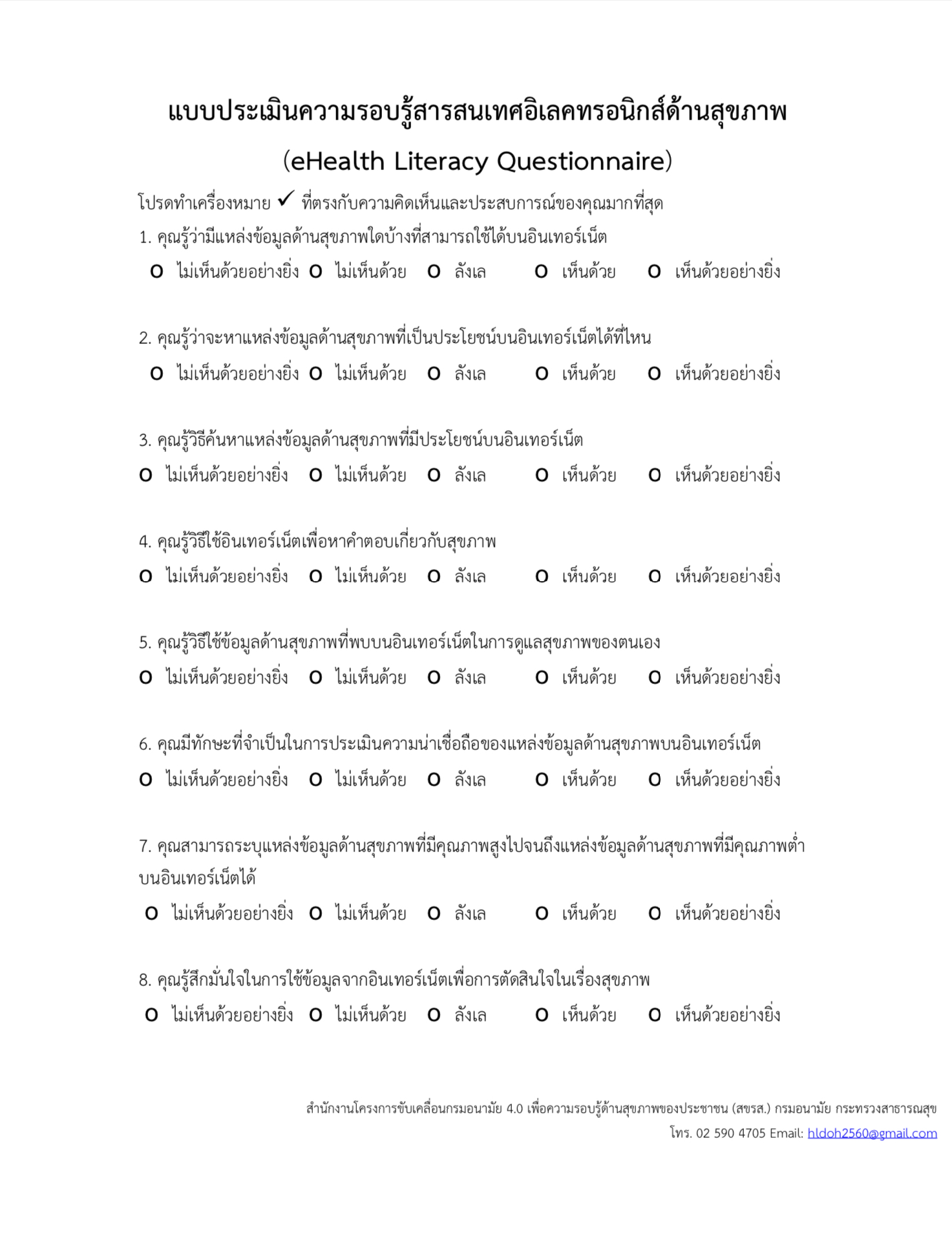
**References**

1. Neter E, & Brainin, E.Association Between Health Literacy, eHealth Literacy, and Health Outcomes Among Patients With Long-Term Conditions. European Psychologist. 2019;24(1):68-81.
2. Nutbeam D**.** Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. Health Promot Int. 2000;15(3):259-67.
3. Berkman ND, Sheridan, S. L., Donahue, K. E., Halpern, D. J., & Crotty, K.Low Health Literacy and Health Outcomes: An Updated Systematic Review. Ann Intern Med. 2011;155(2):97-107.
4. Norman CD, & Skinner, H. A.eHEALS: The eHealth Literacy Scale. J Med Internet Res. 2006;8(4):e27.
5. Chung S, Park, B. K., & Nahm, E. S.The Korean eHealth Literacy Scale (K-eHEALS): Reliability and Validity Testing in Younger Adults Recruited Online. J Med Internet Res. 2018;20(4):e138.
6. Liu H, Zeng, H., Shen, Y., Zhang, F., Sharma, M., Lai, W., Zhao, Y., Tao, G., Yuan, J., & Zhao, Y.Assessment Tools for Health Literacy among the General Population: A Systematic Review. Int J Environ Res Public Health. 2018;15(8):1711.
7. Norman CD**.** Social media and health promotion. Glob Health Promot. 2012;19(4):3-6.
8. Bazm S MM, Fallahzadeh H, Bazm R. **.** Validity and Reliability of the Iranian Version of eHealth Literacy Scale. J Commun Health Res. 2016;5(2):121-30.
9. Ma Z, & Wu, M.The Psychometric Properties of the Chinese eHealth Literacy Scale (C-eHEALS) in a Chinese Rural Population: Cross-Sectional Validation Study. J Med Internet Res. 2019;21(10):e15720.
10. Rajah R, Hassali, M. A. A., & Murugiah, M. K. **.** A systematic review of the prevalence of limited health literacy in Southeast Asian countries. Public Health. 2019;167:8-15.
11. Ministry of Public Health**.** Thai version of eHealth Literacy Questionnaire). 2021.
12. Lezak MD, Howieson DB, Loring DW, Fischer JS**.** Neuropsychological assessment: Oxford University Press, USA; 2004.
13. Osiri M, Wongchinsri J, Ukritchon S, Hanvivadhanakul P, Kasitanon N, Siripaitoon B**.** Comprehensibility, reliability, validity, and responsiveness of the Thai version of the Health Assessment Questionnaire in Thai patients with rheumatoid arthritis. Arthritis Res Ther. 2009;11(4):R129.
14. Tongsiri S**.** The Thai population-based preference scores for EQ-5D health states (Doctoral dissertation). London: London School of Hygiene and Tropical Medicine, University of London; 2009.
15. Nunnally JC**.** Psychometric theory. New York: McGraw-Hill; 1967.
16. Koo TK, Li MY**.** A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiropr Med. 2016;15(2):155-63.
17. Giavarina D**.** Understanding Bland Altman analysis. Biochemia Medica. 2015;25(2):141-51.
18. Brørs G, Wentzel-Larsen, T., Dalen, H., Hansen, T. B., Norman, C. D., Wahl, A., Norekvål, T. M., & CONCARD Investigators Psychometric Properties of the Norwegian Version of the Electronic Health Literacy Scale (eHEALS) Among Patients After Percutaneous Coronary Intervention: Cross-Sectional Validation Study. J Med Internet Res. 2020;22(7):e17312.
19. Mitsutake S, Shibata, A., Ishii, K., Okazaki, K., & Oka, K.[Developing Japanese version of the eHealth Literacy Scale (eHEALS)]. Nihon Koshu Eisei Zasshi. 2011;58(5):361-71.
20. Burzynska J, Rekas M, Januszewicz P**.** Evaluating the Psychometric Properties of the eHealth Literacy Scale (eHEALS) among Polish Social Media Users. Int J Environ Res Public Health. 2022;19(7).
21. van der Vaart R, van Deursen AJ, Drossaert CH, Taal E, van Dijk JA, van de Laar MA**.** Does the eHealth Literacy Scale (eHEALS) measure what it intends to measure? Validation of a Dutch version of the eHEALS in two adult populations. J Med Internet Res. 2011;13(4):e86.
22. Shiferaw KB, Tilahun, B. C., Endehabtu, B. F., Gullslett, M. K., & Mengiste, S. A.E-health literacy and associated factors among chronic patients in a low-income country: a cross-sectional survey. BMC Med Inform Decis Mak. 2020;20(1):181.
23. James DC, & Harville, C., 2nd**.** eHealth Literacy, Online Help-Seeking Behavior, and Willingness to Participate in mHealth Chronic Disease Research Among African Americans, Florida, 2014-2015. Prev Chronic Dis. 2016;13:E156.
24. Le LTT, Tran LT, Dang CS, Nguyen PD, Tran NA, Pham TH, et al.Testing reliability and validity of the Vietnamese version of the eHealth literacy scale (eHEALS) among medical students in Vietnam. Int J Med Inform. 2023;170:104962.
25. Diviani N, Dima AL, Schulz PJ**.** A Psychometric Analysis of the Italian Version of the eHealth Literacy Scale Using Item Response and Classical Test Theory Methods. J Med Internet Res. 2017;19(4):e114.
26. Sudbury-Riley L, FitzPatrick, M., & Schulz, P. J.Exploring the Measurement Properties of the eHealth Literacy Scale (eHEALS) Among Baby Boomers: A Multinational Test of Measurement Invariance. J Med Internet Res. 2017;19(2):e53.
27. Paige SR, Krieger, J. L., Stellefson, M., & Alber, J. M.eHealth literacy in chronic disease patients: An item response theory analysis of the eHealth literacy scale (eHEALS). Patient Educ Couns. 2017;100(2):320-6.
28. Lee K, Hoti K, Hughes JD, Emmerton LM**.** Consumer Use of "Dr Google": A Survey on Health Information-Seeking Behaviors and Navigational Needs. J Med Internet Res. 2015;17(12):e288.
29. Xu RH, Bao XL, Shi LS, Wang D**.** Associations between eHealth literacy, mental health-seeking attitude, and mental wellbeing among young electronic media users in China during the COVID-19 pandemic. Front Public Health. 2023;11:1139786.
30. Guo Z, Zhao SZ, Guo N, Wu Y, Weng X, Wong JY, et al.Socioeconomic Disparities in eHealth Literacy and Preventive Behaviors During the COVID-19 Pandemic in Hong Kong: Cross-sectional Study. J Med Internet Res. 2021;23(4):e24577.
31. Oliveira LPd, Souza, R. C. B., Barros, J. K. de ., Moura, G. M. de ., & Yamaguchi, M. U.Validity of the evidence of the Health Literacy Scale and eHEALS for older people. SciELO journals. 2022;46(spe6):135-47.
32. Wijaya MC, & Kloping, Y. P.Validity and reliability testing of the Indonesian version of the eHealth Literacy Scale during the COVID-19 pandemic. Health Informatics J. 2021;27(1):1460458220975466.
33. Gazibara T, Cakic J, Cakic M, Pekmezovic T, Grgurevic A**.** eHealth and adolescents in Serbia: psychometric properties of eHeals questionnaire and contributing factors to better online health literacy. Health Promot Int. 2019;34(4):770-8.
34. Wangdahl J, Jaensson M, Dahlberg K, Nilsson U**.** The Swedish Version of the Electronic Health Literacy Scale: Prospective Psychometric Evaluation Study Including Thresholds Levels. JMIR Mhealth Uhealth. 2020;8(2):e16316.
35. Coşkun S BH**.** Psychometric evaluation of a Turkish version of the e-health literacy scale (e-heals) in adolescent. Gulhane Med J. 2015;57(4).
36. Zrubka Z, Hajdu O, Rencz F, Baji P, Gulacsi L, Pentek M**.** Psychometric properties of the Hungarian version of the eHealth Literacy Scale. Eur J Health Econ. 2019;20(Suppl 1):57-69.
37. Ziade N, El Khoury, B., Zoghbi, M., Merheb, G., Abi Karam, G., Mroue', K., & Messaykeh, J. **.** Prevalence and pattern of comorbidities in chronic rheumatic and musculoskeletal diseases: the COMORD study. Sci Rep. 2020;10(1):7683.
38. Xie L, Mo PKH**.** Comparison of eHealth Literacy Scale (eHEALS) and Digital Health Literacy Instrument (DHLI) in Assessing Electronic Health Literacy in Chinese Older Adults: A Mixed-Methods Approach. Int J Environ Res Public Health. 2023;20(4).

**Supplementary appendix**

**Supplement 1** Certificate of approval**Graphical user interface, text, application

Description automatically generated**

**Supplement 2** Thai eHEALS questionnaire 

**Supplement 3** Baseline characteristics

|  |  |
| --- | --- |
| **Characteristics** | **N = 140** |
| Age, year, mean (SD) | 45.17 (12.7) |
| Female, N (%) | 115 (82.1) |
| Marital status |  |
| Single, N (%) | 52 (37.1) |
| Married, N (%) | 76 (54.3) |
| Widow, N (%) | 7 (5) |
| Divorced/separated, N (%) | 5 (3.6) |
| Place of residence |  |
| Bangkok, N (%) | 70 (50) |
| Upcountry areas, N (%) | 70 (50) |
| Central, N (%) | 54 (38.6) |
| Northern, N (%) | 3 (2.1) |
| Northeastern, N (%) | 4 (2.9) |
| Southern, N (%) | 4 (2.9) |
| East, N (%) | 3 (2.1) |
| West, N (%) | 2 (1.4) |
| Occupation |  |
| Government officer, N (%) | 40 (28.6) |
| Business employee, N (%) | 20 (14.3) |
| Agriculture, N (%) | 2 (1.4) |
| Student, N (%) | 5 (3.6) |
| Unemployment, N (%) | 15 (10.7) |
| Company employee, N (%) | 34 (24.3) |
| General employee, N (%) | 13 (9.3) |
| Housewife, N (%) | 11 (7.9) |
| Education, years, mean (SD) | 14.18 (3.57) |
| Income per month (THB) |  |
| Low income < 30,000, N (%) | 96 (68.6) |
| High income ≥ 30,000, N (%) | 44 (31.4) |
| Comorbidities |  |
| Ischemic heart disease, N (%) | 3 (2.1) |
| Hypertension, N (%) | 27 (19.3) |
| Diabetes mellitus, N (%) | 11 (7.9) |
| Respiratory disease, N (%) | 4 (2.9) |
| Dyslipidemia, N (%) | 24 (17.1) |
| Idiopathic thrombocytopenia, N (%) | 1 (0.7) |
| Liver disease, N (%) | 4 (2.9) |
| Thyroid disease, N (%) | 5 (3.6) |
| Renal disease, N (%) | 2 (1.4%) |
| Allergic rhinitis, N (%) | 2 (1.4%) |
| Anemia, N (%) | 1 (0.7%) |
| Vitamin D deficiency, N (%) | 3 (2.1%) |
| Deep vein thrombosis, N (%) | 2 (1.4%) |
| G6PD deficiency disease, N (%) | 1 (0.7%) |
| Atrial fibrillation, N (%) | 1 (0.7%) |
| Panic disorder, N (%) | 1 (0.7%) |
| Valvular heart disease, N (%) | 2 (1.4%) |
| Cancer, N (%) | 5 (3.6%) |
| Other comorbidities, N (%) | 4 (2.8%) |
| Rheumatic disease status |  |
| Disease duration, median (min-max) | 7.5 (0.5-35) |
| Rheumatoid arthritis, N (%) | 73 (52.1) |
| Systemic lupus erythematosus, N (%) | 30 (21.4) |
| Ankylosing spondylosis, N (%) | 12 (8.6) |
| Gouty arthritis, N (%) | 7 (5) |
| Psoriatic arthritis, N (%) | 10 (7.1) |
| Sjogren's syndrome, N (%) | 1 (0.7) |
| Still’s disease, N (%) | 1 (0.7) |
| Spondylosis, N (%) | 2 (1.4) |
| Scleroderma, N (%) | 2 (1.4) |
| Osteoarthritis, N (%) | 1 (0.7) |
| Fibromyalgia, N (%) | 1 (0.7) |
| Bechet’s disease, N (%) | 1 (0.7) |
| Unspecified arthritis, N (%) | 2 (1.4) |
| Mixed connective tissue disease, N (%) | 1 (0.7) |
| Juvenile rheumatoid arthritis, N (%) | 1 (0.7) |
| Granulomatosis with polyangiitis, N (%) | 1 (0.7) |
| Enthesitis related arteritis, N (%) | 1 (0.7) |
| HAQ, median (min-max) | 0.13 (0-3) |
| EQ-5D-5L score, median (min-max) | 0.96 (0.6-1.0) |
| Mobility, median (min-max) | 1 (1-4) |
| Self-care, median (min-max) | 1 (1-3) |
| Daily activity, median (min-max) | 1 (1-4) |
| Pain/discomfort, median (min-max) | 2 (1-4) |
| Depression/anxiety, median (min-max) | 1 (1-4) |
| Global health, median (min-max) | 90 (35-100) |
| EQ-5D-5L score, median (min-max) | 0.96 (0.6-1.0) |
| **Internet usage data** |  |
| Frequency of internet use(day per week), mean (SD) | 6.78 (0.89) |
| Duration per time (hour per time), median (min-max) | 1 (0.08-30) |
| Internet searching category |  |
| Information, N (%) | 140 (100) |
| Reading newspaper, N (%) | 61 (43.6) |
| Entertainment, N (%) | 109 (77.9) |
| Communication, N (%) | 123 (87.9) |
| Email, N (%) | 47 (33.6) |
| Online shopping, N (%) | 63 (45) |
| Working, N (%) | 16 (11.4) |
| Other, N (%) | 3 (2.1) |
| Internet access mode |  |
| Facebook®, N (%) | 118 (84.3) |
| Line®, N (%) | 131 (93.6) |
| Instagram®, N (%) | 44 (31.4) |
| Twitter®, N (%) | 21 (15) |
| WhatsApp®, N (%) | 8 (5.7) |
| Youtube®, N (%) | 49 (35) |
| WeChat®, N (%) | 2 (1.4) |
| Newspaper website, N (%) | 4 (2.9) |
| Email, N (%) | 47 (33.6) |
| Google®, N (%) | 109 (77.9) |
| Siriraj connect®, N (%) | 16 (11.4) |
| Mhorprom®, N (%) | 21 (15) |
| TiKToK®, N (%) | 34 (24.3) |
| Pantip®, N (%) | 27 (19.3) |
| Clubhouse®, N (%) | 2 (1.4) |
| Other, N (%)  Club, N (%)  Game, N (%)  Hospital website, N (%)  Zoom®, N (%)  MSN®, N (%)  SLE club, N (%)  Streaming, N (%)  WE TV®, N (%)  Line® meeting, N (%) | 9 (6.4)  1 (0.7)  1 (0.7)  1 (0.7)  1 (0.7)  1 (0.7)  1 (0.7)  1 (0.7)  1 (0.7)  1 (0.7) |
| Internet usage for health data |  |
| Frequency of Electronic health received (day per week), median(min-max) | 3 (1-7) |
| Internet access mode |  |
| Facebook®, N (%) | 75 (53.6) |
| Line®, N (%) | 80 (57.1) |
| Instagram®, N (%) | 9 (6.4) |
| Twitter®, N (%) | 5 (3.6) |
| Youtube®, N (%) | 49 (35) |
| Newspaper website, N (%) | 1 (0.7) |
| Email, N (%) | 6 (4.3) |
| Google®, N (%) | 70 (50) |
| Siriraj connect®, N (%) | 16 (11.4) |
| Mhorprom®, N (%) | 21 (15) |
| TiKToK®, N (%) | 11 (7.9) |
| Pantip®, N (%) | 12 (8.6) |
| Other, N (%)  Club, N (%)  Hospital website, N (%)  SLE club, N (%) | 4 (2.9)  1 (0.7)  2 (1.4)  1 (0.7) |
| **Electronic health information** |  |
| Clinical and progression |  |
| Sign, N (%) | 93 (66.4) |
| Symptom, N (%) | 114 (81.4) |
| Natural history, N (%) | 48 (34.3) |
| Prognosis, N (%) | 46 (32.9) |
| None, N (%) | 21 (15) |
| Diagnosis and modality for diagnosis |  |
| Diagnosis, N (%) | 73 (52.1) |
| Blood test, N (%) | 34 (24.3) |
| Radiographic, N (%) | 20 (14.3) |
| None, N (%) | 56 (40) |
| Treatment |  |
| Drug, N (%) | 97 (69.3) |
| Side effects of treatment, N (%) | 84 (60) |
| Alternative treatment, N (%) | 65 (46.4) |
| Doctor profile, N (%) | 43 (30.7) |
| Hospital profile, N (%) | 46 (32.9) |
| None, N (%) | 25 (17.9) |
| Other |  |
| Patient experience, N (%) | 62 (44.3) |
| Health tools, N (%) | 38 (27.1) |
| Prevention and health promotion, N (%) | 91 (65) |
| Food, N (%) | 39 (27.9) |
| Exercise, N (%) | 16 (11.4) |
| Other, N (%)  Leaflet, N (%)  Vaccine, N (%) | 3 (2.1)  1 (0.7)  2 (1.4) |
| None, N (%) | 21 (15) |

EQ-5D-5L, Euro-Quality of life Group’s 5-dimension and 5-level; HAQ, Health Assessment Questionnaire; Max, maximum; Min, minimum; N, umber; SD, Standard deviation; %, percent