eHealth Literacy and associated factors among Danish adults in the Central Denmark Region: a cross-sectional study

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Submitted to: Journal of Medical Internet Research
on: August 29, 2024

Table of Contents

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Abstract

Background: If the full potential of digital health information is to be realized, it is necessary to consider whether recipients have the required abilities to access, understand and use the information. Digitization has moved information delivery into a digital context, demanding both sufficient health literacy (HL) and digital literacy (DL). Limited HL is quite prevalent, associated with poorer health outcomes and is found to have a negative social gradient. The level of DL is an important determinant for the use of digital services; however, it is not always related to age, gender, or education.

Objective: The objective was to characterise variations concerning the level of HL and DL among a patient population to provide insight into specific areas to be addressed when communicating health information using digital media, helping to accommodate specific needs by personalising the content.

Methods: This was a cross-sectional study. From September to December 2020, participants were included from nine hospital departments at three sites. Adult participants (18+) or adult parents or guardians of a child were included if they were summoned for examination, treatment, or hospitalisation and if they could read and understand Danish. The survey consisted of a questionnaire soliciting sociodemographic data and the eHLA toolkit. Data analysis included descriptive and exploratory statistical analyses and K-mean clustering to develop profiles.

Results: A total of 923 participants participated, of whom 54.2% were female. The mean age was 61.5 years (range 18-93). Most participants presented vocational training (28.4%). Most participants were cohabitating (75.2%), and 61.2% indicated having a chronic disease. Five profiles were developed. Three of these, equivalent to one-third of the participants, experienced difficulties accessing health information in a digital context.

Conclusions: In three profiles, approximately one-third of the total participants may experience difficulties accessing health information in a digital context. Individuals with a higher age and lower level of education are more prevalent in profiles with low eHL compared to those with high eHL. Females at a lower age seem more inclined to obtain health information than males. At a higher age; however, not in a digital context. Having a chronic illness can provide a discrepancy in HL scores, as illness can provide knowledge of health concepts, and lack of illness the opposite. To minimise the risk of inequity introduced by digitalization and unrecognised inadequate levels of eHL amongst patients, it is essential for a successful exploitation of digital health information that efforts are made to motivate and engage the patients to seek out and engage with online health resources, and that the approach is individualised and accommodates the skillset of the recipients.

(JMIR Preprints 29/08/2024:65902)
DOI: https://doi.org/10.2196/preprints.65902

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Introduction

If healthcare is to obtain the true potential of digital health communication, the match between what is developed and what the intended users can access and comprehend must be recognized and remedied. In this study, the aim is to characterise some prerequisites for successful usage of digital health information in a Danish population by examining two core dimensions of the concept of eHealth literacy (eHL): Health literacy (HL) and Digital literacy (DL) [1]. Limited HL is associated with poorer health outcomes, higher use of healthcare services and lesser participation in health-related activities in general [2-5]. Limited HL seems quite prevalent as a European health literacy survey finds that 47% of the general population has limited health literacy, with results differing between countries (29-62%) [6]. In a Danish study, the high prevalence is supported, as they report that 39.12% have low HL [7]. Both studies measure HL with the European Health Literacy Survey Questionnaire (HLS-EU-Q) [8]. Despite slight differences in questionnaires, both studies found a negative social gradient in the occurrence of low HL. Participants with low income, low education, other ethnic backgrounds [7], low social status and old age [6] promote higher proportions of limited health literacy. Thus, not all population groups have the same preconditions to extract full value from the information they are given. Trends are seen where a higher eHL is associated with better health outcomes, e.g., better communication with physicians and enhanced understanding of the disease/condition [9,10]

Denmark is one of the leading countries in the move towards digitalization [11]. In 2019, 67% of the Danish population aged between 16-74 searched online for health-related information. The same was seen in other European countries, with 69% in Norway, 66% in Germany and 62% in Sweden [12]. Current research finds that female citizens are more active and more likely than males to search for health information [13-16], and those searching for information tend to have a longer education and a higher income [17,18]. Supporting this, a US study, with data drawn from 2358 participants, finds that male gender, higher age, and lower socioeconomic background seem to characterise people with less likelihood to seek online health information [19].

To strengthen the digital service transformation and include more, the Danish Government introduced a digital health strategy including different digital initiatives from 2018-2022 [20]. One of the primary goals is to improve cooperation across sectors while focusing on patients and actively involving them in managing their condition [20]. One way to reach this goal includes the mandatory usage of a national digital mailbox in 2014 called e-Boks, which is used to communicate with public authorities, including hospitals [21]. At the time of this study, more than nine of ten citizens between the ages of 16-89 are registered as users of e-Boks, while 8% are not able to use e-Boks and are therefore exempted [15]. Although most citizens are familiar with digital communication technologies in their everyday lives, there might still be a larger group that experiences challenges accessing and using digitally provided health information [22].

Their healthcare providers may not be aware that approximately one in ten does not have access to the national digital infrastructure, e-Boks, and one in three does not seek health information online. Furthermore, the characteristics of those searching for information and those who do not might create a discrepancy between those needing information, e.g., older people with multimorbidity, and those who access information.

A Danish investigation from 2016 examined medical outpatients' usage of the national health portal sundhed.dk and the prevalence of electronic contact with the general practitioner (GP) [23]. Approximately half of these outpatients from a medical department did not take full advantage of digital services. The usage was not related to age, gender or education, but the usage of sundhed.dk was associated with higher levels of eHL measured by the eHLA toolkit [23]. These findings suggest that an individual's satisfactory level of eHL may be an important determinant for the usage of digital services.

There is a need to challenge the general assumption that people with e-Boks are familiar with digital communication and can actively manage their condition by exploring their level of eHealth literacy about their digital behaviour.

For the purpose of this study, we will focus on the dimensions of health literacy and digital literacy, which are described to be part of the individual's knowledge and skills in two widely acknowledged models of health literacy, the Norman&Skinners Lily model [1] and Nørgaard et al. s. eHealth literacy framework [24]. We use the eHealth literacy assessment toolkit (eHLA), which is an instrument which reports more in detail on recipients' health and digital literacy [25]. The eHLA instrument examines eHL by combining specific elements from HL and DL, including self-reported and performance tests, covering two-thirds of the elements from the Lily model.

The objective is to characterise variations concerning the level of HL and DL amongst a population of patients to provide an insight into specific areas to be addressed when communicating health information using digital media, helping to accommodate specific needs by personalising the content, and thus, minimise the risk of inequity introduced by the consequence of increased digitalization and unrecognised inadequate levels of eHL amongst patients.

Method

Study design and setting

A cross-sectional study was conducted, and participants were included for four months, from September to December 2020. Participants were recruited from citizens visiting nine different departments at three different sites (Orthopedic Department in Silkeborg, Diagnostic Center Silkeborg, Orthopedic Department Viborg, Medical Department Viborg, Cardiology Department Viborg, Department of Diagnostic Radiology Viborg, Pediatric ward Viborg, Neurological Department Viborg, Center for Spinal Cord Injury in Western Denmark, Viborg). Participants were included if they were adults (18+) or adult parents or guardians of a child, summoned for examination, treatment, or hospitalisation and if they could read and understand Danish.

Recruitment

The inclusion process consisted of four separate approaches. 1) Citizens convened at the hospital through the Danish digital mailbox, e-Boks, received an electronic letter during the second week of September containing an invitation and a brief study description. A link enclosed in the letter provided additional study information, and if willing, the citizen could participate in the study by completing an electronic questionnaire. 2) Citizens convened at the hospital exempted from the Danish digital mailbox, e-Boks, received the questionnaire in a letter sent by postal mail during the second week of September. These citizens were asked to either hand in the completed questionnaire when attending their appointment at the hospital or return it using the enclosed prepaid postage return envelope. 3) To support the recruitment of citizens not inclined to participate, physical recruitment, on selected days, was performed at all nine inclusion sites from September to December. Allowing citizens to respond via iPads or physical questionnaires on attendance or to bring home the questionnaire to answer when convenient. 4) Furthermore, questionnaires on paper, information flyers, and posters were placed in every department from September to December, with a referral and an invitation to participate in the study.

Measurements

The questionnaire consisted of questions soliciting sociodemographic data and the eHLA toolkit.

Sociodemographic characteristics

Data on gender, age, educational level, cohabitant status, and ethnic background were collected, together with information on the presence of chronic disease and comorbidity. Furthermore, the questionnaire asked for the daily use of prescribed medicine, the residential postal code, and the hospital department to which they were affiliated.

eHealth Literacy Assessment toolkit (eHLA)

The eHLA was used to evaluate health literacy and digital literacy. The eHLA is a validated and psychometrically sound toolkit containing 44 items distributed across 7 tools. Tools 1-4 measure health literacy, and tools 5-7 measure digital literacy [25].

Tool 1 is a performance test describing functional health literacy. It consists of 10 items, and a score is calculated with 1 point for a correct answer; hence, a score between 0-10 is possible. Tool 2 describes self-reported health literacy (HLS-EU9) and consists of 9 items assessed on a 4-option scale ranging from very difficult to very easy. Tool 3 describes familiarity with health and disease concepts and language, consisting of 5 items ranging from no knowledge to full knowledge on a 4-option scale. Tool 4 describes knowledge of health and disease, consists of 6 items and a score is calculated by summarising the points. A correct answer is worth 2 points, and asking for help is 1 point, meaning a score between 0 and 12 is possible. Tool 5 describes familiarity with digital devices and consists of 6 items with 4 options ranging from not at all familiar to completely familiar. Tool 6 describes confidence with digital devices consisting of 4 items assessed on a 4-option scale from very unconfident to very confident. Tool 7 describes digital devices as an incentive and consists of 7 items ranging from strongly disagree to strongly agree.

In tools 2, 3, 5, 6, and 7, the score is calculated by summarising the number of points divided by the number of answered items; hence, a score between 1 and 4 is possible. Each tool gives an independent score, and higher scores indicate a higher level of health literacy and digital literacy [25].

Data management and analysis

All electronic data were collected directly using the Survey system SurveyXact [26]. Data collected through questionnaires filled in on paper were subsequently entered in SurveyXact twice by two independent research assistants. The data was then exported in a format to be used with the statistical software package STATA17, with which all statistical calculations were performed.

Data analysis included descriptive and exploratory statistical analyses. The descriptive statistics were used to describe the participants' sociodemographic characteristics and the eHLA scores. K-mean cluster analysis was applied to use an exploratory clustering method. The method was used to clarify the presence of profiles and identify patterns in skill sets, which are prerequisites for successful usage of digital health information. The number of clusters is never given or can only be determined by statistical parameters. We, therefore, created several k-means solutions with different numbers of groups. The authors JS and LK discussed the clinical relevance of each cluster solution, ranging from three to seven, and found a solution of five that was the most meaningful. After the creation of clusters, each informant was allocated a cluster number, and based on this, differences in sociodemographic characteristics, including the number of chronic conditions, were calculated for each cluster and compared using a one-way analysis of variance. The p-value indicates the discrimination of tool scores between clusters. The tool scores are reported using means, standard deviations (SD) and quartile ranges. The clusters with their data are reported as five profiles.

Ethics

All participants were provided with written information, including information on voluntary participation, data retrieval and use. All questionnaires were initiated with a consent question; it was impossible to move forward without indicating yes or no. Data security and management was approved by the Danish Data Protection Agency (J.no. 1-16-02-284-20). Application for ethical approval is, according to Danish legislation, not required for questionnaire-based studies (Law on ethical conduct in health science, Lovtidende: §14, section 2).

Results

Participant Characteristics

A total of 3287 received an invitation to participate via the digital mailbox, e-Boks, 672 were exempted from e-Boks and received an invitation to participate in a letter sent by postal mail, and 185 citizens were contacted during the physical recruitment. A total of 1138 responded. Of these, 54 did not consent to participate in the study and, thus, did not complete the questionnaire. A total of 42 declined participants; 22 were excluded as they were aged below 18, and 97 were excluded as they had not completed the questionnaire to the extent that it could be assessed.

Thus, 923 participated in the study (23% of first invited). Inclusion from the nine departments were as follows: Orthopedic Department in Silkeborg 29.2%, Diagnostic Center Silkeborg & Department of Diagnostic Radiology Diagnostic Center Silkeborg 30%, Orthopedic Department Viborg 11.6%, Medical Department Viborg 8.5%, Cardiology Department Viborg 9.2%, Department of Diagnostic Radiology Viborg 6.5%, Pediatric ward Viborg 4.6%, Neurologisk Department Viborg & Center for Spinal Cord Injury in Western Denmark, Viborg 5.5%. There was registered participation from a total of 129 different postal codes (Figure 1.)

Figure 1. The dark areas represent postal codes from which patients were included.

A total of 782 questionnaires were completed electronically, and 141 were completed using paper and pencil. Of the 923, 54.2% were female. The mean age was 61.5 years (range 18-93). Most participants present vocational training (28.4%) closely followed by Medium-cycle higher education (3-4 y.) (25.7%). Most participants were cohabitating (75.2%)

A total of 61.2% indicated having a chronic disease, 40.5% had more than one chronic disease, and 53.4% indicated taking medication daily (Table 1). In Table 1, the description of sociodemographics is displayed and divided between the group completing questionnaires on paper (15.3%) and the group completing the electronic questionnaire (84.7%). The only variable that did not display a significant difference between groups was the number of participants with at least one chronic condition and daily medication intake.

Table 1. Sociodemographic data displayed and divided between, the group completing physical questionnaires and the group completing the electronic questionnaire.

Characteristics	Physical questionnaire	Electronic questionnaire	*P* Value	Total n(%)
Gender n(%)				

	Male	51 (36.7%)	371 (47.4%)		422 (45.8%)
	Female	88 (63.3%)	411 (52.56%)	.02	499 (54.2%)
Age					
	Mean age (range)	64.7 (24-93)	61 (18-93)	.01	61.5 (18-93)
Education n(%)					
	Public school	43 (30.9%)	118 (15.2%)		161 (17.6%)
	Vocational training	29 (20.9%)	231 (29.7%)		260 (28.4%)
	General upper secondary education	5 (3.6%)	47 (6.1%)		52 (5.7%)
	Short-cycle higher education (below 3 y.)	27 (19.4%)	98 (12.6%)		125 (13.7%)
	Medium-cycle higher education (3-4 y.)	25 (18%)	210 (27%)		235 (25.7%)
	Long-cycle higher education (above 5 y.)	10 (7.2%)	73 (9.4%)	<.001	83 (9.1%)
Cohabitant status n(%)					
	Living with others	90 (63.8%)	601 (77.2%)		691 (75.2%)
	Living alone	51 (36.2%)	177 (22.8%)	.001	228 (24.8%)
Chronic disease n(%)					
	Yes	103 (74.6%)	456 (58.8%)		559 (61.2%)
	No	35 (25.4%)	320 (41.2%)	<.001	355 (38.8%)
Comorbidity n(%)					
	More than one chronic disease	68 (48,2%)	302 (38.6%)	.02	370 (40.5%)
	Daily medication intake	93 (66%)	400 (51%)	.83	493 (53.4%)
Ethnic background n(%)					

	Danish	125 (91.2%)	728 (94.8%)		853(94.3%)
	Other	12 (8.8%)	40 (5.2%)	.01	52 (5.7%)
Total n(%)		141 (15.3%)	782 (84.7%)		923 (100%)

Characteristics of the overall population, including age and gender, at the nine different inclusion sites during 2019, and the characteristics of the sample included in 2020, can be seen in Table 2.

Table 2. Characteristics of the sample population included in 2020 and the overall population in the included departments in 2020.

Inclusions sites		**Sample Characteristics**	**Population characteristic**
Orthopedic Department in Silkeborg			
	n(%)	261 (29.2%)	24241 (15%)
	Male n(%)	1128(49%)	12801 (53%)
	Age mean(range)	61 (18-91)	56 (2-100)
Diagnostic Center Silkeborg & Department of Diagnostic radiology Diagnostic Center, Silkeborg			
	n(%)	224 (25%)	48366 (30%)
	Male n(%)	101 (45%)	21894 (45%)
	Age mean(range)	64 (19-93)	59 (18-104)
Orthopedic Department Viborg			
	n(%)	104 (11.6%)	12030 (%)
	Male n(%)	45 (43%)	5771 (48%)
	Age mean(range)	58 (18-89)	50 (0-101)
Medical Department Viborg			
	n(%)	76 (8.5%)	14814 (%)
	Male n(%)	35 (46%)	6657 (45%)
	Age mean(range)	59 (18-86)	57 (0-101)

Cardiology Department Viborg			
	n(%)	82(9.2%)	11894 (%)
	Male n(%)	52 (63%)	6445 (54%)
	Age mean(range)	68 (26-93)	64 (1-104)
Department of Diagnostic Radiology Viborg			
	n(%)	58 (6.5%)	40766(%)
	Male n(%)	23 (40%)	17706 (43%)
	Age mean(range)	59 (23-83)	53 (0-102)
Neurologist Department Viborg & Center for Spinal Cord Injury in Western Denmark			
	n(%)	49 (5.5%)	10970 (%)
	Male n(%)	25 (51%)	5690 (52%)
	Age mean(range)	59 (24-93)	56 (0-100)

*It is not possible to generate data on patients of children admitted at the hospital, why these data are not displayed in the above.

Characteristics of the overall population, including age and gender, at the nine different inclusion sites during 2019, and the characteristics of the sample included in 2020, can be seen in Table 2.

eHealth Literacy Scores

In Table 3, the scores of the eHLA tools are displayed as total scores in the last column and presented separately for the group answering a paper questionnaire and the group answering an electronic questionnaire. The tool scores are presented in means, standard deviations, and quartiles. Significant differences are seen in scores between the two groups (electronic and physical questionnaires) in all tools, except tool 1, Functional health literacy (Table 3).

Table 3. eHealth Literacy assessment toolkit (eHLA) displayed and divided between, the group completing physical questionnaires and the group completing the electronic questionnaire.

eHLA-tool	Physical questionnaire mean (SD/Q1-	n	Electronic questionnaire mean (SD/Q1-	n	*P* value	Total mean (SD/ Q1-Q3)	n

	Q3)		Q3)				
1. Functional health literacy							
	9 (1.3/8-10)	94	9.1 (1.3/9-10)	736	.39	9.08 (1.3/9-10)	830
2. Self-assessed health literacy performance							
	3 (.6/2.7-3.3)	135	3.1 (.5/2.9-3.4)	732	.001	3.1 (1.4/2.8-3.4)	867
3. Self-assessed familiarity with concepts and language							
	2 (.9/1.2-2.6)	127	2.2 (.8/1.6-2.8)	727	.001	2.17 (.8/1.6-2.8)	854
4. Knowledge of health and disease							
	8.6 (2.2/7-10)	129	9.1 (2/8-11)	719	.004	9.04 (2/8-11)	848
5. Computer incentives							
	2.3 (1.2/1-3.5)	125	3.2 (.8/2.7-4)	717	<.001	3.08 (3.1/2.5-3.8)	843
6. Familiarity							
	2.3 (1.1/1-3.5)	125	3.3 (.8/2.8-4)	717	<.001	3.13 (.9/2.5-4)	843
7. Computer confidence							
	2.4 (1.1/1.3-3.5)	126	3.3 (.7/3-4)	717	<.001	3.20 (2.75-4)	843

Presentation of profiles

K-mean clustering was done by computing 3-7 clusters, hereafter called profiles. When computing 3 or 4 profiles, there was a loss of two distinct profiles. Computing 4 profiles, there was a loss of profile 1, and computing 3 profiles, there was a loss of profile 1 and 4. When computing 6 or 7 profiles, no new variants emerge regarding tool scores. Thus, K-mean clustering was performed using 5 profiles.

Table 4 presents profile means, standard deviations and quartiles 1 and 3 of all 7 tools from the eHLA in the 5 different profiles.

Table 5 presents profile means and percentages for sociodemographic variables. Testing the variance between groups, the five profiles are significantly different in the distribution of sex, age, education, having a chronic disease, having more than one chronic disease and ethnic background. The profiles do not differ significantly regarding cohabitant status and whether those having a chronic disease take medication daily.

Profile 1

Profile 1 (n=55) exhibited the lowest scores in Tool 1 and Tool 2, the second lowest score in Tool 3 and the lowest score in Tool 4. Furthermore, this profile presented below-average scores in tools 5-7. Profile 1 was predominantly composed of males, with the highest mean age and the lowest level of education. This profile also had the largest percentage of participants with more than one chronic disease. Additionally, this profile had the largest number of participants with a non-Danish background (9%).

Profile 2

Profile 2 (n=231) displayed low scores in tools 3 and 4 but scored sufficiently in tools 1 and 2. Profile 2 had high scores in tools 5-7, indicating sufficient digital literacy. This profile showed an almost equal distribution of sex, with the second lowest mean age and a wide range of education levels.

Profile 3

Profile 3 (n=117) scored the lowest in tools 3, 5-7 and the second lowest in tools 1, 2, and 4, making it one of the profiles with the lowest overall scores. Profile 3 had the highest number of participants with chronic diseases (70%), with almost half of them having more than one disease. This profile showed an almost equal distribution of sex, a high mean age, and a low level of education.

Profile 4

Profile 4 (n=288) had the highest scores in tools 1, 3-6 and the second highest in tools 2 and 7, making it the profile with the highest overall scores. Profile 4 had a higher number of females (64%), the lowest mean age, and the highest level of education. All participants in this profile had a Danish background.

Profile 5

Profile 5 (n=114) scored the highest in Tool 2, average scores in Tools 1 and 4, and just below average in Tool 3. This profile scored low in tools 5 and 6 and below average in tool 7. Profile 5 had a high mean age, a large percentage of females, and most participants had public school or vocational training as their highest educational level.

Table 4. eHLA scores in tools 1-7, presented in profiles 1-5

			Profiles				
			1	2	3	4	5
n(%)			55 (7%)	231(29%)	117 (14%)	288 (36%)	114 (14%)
eHLA-tools							
	1. Functional health literacy						
		Mean	5.56	9.42	9	9.59	9.02

		(SD/Q1-Q3)	(1.44/5-7)	(.78/9-10)	(.8/8-10)	(.68/9-10)	(1/8-10)
	2. Self-assessed health literacy performance						
		Mean (SD/Q1-Q3)	2.83 (.52/2.4-3.1)	3.12 (.42/2.9-3.4)	2.86 (.48/2.6-3)	3.34 (.44/3-3.8)	3.95 (.42/2.8-3.1)
	3. Self-assessed familiarity with concepts and language						
		Mean (SD/Q1-Q3)	1.66 (.59/1.2-2)	2.2 (.69/1.8-2.6)	1.41 (.61/1.2-2)	2.57 (.78/2.1-3)	1.96 (.64/1.4-2.4)
	4. Knowledge of health and disease						
		Mean (SD/Q1-Q3)	6.78 (1.76/6-8)	7.94 (1/7-9)	6.88 (.98/6-8)	11.02 (.83/10-12)	9.97 (.92/9-10)
	5. Computer incentives						
		Mean (SD/Q1–Q3)	2.55 (.9/1.6-3.2)	3.63 (.39/3.3-3.8)	2.03 (.68/1.5-2.5)	3.69 (.39/3.5-4)	2.28 (.65/1.8-2.8)
	6. Familiarity						
		Mean (SD/Q1-Q3)	2.52 (.75/2-3)	3.62 (.42/3.5-4)	2.15 (.66/1.75-2.75)	3.72 (.35/3.5-4)	2.44 (.63/2-3)
	7. Computer confidence						
		Mean (SD/Q1-Q3)	2.96 (.88/2.3-3.8)	3.67 (.43/3.5-4)	2.35 (.77/2-3)	3.65 (.45/3.2-4)	2.6 (.73/2.2-3)

Table 5. Sociodemographic variables between the five presented profiles.

	Profiles					
Variable	1	2	3	4	5	P value
Gender Male n(%)	34	121	63	105	46	<.001

		(62%)	(52%)	(54%)	(36%)	(40%)	
Age Mean (range)		68 (32-91)	58 (19-93)	66 (22-93)	57 (18-85)	66 (24-89)	<.001
Education (%)							<.001
	Public school	25 (45%)	21 (9%)	41 (35%)	3 (3%)	22 (19%)	
	Vocational training	19 (35%)	73 (32%)	53 (45%)	53 (18%)	39 (34%)	
	General upper secondary education	1 (2%)	16 (7%)	2 (2%)	22 (8%)	6 (5%)	
	Short-cycle higher education (below 3 y.)	3 (5%)	29 (13%)	10 (9%)	42 (15%)	24 (21%)	
	Medium-cycle higher education (3-4 y.)	4 (7%)	65 (28%)	9 (8%)	119 (41%)	20 (18%)	
	Long-cycle higher education (above 5 y.)	3 (5%)	27 (12%)	2 (2%)	43 (15%)	3 (3%)	
Cohabitant status %							.3
	Living with others	41 (75%)	180 (78%)	86 (73%)	227 (79%)	79 (69%)	
	Living alone	14 (25%)	51 (22%)	31 (27%)	61 (21%)	35 (31%)	
Chronic disease n/%		37 (67%)	122 (53%)	82 (70%)	169 (59%)	71 (62%)	.02
Comorbidity - more than one Chronic disease n/%		28 (51%)	78 (34%)	54 (46%)	114 (40%)	51 (45%)	.05
	Having a chronic disease and taking medication daily	35 (95%)	109 (90%)	73 (89%)	143 (85%)	67 (94%)	.15
Ethnic background Danish n/%		50 (91%)	217 (94%)	109 (93%)	276 (96%)	114 (100%)	0.04

Discussion

Distribution of levels of digital health literacy:

The results indicate that the population assessed exhibited an overall adequate level of HL and DL as assessed with the eHLA toolkit. The only exception to this trend was observed within tool 3, where the participants self-rate familiarity with health and disease concepts and language. In tool 3, the mean score is 2.17, and 25% of the study population scored below 1.6. The lower score in this tool is similar, but not quite as low, in a study by Holt et al. using the eHLA in two groups of nursing students, one entry-level and the other graduate-level students. The mean scores of tool 3 in the two groups of this study were found to be 2.28 and 2.64 (Q1;1.8. 2.2) [27]. In another study also performed by Holt et al., including 246 patients (diagnosed with diabetes, other endocrine conditions, and/or gastrointestinal diseases), the aim was to investigate how users and nonusers of digital services differ concerning eHL. In this study, the mean tool 3 scores were found to be quite higher, 3.1 and 3.3 (Q1; 3.0, 2.6) and thus higher than both this and the nursing study [23]. Tool 3 was created specifically for eHLA; the scale was inspired by the work of Hargittai et al., who used the familiarity scale in a digital context [25,28]. The final version of tool 3 consists of 5 items and shows an excellent fit to a log-linear Rash model. The scores in tool 3 in the study by Holt et al., including patients, might reflect the knowledge obtained regarding health and disease concepts and language when being a patient diagnosed with a chronic disease [23].

Prerequisites for successful usage of digital health information

It is essential for the successful exploitation of digital health information that the approach acknowledges the skillset of recipients and, at the same time, accommodates the challenges. We find differences in the composition of age, sex, and level of education between profiles; however, that alone does not provide us with sufficient data. The profiling of data and generating five profiles based on the distribution of levels of health and digital literacy scores presents further nuanced insights. Thus, a profile with a higher health literacy score does not necessarily have the higher scores in digital literacy and vice versa. This adds to the understanding of the complexity of user prerequisites when seeking to exploit the advantages of providing patients with digital health information, requiring not only health literacy skills but also digital literacy skills.

Three profiles, profiles 1, 3, and 5, seem to be the ones who could experience difficulties when accessing health information in a digital context. The three profiles constitute one-third of the participants, 35%, or 286 participants.

Profile 1 will probably experience difficulties accessing, understanding and using health information. They might also experience further difficulties when engaging in a digital context as they present experience and confidence with digital services and incentive to use digital services below the average.

The incentive might be especially important for this group to harvest the benefits of digitalization to accommodate the lower scores of HL. In this profile, tool 1's score is low compared to the other profiles.

Tool 1 of the eHLA is inspired by The Test of Functional Health Literacy in Adults (TOFHLA) [29] but offers more similar alternative words for filling in the gaps than in TOFHLA [25]. The scale is developed to measure reading comprehension and numeracy skills and, thus, assess adult literacy in a health setting. The low score of tool 1 gives reason to think that within profile 1, a percentage of people with dyslexia might be found. The exact number of people with dyslexia in Denmark is not known. However, it is estimated that approximately 7-8% of the Danish population are dyslexic [30].

Furthermore, this observation can be attributed to nearly one-tenth of participants in this profile who had a non-Danish background, potentially contributing to the emergence of language barriers. Profile 1 is also characterized by the high percentage of males, high age, low education, and chronic disease corresponding well to those characteristics, according to a US study, who are less likely to seek online health information [19]. Furthermore, it is found that males generally consider health situations less harmful than women, generating less motivation to ask questions and seek information from others [31]. Supporting this argument, the Comprehensive Model of Information Seeking points out that a person's needs or perceptions of risk influence the degree to which the ability to do something about a health problem is considered realistic, thereby generating information-seeking behaviour [32].

To address these difficulties, healthcare providers should remember that patients within this profile may experience difficulties reading and comprehending text material, especially health-related. As a result, healthcare providers should be aware of the complexity of the materials they provide to these patients, whether digital or not. This could involve using plain language and animations and avoiding complex medical terminology that may be unfamiliar to the patient. Efforts should also be made to motivate and engage the patients within this profile to seek out and engage with online health resources. By providing guidance and encouragement, healthcare providers can help bridge the digital and health literacy gap for Profile 1 and help them manage their health better.

Profile 3 will most likely experience difficulties when engaging with electronic and physical health information, being the profile with the lowest scores in most tools. This profile bears many similarities to Profile 1. However, Profile 3 seems to get better scores in tools 1 and 2, and thus, as in Profile 2, discrepancy is found between different literacies within HL. Profile 3 might score sufficiently in functional HL based on their existing disease; however, they do not have a broad knowledge of medical vocabulary and terms. Profile 3 is characterized by having a higher mean age, lower level of education and a higher incidence of chronic disease. Findings of higher age in groups with low eHL correspond well with previous studies, including a variety of populations (Diabetics, patients with cardiovascular risk, lung cancer survivors, and low-income homebound older adults) as they generally agree that age is negatively associated with eHL [32,33]. Thus, this profile 3 is, based on the literature, the most expected and probably the most recognizable. There should be an awareness of the complexity of the materials provided to these patients, whether digital or not.

Profile 5 does score sufficiently in tools related to HL, except for tool 3. Thus, profile 5 seems able to acquire and use health information. However, they might experience difficulties acquiring information in a digital context. This profile might contain a group of participants exempt from e-Boks. The majority are females, and the mean age is higher, as seen in profiles 1 and 3, who also are challenged on DL skill sets. This profile is noteworthy, as individuals in this group possess adequate health literacy skills to navigate the healthcare system but may encounter challenges accessing information digitally.

Consequently, this profile is at risk of experiencing difficulties with the increasing digitization of health information, potentially limiting their ability to access vital health information. This suggests that they may be comfortable with traditional forms of health information dissemination, such as print materials or face-to-face communication, but may need help navigating digital platforms. When healthcare providers provide digital health information to individuals in Profile 5, it is important to carefully consider how they should access the digital service. Healthcare providers, systems developers, and other personnel should make the digital platform user-friendly and easy to navigate, with clear instructions and guidance available. Additionally, an onboarding process could be beneficial, as it would help them become more familiar with the digital platform and build their confidence in accessing health information digitally. By providing onboarding processes, providers can help these individuals become more comfortable with digital health tools and improve their digital literacy skills. Improving digital literacy can especially benefit Profile 5, as they already possess sufficient health literacy skills, and thus, improving their digital literacy can further help them to make informed decisions and take control of their health.

The two profiles, Profile 2 and 4, have received scores in eHLA, indicating that they can access and comprehend digital health information without encountering difficulties. Profile 4 presents high skill sets regarding both HL and DL. This profile has the highest percentage of females, corresponding well to the findings that female citizens are more likely than males to search for health information [13-15]. This profile also represents the lowest mean age and the highest level of education, supporting the findings of Kummervold et al. 2008 and Wangberg et al. 2008, finding that those with a longer education are those who do seek information to a larger extent [17,18]. Based on these scores, Profile 4 will not be challenged to acquire health information, digital or not. Profile 2 represents a sufficient skill set regarding comprehension, reasoning and numeracy skills and assesses one's own HL. However, the profile presents low familiarity with health and disease concepts and language and low knowledge of terms. A previously performed review also found discrepancies between different literacies within HL [33]. The reason for the lack of familiarity with health and disease concepts and terminology and limited knowledge of relevant terms may be found as this profile has the lowest number of participants with a chronic disease and thus only little experience with illness. However, their high level of digital literacy implies that Profile 2 is unlikely to face difficulties in acquiring health information, digital or not.

It is important to note that participants answering the eHLA toolkit questionnaire using paper and pencil differ, with significantly lower scores in tools 5-7. Thus, they represent a group with lower DL than those answering electronic questionnaires. A substantial number of the paper group will most likely represent those exempt from e-Boks. Thus, the finding of low DL in this group might merely confirm the reasoning for exemption.

There is also a significant difference between the two groups regarding scores in tools 2-4, as the paper questionnaire group presents the lowest scores. The paper questionnaire group is represented by most females of older age, have lower education, more frequently live alone, have a chronic disease, and more often do not have a Danish background. This emphasizes the importance of not only distributing questionnaires or surveys electronically as an important group of informants is lost, a group that represents those in need of extra attention and a group that often may require more resources from health care providers.

The lower level of scores in six tools and a concomitant negative social gradient in the group which used paper and pencil corresponds to the findings of both Svendsen et al. and Sørensen et al., as they find a negative social gradient in groups of low HL [6,7]. In this context, it is interesting that the TOFHLA-inspired instrument, despite that it has been developed to be more sensitive, does not appear to capture this difference in skill levels or that the ability to read simple instructions and make basic calculations at a primary school level are not important factors in this context.

Limitations

One limitation of this study is the recruitment method. In the recruitment process, it was not possible to identify all those exempted from e-Boks, as it was possible to participate in the study while sitting in a waiting area at the hospital, and the participants did not indicate whether they were exempted from e-Boks. However, it was possible to identify those exempted from e-Boks during mail and letter inclusion in the second week of September.

The participation rate in the study was 23%, with 923 participants. While the sample size is sufficient, it is important to acknowledge that the lack of data on non-responders could lead to potential selection problems. However, the study made a concerted effort to recruit a diverse population through various recruitment processes. Despite these efforts, it is important to interpret the findings cautiously, as the study's sample may not fully represent the entire population being studied.

Another limitation of this study is the lack of follow-up data on the cohort of participants. Unfortunately, no information was collected from the participants that would allow for any kind of follow-up analysis. This means that we cannot assess how the participants' health and digital literacy levels may have changed over time. Future research should aim to collect follow-up data to better understand the dynamics of health and digital literacy.

Conclusions

We found a tendency for individuals with higher age and lower levels of education to be more prevalent in groups with low eHL. Females seem more inclined to obtain health information; however, at a higher age, they are less inclined to do so in a digital context.

There is an explainable discrepancy between HL scores. Thus, having a chronic illness can provide some knowledge of health concepts, which can give rise to a better score in tool 4 without the score in the other HL tools included. Lack of illness can provide low knowledge of health concepts but high scores in the remaining HL tools.

Profiling data

We found that three profiles (1,3, and 5), approximately one-third of the participants, may experience difficulties accessing health information in a digital context. We found that in two of these profiles (1 and 3), efforts should be made to motivate and engage the patients, for them to seek out and engage with online health resources, and thus benefit from the advances of online health resources and accommodate the lack of health literacy. Improving digital literacy can benefit Profile 5, as they already possess sufficient health literacy skills, and thus, improving their digital literacy can help them to benefit from digital services. In one profile (profile 3), there should be a general awareness of the materials' complexity, whether digital or not.

Another important finding is the need to always supplement digital surveys with alternatives to avoid missing information from a group at risk of being underserved.

It is essential that the approach be individualized and accommodate the recipients' skill sets to minimize the risk of inequity introduced by increased digitalization and unrecognized inadequate levels of eHL among patients.

Acknowledgements:

The authors are grateful to all participants, hospital departments, and clinicians who participated in or recruited participants for this survey. Also, sincere thanks to the Department of Regional Development in the Central Denmark Region, which founded the project and made it possible.

Conflicts of Interest:

None declared.

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Supplementary Files

Untitled.
URL: http://asset.jmir.pub/assets/3733a8ade38dea89cb162a195f756a30.docx

Figures

The dark areas represent postal codes, from which patients were included.