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Special situations in emergency care

The role of health literacy in critical situations -

Finding the appropriate role of the individual in decision-making at the level closest to

it

Doctoral (Ph.D) thesis

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Introduction

In recent years, people have faced a number of critical health situations, both at the societal and individual level *(State of health in the EU Hungary Coutnry Health Profile 2021)*. To make the right choices about the health of oneself and society, it is essential to develop the right level of health literacy. Health literacy is the ability to gather, process and understand information and, as a result, to make appropriate decisions about our own and the society's health and the health care system *(Sørensen et al. 2012)*. The low level of health literacy is strongly correlated with socio-demographic, economic and educational indicators *(Sørensen et al. 2015; N'Goran et al. 2018)*. The low level of health literacy increases the number of hospital admissions and readmissions *(Vandenbosch et al. 2016)* and health expenditures *(Eichler et al. 2009; Palumbo R. 2017)*, and it worsens the patients' chances regarding their illness *(Sørensen et al. 2015; Berkman et al. 2011)*, affect their medication taking habits *(Lor et al. 2019)*, the communication between doctors and patients and the patient compliance *(Griffey et al. 2014)*. Population-based studies have shown that a large proportion of the population in Europe *(Sørensen et al. 2015)*, North America *(Nielsen-Bohlman et al. 2004)* and Asia *(Duong et al. 2017)* have difficulty with health-related information. The European Health Literacy Survey found that almost 50% of the population in the 8 countries surveyed have limited health literacy *(Sørensen et al. 2015)*. In Hungary, previous research suggests that these figures are distributed in similar proportions in terms of subjective health literacy *(Koltai et al. 2016; Bánfai-Csonka et al. 2020)*, but better results are obtained when examining functional health literacy *(Koltai et al. 2016)*. Nevertheless, it is important to stress that although these indicators are poor, the level of health literacy can be improved once the right methods are found. It is important to always start and progress step by step according to the level of health literacy of the social group concerned *(Hersh et al. 2015)*.

As the pandemic created new situations, several new concepts had to be introduced into the public consciousness. Information is pouring in from many sources, creating an "infodemic" (information epidemic), making it difficult for non-professionals to know which information to trust and which to be sceptical about. Critical thinking skills are proving to be essential in these times *(Zarocostas J. 2020; Ashrafi-Rizi et al. 2020)*, as critical thinking, the appropriate use of information and digitalisation can reduce the negative effects of information overload *(Koltay T. 2017)*. Several researchers believe that assessing the level of health literacy is crucial for taking appropriate societal action on the pandemic *(Paakkari et al. 2020; Yusefi et al. 2022)*. Regarding protection, it is essential not only to deal with measures affecting great masses (quarantine, curfew), but also to raise awareness of the importance of protection at the level of individuals (use of masks, compliance with hygiene rules *(Information page on coronavirus. 2022)*. This should be done in a way that is appropriate to the people's level of health literacy, so that they can understand and follow them *(Friis et al. 2016)*. Health literacy helps to identify disinformation, find the right source of information and thus make the best possible decisions about their health and the COVID-19 pandemic *(Okan et al. 2020; Paakkari et al. 2020; Ashrafi-Rizi et al. 2020)*.

Objective

The main question of our study was to identify the factors influencing health literacy among the average Hungarian population, disadvantaged people and university students surveyed, where we can intervene to increase their health literacy levels, thereby improving access to and reducing the expenditures of the health care system and improving their reactions to critical situations.

In "A" and "B" research, we aimed to compare the level of health literacy among people with low socio-demographic and economic indicators and the average Hungarian population. We also aimed to explore the connection between health literacy, state of health, as well as medication taking habits, SBO presentations and knowledge of the triage system.

In "C" research, we also aimed to assess the subjective and functional health literacy levels of students at the Faculty of Health Sciences of the University of Pécs, and whether there is a difference between the health literacy levels of the Hungarian and foreign students.

In "D" research, we assessed the students' subjective and digital health literacy levels in relation to COVID-19, as well as the impact of their university's measures, academic, socio-demographic and economic indicators on health literacy. We wanted to compare the results of the subjective and digital health literacy survey.

In line with our objectives, the following hypotheses were formulated:

H1: It is assumed that the level of health literacy affects satisfaction with the health care system and the work of its staff.

H2: It is assumed that the health literacy level of those who received emergency hospital care in the year prior to completing the questionnaire used in the pilot study (May 2018-May 2019) is lower than that of other respondents.

H3: It is assumed that for individuals surveyed in Ormánság (as Ormánság is a severely disadvantaged area in Hungary), the socio-economic data and health literacy rates will be worse than those recorded in the rest of the country.

H4: It is assumed that the level of health literacy is influenced by whether the respondent has or has not a risk of developing cardiovascular diseases.

H5: We hypothesise that the subjective and objective level of health literacy among university students is influenced by their specialisation and year of studies.

H6: It is assumed that students studying medicine and health sciences will have a higher level of health literacy regarding the COVID-19 pandemic than students studying in other specialisations.

H7: It is assumed that students who score higher on the COVID-19 subjective health literacy scale will also score higher on the digital health literacy scale.
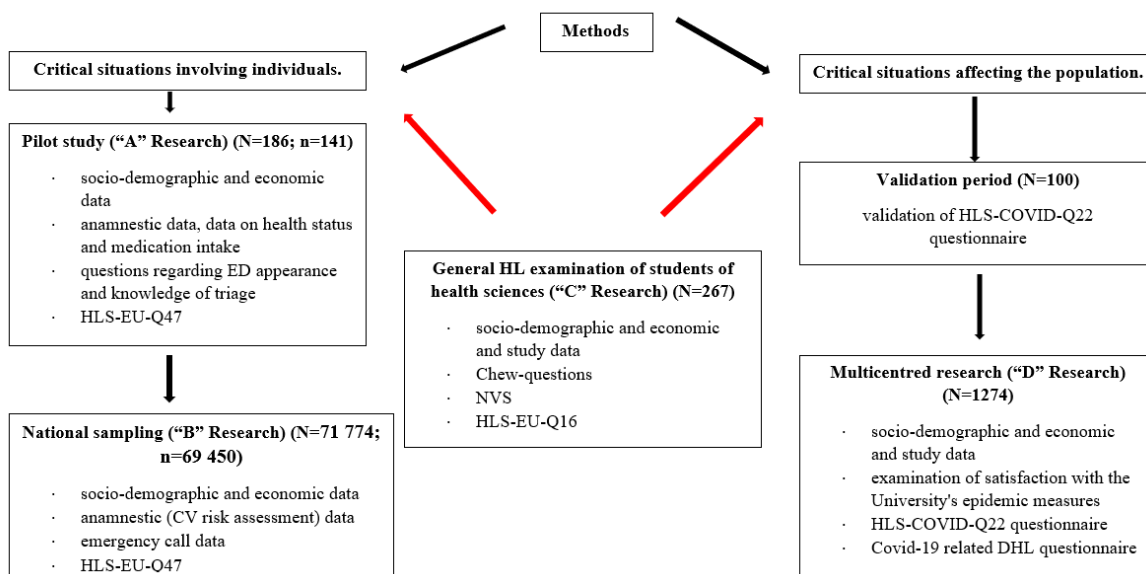
Methods

Our research consisted of several phases, which aimed to investigate health literacy, but in different aspects. The timeline of our research is shown in Figure 1. All studies were cross-sectional.
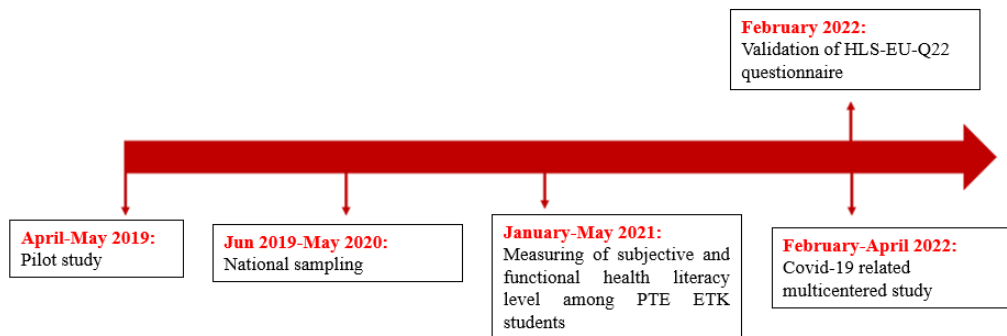
1. Figure: Timeline of the researches

First of all, a pilot study was carried out ("A" Research), where we surveyed people from low socio-economic backgrounds to check the validity of the questionnaire. In this phase, demographic and economic as well as health indicators were examined to see to what extent they influence health literacy. Subsequently, the study was also carried out at national level ("B" Research). In a second step, we measured the subjective and objective health literacy of students studying medicine and health sciences ("C" Research). Reflecting on the pandemic situation, health literacy was also examined from the perspective of the COVID-19 pandemic among students at universities ("D" Research), where medicine and health science courses are offered. In this research, in response to the COVID-19 pandemic, we validated the HLS-COVID-Q22 questionnaire in Hungarian and sent it to the students along with a digital health literacy questionnaire. We started our research in April 2019 and completed the last data collection in May 2022. The methods, measuring instruments and item numbers used in the research are shown in Figure 2.

2. Figure: Presentation of the methods used during the research

Description of measuring instruments

For each survey, we used our own questionnaires, which included standardised items as well.

During the pilot and national sampling, the first part of the questionnaire was used to assess current state of health (weight, height, blood pressure, pulse and blood oxygen level), and to ask questions about socio-demographic status, illnesses, medication taking habits. The BMI was determined retrospectively on the basis of the data collected, and a normal BMI was considered to be between 18.5 and 24.99. Normal blood pressure was determined according to the recommendations of the Hungarian Society of Hypertension.

Relating emergency department admission, we asked questions about the method of admission, reason for admission, waiting times (based on self-recall) and satisfaction, supplemented by questions assessing knowledge of the triage system. The level of satisfaction was measured using a 5-point Likert scale, with the categories as follows: 1- not satisfied at all, 2- not satisfied, 3- neither satisfied nor dissatisfied, 4- satisfied, 5- completely satisfied.

The HLS-EU-Q47 and HLS-EU-Q16 questionnaires were subclassified for subjective assessment of general health literacy. The questionnaires have different sub-dimensions: (1) three health-related domains: health care system (HC), disease prevention (DP) and health promotion (HP), and (2) four information acquisition sub-indices such as access, assessment, understanding and use. Respondents can indicate on a scale of 1 to 4 how easy or difficult it is for them to perform the things listed. The answers could be: 1-very easy, 2-rather easy, 3-rather difficult, 4-very difficult. The respondents' level of health literacy can be divided into four categories based on their answers: 0-25 inadequate, 26-33 problematic, 34-42 adequate and 43-50 excellent. The inadequate and problematic categories are combined to form a limited level of health literacy. The indices and sub-indices were standardised on a scale from 0 to 50, calculated according to the formula: index=(mean-1)*(50/3), where: mean: empirical mean of the questions that make up the index; 1: theoretical minimum of the mean of the indices; 50: standardised maximum of the chosen index; 3: theoretical range of the mean (*Kun et al. 2016*).

The Chew questions ask 3 questions in 3 areas. (1) difficulties of understanding: *"Do you have problems understanding hospital written material to get an adequate picture of your health?"* (2) filling in forms: *"How confident do you feel when filling in forms alone?"* (3) interpreting problem: *"How often does someone (such as a family member, friend, hospital worker or carer) help you interpret hospital written material?"* For these questions, students were asked to select their answers on a Likert scale from 0 to 4, where 0-never, 1-hardly ever, 2-sometimes, 3-most of the time, 4-always.

The NVS measuring instrument is designed to assess objective health literacy through reading, comprehension and calculation tasks. The main component of the measuring instrument is a descriptive label on the back of an ice cream carton. If the respondent answers the first 4 questions correctly, they have an adequate level of health literacy. The scoring was as follows: 0-1 points limited health literacy; 2-3 points probably limited health literacy; 4-6 points adequate health literacy. For question 5, not only were good or bad answers separated, but there was also a "partly good" answer option. This category was given if the respondent knew that they could not eat the ice cream, but could not say why.

In the multicentre research, the HLS-COVID-Q22 questionnaire and the Covid-19 digital health literacy questionnaire were used to assess health literacy. The HLS-COVID-Q22 contained 22 questions, divided into four sub-dimensions: access (6 questions), understanding (6 questions), evaluation (5 questions) and application (5 questions). Respondents are asked to rate on a scale of 1 to 4 how easy or difficult the question is for them (1 - very easy, 2 - rather easy, 3 - rather difficult, 4 - very difficult). The scale is scored as follows: ≤2.5: inadequate health literacy level; >2.5-<3: problematic health literacy level; ≥3: adequate health literacy level.

The questionnaire created to assess digital health literacy, linked to Covid-19, includes the following dimensions: (1) searching information online about the coronavirus, (2) adding own content, (3) assessing the reliability of information about the coronavirus, (4) how much information found relates to the individual, (5) protecting privacy rights online. Each topic was divided into 3 questions, therefore there were 15 questions in total. The response is based on a 4-point scale, from "very easy" to "very difficult" and from "never" to "often". We have also added a separate question to Topic 5 based on the feedback received during the validation process, namely, *"Do you post content about the coronavirus on social media?"* However, this does not affect the assessment.

We asked 6 questions about satisfaction with universities, two of which required a text response. The scoring was based on a 10-point Likert scale, and the students were divided into 3 groups based on their answers: 1-4 points: not satisfied, 5-7 points: satisfied, 8-10 points: completely satisfied.

Data collection procedure

In the pilot and the national studies ("A" and "B" research), the questionnaire was completed by each participant with the help of a survey officer who had information about the research process and the survey method. First the measurements were taken, and then the questions were answered. Any Hungarian citizen over the age of 18 who speaks Hungarian and has signed a consent form was eligible to participate in the research. Exclusion criteria were if someone suffered from certain psychiatric illnesses (e.g. schizophrenia), was under the care of a guardian, had dementia or Alzheimer's disease or was under the influence of alcohol.

Students of the Faculty of Health Sciences of the University of Pécs with active student status from every year of studies, all specialisations, from both Hungarian and English courses were eligible to participate in "C" research. Students of the Faculty of Health Sciences were provided with the access to the questionnaire through the university's system (NEPTUN). The questionnaire was completed via Microsoft365® Microsoft Forms.

"D" research is a quantitative, cross-sectional study with data collected from students at four large universities, the University of Miskolc (ME), the University of Pécs (PTE), Semmelweis University and the University of Szeged (SZTE). All students who had active student status in the spring semester of the academic year 2021/2022 and were enrolled in a course held in Hungarian were eligible to participate in the study. Students who did not complete the questions on academic studies (it was not possible to identify which university they were studying at) or health literacy were excluded. The students filled in the questionnaire using the Survio software, with a direct link to the questionnaire sent via the university's system or its central mail system.

Statistical procedures

Descriptive statistical characteristics (such as relative frequency, mean, standard deviation) were calculated to describe the variables in each study. The internal consistency of the health literacy scales was characterized by Cronbach's α.

The relationships between the independent and dependent variables were first tested binary. Correlations between categorical variables such as socio-demographic, economic and educational data, as well as emergency department admission, triage level knowledge and health literacy categories were tested using the chi-squared test and Fisher's exact test. One way ANOVA test was used to explore the correlations between continuous and multicategorical nominal variables. Examples included examining the correlation between age and health literacy categories, and the relationship between health literacy scores and socio-demographic data (e.g. economic status, type of settlement, education). Correlation analyses were performed to analyse the relationship between continuous variables such as age and health literacy scores, or DHL and HLS-COVID-Q22 questionnaire scores. A two-sample T test was used to compare the scores for the variables of having received health education, having a child in the family and non-variables and health literacy level.

In the second step of the binary analysis, the effects of indicator variables with significant relationships with the dependent variables were tested using multivariate models. We used multiple multinomial or binary logistic models with four categorical or dichotomized versions of the aggregate index and dimensions of health literacy as dependent variables.

Data were recorded and processed using IBM SPSS 22.0. The results were considered significant at a 95% confidence interval with $p<0.05$ value.

Results

Results of the pilot study ("A" Research)

186 respondents took part in the survey, of whom 45 had to be excluded, resulting a sample of 141 (n=141). The response rate was 75.8%.

The majority (70.9%) of participants in the study were women. In terms of their level of education, 22.6% had completed only primary education or lower level, and more than 2/3 of the sample had not received any health-related education. 49% of the participants lived in a village. 46.1% of them had a below average income. More than half of respondents (63.8%) were in a married or cohabiting relationship and 36.9% of households had a child under 18.

Education level (p=0.018), location of residence (p=0.043), and economic status (p=0.027) were associated with overall health literacy levels. In terms of educational attainment, a correlation was found between primary and vocational school graduates and health literacy levels. Respondents who had not received health education (p<0.001), lived in a village, were in a lower than average economic situation and had a lower level of health literacy than those with no health education, living in other types of settlements and in an above average economic situation.

The average BMI of respondents was 26.23. The mean blood pressure in the sample was 125/89 mmHg. 46.1% of the respondents did not take medication regularly and did not have a chronic illness, but 14 (9.9%) had a chronic illness but did not need to take medication. 24 participants (27.6%) did not take their prescribed medication.

Of those surveyed, 69 (48.9%) had been treated in an emergency department in the 12 months prior to the survey. 21.7% of patients had been referred by the National Ambulance Service without a GP referral (18.8%). At the end of care, 92.4% of patients had read the outpatient form, but 27.3% had not informed their GP about the emergency department admission.

The meaning of triage was considered to be known by 65.2% of respondents, but when it came to choosing the correct definition, only 46.8% of respondents could do so.

Surveying **our first hypothesis** we can state that the variables measuring satisfaction with the emergency care system and the work of its staff highly correlated (KMO=0.808 and Bartlett's test is significant, $p<0.001$ and Cronbach's α is 0.916). On the basis of these, the scores of the responses were added together to form a so-called satisfaction index. After dropping the extreme values, this variable was considered to be quasi-normally distributed, so multiple linear regression was used to examine whether the overall health literacy index and its sub-dimensions affect satisfaction. The models include gender, age, type of settlement where they live and education level as independent and control variables. The dependent variable was the satisfaction index.

The results show that the F test was significant ($p<0.05$) for all models. The "explanatory power" (=deterministic coefficients) of the models is 20-21%, which is good for this type of study. Of the predictor (independent) variables included in the models, only the health literacy indices were significant in each model. The value of the significant ($p<0.05$) standardised regression coefficients for each health literacy index: HL index: 0.334; HC index 0.307; DP index 0.274; HP index 0.334.

In testing **our second hypothesis**—the use of emergency care is associated with health literacy—we obtained the following results (Table 1):

	Did you were in the ED in the last 12 months?		p-value
	yes[+]	no[+]	
cHL	35,36 ± 8,28	34,66 ± 9,09	0,639
HC	35,72 ± 8,44	33,92 ± 10,72	0,282
DP	36,24 ± 9,32	35,42 ± 10,37	0,632
HP	34,20 ± 9,37	34,64 ± 9,34	0,784

1. Table: Relationship between visiting ED in the last 12 months and the level of Hl in different dimensions

As shown in Table 1, there is no correlation (p>0.05) between health literacy and emergency department admission in the past 12 months.

In terms of health literacy, the overall health literacy index score was 34.8±8.7 points, the health care system sub-index score was 34.6±9.7 points, the prevention sub-index score was 35.8±9.9 points and the health promotion sub-index score was 34.2±9.4 points. Overall, in almost all categories (with the exception of the prevention sub-index), nearly 50% of respondents had a limited level of health literacy (cHL: 46.1%; HC: 48.2%; DP: 33.3%; HP: 49.6%). Compared to socio-demographic data, a correlation was found between education in health (p=0.001), having a child in the family (p=0.029), level of education (p=0.02) and place of residence (p=0.36). Those who lived in a county seat had lower levels of health literacy than those who lived in a town or village. Economic status was also strongly associated with health literacy (p=0.035). Those with below average incomes had lower levels of health literacy than those with higher incomes. When the correlation between education and cHL was examined using the Scheffe Post Hock Test, a correlation was found between low (primary school) and high educational level (university, college).

National sample results ("B" Research)

71,774 people completed the questionnaire. 61.2% were women of the respondents. In 71,757 cases, Hungarian citizens answered the questions. The average age was 55.4 ±17.33 years. There were 573 people under 18 years of age who were excluded from further analysis. The sample consisted of 254 people living in the Ormánság area by postcode. 66.5% of the sample (47703 people) did not want to answer the question about their highest level of education. Most of the respondents had graduated from vocational training or vocational school (6784; 9.5%).

Cardiovascular risk estimation was possible for 39,645 people of the sample, of which 68.3% had a low or medium risk, the rest had a high or very high risk. 69,542 people answered the question on whether it is easy or difficult to call an ambulance in an emergency. 15.2% said it is "rather difficult" or "very difficult" to call an ambulance in an emergency.

In terms of health literacy level, 39.8% of respondents were in the limited health literacy category in the health care system (HC) sub-index, 40.3% in the disease prevention (DP) sub-index and 46.5% in the health promotion (HP) sub-index. When looking at the overall health literacy index (cHL), 45.7% of respondents were in the limited health literacy category. Among socio-demographic indicators, age was found to be an influential factor in all dimensions (p<0.001). In testing **our third hypothesis**, when looking at outcomes in different dimensions of health literacy, there was a significant correlation (p<0.001) in all dimensions between people living in the Ormánság region and living in another region of Hungary. Comparing people living in Ormánság with the so-called average population, which includes other disadvantaged people, only confirmed how much worse the health literacy of people living in Ormánság is (regardless of gender, age, and whether they have cardiovascular risk). According to **our fourth hypothesis**, when examining subjective health literacy, a significant correlation between the presence of cardiovascular risk and health literacy level was found for all four indices (cHL, HC, DP, HP) (p<0.001). Those with low risk scored higher mean scores on the health literacy scale than those with medium, high or very high risk (Table 2).

HL dimensions	CV risk				p value	F value
	low risk	medium risk	big risk	very big risk		
cHL	35,6±8,07	33,13±8,77	32,47±8,86	31,73±9,11	<0,001	272,070
HC	36,33±8,11	33,78±8,89	33,16±8,99	32,56±9,19	<0,001	266,735
DP	35,92±8,61	33,60±9,31	32,94±9,39	32,12±9,68	<0,001	222,637
HP	34,55±9,46	32,04±9,92	31,29±10,01	30,48±10,31	<0,001	226,945

2. Table: Relationships between CV risk and HL dimensions (n=39565)

A subjective and objective study of health literacy among Hungarian and English language students of health sciences ("C" Research)

The questionnaire was completed online by 267 students, of which 230 were enrolled in the Hungarian and 37 in the English course. Female (86.13%) and Hungarian (86.1%) students were over-represented in our sample. The average age of the students was 21.86±4.6 years. Most people said their economic situation was average (59.2%) or above average (27.7%).

Most students had no chronic illness (81.1%) and 74.5% said they had never smoked. 70.6% of students said they have a general practitioner at the place of their training. More than ¾ of the sample rated their health as good or very good.72.7% had heard the term health literacy, most of them during their studies or through the media. Only 9.7% of respondents thought that their level of health literacy fell into the limited category (a combination of insufficient and problematic).

Chew questions results

Most respondents ask for help to understand hospital documents most of the time (50.9%) or always (31.8%). However, understanding documents relating to their health condition is only a problem hardly ever (31.4%) or sometimes (31.1%). In addition, never or only hardly ever (65.2%) have difficulties filling in hospital documents.

HLS-EU-Q16 questionnaire results

Based on the questionnaire used to assess subjective health literacy, the number of people with limited health literacy is less than 50% for the health care system (HC) sub-index. For all sub-indices, nationality (Hungarian or foreign) was an influential factor (HC p=0.029; DP p=0.002; HP p<0.001). The other socio-demographic factors did not show a correlation with these sub-dimensions.

A large proportion of respondents also have limited health literacy in the areas of information acquisition (38.9%), understanding (53.6%), interpreting (53.6%) and application (58.4%). Nationality was found to be an influential factor in the use of information (p<0.001).

NVS questionnaire results

80.1% of the students were able to answer the questions adequately, and their objectively measured numeracy and literacy skills were sufficient to understand written texts. The proportion of students in the different categories is shown in Table 3.

Health literacy level	Hungarian Students	International Students	Total
inadequate	6	4	10 (3,7%)
Probably limitation	33	10	43 (16,2%)
Adequate	191	23	214 0,1%)

3. Table: Results of NVS scale (n=267 fő)

To test **our fifth hypothesis**—specialisation and year of study are influential factors on subjective and objective health literacy levels—we examined the following. When comparing the results on the subjective health literacy scale with the academic data, the year of study has no effect on any of the sub-dimensions (information acquisition, understanding, interpreting and application and cHL, HC, DP, HP), but the specialisation does. Acquisition (p<0.001), understanding (p=0.012) and interpreting (p=0.004) information were also related to the specialisation of the students examined. Those studying nursing have higher health literacy levels than students in other specialisation in all categories.

When examining the association with objective health literacy, the chi-squared test results did not show a significant association in either case.

Health literacy survey among university students related to the COVID-19 pandemic ("D" Research)

Questionnaire validation results

Reliability of the questionnaire

In a first step, the Cronbach's α was calculated. This is α = 0.938 for the full questionnaire, which is very close to the optimal value of 0.950. For the main dimensions identified by the sub-indices in terms of content, these values are α = 0.786 for access (6 questions), α = 0.899 for understanding (6 questions), α = 0.865 for evaluation (5 questions) and α = 0.846 for application (5 questions).

The Spearman-Brown coefficient of the questionnaire is 0.866 and the Guttman split-half coefficient is 0.861.

Validity of the questionnaire

In the factor analysis used to test construct validity, the Bartlett's test result was significant (p<0.001; chi-squared=1629.292; df=231), with a Kaiser-Meyer-Olkin criterion of 0.876. The data therefore meet the criterion for the applicability of factor analysis. The results of the test

based on own values greater than one show that the first four factors, both in terms of content and the identical items they contain, correspond well to the sub-indices of the original questionnaire. The 4 factors cover 67.08% of the original 22 variables.

Evaluation of health literacy

The Pearson's correlation between the overall HL index and the sub-indices and between the sub-indices is also high (r=0.846-0.887) (Table 4).

Questionnaire and dimensions	Access	Understand	Appraise	Applay
HLS-Covid-Q22	0,846*	0,839*	0,879*	0,887*
Access	1	0,629*	0,661*	0,646*
Understand	-	1	0,561*	0,675*
Appraise	-	-	1	0,794*

4. Table: Korrelation between the HLS-COVID-Q22 questionnaire and dimensions *p<0,001 (two-tailed) (n=100)

The mean score of the overall health literacy index for the sample is 3.08±0.56 points. The average score puts the sample in the sufficient category. For all sub-indices, more than half of the respondents fall into the sufficient category (Table 5).

	Average point	Inadekvát (%)	Problematic (%)	Sufficient (%)
Comprihensive HL	3,08 ± 0,56	15	28	57
Access	3,12 ± 0,56	18	17	65
Understand	3,16 ± 0,68	19	15	66
Appraise	2,95 ±0,70	26	18	56
Aplay	3,11 ± 0,68	21	14	65

5. Table: Results of HLS-COVID-Q22 Questionnaire selected into dimensions (n=100)

Results of the multicentre study

Analysis of the sample

Responses from 1274 university students were processed. 75% of the respondents were female students, with an average age of 25.82±8.715 years. 27.5% of the sample came from PTE, 25.3% from SE, 39.7% from SZTE and 7.5% from ME. 43.2% of the sample continued their

studies in medicine and health sciences. Only 21.4% of the students who rented their accommodation or stayed in halls of residence had a general practitioner at the place of training. For households with children living together, the lowest number was 1 and the highest was 7. Most often there was one person under 18 in the household (mode=1).

Evaluation of digital health literacy

In terms of digital health literacy, respondents found it easy or rather easy to navigate in the digital world in all 4 dimensions (searching for information, generating their own content, reliability and relevance). For gender, type of settlement, origin and residence, there was also a significant correlation with the level of DHL in all 4 dimensions. In all cases and dimensions, women had lower DHL levels than men, and those living in a village or town had lower DHL levels than those living in a town or county seat. Job, average income, level of education and discipline classification were also influential in the generation of own content dimension. For the reliability dimension, the presence of a child in the household and level of education had an impact on the DHL level, while for the relevance dimension, average income, university and education level had an impact. In relation to privacy, sharing other people's data was significantly associated with gender (p=0.002), average income (p=0.037), level of education (p=0.030) and field of education (p=0.022). The field of education also showed a correlation with sharing own data (p=0.018).

The results on the most commonly searched interface for virus-related information are quite varied. Students used various search engines most often (63.8%) to find information, but the use of social media is not negligible (23.2%). The least popular search interfaces include sites for asking questions and blogs.

When looking at search patterns, the most important issues are not prevention and protection, but restrictions, legislation and the current state of the virus.

Results of the subjective health literacy questionnaire (HLS-COVID-Q22)

In terms of subjective health literacy, both in the main dimension and in the sub-dimensions (excluding the survey sub-dimension), respondents achieved an excellent level of health literacy in terms of average scores, and in terms of categories, more than 50% of students in each dimension fell into the satisfactory category.

Comparing HLS-COVID-Q22 results by dimension with socio-demographic data, in the category of not understanding (p=0.003), by type of settlement of origin (p=0.014), by type of settlement for living (p=0,002) also for the category of understanding, university (p=0.02) for the category of HL overall and for the category of application (p=0.034), field of education, discipline (p=0.001) for the category of application showed significant correlations.

According to **our sixth hypothesis**, that there is a correlation between field of education and HL dimensions, no clear correlation was found. However, it can be said that the average health literacy level of non-medicine and health sciences students was better than their peers.

Based on **our seventh hypothesis**, when comparing the results of the two questionnaires (digital health literacy and subjective health literacy related to the COVID-19 pandemic), we

found a correlation between the results in all dimensions. Pearson's correlation shows that the connection is inversely related in almost all dimensions (Table 6).

DHL dimensions		HLS-COVID-Q22 dimensions				
		cHL	access	understand	appraise	apply
information search	p érték	<0,001	<0,001	<0,001	<0,001	<0,001
	r érték	-0,430	-0,401	-0,499	-0,425	-0,503
self-generating content	p érték	<0,001	<0,001	<0,001	<0,001	<0,001
	r érték	-0,377	-0,390	-0,461	-0,434	-0,476
evaluating reliability	p érték	<0,001	<0,001	<0,001	<0,001	<0,001
	r érték	-0,462	-0,365	-0,342	-0,528	-0,381
determining relevance	p érték	<0,001	<0,001	<0,001	<0,001	<0,001
	r érték	-0,551	-0,458	-0,409	-0,570	-0,489
protecting privacy	p érték	0,037	0,016	0,166	0,111	0,020
	r érték	0,282	0,322	0,189	0,218	0,313

6. Table: Comparing the results of correlation test among Covid-19 related DHL and subjective health literacy questionnaire (n=1247)

Satisfaction survey on universities' response to the COVID-19 outbreak

Students were first asked how satisfied they were with the flow of information from their university to them during the pandemic. 14.6% of respondents were not satisfied and 53.5% were completely satisfied. 14% were not satisfied with the measures taken by the university and 55.8% were completely satisfied. Regarding student services, 22.3% said that the quality of these services had decreased and 14.1% said that they had improved.

Overall, the majority of students found online learning challenging, making it more difficult to communicate with teachers and prepare for classes. In addition, there were some concerns with the Registrars Department's work, and the cancelling of programmes was also perceived negatively by the students. However, what some saw as a difficulty, others saw as a positive aspect. Online learning was praised by many, and the range of materials available online also increased. Online and telephone services were also positively rated by many.

33% of the students informed about the pandemic through external press, 36.3% through social networking sites and 26.8% through the university's websites and training courses. Those in the other category mainly cited family, friends and colleagues as their primary source of information.

Discussion

As we face critical situations more and more frequently, both at individual and population level, it is essential to have an adequate knowledge of health literacy at the societal level, so that we can tailor our protection strategy to be truly effective. In order to do this, it is important to be aware of the health literacy of people at different levels of society and to provide information about the situation to each one according to their own level, whether at the individual (before medical intervention, in relation to medication taking habits, illness, etc.) or population level (in the case of a pandemic) *(Okan et al. 2020)*.

In the case of the pilot and the national study, socio-demographic data did not show the level of correlation in the samples that would have been expected from the previously published literature. In a study of people in Poland by Duplaga et al., a correlation was found between health literacy and age (50-59 years), employment status and marital status *(Duplaga et al. 2020)*. Garcia-Codina et al. also associated low socioeconomic status and low level of education (primary school) (p=0.002) with low health literacy*(Garcia-Codina et al. 2019)*. Among the Hungarian studies, the research of Varga et al. should be highlighted, where the study was conducted examining patients diagnosed with hypertension. Their results showed that the highest level of education has the strongest effect on health literacy*(Varga et al. 2021)*. Sántha et al. examined health literacy levels among mothers of different nationalities and ethnicities in 3 countries. Mothers with a child with a chronic illness and low socio-economic status were shown to have poorer health literacy than their peers *(Sántha et al. 2020)*. As a result of our own pilot study, respondents who had not received health education, lived in a municipality and were in a below-average economic situation, had lower health literacy levels than those who had received health education, lived in other types of settlement and were in an above-average economic situation. Gender showed a correlation only in the HC and HP dimensions, while age only for DP. Among the health indicators, BMI was also associated with health literacy levels, as cHL scores increased, BMI approached the normal value. These and other literature data *(Wilsher et al. 2017, Paakkari et al. 2018)* suggest that there is a correlation between BMI and HL. Such data cannot be reported with certainty for the national sample, as many respondents did not wish to answer socio-demographic questions. Ormánság is one of the most disadvantaged areas of our country in socio-demographic and economic terms *(Antal 2009)*. These areas have also been identified in the national sample. It is clear that the level of health literacy of people living in these areas is below the national level. Despite the fact that only a very small percentage of the sample was from this area, the differences were still very striking across all dimensions of health literacy. For all these reasons, we considered that this area is a complex representation of the so-called socio-demographic and economic indicators, and thus our third hypothesis (H3) is confirmed that the health literacy level and socio-economic data of individuals surveyed in Ormánság show a worse picture than in the rest of Hungary. While we already knew that these areas are demographically and economically underdeveloped, our research has highlighted that health literacy—as a complex indicator and one that has a major impact on health expenditures, hospital admissions, emergency department admissions and behaviour during the pandemic—also paints a poor picture *(Okan et al. 2020)*.

In Hungary, 40% of people live with at least one chronic disease. The proportion is even higher (46%) (1) among people living in a poor economic situation. Despite this fact, more than half

of the Hungarian population (58%) rated their own health as good or very good, which is in contrast to the real situation *(KSH 2019)*. Our study showed that individuals with lower risk estimates scored higher on the subjective health literacy scale than those in higher risk categories. The relationship between the two variables was detectable, but the direction of the relationship was not what we expected. Thus, our fourth hypothesis (H4) is not fulfilled.

Low health literacy also affects hospital admissions *(Vandenbosch et al. 2016)* and emergency department admissions *(Eichler et al. 2009; Palumbo et al. 2017)*. Patients with a low level of health literacy are more likely to seek care *(Eichler et al. 2009; Palumbo et al. 2017)*. In our research, we investigated the relationship between emergency department admission and subjective health literacy in a pilot study. Contrary to the literature, our results showed no significant association between emergency department admission and health literacy, so our second hypothesis (H2) was not fulfilled. Our investigation showed that in several cases, hospital care had not been urgent and the patient had been sent home. In addition, the satisfaction of these patients with the emergency care and the people working in the field is good. We also found a correlation between the satisfaction indicator and the level of health literacy. Our first hypothesis (H1) was thus fulfilled.

With the outbreak of the coronavirus pandemic, we also shifted our research into the online space and started to examine students from multiple perspectives of health literacy. First, we measured the subjective and objective level of health literacy. Previous research suggests that students attending medicine and health sciences courses have a better level of health literacy than others *(Klinker et al. 2020)*, which improves as they progress in their studies *(Ozen et al. 2019; Rababah et al. 2019; Bíró et al. 2018)*. Consequently, we hypothesised that both subjective and objective health literacy would be influenced by the year of study and the major for the students examined. However, a clear correlation was found for HLS-EU-Q16 in terms of specialisation. Nursing graduates scored higher than the others in all cases. However, this result is only true for the subjective scale, no such correlation was found for the NVS. In light of this, we could not fulfil our hypothesis five (H5). Based on the literature, we also hypothesized that students in the medicine and health sciences would perform better in COVID-19 related questions than students studying in other specialisations, but this hypothesis (H6) was not fulfil either. This could be explained by the fact that students already studying in this field evaluate the situation more critically than students in other fields, and thus evaluate themselves worse. Looking at the level of health literacy associated with the coronavirus, in a German survey half of the respondents had a problem with health literacy related to the coronavirus *(Okan et al. 2020)*, while in Switzerland, in German-speaking areas, health literacy levels related to the coronavirus pandemic increased from 55% to 63% between spring and winter 2020 *(De Gani et al. 2022)*.

In a survey of subjective and digital health literacy related to the COVID-19 pandemic, students' health literacy related to the digital world was found to be better than at the general level. In fact, students who scored better on the DHL scale performed worse on the HLS-COVID-Q22 scale. This also means that our seventh hypothesis (H7)—the results of the two scales will point in the same direction—was not fulfilled. Bíró et al. used this measuring instrument to assess the health literacy level of the Hungarian population *(Bíró et al. 2022)*. While they found an inadequate level of health literacy in a quarter of the population, a problematic level in less than

a third and a satisfactory level in nearly half, we found an inadequate level in 14% of the students, a problematic level in 28.7% and a satisfactory level in 57.3%. Our results are more in line with the German survey *(Okan et al. 2020)*.

Limitations of the research

One limitation of our study is that we cannot consider our samples as representative. In addition, many questionnaires test subjective levels of health literacy, so the self-image and personality of the individual can influence the results.

Although the involvement of the survey officers was considered as a safety step to avoid incomplete questionnaires, the proportion of partially completed and therefore unassessable questionnaires was still relatively high. However, it should be noted that the survey officers could not oblige anyone to complete the questionnaire in full, as it is stated in the information sheet that it is possible to stop filling in the questionnaire without giving a reason.

The accuracy of the pilot study participants' responses may have been affected by the time interval since their emergency department admission. It is true that we asked about events over the past 12 months, the passage of time may have influenced the answers.

In the context of the survey of respondents' satisfaction, satisfaction with the "work of hospital staff" is subjective in this form, it is not clear what it may refer to (professionalism, communication, etc.), so it should be assessed accordingly.

In the case of the national sample, although the presence of GPs and assistants was considered a guarantee of complete and accurate completion, in many cases socio-demographic data and medical history data were missing, making the analysis difficult.

In the case of the survey of the students, the small number of foreign students who responded may also have had an impact, although the nationality proportions of respondents (domestic and foreign students) are close to the proportions of students in the Faculty.

For foreign students, we could not create different groups by nationality due to the low number of items.

The mortality indicators associated with Covid-19 may be a distortion due to inconsistent data reporting between countries, but these data are still available and can be used as a guide.

Conclusion

In conclusion, the level of health literacy of the Hungarian population is below the European average, especially in disadvantaged municipalities. Those living in these areas demonstrate poor socio-economic conditions, so we would not highlight any specific indicators as an influencing factor. Personalised communication is also important in these areas, but we need to increase not only health literacy, but also knowledge and thus cooperation with professionals and the health care system. If we can raise the level of health literacy in these areas, we can also get better at dealing with critical situations, reducing hospital admissions and health expenditures. The response to the pandemic were not always adequate, also due to low levels of health literacy. By increasing this, the response of people in the next societal emergency situation could be better. It is important to stress that low health literacy is not only a problem among the disadvantaged, but also among the young population in general. The level of

subjective and functional health literacy of university students is also unsatisfactory. It is also important to pay attention to foreign students, so that they can be properly integrated into the domestic health care system after their studies. The case of students studying health and medicine is particularly relevant, since if their own health literacy is not adequate, we cannot expect them to communicate properly with patients, even to assess their level of health literacy and to give them therapeutic and medication plans or preventive procedures and advice using appropriate communication.

Poor health literacy at the societal level affects the whole health care system in the country, so it is essential to improve it, not only at the level of individuals, but also at the level of society. So that the right measures can be put in practice and enforced in the right way in case of the next societal health crisis.

New scientific results

- Internationally, there is research focusing specifically on disadvantaged people, but no such research had been done at national level. In Hungary, this was the first study to clearly show how the very fact of living in the Ormánság region (with all its socio-demographic and economic disadvantages) has a major impact on health literacy.

- To the best of our knowledge, no health literacy survey had ever been conducted on such a large national sample. In several cases, surveys had been conducted on a representative sample of age, gender and place of residence, but they had been based on a sample size of around 1000 respondents. We believe that our own survey of over 69,000 people gives a more complete picture than previous research.

- To the best of our knowledge, no research had been done in Hungary comparing health literacy levels with health indicators (general health, chronic diseases, medication taking habits, BMI, etc.). This should be highlighted as we know from previous research that these indicators can be influenced by health literacy levels. In our research, we also demonstrated a correlation with cardiovascular disease and satisfaction with care.

- Several questionnaires had been used in previous Hungarian research to assess health literacy, but to our knowledge there had been no Hungarian research comparing the results (indicators) of different questionnaires. This is also important because our research showed that there is a correlation between the instruments used to assess functional and subjective health literacy, and that it is indeed important to assess functional and subjective health literacy in order to get a complete picture of the individual.

- Furthermore, there was a contrast between the digital and subjective general health literacy scores among students, highlighting how much easier it is for young people to navigate in the digital world than the non-digital world.

- A survey of students had been conducted in our country before, but not, to our knowledge, among foreign students. In our research, we compared the health literacy levels of Hungarian and foreign students, which surprisingly in some cases favoured foreign students.

- To the best of our knowledge, the HLS-COVID-Q22 questionnaire had not been validated in Hungarian among university students before, so we consider this to be a gap filler.

- Furthermore, we are not aware of any scientific output in Hungarian presenting the COVID-19-related results of digital health literacy among students, which is also a gap filler in today's digital world, especially among young people.

- To the best of our knowledge, there had been no previous Hungarian research that had investigated the relationship between digital health literacy and subjective health literacy, so our research also added new findings to this area.

Proposals

Our recommendations based on our findings are set out below:

- We would propose a survey of all disadvantaged areas to develop a specific health literacy improvement programme for the population of each area.
- We would recommend a broad survey of students attending Hungarian and English courses at universities, as our data is only a starting point due to the low number of items.
- We would suggest complementing the survey we started with a survey of other types of health literacy (e.g. communication health literacy, vaccination health literacy).
- For all health literacy surveys, it is recommended to complement the subjective measuring instrument with an objective measuring instrument.
- It is recommended to assess and develop health literacy starting at a young age, in order to create a generation for whom this is no longer a problem.
- It is recommended that basic cognitive skills (reading comprehension, numeracy) are assessed in the first semester of university to help with later university studies.
- We propose to introduce health literacy into university education. Primarily in health and medical science faculties, helping future doctor-patient encounters and communication.
- It is proposed to complement the research with focus group interviews, the themes of which are set out in Annex XVIII.
- We consider it important to develop a personalised, group-based approach to health literacy, where a framework and expected outcome requirements can be provided, but the curriculum should always be adapted to the actual assessed results within the group.

Publications related to the dissertation:

Original articles:

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2. Bánfai-Csonka, H., Bánfai, B., Derzsi, - Horváth M, Musch, J., Deutsch, K., & Betlehem, J. (2022). Egészségérték és a COVID-19 pandémia kapcsolata. In *XX. Szentágothai János Mutidiszciplináris Konferencia és Hallgatói Verseny Absztrakt kötet / XX. János Szentágothai Multidisciplinary Conference and Student Competition Book of Abstracts* (pp. 498–498).

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4. Bánfai-Csonka, H., Bánfai, B., & Betlehem, J. (2021b). Mennyire befolyásolja egészségértésünket nemzetiségünk? In *14. Képzés és Gyakorlat Nemzetközi Neveléstudományi Konferencia* (pp. 106–106).

5. Bánfai-Csonka, H., Bánfai, B., Derzsi-Horváth, M., Musch, J., & Betlehem, J. (2021). Egészségértés vizsgálata különböző szociodemográfiai körülmények között élő lakosság körében. *NÉPEGÉSZSÉGÜGY*, 98(2), 275–276.

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Organising a seminarium:

1. József, B., János, M., Henrietta, B.-C., Zsófia, A., & Kinga, R. (2021). *Lifelong Health and Wellbeing: Seminar Programme and Abstract Book - EDUC WP9*. (B. József, M. János, B.-C. Henrietta, A. Zsófia, & R. Kinga, Eds.). Pécs: Pécsi Tudományegyetem.

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