

The HLS₁₉–DIGI Instrument to measure Digital Health Literacy

Development of the Instrument

The HLS₁₉–DIGI instrument is a newly developed 8–item questionnaire measuring digital health literacy in general adult populations (HL–DIGI). It is accompanied by a new 2–item questionnaire to measure interaction with digital devices (HL–DIGI–INT) and a new 6–item questionnaire to measure frequency of use of digital resources (HL–DIGI–DD). The HLS₁₉–DIGI is part of the HLS₁₉ family of instruments on measuring health literacy (HL).

The instrument was developed by a working group of the HLS₁₉ (Health Literacy Population Survey 2019–2021) (cf The HLS₁₉ Consortium of the WHO Action Network M–POHL 2021: Chapter 12). HLS₁₉ is the first project of the WHO Action Network on Measuring Population and Organizational Health Literacy (M–POHL; <https://m-pohl.net>), coordinated by the HLS₁₉ International Coordination Centre (ICC).

The HL–DIGI and the HL–DIGI–INT were applied in large samples using different data collection methods in 13 countries participating in the HLS₁₉ study: Austria (AT), Belgium (BE), Czech Republic (CZ), Denmark (DK), France (FR), Germany (DE), Hungary (HU), Ireland (IE), Israel (IL), Norway (NO), Portugal (PT), Slovakia (SK), and Switzerland (CH). The HL–DIGI–DD was applied in the above–mentioned countries, except for NO.

Underlying definition of digital HL: The concept and definition of digital HL in HLS₁₉ is based on the concept and definition of general HL as proposed by the HLS–EU Consortium (Sorensen, 2013), but aligned with existing research on the scope and diversity of digital health resources across societies and cultures (Levin–Zamir & Bertschi, 2019). The definition of digital HL developed by the HLS₁₉ Consortium, building on previous definitions, is: “the ability to search for, access, understand, appraise, validate, and apply online health information, and to formulate and express questions, opinion, thoughts, or feelings when using digital devices.” This concept relates strongly to the frequency with which people use different health resources from digital sources and resources such as online video consultations, digital personal health records, social media, health related apps, etc.

Underlying concept of operationalization: The digital HL measure builds on the eHEALS measure (Norman 2006) and the Digital Health Literacy Instrument (DHLI; van der Vaart & Drossaert, 2017). Operationalization of the items for HL–DIGI and HL–DIGI–INT follows measuring experienced difficulty of included tasks using a four–point Likert scale as in HLS₁₉–Q12 and HLS₁₉–Q47. By that it is a ‘subjective’ perception–based instrument.

Developed for measuring digital HL in general adult national resident’s populations aged 18+.

Available languages: Arabic, Czech, Danish, Dutch, English, French, German, Hebrew, Hungarian, Italian, Norwegian, Portuguese, Russian and Slovak.

Description of the Instrument

Introductory question¹ and items of the English (original) version

Digital Health Literacy – dealing with digital health information (HL-DIGI)

“When you search online for information on health, how easy or difficult is it for you”

1. to judge whether the information is reliable?
2. to judge whether the information is offered with commercial interests?
3. to understand the information?
4. to use the information to help solve a health problem?
5. to judge whether the information is applicable to you?
6. to find the exact information you are searching for?
7. to visit different websites to check whether they provide similar information about a topic?
8. to use the proper words or search query to find the information you are looking for?

Interaction with digital resources for health (HL-DIGI-INT):

“When typing a health-related message on a digital device how easy or difficult is it for you to”

1. express your opinion, thoughts, or feelings, ask a question in writing on social media including online forums?
2. clearly formulate your written message when communicating with a health provider?

For the measures HL-DIGI and HL-DIGI-INT, the response categories are: 4 “Very easy”, 3 “Easy”, 2 “Difficult”, 1 “Very difficult”, 999 “DK / Refusal (SPONTANEOUS)”

Use of digital devices for health (HL-DIGI-DD):

“In a typical week, how many days do you use the following digital resources for getting health related information?”

1. Websites
2. Social media including online Forums
3. A digital device related to health or health care
4. Health app on your mobile phone
5. Digital interaction with your health system
6. Other

The response possibilities for the HL-DIGI-DD are: less than once per week, 1–3 days per week, 4–6 days per week, once a day, more than once per day, not relevant for me, DK / Refusal (SPONTANEOUS)

This measure can be used as a correlate to learn of the extent to which HL-DIGI is associated with the use of digital resources (DIGI-DD) for health.

¹ This wording was used in personal interviews (CAPI/PAPI) and online surveys (CAWI). In telephone interviews (CATI), the question was: “On a scale from very easy, easy, difficult, and very difficult, how easy would you say it is ...”
June 2022

Calculation of the HL-DIGI and HL-DIGI-INT scores: The scores are calculated as the percentage (ranging from 0 to 100) of items with valid responses that were answered with “very easy” or “easy” provided that at least 80 % of the items contain valid responses:

$$\frac{\text{Number of “easy” or “very easy” responses}}{\text{Number of valid responses}} \times 100$$

If less than 80 % of the items contain valid responses, the score is set to “missing”. A higher score value signifies a higher level of digital HL.

Interpretation of the score: Users should keep in mind that the HL-DIGI score and the HL-DIGI-INT score assess perceived difficulties of tasks related to the interaction of personal abilities and contextual factors related to the health system and the general situation of the respective country.

Calculation of the DIGI-DD score – Use of Digital Devices/Resources

A mean score (ranging from 1 “Not relevant or less than once per week” to 5 “More than once per day”) can be calculated as a relative measure for the frequency of use of health-related digital resources. The values of this mean score have no direct interpretation but can be used to order respondents by the average frequency of use of digital resources.

Psychometric properties

In the following, the main characteristics of the 13 HLS₁₉ national surveys (in the general adult population, i.e., 18 years or older) are summarized for the countries that collected data on digital HL as part of HLS₁₉. Further below, the Cronbach’s alpha coefficients and the results of confirmatory factor analyses, Partial Credit Models and Rasch analyses are shown.

Table 1: Main characteristics of the national HLS₁₉ surveys that measured digital HL as an optional package

Country	Languages	Type of data collection	Sampling procedure	Period of data collection	Valid responses
Austria	German	CATI	Multi-stage random sampling	16.03.2020–26.05.2020	2,967
Belgium	Dutch, French	CAWI	Quota sampling	30.01.2020–28.02.2020 and 01.10.2020–26.10.2020	1,000
Czech Republic	Czech	CATI, CAWI	Random digital procedure and random quota sampling	10.11.2020–24.11.2020	1,599
Denmark	Danish	CAWI	Multi-stage random sampling	11.12.2020–05.02.2021	3,602
France	French	CAWI	Quota sampling	27.05.2020–05.06.2020 and 08.01.2021–18.01.2021	2,003
Germany	German	PAPI	Multi-stage random and quota sampling	13.12.2019–27.01.2020	2,143
Hungary	Hungarian	CATI	Multi-stage random sampling	02.12.2020–20.12.2020	1,195
Ireland	English	CATI	Random digit dialing approach	24.07.2020–07.12.2020	4,487
Israel	Hebrew, Arab, Russian	CATI, CAWI	Multi-stage random sampling	15.12.2020–10.01.2021	1,315
Norway	Norwegian	CATI	Random sampling procedure within each stratum	04.04.2020–13.05.2020	2,855
Portugal	Portuguese	CATI	Random stratified sampling	10.12.2020–13.01.2021	1,247
Slovakia	Slovak	CAPI	Multi-stage random sampling	22.06.2020–14.09.2020	2,145
Switzerland	French, German, Italian	CAWI*	Multi-stage random sampling	05.03.2020–29.04.2020	2,502

CATI Computer-assisted telephone interview
 CAWI Computer-assisted web-based interview
 CAPI Computer-assisted personal interview
 PAPI Paper-assisted personal interview

*CAWI was the main type of data collection; additionally, a small number of CATI interviews were conducted.

Source: HLS₁₉ Consortium

Psychometric properties of the HL-DIGI score

Cronbach's alpha for HL-DIGI: The Cronbach's alphas for the HL-DIGI score range from 0.77 (Norway) to 0.87 (Slovakia) with a mean of 0.83 (see Table 2).

Single-Factor Confirmatory Factor Models by country [CFA] for HL-DIGI: The Standardized Root Mean Square Residual [SRMSR], the Root Mean Square Error of Approximation [RMSEA], the Comparative Fit Index [CFI], the Tucker-Lewis Index [TLI], the Goodness of Fit Index [GFI], and the Adjusted Goodness of Fit Index [AGFI] indicate an acceptable model-data fit for all 13 surveys for the dichotomised items (Table 2). For details, please see Chapter 12 section 12.2.2 of the HLS₁₉ Report (The HLS₁₉ Consortium of the WHO Action Network M-POHL 2021).

Table 2: Cronbach's alpha and Single-Factor Confirmatory Factor Analysis for the HL-DIGI

Country	Cronbach's alpha	Single-Factor Confirmatory Factor Analysis		
		SRMSR	RMSEA	CFI
Austria	0.81	0.07	0.08	0.98
Belgium	0.86	0.12	0.13	0.98
Czech Republic	0.82	0.07	0.07	0.99
Denmark	0.86	0.09	0.11	0.98
France	0.86	0.06	0.07	0.99
Germany	0.83	0.07	0.08	0.99
Hungary	0.79	0.10	0.10	0.96
Ireland	0.79	0.06	0.06	0.99
Israel	0.83	0.08	0.08	0.99
Norway	0.77	0.07	0.06	0.98
Portugal	0.83	0.07	0.08	0.99
Slovakia	0.87	0.07	0.08	0.99
Switzerland	0.85	0.08	0.09	0.99

CFI=Comparative Fit Index; RMSEA=Root Mean Square Error of Approximation; SRMSR=Standardized Root Mean Square Residual
NOTE: These values are based on the 8 dichotomized HLS₁₉-items (very easy + easy vs. difficult + very difficult).

Source: HLS₁₉ Consortium

Rasch Partial Credit Model (PCM) for HL-DIGI: The unidimensionality of the HL-DIGI is confirmed by Rasch analysis. A principal component analysis (PCA) of Rasch model residuals combined with dependent t-tests to identify possible empirical subscales show that the scale is sufficiently unidimensional. The thresholds, and thus the response categories, are ordered and well-functioning, and there is no significant statistical dependence between pairs of items, which means that no items are "too similar" and collect redundant information. For details, please see Chapter 12, section 1.2.2. of the HLS₁₉ Report (The HLS₁₉ Consortium of the WHO Action Network M-POHL 2021).

Validity:

Content and face validity for HL-DIGI are ensured by using a theory-based model and definition of digital HL for selecting and operationalizing the included indicators.

Discriminant validity for HL-DIGI: According to the results of the HLS₁₉ survey, the HL-DIGI measure is correlated with general HL ($r=0.53$) (for 13 countries), navigational HL ($r=0.55$) (for 7 countries), communicative HL (Q11: $r=0.39$ (for 2 countries), Q6: $r=0.31$ (for 7 countries)), and vaccination HL ($r=0.38$) (for eight countries), and thus proves to be sufficiently related to other sub-forms of HL to be considered a measure of health literacy, yet independent enough to measure a specific aspect of HL.

Concurrent predictive validity for HL-DIGI: According to the results of the HLS₁₉ survey, in most countries, HL-DIGI is associated with self-perceived health, and in some countries also with the utilization of health services (i.e., frequency of consultation with GPs/family physicians). While there is a considerable proportion of respondents with lower digital HL in all countries, there is a social gradient for digital HL in most countries. For details, please refer to Chapter 12 of the HLS₁₉ Report (The HLS₁₉ Consortium of the WHO Action Network M-POHL 2021).

Psychometric properties of the HL-DIGI -INT score

Cronbach's alpha for HL-DIGI-INT: The Cronbach's alphas for the HL-DIGI-INT score range from 0.55 (Norway) to 0.82 (Hungary and Slovakia) with a mean of 0.73 (see Table 3).

Table 3: Cronbach's alpha for the HL-DIGI-INT

Country	Cronbach's alpha
Austria	0.69
Belgium	0.74
Czech Republic	0.70
Denmark	0.79
France	0.62
Germany	0.76
Hungary	0.82
Ireland	0.61
Israel	0.80
Norway	0.55
Portugal	0.77
Slovakia	0.82
Switzerland	0.80

Source: HLS₁₉ Consortium

The correlation between DIGI-HL and HL-DIGI-INT is considerable ($r=0.48$), but low enough to justify two different measures.

Summarizing: The HLS₁₉-DIGI was validated for 4 modes of data collection (PAPI, CAPI, CATI, CAWI), for several languages, in large national samples collected in most cases by multi-stage random sampling or quota sampling procedures and demonstrated good psychometric properties and validity.

Use of the HLS₁₉-DIGI Instrument

Procedure for obtaining the instrument: The ownership of the HLS₁₉-DIGI rests with the HLS₁₉ Consortium, which developed the instrument. The HLS₁₉-DIGI can be used by third parties for research purposes free of charge but requires a contractual agreement between the user and the ICC of the HLS₁₉ Consortium. The use of the instrument is free of charge. An application form with details on the conditions for getting permission to use the instrument can be found at <https://m-pohl.net/tools>.

Address any questions to: The International Coordination Centre (ICC) of the HLS₁₉ Project, located at:

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The HLS₁₉-DIGI is part of a family of instruments that measure specific types of HL (please see <https://m-pohl.net/tools>):

- » HLS₁₉-Q12, HLS₁₉-Q47 and HLS₁₉-Q16 to measure General Health Literacy
- » HLS₁₉-COM-P-Q11 (long form) and HLS₁₉-COM-P-Q6 (short form) to measure Communicative Health Literacy
- » HLS₁₉-NAV to measure Navigational Health Literacy
- » HLS₁₉-VAC to measure Vaccination Literacy.

Please cite as: The HLS₁₉ Consortium of the WHO Action Network M-POHL (2022): The HLS₁₉-DIGI Instrument to measure Digital Health Literacy. Factsheet. Austrian National Public Health Institute, Vienna

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WHO (2018): WHO guideline: recommendations on digital interventions for health system strengthening. World Health Organization; 2019. Licence: CC BY-NC-SA 3.0 IGO, Geneva

A list of further publications relating to the instruments can be found at:

- » <https://m-pohl.net/Results>
- » https://m-pohl.net/HLS_Project_Publications_Presentations