

## Factsheet

# The HLS<sub>19</sub>–DIGI Instruments for measuring Digital Health Literacy

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M-POHL  
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## Development of the Instruments

The HLS<sub>19</sub>–DIGI–HI<sup>1</sup> instrument is a newly developed 8–item questionnaire measuring digital health literacy (HL) in general adult populations. It is accompanied by a new 2–item questionnaire to measure interaction using digital devices (HLS<sub>19</sub>–DIGI–INT) and a new 6–item questionnaire to measure reported frequency of use of digital resources (HLS<sub>19</sub>–DIGI–DD). The HLS<sub>19</sub>–DIGI–HI and the HLS<sub>19</sub>–DIGI–INT part of the HLS<sub>19</sub> family of instruments on measuring HL.

The instruments were developed by a working group of the HLS<sub>19</sub> (Health Literacy Population Survey 2019–2021) (cf The HLS<sub>19</sub> Consortium of the WHO Action Network M-POHL 2021: Chapter 12). HLS<sub>19</sub> 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 HLS<sub>19</sub> International Coordination Centre (ICC).

The HLS<sub>19</sub>–DIGI–HI and the HLS<sub>19</sub>–DIGI–INT were applied in large samples using different data collection methods in 13 countries participating in the HLS<sub>19</sub> 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 HLS<sub>19</sub> 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 HLS<sub>19</sub> 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

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<sup>1</sup> In the international HLS<sub>19</sub> report, this instrument was referred to as HLS<sub>19</sub>–DIGI. To avoid misunderstandings, the name of the instrument has been changed to HLS<sub>19</sub>–DIGI–HI.

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 HLS<sub>19</sub>-DIGI-HI and HL-DIGI-INT follow measuring experienced ease or difficulty of included tasks using a four-point Likert scale as in HLS<sub>19</sub>-Q12 and HLS<sub>19</sub>-Q47. By that it is a 'subjective' perception-based instrument.

**Developed and currently tested for** measuring digital HL in general adult national populations of residents aged 18+.

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

## Description of the instrument

### Introductory question<sup>2</sup> and items of the English (original) version

#### Digital Health Literacy – dealing with digital health information (HLS<sub>19</sub>-DIGI-HI)

“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 (HLS<sub>19</sub>-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)”

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<sup>2</sup> 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 ...”

### **Use of digital devices for health (HLS<sub>19</sub>-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 HLS<sub>19</sub>-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 the ability to deal with digital health information (DIGI-HI) is associated with the use of digital resources for health.

**Calculation of the scores:** The DIGI-HI score is calculated as the mean of the numeric values of the items, scaled from 0 to 100. A higher score value signifies a higher level of DIGI-HI. If less than 80% of the items contain valid responses, the score is set to “missing”. The DIGI-INT score is calculated as the mean of the numeric values of the items, scaled from 0 to 100, with no missing values tolerated.

Please note that the HLS<sub>19</sub> International Report (The HLS<sub>19</sub> Consortium of the WHO Action Network M-POHL 2021) used a different way of calculating the scores.

**Interpretation of the score:** Users should keep in mind that the DIGI-HI and the DIGI-INT-HI scores assess the perceived ease or difficulty 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 as a correlate to order respondents by the average frequency of use of digital resources.

## **Psychometric Properties**

In the following, the main characteristics of the 13 HLS<sub>19</sub> 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 HLS<sub>19</sub>. 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 surveys that collected data on digital HL as part of HLS<sub>19</sub>

Country	Languages	Type of data collection	Sampling procedure	Period of data collection	Valid responses
<b>Austria</b>	German	CATI	Multi-stage random sampling	16.03.2020–26.05.2020	2,967
<b>Belgium</b>	Dutch, French	CAWI	Quota sampling	30.01.2020–28.02.2020 and 01.10.2020–26.10.2020	1,000
<b>Czech Republic</b>	Czech	CATI, CAWI	Random digital procedure and random quota sampling	10.11.2020–24.11.2020	1,599
<b>Denmark</b>	Danish	CAWI	Multi-stage random sampling	11.12.2020–05.02.2021	3,602
<b>France</b>	French	CAWI	Quota sampling	27.05.2020–05.06.2020 and 08.01.2021–18.01.2021	2,003
<b>Germany</b>	German	PAPI	Multi-stage random and quota sampling	13.12.2019–27.01.2020	2,143
<b>Hungary</b>	Hungarian	CATI	Multi-stage random sampling	02.12.2020–20.12.2020	1,195
<b>Ireland</b>	English	CATI	Random digit dialing approach	24.07.2020–07.12.2020	4,487
<b>Israel</b>	Hebrew, Arab, Russian	CATI, CAWI	Multi-stage random sampling	15.12.2020–10.01.2021	1,315
<b>Norway</b>	Norwegian	CATI	Random sampling procedure within each stratum	04.04.2020–13.05.2020	2,855
<b>Portugal</b>	Portuguese	CATI	Random stratified sampling	10.12.2020–13.01.2021	1,247
<b>Slovakia</b>	Slovak	CAPI	Multi-stage random sampling	22.06.2020–14.09.2020	2,145
<b>Switzerland</b>	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: HLS<sub>19</sub> Consortium

### *Psychometric properties of the HLS<sub>19</sub>-DIGI -HI instrument*

**Cronbach's alpha:** The Cronbach's alphas for the DIGI-HI score range from 0.84 (Hungary) to 0.92 (Denmark, Slovakia) with a mean of 0.89 (see Table 2).

**Single-Factor Confirmatory Factor Models by country [CFA]:** The Standardized Root Mean Square Residual [SRMSR] (should be  $\leq 0.08$ ), the Root Mean Square Error of Approximation [RMSEA] ( $\leq 0.06$ ), the Comparative Fit Index [CFI] ( $\geq 0.95$ ), 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 polytomous items (Table 2).

Table 2:

Cronbach's alpha and Single-Factor Confirmatory Factor Analysis for the HLS<sub>19</sub>-DIGI-HI

Country	Cronbach's alpha	Single-Factor Confirmatory Factor Analysis		
		SRMSR	RMSEA	CFI
Austria	0.89	0.05	0.11	0.99
Belgium	0.91	0.09	0.19	0.98
Czech Republic	0.88	0.06	0.12	0.99
Denmark	0.92	0.07	0.15	0.99
France	0.89	0.06	0.13	0.99
Germany	0.91	0.06	0.12	0.99
Hungary	0.84	0.10	0.19	0.96
Ireland	0.86	0.04	0.08	0.99
Israel	0.89	0.07	0.13	0.99
Norway	0.87	0.06	0.12	0.98
Portugal	0.89	0.05	0.11	0.99
Slovakia	0.92	0.05	0.13	0.99
Switzerland	0.91	0.07	0.15	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 polytomous HLS<sub>19</sub>-items (very easy, easy, difficult, very difficult).

Source: HLS<sub>19</sub> Consortium

**Rasch Partial Credit Model (PCM):** The unidimensionality of the HLS<sub>19</sub>-DIGI-HI 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 HLS<sub>19</sub> Report (The HLS<sub>19</sub> Consortium of the WHO Action Network M-POHL 2021).

**Distribution of the score:** The distribution of the DIGI-HI score is almost symmetric in many countries, but shows deviating patterns in some countries (e.g., leptokurtic distribution, double peaks).

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

**Discriminant validity:** According to the results of the HLS<sub>19</sub> survey, the DIGI-HI measure is correlated with general HL ( $r=0.58$ ) (for 13 countries), navigational HL ( $r=0.58$ ) (for 7 countries), communicative HL (Q11:  $r=0.47$  (for 2 countries), Q6:  $r=0.40$  (for 7 countries), and vaccination HL ( $r=0.44$ )

(for 8 countries), thus proving 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:** According to the results of the HLS<sub>19</sub> survey, in most countries, DIGI-HI 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 DIGI-HI in all countries, there is a social gradient for DIGI-HI in most countries.

### *Psychometric properties of the HLS<sub>19</sub>-DIGI-INT instrument*

**Cronbach's alpha:** The Cronbach's alphas for the DIGI-INT score range from 0.65 (Norway) to 0.89 (Israel) with a mean of 0.8 (see Table 3).

Table 3:  
Cronbach's alpha for the HLS<sub>19</sub>-DIGI-INT

Country	Cronbach's alpha
Austria	0.77
Belgium	0.83
Czech Republic	0.78
Denmark	0.83
France	0.69
Germany	0.80
Hungary	0.87
Ireland	0.71
Israel	0.89
Norway	0.65
Portugal	0.88
Slovakia	0.87
Switzerland	0.84

Source: HLS<sub>19</sub> Consortium

The correlation between DIGI-HI and DIGI-INT is considerable ( $r=0.55$ ), but low enough to justify two different measures.

**Summarizing:** The HLS<sub>19</sub>-DIGI-HI and HLS<sub>19</sub>-DIGI-INT were validated for 4 methods 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 Instrument

**Procedure for obtaining the instrument:** The ownership of the HLS<sub>19</sub>-DIGI-HI and HLS<sub>19</sub>-DIGI-INT rests with the HLS<sub>19</sub> Consortium, which developed the instrument. The instruments 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 HLS<sub>19</sub> 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/HLS19Instruments>.

**Address any questions to:** The International Coordination Centre (ICC) of the HLS<sub>19</sub> Project, located at:

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The HLS<sub>19</sub>-DIGI-HI and HLS<sub>19</sub>-DIGI-INT are part of a family of instruments that measure specific types of HL (please see <https://m-pohl.net/HLS19Design%26Methods>):

- » HLS<sub>19</sub>-Q12, HLS<sub>19</sub>-Q47 and HLS<sub>19</sub>-Q16 to measure General Health Literacy
- » HLS<sub>19</sub>-COM-P-Q11 (long form) and HLS<sub>19</sub>-COM-P-Q6 (short form) to measure Communicative Health Literacy
- » HLS<sub>19</sub>-NAV to measure Navigational Health Literacy
- » HLS<sub>19</sub>-VAC to measure Vaccination Literacy.

## References

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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>